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# Overview on bioceramics used in endodontics

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Bioceramics have been classified as bioinert, bioactive, and biodegradable materials due to their inertness to surrounding tissues. The first generation of bioceramic namely mineral trioxide aggregate (MTA) was introduced in the field of endodontics in the 1990s. Due to its difficult handling, long setting time, low cohesive strength, heavy metal leaching and tooth discolouration, newer generation of bioceramics have been formulated to address these limitations while maintaining its original biocompatibility and excellent sealing ability properties (Chang *et al.*, 2018).

Clinicians need to consider various aspects when selecting bioceramics in endodontic applications such as physicochemical properties, cytotoxicity, and/or mineralisation potential. The incorporation of radiopacifier in bioceramics facilitate evaluation through radiographs although some materials have similar radiodensity as of dentine compromising the evaluation. Apart from that, a shortened setting time of approximately 20 minutes, more resistant to washout, and premixed syringe delivery allow the clinicians to perform the endodontic procedures more effectively. It is important to note that the components in bioceramics when hydrated in the oral environment form calcium hydroxide, which is rapidly dissociates into $Ca^{2+}$ and $OH^-$ ions, increasing the pH of the medium for antimicrobial properties (Villa *et al.*, 2020).

In general, newer generation of bioceramics are biocompatible, comparable to MTA, has mineralisation potential, and are designed for various endodontic procedures. These include vital pulp therapy, as an intracanal medicament, apexification, perforation repair, regenerative endodontics, periapical surgery and retrograde filling during tooth reimplantation. Promising results have been observed through various studies although the data on permanent teeth remain scarce.

In the event of limited access to bioceramics, the use of conventional materials has shown promising results as well, provided that clinicians adhere to standard treatment protocols. Despite a clear shift towards bioceramics use in clinical practice, selection of the appropriate bioceramic is still subject to individual case, availability of the bioceramics, clinician's preference, as well as clinician's skills and experience at handling the materials. The future of endodontics should focus on continuous development of bioceramics for various clinical applications, supported by robust scientific evidence to allow clinicians to provide better endodontic treatment for the community.

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