



## Original Research Article

## Coronal leakage of a new temporary restorative material: An invitro study

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## ABSTRACT

**Background:** This invitro study aims to assess the potency of new temporary restorative material Orafil LC with other temporary restoratives: Zinc oxide eugenol and Cavit G in preventing microleakage during the inter-appointment period of endodontic treatment.

**Materials and Methods:** Endodontic access cavity was prepared on 60 premolar teeth and restored with 3 different temporary restorative materials in the respective groups. (n=20)The teeth were stored in methylene blue stain and were sectioned to be observed under a compound microscope at 1,2,3 and 7 days to access coronal microleakage and further investigations were under a scanning electron microscope.

**Results:** All the tested materials showed microleakage with maximum leakage in Zinc oxide eugenol followed by Cavit G and Orafil LC. Orafil LC showed the least microleakage.

**Conclusion:** Orafil LC showed least microleakage when compared with other temporary restorative materials used in this study

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## 1. Introduction

The goal of endodontic therapy is to remove infected and inflamed pulpal tissue and prevent further invasion of oral microbes in order to successfully treat infected teeth.

Root canal therapy can be performed on vital, uninfected teeth in a single visit, eliminating the need for restorative or temporary restorations. Many clinical cases with infected canals require dressing with antibacterial medicaments in a multi-visit treatment regimen and require effective interim care over varying periods of time.

Lack of a satisfactory provisional restorations during endodontic therapy is ranked second most important factor in persistent pain after the initiation of treatment.<sup>1</sup> various gram negative and gram positive bacteria have been reported in persistent infections which will lead to the

failure of endodontic treatment.<sup>2-5</sup>

Various measures followed to reduce or eliminate the bacteria load from the canals are rubber dam application, mechanical debridements, using various activation irrigation methods, intracanal dressing.<sup>6</sup>

An endodontic temporary restoration aims to prevent interappointment bacterial contamination to have clean and sterile environment for further appointments and successful endodontic treatment with a perfect endodontic seal.<sup>7</sup>

The properties of temporary restoratives should include easy to manipulate, not soluble in saliva, non-toxic, capable of withstanding masticatory stress, impermeable to fluids and bacteria, and should be easily removed from the access cavity.<sup>8</sup>

Zinc oxide eugenol is a traditional material that has been used as a temporary restorative for over 50 years. Literature indicates that it provides an airtight seal. However, there are numerous studies showing that long-term use of this

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material can cause coronary microleakage.<sup>9</sup>

Cavit-G is a premixed eugenol free temporary restorative material which is zinc oxide/zinc sulfate-based cement having high coefficient of linear expansion resulting from water sorption.

Several light cure temporary restorative materials such as Temp.it Blu, Fermit, Clip, Bioplic, and Orafil LC are currently commercially available. Orafil LC is a recently introduced material which is urethane dimethacrylate based light-cured temporary material that is easy to place and remove from the access cavities

In the course of root canal therapy, the sealing ability of temporary restorative material plays a prime role and with the introduction of light cure temporary restoratives like Orafil LC, their sealing abilities have not received much research attention and therefore, there is a need to investigate about the same.

Therefore this study analogize the microleakage of various temporary restorative materials like Zinc oxide eugenol , Cavit-G, And Orafil LC using methylene blue dye penetration method.

**2. Materials and Methods**

Sixty premolars were collected for this study. The materials used in the study included: Zinc oxide eugenol, Cavit G, and Orafil LC. Study groups were as follows:

- Group 1 - Teeth restored with Zinc oxide eugenol
- Group 2 - Teeth restored with Cavit G
- Group 3 - Teeth restored with Orafil LC

Endodontic access cavities of approximately 4 × 4 mm were prepared. After rinsing with distilled water for 20 s and air drying for 20s, a dry cotton pellet was placed on the floor of the pulp chamber. The depth of the prepared cavity was measured using a periodontal probe and then was filled with the temporary material.

Three groups of 20 teeth each were randomly assigned and the materials were handled according to the manufacturer’s instructions.

The materials were then laid out in sections and pressed against the wall to make sure of a complete seal.

The teeth were then placed in separate groups in saline for 2 hours to ensure the material rigidity. All the teeth surfaces (including root and crown) other than the occlusal surface were covered with two layers of nail polish to prevent dye penetration. All the teeth were then placed in methylene blue dye for 24 hours.

After the 1st, 2nd, 3<sup>rd</sup>, and 7th day, the specimens were taken out, sectioned, and observed under the compound microscope (Figure 1) and scanning electron microscope (Figure 2), and then dye penetration rate on the occlusal surface was measured and scored (Table 1) according to the following evaluation criteria.

- 0- No staining
- 1- Staining up to one-third of the cavity wall
- 2 -Staining from one-third to two-thirds of the wall
- 3 -Staining more than two-thirds of the wall
- 4 -Dye penetrating to cotton pellet in the pulp chamber

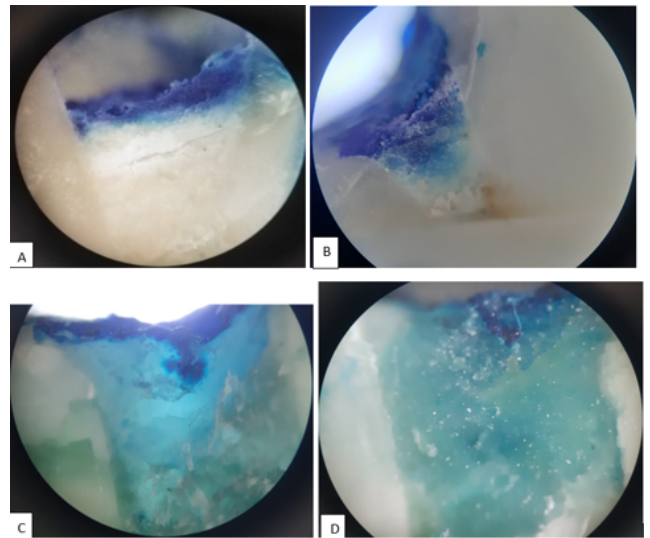


**3. Results**

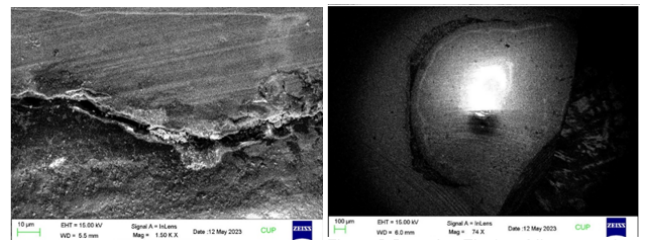
The data was evaluated using Mann Whitney U test. Significant statistical difference in dye leakage was found in Group 1 in comparison to Group 2 and Group 3. There was not much significant difference in microleakage on the 1st, 2<sup>nd</sup>, 3rd, and 7<sup>th</sup> day.(p>0.05). Orafil LC showed less penetration of dye(p<0.05).

**Table 1:** Day 1 microleakage scores of different groups

|                    | Total samples | Grade 0 | Grade 1 | Grade 2 | Grade 3 | Grade 4 |
|--------------------|---------------|---------|---------|---------|---------|---------|
| Zinc oxide eugenol | 20            |         |         |         | 4       | 16      |
| Cavit G            | 20            |         | 12      | 6       | 2       |         |
| Orafil LC          | 20            |         | 18      | 2       |         |         |



**Figure 1:** Compound microscope images; a: ZOE; b: Cavit G; c & d: Orafil LC



**Figure 2:** Scanning electron microscope images of microleakage

#### 4. Discussion

A hermetic seal of temporary restorative material plays a very crucial role in the favorable outcome of endodontic therapy. Temporary restoration can be stated precisely as a restoration placed within an endodontic cavity that has been cut through an interim restoration or tooth structure. These materials also halt the dislodgement of the medicament placed in the coronal and the radicular root canal system.<sup>10</sup>

Radioisotopes, bacterial penetration model, dye penetration and glucose penetration model, etc. are the various other methods that have been used to assess the microleakage of temporary restorative materials. Dye penetration is one of the most commonly used methods for the assessment of microleakage of the temporary restorative material as it is a simple and easy method to measure the microleakage. Various dyes can be used in dye penetration tests, e.g., black India ink, methylene blue, and eosin.<sup>10</sup>

Methylene blue dye has been used in this study owing to its high-water solubility, ability to move by simple diffusion, resistant to absorption by hydroxyl apatite crystals present in dentin, and the molecular size of methylene blue dye is smaller than the size of bacteria.<sup>11</sup>

To stimulate the oral conditions, the samples were placed in saline after cavity seal and to yield immediate hygroscopic expansion of the sealing material.<sup>8</sup>

Here, in comparison with counter groups, Zinc oxide eugenol temporary restorative material showed more microleakage as the material showed less homogeneity due to the mixing of the powder and liquid components. In addition to our study, other previous studies have also shown that ZnO has more microleakage than Cavit G. Discussing about, the premixed Cavit-G under various conditions this material provides better dentin wall adaptation as it expands with the absorption of water and hence it has high coefficient of linear expansion but on the contrary slow setting time and reduced strength is a major drawback of this material.<sup>7,12</sup>

On the other hand, Orafil LC is a recent light cure temporary material whose setting is initiated when exposed to a visible light source which can be cured to the depth of 4 mm with tight margins, is ready to use, easy to manipulate, and can be removed in a single entity without causing any damage to the tooth preparation. Since it does not contain eugenol, it does not adversely affect composite bond strength.<sup>7</sup>

In the present study, the temporary material was placed in 4mm thickness which was reported to be minimally sufficient to prevent microleakage.<sup>12–14</sup>

Another relevant factor which contribute in the microleakage is the occlusal loading on the teeth specially in the posterior teeth,<sup>12,15</sup> further in vivo studies should be conducted to assess the microleakage of Orafil LC with the conventional temporary materials used.

#### 5. Conclusion

Within the limitation of this study, it can be concluded that choosing an appropriate temporary restorative material gives an excellent coronal seal and thereby prevents microleakage and root canal contamination hence plays a key role in the success of endodontic therapy. Light cure temporary restorative material, Orafil LC have low microleakage and hence is superior to the conventional temporary restorative materials. Further studies have to be conducted to evaluate the microleakage after 7 days

#### 6. Source of Funding

None.

#### 7. Conflict of Interest

None.

#### References

- Sivakumar JS, Kumar BN, Shyamala PV. Role of provisional restorations in endodontic therapy. *J Pharm Bioallied Sci.* 2013;5(Suppl 1):120–4.
- Paulo S, Abrantes AM, Xavier M, Brito AF, Teixo R, Coelho AS, et al. Microleakage Evaluation of Temporary Restorations Used in Endodontic Treatment-An Ex Vivo Study. *J Funct Biomater.* 2009;14(5):264–4.
- Shanmugam S, Pradeepkumar AR, Abbott PV, Periasamy R, Velayutham G, Krishnamoorthy S, et al. Coronal Bacterial Penetration after 7 Days in Class II Endodontic Access Cavities Restored with Two Temporary Restorations: A Randomised Clinical Trial. *Aust Endod J.* 2020;46(3):358–64.
- Siqueira JF, Rôças IN. Present Status and Future Directions: Microbiology of Endodontic Infections. *Int Endod J.* 2022;55(Suppl 3):512–30.
- Alghamdi F, Shakir M. The Influence of Enterococcus Faecalis as a Dental Root Canal Pathogen on Endodontic Treatment: A Systematic Review. *Cureus.* 2020;12(3):e7257. doi:10.7759/cureus.7257.
- Wuersching SN, Moser L, Obermeier KT, Kollmuss M. Microleakage of Restorative Materials Used for Temporization of Endodontic Access Cavities. *J Clin Med.* 2023;12(14):4762. doi:10.3390/jcm12144762.
- Chadgal S, Farooq R, Purra AR, Ahangar FA, Thapa T. Coronal sealing ability of three temporary restorative materials used in endodontics: an in vitro dye penetration study. *Int J Res Rev.* 2019;6(2):12–5.
- Lee YC, Yang SF, Hwang YF, Chueh LH, Chung KH. Microleakage of endodontic temporary restorative materials. *J Endod.* 1993;19(10):516–20.
- Atul UR, Prasad BK, Poornima P. Assessment of Coronal Microleakage of Different Temporary Restorative Materials Used for Endodontic Access Cavity Restoration. *J Grid.* 2022;14(1):20–3.
- Shah H, Shah K, Shah M, Patel K, Shah P, Panchal N, et al. Impact of coronal sealing ability of three temporary restorative materials to prevent microleakage: A comparative study. *World J Dent.* 2021;12(3):219–22.
- Nair S, Patil A, Jain AK, Mali S, Rao RD, Jaiswal H, et al. Comparative evaluation of coronal sealing ability of light cure temporary restorative materials with conventional temporary restorative material using stereomicroscope: An in vitro study. *Int J Health Sci.* 2022;6(S2):7192–9.
- Çiftçi A, Vardarlı DA, Sönmez IŞ. Coronal microleakage of four endodontic temporary restorative materials: an in vitro study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009;108(4):67–70.

13. Webber RT, del Rio C, Brady JM, Segall RO. Sealing quality of a temporary filling material. *Oral Surg Oral Med Oral Pathol.* 1978;46(1):123–30.
14. Zmener O, Banegas G, Pameijer CH. Coronal microleakage of three temporary restorative materials: an in vitro study. *J Endod.* 2004;30(8):582–4.
15. Qvist V. The effect of mastication on marginal adaptation of composite restorations in vivo. *J Dent Res.* 1983;62(8):904–6.


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