

Bioactive Glass-Based Materials for Soft and Hard Tissue Regeneration: A New Future for Dental and Biomedical Applications

Nina Attik ^{1,*}, Rémy Gauthier ^{2,*} and Mohammed Ahmed ³

¹ Faculté d'Odontologie, Université Claude Bernard Lyon 1, Université de Lyon, 69372 Lyon, France

² CNRS, INSA de Lyon, UCBL, MATEIS UMR CNRS 5510, Lyon, Bât. Saint Exupéry, 23 Av. Jean Capelle, 69621 Villeurbanne, France

³ Department of Dental Biomaterials, Tanta University, Tanta 31527, Egypt

* Correspondence: nina.attik@univ-lyon1.fr (N.A.); remy.gauthier@cnrs.fr (R.G.)

In order to enhance and promote tissue repair and healing processes, current exploratory and investigative research lines in medical and dental treatments are focusing on the use of bioactive materials that are able to induce and trigger a specific targeted biological activity to stimulate the suitable response from the host tissue.

In this context, bioactive glasses (BAGs) could be classified as “bioactive materials” because of their ability to interact with biological tissues through formation of a hydroxylapatite-rich layer at the BAG–tissue interfaces, and encourage tissue remineralization, regeneration and integration. One of the potential interactions is the formation of a chemical bond with bone, or at least, promoting its self-healing potential through cell stimulation. Since the introduction of BAGs in 1969 by Professor Larry Hench, the development of BAG-based materials has continued to rise for diverse clinical indications for minimally invasive and biologically based therapies [1] such as:

- In oral hygiene: Novamin® and BiominF® are examples of two developed toothpastes containing BAGs (with or without Fluor) for enamel remineralisation and dental hypersensitivity/tooth sensitivity [2].
- In endodontics: BAG-based pulp capping materials could stimulate pulp cells' secretory potential, increase the sealing ability, decrease bacterial infiltration, and preserve pulp vitality.
- In restorative dentistry: BAGs can be potentially added to dental adhesives and composites. BAG-based restorative materials are expected to possess remineralizing potential or at least to provide a certain degree of anti-enzymatic/bacterial activity with sustained durability over time.
- In bone healing: Some products containing BAG particles are already available in the market such as bone filling materials (Biogran®-Perioglas®) or implant coatings to improve osteointegration. Current research lines are focused on the development of BAG-based bone scaffolds to promote bone regeneration through in vivo tissue engineering [3].

Although the majority of BAG-based dental materials are still in the experimental phase, this Special Issue aims to explore and elucidate the current status and future perspectives related to BAG use in dental biomaterials and highlight the rationale and benefits behind their applications in the medical as well as dental fields.

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Short Biography of Authors

Nina Attik is currently an associate professor at the faculty of dentistry, from Claude Bernard Lyon 1 University (France). She has completed her Ph.D. (prepared within a European program) from Nancy University. Winner of the Support Program for the “young” Creation of Innovative Companies in the Mediterranean (PACEIM, IRD Montpellier, France). She has published more than 50 papers and reviewed many original articles and literature reviews. Nina has also participate in the management of many research projects and laboratory budgets.

Rémy Gauthier is an associate researcher at the CNRS, working in MatéIS laboratory (UMR CNRS 5510, Laboratoire Matériaux: Ingénierie et Science) in the Materials Science department of INSA de Lyon, Lyon, France. He is working on bone biomechanics to improve bone fracture risk prediction and bone regeneration strategies. In particular, he investigates osteocytes mechanical stimulations within the lacunocanalicular network crossing bone matrix in order to better understand bone remodeling and regenerative mechanisms.

Mohammed Ahmed is currently an associate professor in the Department of Dental Biomaterials at Tanta University, Egypt. Ahmed was awarded his bachelor's and MSc degrees from Tanta university, Egypt. In 2020, he had his Ph.D. in dental biomaterials from BIOMAT-KU Leuven. After obtaining his Ph.D., he co-founded DentPlanet, a leading Belgian start up in ecological transformation of dental instruments and biomaterials. His research focuses on durability of adhesive dentin interfaces with more than 25 peer-reviewed articles.

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