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 refers to the ability of a material to induce specific and predictable biological responses. It is a term used to describe the interaction between a material and living tissue, including bone and other connective tissues. Bioactive materials are capable of forming hydroxyapatite minerals on their 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 predictable biological responses. 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.

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 addition, its activity has been demonstrated in pulp capping experiments in non-human primates.

Thus, 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.
ACTIVA BioACTIVE-RESTORATIVE and ACTIVA BioACTIVE-BASE/LINER (Pulpdent) have been shown to exhibit bioactive properties based on this latest 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 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 microruptures and recharges of significant amounts of calcium, phosphate and fluoride ions provide patients with long-term benefits.
In endodontics at Tufts University, I did my postdoctoral programme. After finishing my DDS in Mexico, Dr Vera, what is your background in dentistry? His favourite products that he uses is a long time. I also enjoy preparing their use and eventually seeing lectures and courses. Documenting their use and eventually seeing the cases presented here with radiographs determined whether the treatment formation in the presence of saliva, which was etched and rinsed, followed by application of the dentine bonding agent (All-Bond Universal). The canal was filled with ACTIVA CE- MENT and a fibre post was placed, and after 20 seconds, it was light-cured (Fig. 12). After three years, a radiograph showed complete bone healing and periodontal attachment (Fig. 13).

Conclusion
Based on the available published research and after early favourable results had established the effectiveness of ACTIVA BioACTIVE materials, and based on the pH, release of calci- um and phosphate ions and apatite formation in the presence of saliva, 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 bio- active properties of ACTIVA BioAC- TIVE materials through their ability to stimulate apatite formation and osteoblasts provided a viable treat- ment option. The evidence has been presented here with radiographs and CBCT scans showing new bone treat- ment. Although histopathologi- cal evidence has not been provided, a periodontal evaluation demon- strated periodontal attachment in the cases presented here.

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

This article was originally published in roots-international magazine of endodontology, issue 4/2018.

What is one piece of advice that you would like to share with aspir- ing endodontists?

To be both open and critical about new techniques and devices arriv- ing on the market, he always brings 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 advis- able to take new courses every year.

Thank you very much for the interview.

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

Dr. Antonios Chaniotis, Greece

He currently serves as an active member of the Hellenic Society of Endodontology and the Academy of Microscope Enhanced Dentistry and is a certified member of the European Society of Endodontology.

Course Objectives
- DAY 1: Delegates will be able to:
  - Remove gutta-percha obturations from root canals.
  - Remove Carrier based obturations from the root canals.
  - Remove paste 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 lateral condensation.
  - Understand all the preventive measures to avoid complications during endodontic instrumentation.
  - Repair a pulpal floor perforation.
  - Obstruct an internal resorption defect.
  - Perform apical plugs with biocompatible materials.

Endo Micro Surgical Retreatment (Management of Endodontic Failure)

Prof. James Pichard, UK

He has been in active clinical practice and is a visiting professor at universities in Europe and the USA.

Course Objectives
- 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 intracanal root preparation and how to identify anatomical markers.
  - Which equipment is appropriate for use in micro-surgical techniques.
  - Outcomes of endodontic microsurgery vs traditional apicectomy.

- 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 canal space.
  - Performed microsurgical suturing.
  - Developed a post-operative care strategy to minimize complications and improve healing.