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, as 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. 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 questions 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
Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

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 ion resin matrix. They have a shock-absorbing, rubberised resin component and reactive ionomer glass 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.** ACTIVA seals teeth against microleakage and its continuous release of calcium, phosphate and fluoride ions provide patients with long-term benefits.

In the US, the bioactivity claim for ACTIVA, being the first 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 ACTIVA BioACTIVE/BASE/LINER 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 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. 6). 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 furcation was flushed with metronidazole (liquid, Polpharma) and 17% EDTA (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 thorough rinsing. Through the perforation, a collagen sponge (ANTHEMA, Molerini Dental) was applied to support the ACTIVA BioACTIVE/BASE/LINER and to protect the underlying bone defect. The sponge was not visible on the radiograph. The canal fillings were protected with cotton pellets and the entire pulp chamber was treated with a dentine bonding agent (DentTASTIC UNO, Pulpdent), which was light-cured, and then covered with ACTIVA BioACTIVE/BASE/LINER, covering the floor of the pulp chamber (Fig. 5).

The root was closed with GIZ glass ionomer (Ihde Dental) as a temporary filling. The patient was pain-free within two days. A follow-up radiograph taken on 3 November 2015 (14 days postoperatively) showed the beginning of the healing of the bone in the furcation area (Fig. 3).

Case 2

A 16-year-old patient was referred with root resorption of tooth #21. A Cток scan and radiograph (Figs. 4 & 5) taken on 30 March 2017 clearly demonstrated the root resorption. Note the temporary filling in the furcation area (Fig. 4). Perforation of the floor of the pulp chamber was diagnosed.

The tooth was closed with GIZ glass ionomer (Ihde Dental) as a temporary filling. The patient was pain-free within two days. A follow-up radiograph taken on 30 March 2017 (14 days postoperatively) showed the beginning of the healing of the bone in the furcation area (Fig. 3).

After removal of the temporary filling, an inflamed granulation tissue was seen inside the canal. Beneath it and in spite of the fact that the apical portion of the canal was calcified, it was located. The canal was shaped and cleaned with the Self-Adjusting File (SAF) System (BoDent NOVA) and XP-endo Finisher (KG Dentaire), and flushed with 5.25% sodium hypochlorite (NaClO), 17% EDTA (Cerkamed) and metronidazole (Polpharma). As a first temporary canal filling, Dexadent (Chem-Ette-Häkner) was applied for one week to treat the inflammatory tissue in the canal. During subsequent visits, the canal was filled with 40% citric acid (Cerkamed) and 2% chlorhexidine (Cerkamed) for one week to treat the inflammatory tissue and to stimulate bone regeneration. Over the course of about seven months, a reduction of the bone lesion was observed, as evidenced by radiographs (Fig. 6) and CBCT and under high magnification.

The final treatment after approximately 11 months (Fig. 7) consisted of cleaning the canal with the XP-endo Finisher and EDTA and 2% chlorhexidine irrigation. The resorption area was plugged with a collagen sponge (Anterta) to provide support for ACTIVA BioACTIVE CEMENT and to prevent it from flowing beyond the root structure. A dentine bonding agent (All Bond Universal, Bisco) was applied to the canal space, but not polymerised, just slightly air-dried, and the root was filled from the apex to the pulp chamber with ACTIVA BioACTIVE/BASE/LINER. A fibre post (Lycée blanc, Hahnenkratt) 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 (Fig. 8). 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. 9) revealed a heavily restored dentition with single crowns, a three-unit bridge and multiple missing teeth. The patient underwent therapy and root canals in both arches. She complained of pain in the mandibular premolar area. Her medical history did not present any contraindications to dental treatment.

When the patient was informed that tooth #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. 10) reaching the apex of the root. The diagnosis was periapical periodontitis with purulent exudate and root canalations in the mesio-vestibular aspect. The treatment consisted of endodontic and periodontal treatment after a panoramic radiograph and bone-morphogenetic protein 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 (COTEN) and the SAF System. The pus was evacuated from the root canal and the canal was flushed with 5.25% NaClO and meticulous root canal filling was done with a retrograde poppy of MTA-Elektromet. A radiograph revealed a heavy dressing on the root canal. During subsequent visits, the canal was filled with 40% citric acid (Cerkamed) and 2% chlorhexidine (Cerkamed) for one week to treat the inflammatory tissue and to stimulate bone regeneration. The treatment area was cleaned, and after 11 months (Fig. 7) the final treatment was carried out with the SAF System and XP-endo Finisher. A radiographic treatment revealed a well-shaped canal. The root canal was filled with MTA-Elektromet. The final result can be seen on a radiograph from 13 February 2018 (Fig. 8). The radiograph shows the fibre post, the collagen sponge and ACTIVA BioACTIVE CEMENT do not possess sufficient radiopacity to be seen on a radiograph.
Dr. Vera, what is your background in endodontics at Tufts University?

Dr. Jorge Vera five quickfire questions

By Dental Tribune International

Dental Tribune International asked Dr. Jorge Vera five quickfire questions about his background in dentistry and what inspired him to practice endodontics every day in the interview. Vera also shed some light on his favourite products that he uses in his private practice and provided some useful tips for aspiring endodontists.

Dr. Vera, what is your background in endodontics?

After finishing my DDS in Mexico, I did my postgraduate programme in endodontics at Tufts University School of Dental Medicine in Boston in the US, from 1991 to 1993, helping to teach in the undergraduate clinic and doing many research projects under a great team consisting of Drs Joseph Tenca, Robert White and Melvin Goldman. Once I got my certificate, I returned to practising and teaching in Mexico.

What are your three favourite things about endodontics?

Firstly I like the challenge of properly diagnosing and treating oral 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 carry requires continuous study to better perform clinically in fields like pharmacology, physiology and others.

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

I would not be able to work without a microscope and ultrasonic tips because they change the approach to removing remaining pulp calcifications and previously placed materials from the root canal system in a conservative way. Also, the use of root/canopy rotating instruments is essential in my everyday practice— their evolution is making root canal preparation easier while maintaining more dentine—and, finally, the use of hydraulic calcium silicate/phosphate ions and apatite formation in the presence of saliva, which was the decision was made to expand the number of suitable cases. Although a favourable outcome could not be guaranteed, clinical cases followed over a period of three and more years presented with positive results and provided evidence that the bioactive properties of ACTIVA BioACTIVE materials through their ability to stimulate apatite formation and osteoblasts provided a viable treatment option. The evidence has been presented here with radiographs and CBCT scans showing new bone treatment.

What inspires you in your day-to-day work?

Being able to bring new techniques, devices and materials into my practice about which I have learnt in lectures and courses. Documenting their use and eventually seeing those patients on which they were used, heal and remain functional for a long time. I also enjoy preparing lectures for students and peers on those same topics.

Thank you very much for the interview.

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.

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

DAY 1 - Delegates will be able to:

• Remove gutta-percha obturations from root canals.
• Remove Caries based obturations from the root canals.
• Remove past obturations and remove fiber posts.
• Have the opportunity to use most of the current technology used during retreatment procedures.

DAY 2 - Delegates will be able to:

• Bypass endodontic files.
• Understand all the preventive measures to avoid complications during endodontic instrumentation.
• Repair a pulp floor perforation.
• Obtain an internal root resorption defect.
• Perform apical plugs with bioresorbable materials.

Endo Micro Surgical Retreatment (Management of Endodontic Failure)

DAY 1 - By the end of the course delegates will understand:

• Outcomes of endodontic microsurgery vs traditional apicectomy.
• The science behind effective local anaesthesia in endodontic microsurgery.
• The use of a dental operating microscope in endodontic microsurgery.
• Flap design and tissue handling to improve post-surgical healing.
• How to effectively prepare an osteotomy.
• Correct methods of ultrasonic root-end preparation and how to identify anatomical markers.
• Which equipment is appropriate for use in micro-surgical techniques.

DAY 2 - By the end of the course delegates will have:

• Been calibrated to a dental operating microscope.
• Have identified cases where surgical intervention is appropriate.
• Have raised a flap with microsurgical instruments.
• Created an osteotomy and identified anatomical markers.
• Performed root end resection and retrograde preparation of the root canals.
• Performed microsurgical suturing.

About the author

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PhD, graduated with a DDS from the Medical University of Bialystok in 1999 and completed a one-year specialty in conservative dentistry and endodontics from the university’s Department of Restorative Dentistry. From 2004 to 2009, she was an assistant in the same department. In 2009, she received a PhD in medical sciences in dermatology. She is a member of the Polish Dental Association and Polish Endodontic Association. She has authored many publications, and since 2015, she has been a reviewer for 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 prosthetics. She can be contacted at martamaciak2012@gmail.com.
Whether you’re an endodontic enthusiast, and rely on performance and versatility, or a novice, who prefers simplicity and confidence in their endodontic treatment – we’ve got the solution for you. Our complete ProTaper Next® and WaveOne® Gold solutions, from glide path to obturation, gives you the choice.

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