

REVIEW ARTICLE

# TEMPORIZATION IN ENDODONTICS - AN IMPORTANT FACTOR IN CORONAL LEAKAGE AND SUCCESSFUL OUTCOME

**Authors:**  
Prasanth Dhanapal<sup>1</sup>,  
Sheena B Prasanth<sup>2</sup>

<sup>1</sup>Professor,  
Dept. of Conservative Dentistry and  
Endodontics, KMCT Dental College,  
Mukkam, Kozhikode, Kerala, India.

<sup>2</sup>Senior Dental Surgeon,  
Quality Dental Care,  
Kadavanthra, Cochin, Kerala, India

Address for correspondence:  
Dr. Prasanth Dhanapal T.,  
'Sahyadri',  
NJRA-233, North Janatha Road,  
Palarivattom, Cochin 682 025,  
Kerala, India.  
E mail: prasanthdhanapal@gmail.com.

**ABSTRACT:**

In multivisit endodontic therapy temporization of teeth being treated is mandatory so as to prevent leakage of oral fluids and other contaminants into the cleaned root canal system. Thus provided temporary restorations can be either for a short duration or intended for a longer period of time based on the time taken to complete the treatment. This review article outlines the different temporization material used in endodontics and the rationale behind their usage with a brief outline on different temporization protocols and their importance.

**KEY WORDS:** Temporary restoration, Endodontic Temporaries, Endodontic Provisionals, Zinc oxide eugenol, Glass ionomer, Coronal leakage

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## INTRODUCTION:

Bacterial cause is mainly implicated in pulpal disease<sup>[1]</sup>. Pulpal inflammation or infection can cause periradicular inflammation. The main objective of endodontic treatment is to remove all possible bacteria and their by products from the root canal system and achieve the maximum disinfection of the root canal system. Many mechanical and chemical means are employed to achieve this objective.

In case of single visit endodontic therapy root canal treatment is carried out in a single visit thereby the need for temporization can be eliminated<sup>[2]</sup>. On the contrary endodontic therapy of infected root canals is suggested to be carried out in multiple visits with placement of intracanal medications within the canal for a period of time. This mandates an effective temporization of the teeth being treated<sup>[3]</sup>. Non effective temporary restoration during endodontic therapy has been even suggested as one of the contributing factors for continuation of pain after commencement of endodontic therapy<sup>[4]</sup>.

## CORONAL LEAKAGE AND FAILURES

It is now a well accepted fact that leakage from the coronal aspect either during or after endodontic therapy can affect the outcome of endodontic treatment. Coronal leakage can bring about reinfection of satisfactorily endodontically treated teeth affecting its long term prognosis. Achieving fluid tight seal between visits in endodontic therapy has been advocated by many researchers since years<sup>[5]</sup>. Leakage of temporary restorations can lead to coronal leakage and in turn can negatively affect the outcome of treatment. Safavi et al<sup>[6]</sup> in an in vivo study observed greater endodontic treatment success in teeth restored with permanent restorations within 2 months of completion of root-canal therapy than teeth with temporary restorations.

## REQUIREMENTS FOR TEMPORARIES

Temporary restoration during multivisit endodontic therapy should provide an adequate seal against ingress of bacteria, fluids and organic materials from the oral cavity to the root-canal system, and at the same time prevent seepage of intracanal medications placed in the canals into the oral cavity. These materials are required to allow ease of placement and removal, provide acceptable aesthetics,

and protect tooth structure during treatment till a definitive restoration is placed.

## TEMPORIZATION OF ACCESS CAVITY IN TOOTH

Many a materials are available to be used as temporary during conventional endodontic therapy. Most of these materials are cements that are used to seal the access between appointments. Based on the duration it can be meant for short time, moderate or interim period or a long term restorations

## ZINC OXIDE EUGENOL CEMENT AND ITS MODIFICATIONS

Zinc oxide eugenol cement or many of its modifications have been used as a temporary restoration in endodontics for years and is one of the popular materials with clinicians.

**ZINC OXIDE EUGENOL CEMENT:** it is one of the oldest and popularly used cement for endodontic temporization. Grossman concluded that zinc oxide and eugenol (ZOE) cements provided the best seal when compared to gutta-percha and oxyphosphate cements<sup>[5]</sup>. Conventionally zinc oxide eugenol cement is mixed with a powder liquid ratio of 4:1. The mix made of this ratio has shown to have a poor initial seal on placement. The seal have shown to improve after 1 week of placement. On the other hand a mix made of powder to liquid ratio of 2:1 gives better initial seal ability of the access cavity. But have shown to deteriorated seal with time<sup>[7]</sup>. Considering the above facts a mix with less powder to liquid ratio can be used for very short term temporization (3-5 days) of the access cavity.

**KALZINOL:** Kalzinol is zinc oxide eugenol based cement. Reinforced with 2% by weight polystyrene polymer to double the compressive strength in comparison with conventional zinc oxide eugenol cement. Kalzinol cement provided better sealing properties when compared to Cavit-W. The use of less powder is reported to improve the sealing ability without compromising much on the physical properties of the cement<sup>[7, 8]</sup>. A softer mix has also shown to exhibit greater antibacterial activity due to hydrolysis and the subsequent increase in the release of eugenol. The release of the antimicrobial agent may contribute to prevention of bacterial colonization if leakage takes place<sup>[9]</sup>. It can be useful in cases

when intracanal medicaments are placed and the time gap for the next schedule is approximately 2-3 weeks.

**COLTOSOL:** Coltosol is temporary cement indicated for short term temporization not exceeding 2 weeks. It is made up of a mixture of zinc oxide, zinc sulphate and calcium sulphate hemihydrate. The surface of Coltosol hardens upon contact with moisture within 20 to 30 minutes and achieves moderate strength to withstand mastication by 2 to 3 hours. The ease of placement makes it desirable cement and indications are the same as those of conventional zinc oxide eugenol cement endodontic temporaries.

**CAVIT:** Cavit is a premixed temporary filling material containing zinc oxide, calcium sulphate, zinc sulphate, glycol acetate, polyvinyl acetate resins, polyvinyl chloride acetate, triethanolamine and pigments. Being a premixed material the clinician has the ease of manipulation. By virtue of water sorption Cavit exhibits a high coefficient of linear expansion, which is almost double as that of zinc oxide eugenol cement. The compressive strength of Cavit is approximately half that of zinc oxide eugenol cement. In order to compensate the poor strength qualities and to improve the marginal seal sufficient bulk of the material is to be provided as an endodontic temporary<sup>[10, 11]</sup>. A minimum thickness of 3.5 mm is needed to prevent dye leakage<sup>[11]</sup>. Cavit is indicated for endodontic temporization of access for short term and can be easily removed from the access after setting. When used for longer term surface deterioration can be a problem.

**GUTTAPERCHA:** Base plate gutta-percha and temporary stopping guttapercha were one of the oldest temporary materials used in endodontics. Temporary stopping guttapercha still finds its use as a temporary restorative material in many practices. It has been found to have less than ideal requirements of temporary cements in endodontics. Guttapercha based temporaries are prone to greater leakage when temperature changes happen within the oral cavity<sup>[12]</sup> and was found to be inferior to zinc oxide eugenol based cements with or without thermocycling<sup>[13]</sup>.

**POLYCARBOXYLATE CEMENT:** Zinc polycarboxylate cement is not recommended for endodontic temporization by many researchers as its clinical effectiveness is not much established by studies. The sealing ability was observed to be less in comparison to zinc oxide eugenol based cements, Cavit and IRM<sup>[14]</sup>. More over removal of the temporary from the access is difficult and troublesome.

**ZINC PHOSPHATE CEMENT:** Introduction of newer temporary materials with proven sealing ability has lead to the decline in the use of zinc phosphate cement as endodontic temporary cement. Zinc phosphate cement as access temporaries have shown to provide adequate seal against leakage in many studies<sup>[15]</sup>.

**GLASS IONOMER CEMENT:** Chemical adhesion to the tooth structure by glass ionomer cement contributes to the good sealing ability of the cement<sup>[16]</sup>. In one study using the fluid filtration method, glass-ionomer cement microleakage values did not differ significantly from the intact crown values after 8 weeks<sup>[17]</sup>.

Glass-ionomer cements also possess antibacterial properties against many bacterial strains<sup>[18-21]</sup>. This antibacterial activity of the material is attributed to the release of fluoride, low pH and/or the presence of certain cations, such as strontium and zinc in some cement. This property is of importance in an endodontic temporary and is recommended in cases when moderately long term temporization is required. In cases when it is considered for long term temporization it is recommended to condition the exposed tooth surface with the polyacrylic acid before the cement is placed and upon insertion protect the surface of the cement using a layer of unfilled resin or varnish to minimize surface deterioration and improve the long term seal ability<sup>[22, 23]</sup>. The cost of the cement, decreased setting time and the difficulty in differentiating glass ionomer from the surrounding tooth structure during removal by the clinician are considered the drawbacks of this cement. A new material, Fuji VII Command Set has been introduced into the market mainly to be used as a temporary or an interim restorative material. Upon visible light curing this material sets in 20 to 40 seconds and chemically hardens in 4 min. this variant

has a pink chroma which makes it easy to differentiate from the tooth margins. It also claims a higher fluoride release than other glass-ionomer cements.

#### CLINICAL METHODOLOGY FOR TEMPORIZATION OF ENDODONTIC ACCESS

Whenever an access cavity needs to be temporised the pulp chamber floor and walls should be dry. The use of a thin layer of cotton wool over canal orifices is a controversial. Usage of a cotton wool beneath the temporary cement allows for ease of removal of the temporary without running the risk of unnecessary removal of intact tooth structure or even worse, perforating the floor of the pulp chamber. Placement of cotton layer will also minimize the chance of accidental blockage of the canal by small fragments of the cement displaced into the canal.

Many drawbacks of use of a cotton layer have been reported in the literature. It may significantly reduce the thickness of the temporary cement which can lead to increase in leakage. It can also compromise the stability of the restoration by acting as a cushion allowing displacement during mastication. Cotton layer can also compromise the adaptation of the temporary cement during placement. Fibres of the cotton pellet may inadvertently adhere to the cavity walls and serve as a wick. It was also concluded that there could be an increased risk of leakage through exposed lateral canals<sup>[11,24,25]</sup>. The recommended procedure is either a small-sized pellet that covers the orifice but avoids the floor of the chamber, or a thin well-adapted cotton layer to cover the floor of the chamber may be used. A small sterile and well-adapted piece of polytetrafluoroethylene tape can also be used as a mechanical barrier under the temporary restoration<sup>[26]</sup>. The temporary material should be inserted in increments with good condensation into the access cavity to obtain adequate adaptation to cavity walls. The margins of the access temporary should be carefully finished and the occlusion adjusted. Removal of the temporary restoration during the procedure can be accomplished with rotary instruments or the use of ultrasonically energised tips to avoid possible complications<sup>[25]</sup>. On completion of endodontic treatment gutta-percha extending from the canal orifices should be cut back to the canal orifices level and an intermediary restoration (coronal barrier) placed to protect it.

#### COMPOSITE RESINS AS PROVISIONAL RESTORATIONS

TERM: It is a relatively new temporary restorative material introduced for endodontic purpose. It is a one component light-curable composite resin containing UDMA based polymers, radiopaque inorganic filler, prepolymerized organic filler and initiators. As with any light cured composite resin material this material also undergoes polymerization shrinkage. This shrinkage is in the range of 2.5% of its volume, which is followed by secondary water sorption associated expansion thus providing a satisfactory seal<sup>[27]</sup>.

#### TEMPORIZATION OF ACCESS THROUGH EXISTING RESTORATIONS

In many cases endodontic therapy may be required in a tooth which has an existing intracoronal restoration made of amalgam or metal. If the overall condition of the restoration is good and the margins of the existing restoration do not show any evidence of leakage or failure, access can be made through these restorations. Such prepared access cavities through the intracoronal restorations can be temporized with an appropriate temporary filling material. Most of the temporary cements suggested for primary endodontic purpose can also be used to seal the access through the intracoronal restoration. On the other hand if there is any suspicion in the quality of the seal provided by the existing restoration or by the temporary material the entire existing restoration should be removed, margins examined and replaced with a new temporary material during the course of endodontic treatment<sup>[28]</sup>.

#### TEMPORIZATION OF ACCESS THROUGH CROWNS

Teeth acting as abutment for fixed bridge or with existing crowns may present for either primary endodontic treatment or re-treatment. Endodontic treatment can be completed through an access prepared and obtained in a well-fitted good quality cast restoration<sup>[29]</sup>. When the crown is of an unacceptable quality or secondary caries is present around its margins or doubts arise about the remaining tooth structure under the restoration, the crown should be removed and a provisional replacement should be provided until a definitive final restoration is placed

.The access cavity through the core must be temporized between the appointments.

#### TEMPORIZATION OF BROKEN DOWN TEETH

Extensive loss of tooth structure in a badly broken down teeth requiring endodontic therapy would hamper proper placement of the rubber dam and hence the isolation of the teeth being treated. Use of temporary cements to rebuilt the lost structure, use of copper bands and orthodontic bands as an interim measure, placement of temporary crowns have been advocated. Many of these methods have shown not to provide an adequate seal of the root canal system during the course of treatment<sup>[30]</sup>. More over many of the methods are time consuming, and gaining an access through the cements can run the risk of introducing and blocking a canal with cement particles. It has also been reported that it is difficult, if not impossible, to obtain acceptable restoration contours, marginal adaptation and occlusion<sup>[31-33]</sup>. Interim restorations to restore the lost structure employing pin-retained amalgam or composite resin to aid isolation have been suggested<sup>[32, 34]</sup>. This interim measures may Influence future restorative options after endodontic therapy and also carries the risks associated with the procedures such as pin placement and their possible removal.

Glass ionomer cement can be satisfactorily used for provisional built up<sup>[35-37]</sup>. The advantages of using GIC for provisional built up of the tooth structure includes obtaining adequate seal with the tooth structure and achieving sufficient strength and retention to withstand the forces of the application of the rubber-dam clamp. Glass ionomer is also radiopaque and can be easily placed with the possibility to commence start of endodontic treatment at the same appointment<sup>[35-37]</sup>. Once the cement sets, endodontic access can be created through the cement, followed by instrumentation and obturation in the usual manner. Less desired esthetic result may limit the use of glass ionomer as a provisional built up in the anterior segment. Use of command-set resin-modified glass-ionomer cement and relieving the tooth being treated 'out of occlusion' would be better in the management for badly broken down posterior teeth.

Composite resins is the most popular material for provisional built up of badly broken down teeth

prior to and during endodontic therapy. This is attributed to the superior aesthetic results and micromechanical bonding to the prepared tooth structure<sup>[31]</sup>. Care should be taken and caution exercised if the contamination of the bonding surface can be an issue and isolation of the filed cannot be assured during placement and curing of the resin composite built up<sup>[38]</sup>.

#### LONG TERM TEMPORIZATION

Some clinical conditions such as treatment of an open apex with apexification procedure, attempt for revascularization or treatment of root resorption may require long-term temporization. A permanent-type restoration can be used in these instances. Glass-ionomer cement can be considered for this cases as its seal ability for longer periods is established clinically<sup>[17, 23, 39]</sup>. Another alternative in such cases is use of resin composites. If composites are to be used as a material it will be preferable to seal the canal orifices with some other temporary material before placement of composite. This allows relative ease of access during the course of treatment and to prevent accidental loss of composite material into the root canal.

#### TEMPORARY RESTORATION AND ITS INTERACTION WITH PERMANENT RESTORATIONS:

Temporary or provisional material used in endodontics should not affect the polymerization or adhesion of the future permanent restorative material. Eugenol residue has shown to have a deleterious effect on the physical properties of composite resin restorations such as microhardness surface roughness and colour stability. It is recommended to use bonding systems that rely on the total-etch technique. The use of 30 to 35 % phosphoric acid for 15 seconds for etching prior to bonding will result in demineralization of dentine to a depth of approximately 10 mm and this has found to remove any residual cement. In spite of this it is preferable to avoid the use of ZOE temporary restorations in cavities to be restored permanently with composites.

#### CONCLUSION:

The predictability and long term prognosis of an endodontically treated teeth depends on achieving almost complete disinfection of the root canal sys-

tem and achieving a three dimensional obturation of the root canal. Coronal seal is of great importance than earlier thought in maintaining the asepsis obtained and preventing percolation. A proper coronal seal can only be obtained and maintained if a good temporary restoration is employed during and immediately after endodontic therapy till a definitive restoration is in place. Every importance should be given to temporization during endodontic therapy to achieve long term success.

#### REFERENCES:

- 1) Kakehashi S, Stanley HR, Fitzgerald RJ: The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats: *OOO*: 1965:20:340-9.
- 2) Orstavik D: Intracanal medication. Pitt Ford TR, Editor. *Harty's Endodontics in Clinical Practice*, 4th Edn : 1997: Oxford, UK: Wright, Page: 113
- 3) Sjogren U, Figdor D, Persson S, Sundqvist G: Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis: *Int Endod Jour*: 1997: 30:297-306.
- 4) Abbott PV: Factors associated with continuing pain in endodontics: *Aus Dent Jour*: 1994:39: 157-61.
- 5) Grossman LI: A study of temporary fillings as hermetic sealing agents: *Jour Dent Res*: 1939: 18:67-71.
- 6) Safavi KE, Dowden WE, Langeland K: Influence of delayed coronal permanent restoration on endodontic prognosis: *Endod Dent Trauma*: 1987:3:187-91.
- 7) Pashley EL, Tao L: The sealing properties of temporary filling materials: *Jour Pros Dent*: 1988:60:292-96.
- 8) Anderson RW, Powell BJ, Pashley DH: Microleakage of IRM used to restore endodontic access preparations: *Endod Dent Trauma*: 1990:6:137-41.
- 9) Chandler NP, Heling I: Efficacy of three cavity liners in eliminating bacteria from infected dentinal tubules: *Quint Inter*: 1995:26:655-59.
- 10) Wideman FH, Eames WB, Serene TP: The physical and biologic properties of Cavit: *Jour Am Dent Assoc*: 1971:82:378-82.
- 11) Webber RT, delRio CE, Brady JM, : Sealing quality of a temporary filling material : *OOO* : 1978:46:123-30
- 12) Parris L, Kapsimalis P, Cobe H, Evans R: The effect of temperature change on the sealing properties of temporary filling materials. Part II: *OOO*: 1964:17:771-78.
- 13) Kakar RC, Subramanian V: Sealing qualities of various restorative materials: *Jour Prost Dent*: 1963:13:156-65.
- 14) Marosky JE, Patterson SS, Swartz M: Marginal leakage of temporary sealing materials used between endodontic appointments and assessed by calcium 45 - an in vitro study: *Jour Endod*: 1977:3:110-13.
- 15) Krakow AA, destoppelaar JD, GrUn P: In vivo study of temporary filling materials used in endodontics in anterior teeth: *OOO*: 1977: 43:615-20.
- 16) Watson TF: Bonding glass-ionomer cements to tooth structure. In: Davidson CL, Mjor IA, editors: *Advances in Glass-Ionomer cements*: 1999: Chicago, USA: Quintessence Books, pages 121-35.
- 17) Bobotis HG, Anderson RW, Pashley DH, Pantera EA: A microleakage study of temporary restorative materials used in endodontics: *Journ Endod*: 1989:15:569-72.
- 18) Tobias RS, Browne RM, Wilson CA : Antibacterial activity of dental restorative material: *Intern Endod Journ* : 1985:18:161-71
- 19) Chong BS, Owadally ID, Pitt FordTR, Wilson RF: Antibacterial activity of potential retrograde root filling materials: *Endod Dent Traum*: 1994:10:66-70.
- 20) Heling I, Chandler NP : The antimicrobial effect within dentinal tubules of four root canal sealers : *Journ Endod*: 1996:22:257-9

- 21) Herrera M, Castillo A, Baca P, Carrion P: Antibacterial activity of glass-ionomer restorative cements exposed to cavity-producing microorganisms: *Oper Dent*: 1999;24:286-91.
- 22) Lim KC: The microleakage of a glass ionomer cement using two methods of moisture protection: *Quint Intern*: 1987;18:835-9.
- 23) Lim KC: Microleakage of intermediate restorative materials: *Journ Endod*: 1990;16:116-8.
- 24) Orahod JP, Cochran MA, Swartz M, Newton CW: In vitro study of marginal leakage between temporary sealing materials and recently placed restorative materials: *Journ Endod*: 1986;12:523-7.
- 25) Bishop K, Briggs P: Endodontic failure - a problem from top to bottom: *BDJ*:1995: 179:35-6.
- 26) Stean H: PTFE tape: a versatile material in restorative dentistry: *Dent Update*: 1993;20: 146-8.
- 27) Deveaux E, Hildelbert P, Neut C, Boniface B, Romond C: Bacterial microleakage of Cavit, IRM, and TERM: *OOOE*: 1992;74:634-43.
- 28) Melton D, Cobb S, Krell KV: A comparison of two temporary restorations: light-cured resin versus a self-polymerizing temporary restoration: *OOOE*: 1990;70:221-5.
- 29) Beach CW, Calhoun JC, Bramwell D, Hutter JW, Miller GA : Clinical evaluation of bacterial leakage of endodontic temporary filling materials : *Journ Endod* : 1996;22:459-62.
- 30) Walton RE: Access preparation and length determination. In: Walton RE, Torabinejad M, editors: *Principles and Practice of Endodontics*, 3rd edn. Philadelphia, USA: 2002: W.B. Saunders Co: page: 189.
- 31) Abdullah Samani SI, Harris WT: Provisional restorations for anterior teeth requiring endodontic therapy: *Journ Endod*: 1979;11: 340-3.
- 32) Kahn H: Coronal build-up of the degraded tooth before endodontic therapy: *Journ Endod*: 1982;8:83-4.
- 33) Brady WF: Composite resin interim restorations for broken-down non vital posterior teeth: *JADA*: 1983;106:462-6.
- 34) Messing JJ: Restoration of the crown-less tooth as a prelude to endodontic treatment: *BDJ*: 1976;140:178-80.
- 35) Bass EV, Kafalias MC: Provisional coronal build-up of posterior teeth for endodontic treatment. Case report: *Aust Dent Journ*: 1987;32:417-20.
- 36) Morgan LA, Marshall JG: Solving endodontic isolation problems with interim buildups of reinforced glass ionomer cement: *Journ Endod*: 1990;16:450-3.
- 37) Rice TR, Jackson RC: Tooth build-up prior to endodontic treatment: *Quint Intern*: 1992: 23:341-4.
- 38) Derkson GD, Pashley DH, Derkson ME: Microleakage measurement of selected restorative materials: a new in vitro method: *Journ Prost Dent*: 1986;56:435-40.
- 39) Barthel CR, Strobach A, Briedigkeit H, Gobel UB, Roulet JF : Leakage in roots coronally sealed with different temporary fillings : *Journ Endod*: 1999;25:731-4.