

# Impact of Coronal Sealing Ability of Three Temporary Restorative Materials to Prevent Microleakage: A Comparative Study

Himani Shah<sup>1</sup>, Khoobi Shah<sup>2</sup>, Mauli Shah<sup>3</sup>, Karishnee Patel<sup>4</sup>, Parin Shah<sup>5</sup>, Nilakshi Panchal<sup>6</sup>, Disha Patel<sup>7</sup>

## ABSTRACT

**Aim and objective:** This study aimed to evaluate the impact of coronal sealing ability of three temporary restorative materials called Orafil LC, Cavit-G, and Coltosol to prevent microleakage.

**Materials and methods:** Endodontic access cavities were prepared in 60 caries-free human extracted premolars. All 60 extracted teeth were divided into 3 experimental groups randomly and filled with Orafil LC, Cavit-G, and Coltosol into 4 mm deep cavities. The thermocycling process was performed and then all 60 teeth were immersed in 10% India ink at 37°C for 1 week. Teeth were sectioned buccolingually and a stereomicroscope was used to measure dye penetration. Data were analyzed using Fisher's exact test.

**Results:** There were significant differences present between Orafil LC, Cavit-G, and Orafil LC–Coltosol groups. The highest and lowest leakage scores were present in Coltosol and Orafil LC experimental groups, respectively.

**Conclusion:** Orafil LC showed better sealing ability compared to Cavit-G and Coltosol. The selection of temporary restorative material is very important for long-term endodontic treatment success.

**Clinical significance:** The importance of temporary restorative materials should not be ignored by a dental practitioner. Orafil LC showed better sealing ability compared to other materials.

**Keywords:** Coronal sealing ability, Microleakage, Temporary restorative materials.

*World Journal of Dentistry* (2021): 10.5005/jp-journals-10015-1822

## INTRODUCTION

The main purpose of endodontic treatment is to eliminate infected and inflamed pulpal tissues and to prevent further entry of oral microorganisms. For the successful endodontic treatment, sealing ability of temporary restorative material is a key parameter.<sup>1</sup>

Temporary restorative materials are used as a temporary filling material and it replaces the lost tooth structure temporarily until the permanent restoration is carried out.<sup>2</sup> To prevent access to the cavity, ideal temporary restorative materials should have an adequate sealing capacity for successful endodontic treatment. Therefore, the contamination of the whole root canal system can be prevented from the oral cavity; and the dislodgement of therapeutic agents inserted in the pulp chamber can also be prevented.<sup>3</sup>

Temporary restorative materials are used to insulate the pulpal tissues and it also maintains the healthy periodontal relationship.<sup>2</sup> Due to the lack of adhesion of restorative materials, a small space is always present between the restoration and cavity walls which results in the passage of saliva and salivary fluids. Microleakage occurs due to the gap formation and this formation allows the undetectable passage of bacteria, fluids, molecules, or ions.<sup>4</sup>

A good coronal restorative material is considered effective when it has certain properties such as good sealing at the cement tooth junction (against marginal infiltration), good sealing of the cement itself (against porosity), good sealing at tooth margins, good resistance to abrasion and compression, easy to insert and remove, should have good compatibility with intracanal medicament, and it should provide good esthetic.<sup>5</sup>

There are various types of temporary restorative materials present with different setting times, compositions, and

<sup>1</sup>Department of Pediatric and Preventive Dentistry, College of Dental Sciences and Research Centre, Ahmedabad, Gujarat, India

<sup>2</sup>Department of Periodontology and Implantology, College of Dental Sciences and Research Centre, Ahmedabad, Gujarat, India

<sup>3</sup>Department of Orthodontics and Dentofacial Orthopedics, Ahmedabad Dental College and Hospital, Ahmedabad, Gujarat, India

<sup>4</sup>Ahmedabad Dental College and Hospital, Ahmedabad, Gujarat, India

<sup>5</sup>Government Dental College and Hospital, Gujarat, India

<sup>6</sup>Dharamsinh Desai University, Nadiad, Gujarat, India

<sup>7</sup>Department of Pediatric and Preventive Dentistry, Ahmedabad Dental College and Hospital, Ahmedabad, Gujarat, India

**Corresponding Author:** Himani Shah, Department of Pediatric and Preventive Dentistry, College of Dental Sciences and Research Centre, Ahmedabad, Gujarat, India, Phone: +91 9687386840, e-mail: gandhihimani89@gmail.com

**How to cite this article:** Shah H, Shah K, Shah M, *et al.* Impact of Coronal Sealing Ability of Three Temporary Restorative Materials to Prevent Microleakage: A Comparative Study. *World J Dent* 2021;12(3): 219–222.

**Source of support:** Nil

**Conflict of interest:** None

microstructures. Coltosol is a non-eugenol temporary filling material that is zinc oxide-based single-component cement. The hardening property of Coltosol is due to water absorption which is correlated with 20% of hygroscopic expansion.<sup>6</sup> Cavit-G is a premixed eugenol free temporary restorative material which is zinc oxide/zinc sulfate-based cement and it has a high coefficient

of linear expansion which results from water sorption. Orafil LC is a recently introduced material which is urethane dimethacrylate-based light-cured temporary material which is easy to place and remove from the access cavities.<sup>3</sup> Different temporary materials have been used as provisional restoration in dentistry, but studies of their sealing ability have shown contradictory results.<sup>4</sup>

The aim of this *in vitro* study was to compare the sealing ability of three different temporary restorative materials namely Coltosol, Cavit-G, and Orafil LC by dye penetration method.

## MATERIALS AND METHODS

This *in vitro* study was conducted in private clinic of Ahmedabad, India. A total of 60 caries-free intact human premolars extracted due to orthodontic or periodontal purpose were selected for this study and then the teeth were immersed in 10% formalin after extraction. After 5 days, the surfaces were cleaned using a scaler and afterward teeth were washed and stored in saline until the study was performed.

Standardized coronal access cavities of 4 × 4 mm were prepared by the same operator. High speed diamond shaped fissure bur was used to prepare the cavity and the contents of the pulp chamber were removed with the help of excavator. A cotton pellet was placed in the coronal portion of pulp cavity. Minimum 4 mm coronal space was left to accommodate the temporary restorative material. For measurement of the depth of the opening, a periodontal probe was used. The teeth were randomly divided into three experimental groups of 20 premolar teeth each. Three temporary restorative material groups were taken in this study:

- Orafil LC (Prevest DenPro Limited, Jammu, India) was placed into the cavities, condensed, and for 40 seconds it was light-cured. Scalpel was used for the removal of extra material.
- Cavit-G (3M ESPE, Minnesota, USA) was placed and condensed using a wet cotton pellet.
- Coltosol (Coltene, Altstätten, Switzerland) was placed according to the manufacturer's instructions.

To ensure complete setting of the temporary restorative filling materials, samples were stored at 37°C for a day. The thermal cycling process was performed for 500 cycles at 5°C and 55°C with a dwell time of 30 seconds in each bath. After that, samples were air-dried and covered with two layers of nail varnish after that they were allowed to dry for 30 minutes after each application. For the prevention of dye, leakage apex was sealed with sticky wax. All the samples were placed in 10% India Ink at 37°C and 100% humidity for 7 days in an incubator. Afterward, samples were removed from India ink solution, washed under tap water, and dried by exposure to the air. Wax layer and nail varnish were removed with scalpel. Using a diamond disc, tooth were sectioned buccolingually. The specimens were viewed to evaluate the degree of leakage and then analyzed under a stereomicroscope with 10× magnification.

Measurements were carried out based on a 5-point scale to evaluate the dye penetration.

As per Radhika et al. method scoring was performed.<sup>7</sup>

0 = No dye penetration.

1 = Dye penetration limited to the outer half of the axial wall.

2 = Dye penetration limited to the inner half of the axial wall.

3 = Dye penetration reach the pulpal wall.

4 = Dye penetration beyond the pulpal wall.

Data analysis was done using Fisher's exact test  $p < 0.05$ .

## RESULTS

Table 1 depicts dye penetration score obtained in three different restorative materials based on the 5-point scale method.

Table 2 and Figure 1 depict mean values of three materials, i.e., Orafil LC with 0.8 mm, Cavit-G with 2.05 mm, and Coltosol with 2.35 mm, respectively. Orafil LC showed the lowest mean value of 0.8 mm and Coltosol showed highest mean value of 2.35 mm.

Table 3 depicts that a statistically significant difference was present between Orafil LC and Cavit-G ( $p = 0.046$ ) and between Coltosol and Orafil LC ( $p = 0.008$ ). The  $p$  value  $< 0.05$  indicates that the difference between the groups were statistically significant. However, there was no significant difference present between Cavit-G and Coltosol ( $p = 0.937$ ).

Results showed that Orafil LC had better sealing ability followed by Cavit-G and Coltosol.

## DISCUSSION

Tight sealing of temporary restorative material is very important for the success of endodontic therapy.<sup>1</sup> Temporary restoration can be defined as a restoration placed within an endodontic cavity that has been cut through an interim restoration or tooth structure. These materials also prevent the dislodgement of the medicament placed in the coronal pulp chamber and the radicular root canal system.<sup>7</sup>

Different methods have been used to evaluate the microleakage of the temporary restorative materials, which includes radioisotopes, bacterial penetration model, dye penetration and glucose penetration model, etc. Out of all dye, penetration is one of the most commonly used methods for the assessment of microleakage of the temporary restorative material. In dye penetration, various dyes can be used, e.g., black India ink, methylene blue, and eosin.<sup>8</sup> It is a simple and easy method to measure the microleakage. In this study, India ink black dye was used because by simple diffusion small particles of ink can be easily penetrated.<sup>9</sup>

A thermocycling procedure was performed to simulate intraoral conditions. The temperature range used in thermocycling was 5°C and 50°C.

In the present study, Cavit-G and Coltosol were compared with newly introduced temporary restorative material called Orafil LC. All these experimental groups demonstrated some amount of leakage within the material.

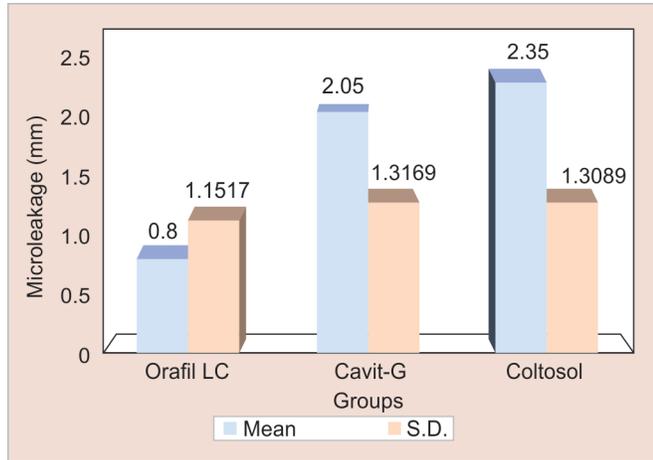
Coltosol and Cavit-G showed significantly higher marginal leakage compared to Orafil LC because of their poor sealing ability. Disadvantage of Cavit-G is its slow setting time whereas in Orafil LC setting process is initiated by exposure to a visible light source. Orafil LC is a durable light curing restorative material which can be cured up to 4 mm. Advantages of Orafil LC are many such as it is ready to

**Table 1:** Dye penetration score and measurements of sealing effectiveness of three restorative materials

Group/dye score	0	1	2	3	4	Total
Orafil LC	11	5	2	1	1	20
Cavit-G	3	4	5	5	3	20
Coltosol	2	3	6	4	5	20

**Table 2:** Mean and SD values of three materials

Group	N	Mean	SD values
Orafil LC	20	0.8	1.1517
Cavit-G	20	2.05	1.3169
Coltosol	20	2.35	1.3089

**Fig. 1:** Mean and SD values of three materials**Table 3:** Statistic data of dye coronal microleakage of the three different experimental materials

	<i>p value</i>
Orafil LC–Cavit-G	0.0465
Cavit-G–Coltosol	0.9379
Coltosol Orafil LC	0.00836

use, it provides tight margins, easy to place, and can be removed easily in one shot without any damage to the tooth preparations. One of the major advantages of Orafil LC is that it is eugenol free and it has no negative impact on composite bond strength.<sup>3</sup>

After Orafil LC, Cavit-G was the second-best material observed in this study. Cavit-G is a premixed temporary restorative material which is having high linear expansion during setting.<sup>4</sup>

Coltosol is non-eugenol, zinc oxide-based self-setting hydroscopic cement which expands when in contact with moisture and hardens by water sorption. This provides good adaptation between the cavity walls and temporary restorative material.<sup>10,11</sup> Some authors claimed that expansion of hydroscopic restorative materials leads to poor adaptation.<sup>10,12</sup> In this study, the sealing ability of Coltosol was poor when compared to Cavit-G and Orafil LC.

Shahi et al. compared the sealing capacity of Coltosol with three of the materials called Zonalin, Zamherir, and IRM he concluded that Coltosol and IRM had the greatest microleakage than the Zonalin and Zamherir.<sup>9</sup> The findings of this study support the result of the current study.

Another study conducted by Kuzekanani and Lotfi was similar to the present study which showed Coltosol had higher microleakage than Cavit.<sup>13</sup>

Udayakumar et al. concluded that good sealing properties were seen in Coltosol-F and Cavit groups. This result does not support the result of the present study.<sup>14</sup>

Kazemi et al. showed that Cavit is better temporary restorative material when compared with IRM and Tempit.<sup>15</sup>

Chadgal et al. evaluated the coronal sealing ability of three temporary restorative materials Cavit-G, Orafil LC, and IRM. From his study, he concluded that Orafil LC showed significantly lowered dye leakage. The result of his study supports the result of the present study.<sup>1</sup>

A study conducted by Prabhakar et al. compared sealing properties of Cavit G, IRM, and GC cavitation and concluded that dye penetration was highest in Cavit G.<sup>16</sup>

Jensen et al. concluded that few important variables that might impact on the treatment outcome are: water absorption, expansion, and setting reactions of the materials, whether the materials are hand mixed, premixed, or supplied in capsules, and possible interaction between the different materials used.<sup>17</sup>

## LIMITATIONS OF THIS STUDY

Coronal sealing ability of temporary restorative materials may be attributed to the changes found in the oral cavity such as temperature, diet, and salivary flow changes.

## CONCLUSION

The finding of this *in vitro* study suggest that Orafil LC have low microleakage when compared with Cavit-G and Coltosol. Coronal sealing ability of material is an important key factor for successful endodontic treatment. Hence, the importance of temporary restorative materials should not be neglected and undervalued.

## ACKNOWLEDGMENTS

I would like to thank all the authors mentioned above for their help and advice throughout this research study.

## REFERENCES

1. Chadgal S, Farooq R, Purra AR, et al. Coronal sealing ability of three temporary restorative materials used in endodontics: an *in vitro* dye penetration study. *Int J Res Rev* 2019;6(2):12–15.
2. Devika Warriar E, Jayalakshmi. A review on temporary restorative materials. *Int J Pharma Sci Res* 2016;7(7):315–319.
3. Dos Santos GL, Beltrame AD, Triches TC, et al. Analysis of microleakage of temporary restorative materials in primary teeth. *J Indian Soc Pedod Prev Dent* 2014;32(2):130–134. DOI: 10.4103/0970-4388.130963.
4. Markose A, Krishnan R, Ramesh M, et al. A comparison of the sealing ability of various temporary restorative materials to seal the access cavity: an *in vitro* study. *J Pharm Bioall Sci* 2016;8:42–44.
5. Deveaux E, Hildebert P, Neut C, et al. Bacterial microleakage of Cavit, IRM, and TERM. *Oral Surg Oral Med Oral Pathol* 1992;74(5):634–643. DOI: 10.1016/0030-4220(92)90358-W.
6. Milani S, Seraj B, Heidari A, et al. Coronal sealing capacity of temporary restorative materials in pediatric dentistry: a comparative study. *Int J Clin Pediatr Dent* 2017;10(2):115–118. DOI: 10.5005/jp-journals-10005-1419.
7. Radhika M, Sajjan GS, Kumarswamy BN, et al. Effect of different placement techniques on marginal microleakage of deep class II cavities restored with two composite resin formulations. *J Conserv Dent* 2010;13(1):9–15. DOI: 10.4103/0972-0707.62633.
8. Patel MC, Jethva DA, Patel C, et al. Sealing ability of three different interim restorative materials - a comparative study. *J Adv Med Dent Scie Res* 2020;8(9):158–163.
9. Shahi S, Samiei M, Rahimi S, et al. *In vitro* comparison of dye penetration through four temporary restorative materials. *Iran Endod J* 2010;5(2):59–63.

10. Webber RT, del Rio CE, Brady JM, et al. Sealing quality of a temporary filling material. *Oral Surg Oral Med Oral Pathol* 1978;46(1):123–130. DOI: 10.1016/0030-4220(78)90446-2.
11. Cruz EV, Shigetani Y, Ishikawa K, et al. A laboratory study of coronal microleakage using four temporary restorative materials. *Int Endod J* 2002;35(4):315–320. DOI: 10.1046/j.1365-2591.2002.00446.x.
12. Uranga A, Blum JY, Esber S, et al. A comparative study of four coronal obturation materials in endodontic treatment. *J Endod* 1999;25(3):178–180. DOI: 10.1016/S0099-2399(99)80137-X.
13. Kuzekanani M, Lotfi P. The comparison of coronal microleakage of a New Iranian temporary restoration cavizol with foreign samples. *Dent News (Lond)* 2006;8(1):26–28.
14. Udayakumar P, Kaushik M, Prashar N, et al. Coronal leakage of provisional restorative materials used in endodontics with and without intracanal medication after exposure to human saliva. *Saudi Endod J* 2016;6(2):77–81. DOI: 10.4103/1658-5984.180620.
15. Kazemi RB, Safavi KE, Spångberg LS. Assessment of marginal stability and permeability of an interim restorative endodontic material. *Oral Surg Oral Med Oral Pathol* 1994;78(6):788–796. DOI: 10.1016/0030-4220(94)90097-3.
16. Prabhakar AR, Rani NS, Niak SV. Comparative evaluation of sealing ability, water sorption, and solubility of three temporary restorative materials: an in vitro study. *Int J Clin Pediatr Dent* 2017;10(2):136–141. DOI: 10.5005/jp-journals-10005-1423.
17. Jensen AL, Abbott PV, Castro Salgado J. Interim and temporary restoration of teeth during endodontic treatment. *Aust Dent J* 2007;52(1):83–99.