Novel applications of a bioactive resin in perforations, root resorption and endodontic-periodontic lesions

By Dr Marta Maciak, Poland

During the last decade, a considerable amount of attention has been directed towards the development of so-called bioactive materials. To understand this phenomenon better and to avoid misinterpretation, a condensed review of the literature and an assessment of various definitions need to be considered.

There are already several commercially available dental materials that can be defined as bioactive: for instance, any fluoride-releasing material, calcium silicate- and calcium aluminate-based cements, and calcium-based or calcium-containing materials. Biomaterial scientists in the field of implantology have adopted the word "bioactive" to mean materials that are bound to each other through a biomineralised interface. There appears to be confusion within the dental profession, including among scientists, clinicians and industry persons, to what extent biomineralisation can be achieved with dental materials and which materials can be appropriately termed "bioactive" or "biomineralising".

Bioactivity has been defined and can be interpreted in various ways. A broad definition that has several meanings is the following: a material that is able to have a biological effect or a material that is biologically active and forms a bond between the tissue and the material. In the field of tissue engineering, the term "bioactivity" is related to the cellular effects induced by the release of biologically active substances and ions from the biomaterial, for example from bioactive glasses both in soft- and hard-tissue engineering applications. In medicine, bioactivity covers all interaction of materials with living cells and tissue, including the effects of pharmaceuticals. In biomaterial science, with bioceramics and bioactive glasses, bioactivity of a material usually denotes that the material is capable of forming hydroxyapatite minerals on its surface in vitro and in vivo.

The following theoretical question should be asked: can a material that releases ions for biomineralisation be considered bioactive or is the substrate on which the biomineralisation occurs bioactive? Thus, bioactivity of dental materials relates to their potential to induce specific and
ACTIVA BioACTIVE-RESTORATIVE and ACTIVA BioACTIVE-BASE/LINER (Pulpdent) have been shown to exhibit bioactive properties based on this lab definition. ACTIVA BioACTIVE products are the first dental resins with a bioactive ionic resin matrix. They have a shock-absorbing, rubberised resin component and reactive ionomer resin fillers that mimic the physical and chemical properties of natural teeth. These bioactive materials actively participate in the cycles of ion exchange that regulate the natural chemistry of the teeth and saliva and contribute to the maintenance of tooth structure and oral health. ACTIVA has the strength, aesthetics and physical properties of resin composites and is more bioactive than glass ionomer cements.24 ACTIVA seals teeth against micromotion and recharge of significant amounts of calcium, phosphate and fluoride ions provide patients with long-term benefits.

In the US, the bioactivity claim for ACTIVA, being the first bioactive resin material, has been accepted. Based on its strength and durability due to a patented rubberised resin molecule that absorbs stress and resists fracture, the author has used ACTIVA BioACTIVE-RESTORATIVE and ACTIVA BioACTIVE-BASE/LINER in lieu of mineral trioxide aggregate (MTA) and Biocement (Septodont) for selected endodontic and other procedures.

The cases presented here are off-label treatments using the bioactive materials in cases with a poor prognosis and in which extraction (and an implant) may have seemed a more obvious choice of therapy. These procedures are not listed in the company’s indications for use and were carried out by the author after explaining the possible potential benefits, as well as the risks, to the patient. All of the patients agreed to the treatment proposal and signed an informed consent form for endodontic treatment.

**Case 1**

A 28-year-old female patient was referred and presented with pain of tooth 46. The referral letter stated that endodontic retreatment was needed and the perforation had been closed with MTA. The patient was in considerable pain when eating and when closing her mouth. Her medical history did not present any contraindications to dental treatment.

The clinical examination showed a temporary filling in tooth 46. A radiograph taken on 20 October 2015 showed extrusion of MTA into the furcation, as well as a bony defect (Fig. 5). Perforation of the floor of the pulp chamber was diagnosed.

Upon removal of the temporary filling, a large amount of purulent exudate filled the pulp chamber and was evacuated. After the MTA had been removed, the perforation was flushed with metronidazole (Liquid, Polpharma) and 2% chlorhexidine (Cerkamed). The borders of the perforation were refreshed with a carbide bur, and then the pulp chamber was etched with 37% orthophosphoric acid for 10 seconds, followed by a thorough rinse. Through the perforation, a collagen sponge (ANTENA, Motorex Dental) was supplied to support the ACTIVA BioACTIVE-BASE/LINER and to protect the underlying bone defect. The sponge was not visible on the radiograph. The canal orifices were protected with cotton orifices and the entire pulp chamber was treated with a dentine bonding agent (Dentinastic UNO, Pulpdent), which was light cured, and then covered with ACTIVA BioACTIVE-BASE/LINER, covering the floor of the pulp chamber (Fig. 6).

The tooth was closed with G2E glass ionomer (Bite Dental) as a temporary filling. The patient was pain-free within two days. A follow-up radiograph taken on 5 November 2015 (4 days postoperatively) showed the beginning of the healing of the bone in the furcation area (Fig. 7).

**Case 2**

A 16-year-old patient was referred with root resorption of tooth 12. A CT scan and radiographs (Figs. 8 & 9) taken on 30 March 2017 clearly demonstrated the root resorption. Note the temporary filling in the pulp chamber. The patient’s medical history was non-contributory. The diagnosis was maxillary internal and external root resorption.

After removal of the temporary filling, infiltrated granulation tissue was seen inside the canal. In spite of the fact that the apical portion of the canal was calcified, it was located. The canal was shaped and dried with the Self-Adjusting File (Saf System (BioDent NON) and XP-endo Finisher (KG Dentaire), and flushed with 5.25% sodium hypochlorite (NaOCl), 17% EDTA (Cerkamed) and metronidazole (Polpharma) as a first temporary canal filling. Deracetin (Che- ma-Häkimeret) was applied for one week to treat the inflammatory tissue in the canal. During subsequent visits, the canal was mixed with 40% citric acid (Cerkamed) and 2% chlorhexidine. A fibre post (Insys, Hahnenthal) was immediately placed, following which the pulp chamber was filled with ACTIVA. After 20 seconds, the restoration was light-cured from three different directions for 20 seconds each. The final result can be seen on a radiograph from 13 February 2018. Complete bone healing adjacent to the root resorption was observed (Fig. 10). While the radiograph shows the fibre post, the collagen sponge and ACTIVA BioACTIVE CEMENT do not possess sufficient radiopacity to be seen on a radiograph.

**Case 3**

A 63-year-old female patient presented for dental treatment. A panoramic radiograph (Fig. 11) revealed a heavily restored dentition with single crowns, a three-unit bridge and multiple missing teeth in both dentes. She complained of pain in the maxillary right premolar area. Her medical history did not present any contra-indications to dental treatment.

When the patient was informed that teeth #43 would have to be extracted, she objected and asked if anything could be done to save it, even if only on a temporary basis, as she was reluctant to commit to wearing a removable partial denture. The thus consented to a treatment that offered no guarantee of success. Clinical examination showed third-stage luxation and pus in the gingival pocket. A radiograph showed a three-wall infrabony pocket (Fig. 12) reaching the apex of the root. The diagnosis was periapical periodontitis with purulent exudate and root caries on the apical area. The treatment consisted of endodontic and periodontal treatment after a periapical radiographic and bone polymerase chain reaction (PET test, PET Plus, MIP Pharma) were performed.

Endodontic treatment was performed on 2 July 2014 with a Hyflex file of size 25.04 (COLTECEN) and the SAF System. The pus was evacuated from the root canal and the canal was flushed with 5.25% NaOCl and mercurialised content was placed.
Five quick questions with Dr Jorge Vera

By Dental Tribune International

Dental Tribune International asked Dr Jorge Vera five quickfire questions about his background in dentistry and what inspires him to practice endodontics.

Dr Jorge Vera five quickfire questions

What is your background in endodontics?

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What are your three favourite things about endodontics?

I like the challenge of properly diagnosing and treating canals and dental pain, and, of course, relieving the affected patients. And then being able to treat symptomatic and previously endodontically treated teeth with retreatment techniques using CBCT, the microscope or endodontic microsurgery, and returning them to functionality. Lastly, the tremendous load of basic science that endodontists must carry requires continuous study to better perform clinically in fields like pharmacology, physiology and others.

With endo products couldn’t you do without and why?

I could not be able to work without a microscope and ultrasonic tips because they change the approach to removing instruments like calcifications and previously placed materials from the root canal system in a conservative way. Also, the use of rotary/reciprocating instruments is essential in my everyday practice—those same topics.

What is one piece of advice that you would like to share with aspiring endodontists?

To be both open and critical about new techniques and devices arriving on the market, to always bring basic science into everyday practice because therein lies the foundation of our profession, so that whatever we use on patients helps both them and us, to study every single day to revise old notes from school and to read the journals. Finally, it is advisable to take new courses every year.

Thank you very much for the interview.

ENDO TRIBUNE

Endo Non-surgical and Surgical Retreatment (Management of Endodontic Failure)

DAY 1
05-06 March 2020
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Area of interest: Endodontics
AED 4,400
1,200

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DAY 2
07-08 March 2020
CAPP Training Institute Dubai | UAE
Area of interest: Endodontics
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About the author

Dr Jorge Vera, Brazil, graduated with a DDS from the Federal University of São Paulo University in 1995. In 2002, she was awarded a scholarship to attend a specialty in endodontics and aesthetic dentistry at the University of Western Australia. In 2009, she received a PhD in medical sciences in dentistry. She is a member of the Brazilian Dental Association and Brazilian Endodontics Association. She has authored many publications, and since 2015, she has lectured in Brazil and numerous other countries, in addition to presenting practical training in the fields of endodontics and aesthetic dentistry. Her main interests are aesthetic dentistry, endodontics and prosthodontics. She can be contacted at martasmaki2012@gmail.com.

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Endodontists.

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In the view, Vera also shed some light on her experiences in Mexico.

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Thank you very much for the interview.
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