

# COMPARISON BETWEEN THE BIOCERAMIC ENDODONTIC SEALERS ENDOSEQUENCE BC SEALER AND MTA FILLAPEX: LITERATURE REVIEW

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## ABSTRACT

The use of bioceramic sealers in endodontics has been shown to be remarkably promising. Its inorganic composition possesses great similarity with hydroxyapatite crystals, having osteoinductive capacity, which causes a favorable response in the healing process. They have been used in dentistry for filling up bony defects, endodontic sealers, root repair materials, perforation sealing, apical fill materials, and as aids in pulp regeneration. The present literature review aims to compare the several properties of two endodontic sealers classified as bioceramic, EndoSequence BC Sealer and MTA Fillapex. For the research, the Pubmed platform was used, from which English language indexed periodicals from the last 5 years which had correlation with the objective of the study were selected. It was observed that the EndoSequence BC Sealer and MTA Fillapex sealers presented some differences between each other, in relation to their compositions and properties. In light of the literature review performed, the excellent qualities of the bioceramic sealers and the superiority of EndoSequence BC Sealer over MTA Fillapex could be observed, in relation to their composition and properties studied in the present article. Bioceramic sealers have emerged from a category of endodontic sealers. These sealers are used as repairers and obturators and their properties have shown better results on root canal therapy.

**KEYWORDS:** EndoSequence BC, MTA Fillapex, Endodontic sealer, Bioceramic Sealer.

## 1. INTRODUCTION

Bioceramic sealers have emerged from a category of endodontic sealers, with the intention to improve their properties, and can be classified as bioinert, bioactive and biodegradable. Bioinert, for not responding to interactions with biological fluids and tissues; bioactive, for their interaction stimulates and regenerates surrounding biological tissues; and biodegradable for being soluble and resorbable when incorporated to the tissues. Also, bioceramics have

been observed to suffer biochemical interactions in accordance to the surrounding tissues. These sealers are used as repairers and obturators and their properties have shown better results than conventional endodontic sealers<sup>1-9</sup>.

The use of bioceramic sealers, in endodontics, has been shown to be remarkably promising, due to its biocompatibility, capacity for proper sealing, radiopacity, and to its antibacterial and antifungal activity. These are composed by bioactive materials such as glass, calcium silicates, calcium phosphates, glass ceramics, hydroxyapatites, alumina and zirconia. Such components have great influence in the success of endodontic treatments, due to their capacity of integration with periradicular tissues. Their crystals present great similarities to hydroxyapatite crystals, which do not allow for the adhesion of bacteria, presenting osteoinductive capacity and providing a favorable response in the healing process and also causing the release of fluoride through the apatite components<sup>1,7,9-14</sup>.

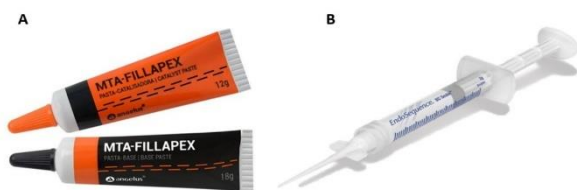
The bioceramic cement EndoSequence BC Sealer is composed of premixed calcium phosphate silicate, zirconium oxide and thickeners<sup>15</sup>. Its presentation is in injectable form and it is hydrophilic, meaning it needs humidity in the root canals to accelerate its bioactivity and hardening.<sup>1,4,6,11,16-19</sup> It is a bioactive and bioinert material, and also possesses several characteristics such as alkaline pH, antimicrobial activity, biocompatibility and releases high concentrations of calcium, which favors the reestablishment of periradicular tissues<sup>11,16,18</sup>. It presents a working time of approximately 2 hours at room temperature and its introduced immediately into the canals, according to the manufacturer. It acts through the creation of an union between the appropriate filling material and dentin, which could lead to the formation of hydroxyapatite<sup>15</sup>.

The MTA Fillapex is an endodontic cement composed of mineral trioxide aggregate and bioceramic particles with

the intention of enhancing its physicochemical characteristics<sup>19-20</sup>. Also, it possesses in its composition natural resin, salicylate resin, diluted resin, bismuth trioxide, silica nanoparticles and pigments, according to the manufacturers. Its presentation is in the form of two pastes, one of them being the catalyst containing bioceramic based resinous cement, with the intention of enhancing its physicochemical characteristics. Its formulation permits a proper insertion in the root canal system for conventional sealing procedures<sup>21</sup>, however it also presents inferior biocompatible characteristics, being cytotoxic and genotoxic, which leads to the conclusion that it should not be considered as a bioceramic cement but as an aggregate endodontic cement with enhanced characteristics.

## 2. MATERIAL AND METHODS

Given this information, the objective of this study was to compare the composition and properties of two bioceramic sealers, the EndoSequence BC Sealer and MTA Fillapex (Figure 1), in relation to its composition and properties. To perform this literature review, the data platform PubMed was used, where indexed periodicals from the last 5 years which had correlation with the objective of the study were selected. For this, the inclusion criteria used was the year of publication and descriptors such as EndoSequence BC; MTA Fillapex; Endodontic sealer; Bioceramic Sealer. As exclusion criteria, only english language articles were selected.



**Figure 1.** Representation of bioceramic sealers: A- MTA Fillapex and B- EndoSequence BC Sealer.

## 3. RESULTS

Within the established criteria, 22 articles pertaining to the theme of this study were selected. According to the selected publications, the bioceramic sealers EndoSequence BC Sealer and MTA Fillapex presented some difference between each other, in the comparisons made between their compositions and properties. Table 1 refers to the composition of the endodontic bioceramic compared.

Table 2 describes some of the properties of the sealers compared in this review, such as biocompatibility, radiopacity, hardening time, solubility, leaching, cytotoxicity, tissue reparation and pH.

**Table 1.** Composition of the endodontic sealers EndoSequence BC Sealer and MTA Fillapex.

COMPOSITION	
BIOCERAMICS	Calcium Oxide, Calcium Hydroxide, Phosphate, Calcium Silicate
ENDOSEQUENCE BC SEALER	Calcium, Silicate Phosphate, Zirconia Oxide, Thickener
MTA FILLAPEX	Natural Resin, Salicylate Resin, Diluted Resin, Bismuth Trioxide, Silica Nanoparticles, Pigments

**Table 2.** Comparison between the properties of the bioceramic sealers EndoSequence BC Sealer and MTA Fillapex.

SEALERS	BIOCOMPATIBILITY	RADIOPACITY	HARDENING TIME (MINUTES)	SOLUBILITY CAPACITY (%)	LOSING IONS	CYTOTOXICITY	pH	HISTOPATHOLOGICAL TISSUE REPARATION FOR LYMPHOCYTES
ENDOSEQUENCE BC SEALER	High	10.8 Scale	22.3	3%	Calcium Leaching	No Significant Relevance	>11	90 Days
MTA FILLAPEX	Medium	43 Scale	19.3	3%	Phosphorous	Strong	<8	>90 Days

The results showed the superiority of the EndoSequence BC Sealer cement over MTA Fillapex, when comparing their composition and properties.

## 4. DISCUSSION

Bioceramics became remarkably promising in odontology, due to their osteoinductive capacity, with significantly positive responses in periradicular tissues, with good radiopacity, excellent sealing, being indissoluble to tissue fluids, besides also possessing good working characteristics. Bioceramic sealers are composed by several components such as calcium oxide, calcium hydroxide, phosphate, calcium silicate. This composition, when mixed to water and/or root canal fluids, enters a hydration process, becoming similar to the dentinal tissues. Thus, its application in endodontics is beneficial, due to the formation of dentinal bridges to the adjacent tissues, reestablishing the tissues lost to inflammatory processes<sup>1,4,6,11,13,16,17,22,23</sup>.

MTA Fillapex is an endodontic cement composed of mineral trioxide aggregate with ceramic particles. Also, it possesses in its composition natural resin, salicylate resin, diluted resin, bismuth trioxide, silica nanoparticles and pigments. Its presentation is in the form of two pastes, one of them being the catalyst containing bioceramic based resinous cement, with the intention of enhancing its physicochemical characteristics. Its formula allows for proper insertion in the root canal system for conventional sealing procedures. EndoSequence BC Sealer cement is a hydrophilic calcium bioceramic premixed with phosphate silicate, zirconium oxide and thickeners. Its presentation is injectable.<sup>1,4,6,11,16,17,19,22</sup>.

It is known that biocompatibility is essential to endodontic sealers. The cement EndoSequence BC Sealer presented tissue reparation within 90 days, while MTA

Fillapex did not present similar response, and the presence of inflammatory processes for a larger amount of time was verified, influencing directly its biocompatibility potential<sup>19</sup>.

Characteristics such as radiopacity are also of great importance for endodontics, for all the treatment can be evaluated and followed through radiographic examination, and it can be assured that the filling of the root canal systems is correct. Studies show that the bioceramic EndoSequence BC Sealer obtained a scale of 10.8 in radiopacity, while the MTA Fillapex obtained a 4.3. Therefore, superiority of the EndoSequence BC Sealer in relation to the MTA Fillapex was pointed out<sup>22</sup>.

As of the hardening time, bioceramics harden faster when in humid environments. It is known that their action is dependent of the permeability and of the fluids in the dentinal tubules. A hardening time of 22.3 minutes was estimated for the EndoSequence BC Sealer and 19.3 minutes for MTA Fillapex<sup>19,22</sup>.

In relation to the solubility, according to the specification of the American Dental Association (ADA) and the National Health Agency (NHA), the norm ISO 6876/2001 establishes that the degree of solubility of cementing materials should not exceed 3%. Studies show that both EndoSequence BC Sealer and MTA Fillapex bioceramic sealers are within the enforced standards. This occurs, probably, due to the silica particles which preserve the integrity of solubility of the sealers<sup>22</sup>.

The sealers were also analysed as of their capability of releasing calcium and phosphorus ions. The EndoSequence BC Sealer was considered superior to MTA Fillapex, which presented absorption of phosphorus instead or releasing. In this comparison, it could be stated that a deficient calcium leaching interferes directly in the hydration and consequently in the reparation of the tissue bioactivity<sup>22</sup>.

Endodontic sealers should be biologically compatible, for during the obturation of the root canals, material extrusion can occur, which could lead to inflammatory responses. During this review, it was verified that inflammatory mediators such as cytokines and chemokines presented the response of higher correlation and inflammatory processes, as of periradicular extrusion, with the cement MTA Fillapex in detriment of EndoSequence BC Sealer.

In relation to cytotoxicity, the EndoSequence BC Sealer did not present relevant conditions, while the MTA Fillapex cement presented elevated responses. The cytotoxic effect could occur due to the excessive incorporation of some components such as diluting resin and salicylate resin, which could cause alterations in their properties, lessening the biocompatibility and bioactivity<sup>16,17</sup>.

Properties such as pH are highly important in combating the control of microorganisms. Studies reveal that a

more alkaline mean favors antimicrobial action and deposition of mineralized tissues, due to the neutralization of lactic acid, which prevents the dissociation of the mineralized tissues and contributes to the healing process. The pH of the cement EndoSequence BC Sealer was shown to be more alkaline, around 11, while the MTA Fillapex started neutral and then became somewhat acidic<sup>16,19,22</sup>.

In comparative histopatologic researches, they were analysed for tissue reparation and inflammatory action. The tests revealed that, within 7 days, all tested sealers showed significant responses. It can be observed that within 30 days, macrophage and eosinophilic cells were not present in the tissue samples analysed. It was observed, also, that lymphocyte cells were absent in tissues with samples of the cement EndoSequence BC Sealer, however they were found in large quantities in the samples of the cement MTA Fillapex. Thus, the cement MTA Fillapex presented slower tissue reparation<sup>19</sup>.

Comparative studies concerning the removal of cement from root canals showed that both sealers studied presented higher difficulty in maintaining patency of the root canal. The bioceramics compared in this literature review presented higher difficulty than epoxy resin based sealers, such as AH Plus, which is considered the gold standard of endodontic sealers<sup>1,4,13,16,17,19,22,23</sup>.

## 5. CONCLUSION

Thus, according to this literature review, it could be concluded that the bioceramic sealers EndoSequence BC Sealer and MTA Fillapex possess some differences between each other in relation to their compositions and properties. The superiority of the cement EndoSequence BC Sealer was highlighted in the comparisons performed. Bioceramic sealers have emerged from a category of endodontic sealers. These sealers are used as repairers and obturators and their properties have shown better results on root canal therapy.

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