TEMPORARY FILLING MATERIALS IN ENDODONTICS—A LITERATURE REVIEW

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ABSTRACT

INTRODUCTION: When root canal treatment is performed, teeth can suffer microbial contamination not only during the treatment, but also after it. In case a multi-visit endodontic approach is the method of choice, the access cavity should be sealed with temporary filling.

AIM: The aim of this research is to provide an overview of the temporary filling materials—requirements, properties, and choice.

MATERIALS AND METHODS: A series of related articles, publications, and results of different studies have been analyzed and summarized in order to provide an overview of the materials, the requirements towards them, the ideal properties that they need to possess, and to answer the question of how to choose the best temporary filling material for each clinical case.

RESULTS: The review of the articles shows that there is a great variety of temporary filling materials on the market. There are different factors that can influence the choice of material for temporary restoration. The biggest problem is how to avoid the microleakage between the visits.

CONCLUSION: The literature review suggests that bacteria-tight temporary seal should be provided between the visits, when root canal treatment is performed. The selection of proper temporary filling material is of great importance.

Keywords: *temporary filling materials, requirements, properties, microleakage, microorganisms*

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INTRODUCTION

The main etiological factor for pulp and periapical diseases are the bacteria, which are present in the tooth and especially within the root canal system (1). It is believed that the most usual routes of bacterial penetration into the tooth are via caries, cracks, exposed dentin, and broken restoration margins (2). The elimination of the microorganisms from the root canal system is among the main goals of end-

odontics. It is also important to avoid bacterial penetration during or after the root canal treatment.

A single-visit endodontic treatment is preferred when the teeth are vital and non-infected. In these cases, there is no need for dressing and temporary restoration. On the contrary, when the root canals are infected, multi-visit therapy should be preferred, because dressing with antibacterial medicaments is required. That's why good temporary filling is necessary.

In order to perform effective sealing of the endodontic cavity between the appointments, it is very important for the clinician to be aware of the different types of temporary filling materials and their properties, as well as the individual features of each case (complexity of access, degree of destruction of hard dental tissues), and the specific requirements for stay time and wear and pressure resistance (3).

AIM

The aim of this research is to provide an overview of the temporary filling materials—requirements, properties and choice.

MATERIALS AND METHODS

The article is a literature survey on temporary filling materials. A series of related articles, publications, and results of different studies have been analyzed and summarized in order to answer the following questions:

- Which requirements do the temporary filling materials need to meet?
- Which are the ideal properties of temporary filling materials?
- What kinds of materials are available on the market and how to select the best one for our clinical case?
- Why is microleakage such a big problem not only for permanent restorative materials, but also for temporary filling materials?

RESULTS

Requirements

Temporary filling materials stay for a short period in the oral cavity—for a couple of days usually, or for several weeks in rare cases. Nevertheless, they should meet all or at least the majority of the following requirements:

- They need to help the normal function of the tooth.
- They should preserve the tooth from migrating (4).
- They should prevent parts of the intracanal dressing from entering the oral cavity.
- They should be easily distinguished from the hard dental tissues, thus preventing unnecessary removal of sound dental tissues.
- They should be radiopaque.
- They need to meet the esthetic requirements in the anterior area.
- They need to be easily inserted and removed from the cavity preparations.
- They should have no taste or smell.
- They have to be biocompatible.
- Temporary restorations should not accumulate calculus and plaque.
- They should prevent periodontal tissues damages.
- They should not irritate the oral mucosa.
- They should not change the properties of the saliva.
- They should be compatible with the materials for definitive restoration.
- They should have antibacterial properties (5).
- They should seal the endodontic cavity in order to avoid infection and reinfection of the root canal system.
- They should help the healing processes in the dental pulp.
- They need to have good adhesion to the hard dental tissues without the need of extra retentions.
- They shouldn't allow microleakage.
- These materials should not be moisture sensitive.
- They should be chemically resistant against the intracanal dressing.
- Their mechanical strength should be good, even in cavities that are not so deep.
- They should prevent tooth fractures.
- They should have good abrasion resistance (6).
- Their price should be low.

The list is long and constantly changing along with the updating of the therapeutic approaches, methods, materials, and trends. Although it is better to work fast and apply single-visit procedures, the general health of the patient or the features of the localized infection may necessitate multi-visit treatments. Temporary filling materials are used then, and our choice depends on the classic and specific requirements that we follow, as well as their individual properties.

Properties of Temporary Filling Materials

The main property of temporary filling materials is that they seal the cavity of the tooth for a certain period of time. Additionally, they preserve the dental tissues and prevent reinfection, for which other properties help:

- Mechanical strength—temporary restorations must provide good marginal stability, minimum porosity, and resistance to abrasion and pressure (7).
- Marginal integrity—temporary filling materials seal the cavity between the visits of an endodontic treatment or before permanent restoration placement with the purpose to prevent microleakage (8).
- Antibacterial properties—despite the presence of intracanal antibacterial dressing it is proved that residual microflora can be found in the root canals. It is similar to the microflora in the oral cavity and contains the following species: *Streptococci, Staphylococci (Staphylococcus epidermis), other Gram-positive bacteria, Gram-negative bacteria, other microorganisms*. That's why it is important for the temporary filling material to possess not only good sealing properties, but also good antibacterial properties (9).
- Water adsorption and solubility—minimal adsorption and solubility are required. Usually the adsorption of water leads to changes in volume, swelling and softening of materials, which can compromise their microstructure and their sealing ability.

Different Types of Temporary Filling Materials

The various requirements and desired useful properties lead to the creation of many different temporary filling materials. A classification is presented in Table 1.

- Sulfate-based materials is a group whose main representatives are Cavit and Cavidentin. Cavit is a soft material which undergoes hygroscopic hardening in contact with water after the placement in the cavity. It shows minimal leakage (11). Cavidentin is a ready-to-use calcium sulphate-based temporary obturation material.

Table 1. Classification of temporary filling materials

Classifying Factor	Groups	
Period of stay		
	Temporary filling materials with a short stay (1–2 weeks)	
	Temporary filling materials with an average stay (they are placed for a few weeks)	
	Temporary filling materials with long stay (they are placed for a period of up to 6 months) (10)	
Composition		
	Sulfate-based materials	Conventional
		Enriched with plastic
	Eugenol-based materials	Conventional
		Reinforced
	Zinc phosphate cement	
	Zinc polycarboxylate cement	
	Polyacrylic acid-based materials	
	Gutta-percha-based materials	
	Glass ionomer cements (GIC)	
	Resin-based materials	

The enriched with plastic sulfate-based materials need mixing between fingers covered with gloves in order to plasticize. Removing these materials from the cavity often becomes difficult, which requires the use of a round steel bur.

- Eugenol-based materials are often used in dentistry. When zinc oxide-eugenol is placed in the cavity, small amounts of eugenol diffuse through the dentin into the pulp and exhibit anti-inflammatory and anesthetic effects on the pulp (12).

Eugenol-based temporary obturation materials are divided into two groups—conventional and reinforced. The composition of both includes zinc oxide and eugenol, as eugenol is the plasticizer. The reinforcing factor in the second group is polyester, added in small amounts.

- Zinc phosphate cement has been developed in 1902 and it is the oldest cement. It consists of powder and liquid (13).
- Zinc polycarboxylate cement contains polyacrylic acid, which has higher viscosity compared to the liquids of other products and this affects the mixing of the cement. Zinc polycarboxylate cement should be applied as soon as possible due to the risk of poor adhesion between the tooth and the cement over time.
- Polyacrylic acid-based materials—Ultratemp firm (Ultradent) can be mentioned as a representative of this group. It consists of two components. One of them contains mainly zinc oxide, X-ray contrast filler and plasticizer, and the other one—gel form of polyacrylic acid and water.
- Gutta-percha-based materials are plasticized on a flame and placed in the cavity. Overheating makes the material crumbly. Advantage of these materials is the easy placement and removal from the cavity. They are also characterized by good biological tolerance. On the other hand, the low resistance to chewing pressure and the requirement for dry cavity are among their disadvantages.
- Glass ionomer cements (GICs) are composed of powder and liquid. Powder contains calcium-aluminum-fluorine-silicon glass. Liquid is polyacrylic acid, which may consist of polymers and copolymers of polyacrylic, maleic and vinyl phosphate acid. According to various studies, their use as a material for temporary restoration between visits in endodontic treatment has given quite satisfactory results.

Factors Influencing the Choice of Material for Temporary Restoration

- Type of the final restoration—materials based on zinc oxide eugenol are used before final metallic restorations. Non-metallic definitive restorations require the use of non-eugenol materials for temporary fillings, as residual eugenol in dentinal tubules can inhibit the polymerization process and affect the adhesion of composite restorations.
- Tooth vitality—teeth that have undergone root canal treatment require more intensive protection to prevent fractures under the action of masticatory forces. It is believed that non-vital teeth are weakened due to tissue loss from the carious process and the following preparation of the endodontic cavity, and due to the dentin dehydration.
- Size of the cavity—the smaller is the cavity, the less is the need for zinc oxide-eugenol temporary filling materials. Larger cavities require the use of materials containing zinc oxide-eugenol, as well as those based on resins.
- Time of stay of the temporary obturation—for periods less than two weeks, the use of zinc oxide-eugenol or soft finished materials for temporary restoration is recommended. Period longer than two weeks requires materials of reinforced zinc oxide-eugenol, medium or solid finished materials for temporary filling, as well as those based on resins.

Microleakage Around Temporary Filling Materials

It is very important to ensure proper sealing of the endodontic access cavity during endodontic treatment in order to prevent marginal infiltration and penetration of oral fluids and microorganisms. Temporary filling materials receive less attention than definitive ones. However, they play a significant role in the disinfection and prevention of contamination and recontamination of root canals (14).

The microleakage is the most common reason for failure of endodontic treatment. The lack of adequate coronary sealing of the cavity allows the entry of oral fluids through the gap between the filling and the walls of the cavity preparation. Micropermeability can be cited as one of the biggest problems of operative dentistry (15).

DISCUSSION

After a thorough review of the literature, we confirm the need for temporary restorations between visits. We cannot unambiguously decide which one is the best material for temporary filling as each of the considered materials is suitable for specific situations. Clinicians must be well aware of the advantages and disadvantages of the materials and apply them adequately.

CONCLUSION

According to the available literature-based evidence, tight temporary seal is needed between the appointments during multi-visit endodontic treatment in order to prevent microleakage, which is one of the main reasons for endodontic failure.

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