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Endodontic Grafting: A Brief Review

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Abstract: *The most ideal outcome of an endodontictreatment is hard tissue closure,which permanently separates the rootcanalfromthe periapical tissues and preventschronic irritationand foreign body reactions bymaterial components. Bioceramic sealers can be used to achieve a hermetic seal even in contact with wet environment of periapical tissues. Most of the traditionally used endodontic sealers lose their adhesiveness in the apical third of the root canal. The present review highlights the technique of Endodontic Grafting for using bioceramic based sealers. The bioceramic sealers can provide promising results owing to their properties of osseoconductivity, adhesiveness and hydrophilicity.*

Key words:*bioceramic based sealers, osseoconductivity, endodontic grafting, capillary condensation.*

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I. Introduction

The apical third of the root canal is the critical area in terms of its cleaning as well as shaping.Owing to the active and constant metabolic processes occurring in the periapical area it needs special attention. It is in continuous and dynamic contact with the surrounding periodontium and the body fluids.All the employed shaping and cleaning procedures must ensure the complete debridement and adequate filing of this area with an inert material.**[1]**

The most widely used obturating material, gutta percha has no inherent property of osseoconductivity. Visualization of sealer "puff" in periapical space on radiography does not give enough grounds to say that seemingly adequate root canal filling is an absolute guarantee of successful healing result.[1] Shrinking of gutta-percha after the end of warm condensation and lack of adhesion of the root filling materials to dentinal root canal walls are factors creating enough predispositions for micro leakage.[2]

In the cases with apical resorption and periapical pathologies, the obturating material must promote apical hard tissue closure and periapical healing.**[3,4]**Hence, we have to rely on osseoconductivity of the sealer for promoting hard tissue closure of the canal. Filling of the root canal with bioceramic sealer, which due to its osseoconductivity action promotes the physiological closure of the canal by cementoid hard tissue, can be called "endodontic grafting."[1] Such endodontic grafting can ensure the lasting root's health while it constantly remains in contact with body fluids. Thoughthe bis-GMA based adhesive sealers bond well with the walls of the root canal but in apical third they have shown degradation owing to lack of inherent hydrophilicity. **[5-7]**

This article briefly describes the technique of endodontic grafting for placement of bio-ceramic based sealers. The sealers used for endodontic grafting are listed in table 1 and their properties are listed in table 2.

SEALERS USED FOR ENDODONTIC GRAFTING	
1. Calcium-silicate-phosphate-basedbioceramic nano-compositions	BioAggregate, iRoot SP and iRoot BP (IBC, Canada).
2. MTA-based products	MTA — Angelus, (AN-GELUS, Brazil), ProRoot (Dentsply, USA), Aureoseal (OGNA, Italy).

PROPERTIES OF BIOCERAMIC BASED SEALERS
• Ceramic based sealers ensure much better apical seal than IRM, amalgam or Super EBA materials, and this excellent seal is combined with excellent biocompatibility and significant stimulation of periodontal regeneration.[4, ,9]
• They are very stable in time. They do not getdestroyed during their hardening and afterward whilebeing constantly in contact with the wet periapicalenvironment.
• During setting, hard ceramic based sealers expand. Expansion of Bioaggregate and iroot SP and iroot BP is significant – 0.20.
• They form chemical bond with the canal dentinal walls. That is why no space is left between sealer and dentinal walls.[2]
• Bioceramic-based sealers are capable of achieving fast alleviation of the pain syndrome in cases of acute periapical inflammation. After appropriate instrumentation and cleaning of the root canal, followed by immediate filling with iRoot SP, pain rapidly diminishes and most often is totally gone within a period of 50 minutes to few hours
• When bioceramic-based sealers BioAggregate or iRoot SP are extruded, the pain is relatively small or totally absent. Such lack of pain may be explained with the characteristics of these new materials. During hardening they "produce" hydroxyapatite and after the end of hardening process they exhibit the same features as non-resorbable hydroxyapatite-based bioceramics used for bone replacement in oral surgery. Due to the hydroxyapatite formed, they are also osseoconductive.
• MTA-based materials and BioAggregate havequite poor radiopacity, different from bioceramicbased iRoot SP and iRoot BP sealers.

TECHNIQUE OF ENDODONTIC GRAFTING AS SUGGESTED BY Deyan Kossev& Valeri Stefanov. [2]

Until recently the application of all bioceramic based sealers, except for iRoot SP and iRoot BP, required significant widening of the root canal apical third — up to #60–70 — and use of specially developed instruments to carry the materials to apical third of the canal. These purely technological limitations were reducing ceramic-based materials use as regular antegrade root canal filling materials. Hence this technique of endodontic grafting came into existence. The "capillary condensation" technique, does not require enlargement of the canal's apical third more than # 35-40 / 04. Apical third of canal space is widened based on its original size and shape only.[1] Method comprises of several stages:

I. Preparation of "coronal reservoir" from which ceramic sealer is to be condensed aside to canal walls and toward and into canal's apical third so that to seal the canal's apical orifice.
II. Method for 'capillary condensation' of ceramics-based endodontic sealers to fill the root canal
III. Insertion of gutta-percha cones

STEP: 1Preparation of "coronal reservoir

Using GG drills, the coronal third of the root canal is conically widened to form a "coronal reservoir," which is subsequently to be filled with MTA, BioAggregate, iRoot SP or iRoot BP material.There are two different approaches:

A."Coronal reservoir" is filled directly with ready-to-use material packed into syringes (iRoot SP or iRoot BP). Mini applicators included in the package are used for direct filling of reservoir with factory premixed material.

B.Powder-like ceramic material (MTA or bioceramic-based Bio Aggregate) is mixed with distilled water to form a paste with suitable viscosity to allow carrying it into the "reservoir" by plastic carrier designed by the author. Micro applicator handle, with "fluffy" head cut, may be used instead, too. (Fig. 7.2)

The dentist can fold the plastic carrier as needed to make it suitable to easily get inside the "coronal reservoir." Small portions of "extempore" mixed sealer are carried into the "reservoir" until it gets full. It is important to work in constantly slightly wet root canal. Before putting next small portion of MTA or Bio Aggregate sealer into reservoir, the dentist visually controls the moisture of the sealer mass. If necessary, the tip of the plastic carrier is wetted with distilled water and put inside the reservoir to increase the humidity of the sealer mass inside. Thus, the risk of drying of material at the bottom of the reservoir is avoided and ceramic sealer is prepared for condensation further inside the root canal.

STEP II. "Capillary condensation" of the sealer to fill the root canalp

This stage is valid for both (A and B) types of ceramic sealers. Condensation of the sealer is made with condensor. The basic rule is correctly chosen instrument to get freely inside into root canal within 1 mm less than canal's measured working length (WL). In case of straight canals, the number of the instrument must be one number less than MAF. In slightly or severely curved canals the number of the used instrument must be two to three number less than MAF. It is preferable to use NiTi made instruments, especially in curved canals.

By pushing the condensor slowly in and then getting it out, without taking it totally out of "coronal reservoir," the sealer is condensed inside the canal, aside to canal's walls and at the same time toward its apical orifice, down to previously defined depth of 1 mm less than WL. Condensation must be done slowly and with maximum possible amplitude of the "push in" and "take-out" movements.

When condensing the powder-like ceramic sealers (MTA-based or BioAggregate) that are mixed "ex tempore" before use, there should not be a tactile feeling of "tightening" of the instrument inside the canal during condensation. If such a feeling appears, the dentist must take the condensor totally out of the canal and must wet the tip of the instrument with water before inserting it inside the canal again. The total time for the sealer's condensation is approximately 10–15 seconds. Between 12 and 15 "push-in/take out" movements are needed to achieve a good filling of the canal's apical third and to ensure good adhesion of the sealer to canal's walls, too. Ten seconds after the start of condensation (approximately 10 "push-in" movements) the dentist must take the instrument out of canal. There should not be hardened aggregates on the instrument's surface, but only liquid white solution. Then one must look at the bottom of the "coronal reservoir." If there is a "black hole," this means more water must be added to the sealer inside the reservoir. The tip of plastic carrier is wetted with water and is put inside the reservoir. This is to be immediately followed by adding small portion of the mixed sealer into the reservoir. Do not add water when using bioceramic-based iRoot SP and iRoot BP sealers. Only the additional portion of sealer must be added when using iRoot SP or iRoot BP. These two sealers are supplied premixed and "ready to use" and do not need additional water.

STEP III: INSERTION OF MASTER CONE

At the moment of choosing the correct size conndensor, the dentist must also choose the same size gutta-percha master cone. Inserting of the guttapercha cone inside the canal will serve three functions simultaneously.

A. It will finish the condensation of the sealer inside the root canal and will make sealer layer along the canal's length even. It will eliminate any air still entrapped inside the canal, too.
B. It will create a pliable space inside the canal with which to accommodate the stress created by expansion of the ceramic sealers during their hardening.
C. By inserting the gutta-percha cones the possibility for re-entering the canal is maintained, and easier preparation of calibrated "bed," for cementing a fiberglass post inside, is ensured.

The master gutta-percha cone is inserted slowly with "push-in" and "take-out" motions down to 1 mm less than WL. Additional smaller diameter guttapercha cones may be added, if necessary. The ends of gutta-percha cones extending out of the root canal are cut and cones are condensed with round head metal instrument. During gutta-percha condensation excessive water and excessive sealer remnants are also pushed outside and are wiped out with small cotton pellet. A temporary filling is placed in the tooth cavity. After the ceramic sealer is hardened, preferably 24 hours after canals are filled, the final restoration is made.

II. Discussion

The use of bioceramic-based sealers with their features — osseoconductivity, hydrophylity, adhesiveness and chemical bonding to root canal dentinal walls — appears to be an effective approach to eliminate on long term, the microspace, otherwise remaining between the root canal walls and the materials filling the root canal. Such microspace is a potential place for possible microbial growth, because of microleakage observed with other kind of sealers.[2]Another term used by the authors for the obturation with bioceramic based sealers is biofilling. Biofilling also known as orthograde canal grafting technique or 4D sealing, is an endodontic root canal obturation technique with a Bioceramic material after root canal preparation and enlargement procedure. The use endodontic grafting anf capillary condensation technique can reduce considerably the number of cases of apical periodontitis treated with periapical surgery.iRoot SP is currently probably the best product to be used with "capillary condensation" technique for "endodontic grafting" of apical third and for hermetic sealing of complex root canals space.[2]

III. Conclusion

Owing to their near ideal properties, biocermic based sealers are the best possible sealers to be used for orthograde filling of the root canals.

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