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Original Research Article

A Stereo Microscopic Assessment of Sealing Ability of Orafil LC, Cavit G and IRM In Endodontically Treated Teeth - An In Vitro Study

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Abstract

The primary function of a temporary filling material is to prevent the contamination of the root canal system by fluids, organic debris, and bacteria from the oral cavity in multiple-appointment root canal treatment. The aim of this study was to evaluate the sealing ability of a new temporary filling material Orafil LC compared with Cavit G and IRM using a dye penetration test. Standard endodontic access cavities were prepared in 24 human premolars. The teeth were divided into three groups (n = 8 for each group). Samples are de-coronated at the level of CEJ, 4mm of obturated material was removed from the coronal portion and were sealed with one of the three temporary restorative material. Samples were immersed in 2% methylene blue dye solution for 3 days. The teeth were then rinsed, dried, sectioned in bucco-lingual direction and evaluated under a stereomicroscope for dye penetration. Data were analysed. The dye penetration was observed in all experimental groups. The lowest mean leakage was in Cavit G followed by (in ascending order of dye penetration) IRM, Orafil LC. Dye penetration was observed in all the samples. Cavit G exhibited minimal dye penetration when compared to IRM and Orafil LC. Within the limitation of the present study Cavit G is considered to be a promising option for the provisional restoration of endodontically treated teeth.

Keywords: Temporary restorative material, Coronal seal, Micro leakage, Sealing ability, Endodontics, stereo microscope, Orafil LC, CavitG, IRM.

INTRODUCTION

The classic studies by Kakehashi *et al.*, [1], Moller [2], Sundqvist [3] and others [4-8] have clearly established that most pulp and periapical diseases are a result of the presence of bacteria within the tooth, and particularly within the root canal system. The main aim of root canal treatment would be eliminating all bacteria from the tooth, and to maintain the tooth in this disinfected state by preventing any further ingress of bacteria during and after treatment.

An appropriate temporary filling material is one of the key factors predicting the success or failure of root canal treatment. These materials seal the tooth temporarily, preventing percolation of fluids, microorganisms and other organic materials from the oral cavity. Reaching periapical tissues, these factors can induce or propagate peri-radicular diseases [9-12].

A microscopic space always exists between the restoration and the prepared cavity due to lack of adhesion of restorative materials which results in passage of saliva and salivary products between the cavity wall and restorative material applied to it [13]. This clinically undetectable passage of bacteria, fluids, molecules, or ions has been defined as marginal leakage or microleakage. Recent studies have shown that coronal microleakage is a significant factor in the prognosis of root canal treatment [14, 15].

A number of temporary materials have been advocated for use in provisional restoration, but studies of their sealing ability have often shown contradictory results [16, 17]. The aim of this study was to compare the sealing ability of Orafil LC, Cavit G and IRM. The null hypothesis tested was that there was no significant difference in the sealing ability among the different tested materials.

MATERIALS AND METHODS

A total of twenty four extracted noncarious unrestored human mandibular teeth with intact crowns and roots were selected for the study. The teeth were cleaned of soft tissue and debris using ultrasonic scaler and stored in 10% formalin until the beginning of the study.

Standard endodontic access cavities, with approximately 3.5× 2.5 mm (bucco-lingual × mesio-distal) were performed using a round diamond and EndoZ burs under water cooling. All access cavities were performed by the same operator.

Gates Glidden drills were used to enlarge the orifice. Working length was established using 15-K file into each root canal until it was visible at the apical foramen and subtracting 1 mm from this point. The roots were instrumented with step-back technique and hand-files. 3% Sodium hypochlorite and saline were used for irrigation alternatively. Final irrigation was done using 17% EDTA. The specimens were obturated with Gutta-percha using zinc oxide-eugenol (ZnOE) as sealer and by lateral condensation.

The samples were de-coronated at the level of CEJ to ensure the reference point to be flat. Gutta-percha was removed from the coronal part of the sample using a heat carrier instrument up to 4 mm. The teeth were then randomly selected and divided into three experimental groups of eight samples each and restored accordingly. All materials (Figure-1) were handled by the same operator according to the manufacturer's instruction.

- Group I : Orafil LC
- Group II : Cavit G
- Group III : IRM

Fig-1: Temporary restorative materials used in the study

Evaluation of Linear Dye Penetration

The samples were coated with four layers of nail varnish except on the coronal surface area, in different colours according to each group (Figure-2) and dried, samples were then immersed in 2% methylene blue dye solution for 3 days.

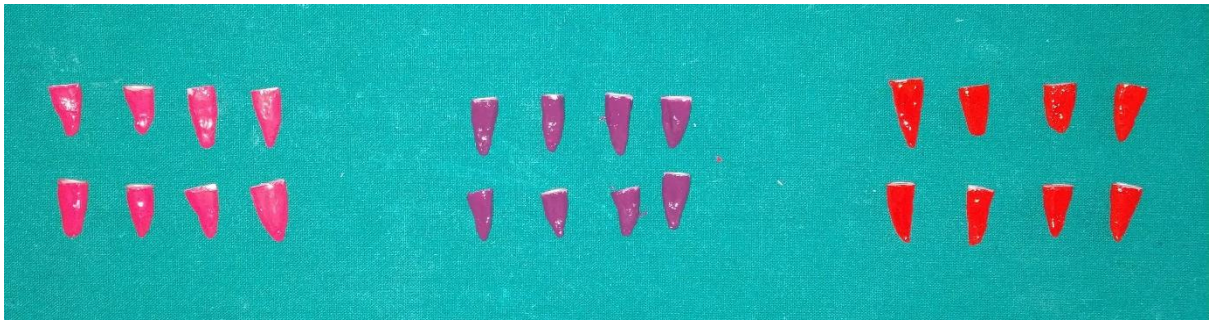


Fig-2: samples after application of nail varnish

After that, the samples were washed in running water for 1 h and dried for 12 h at room temperature. The specimens were sectioned in the bucco-lingual direction. All sealing materials and Gutta-percha were gently removed from the walls of the canal (Figure-3).

The distance from the canal orifice to the maximum depth of dye penetration was recorded and calculated in millimetres using graduated eye piece under a stereomicroscope at ×4 magnification (Figure-4). The greatest depth of dye penetration for each tooth was observed and recorded.

The data were then subjected to statistical analysis and the difference in the sealing ability of the different materials were compared.

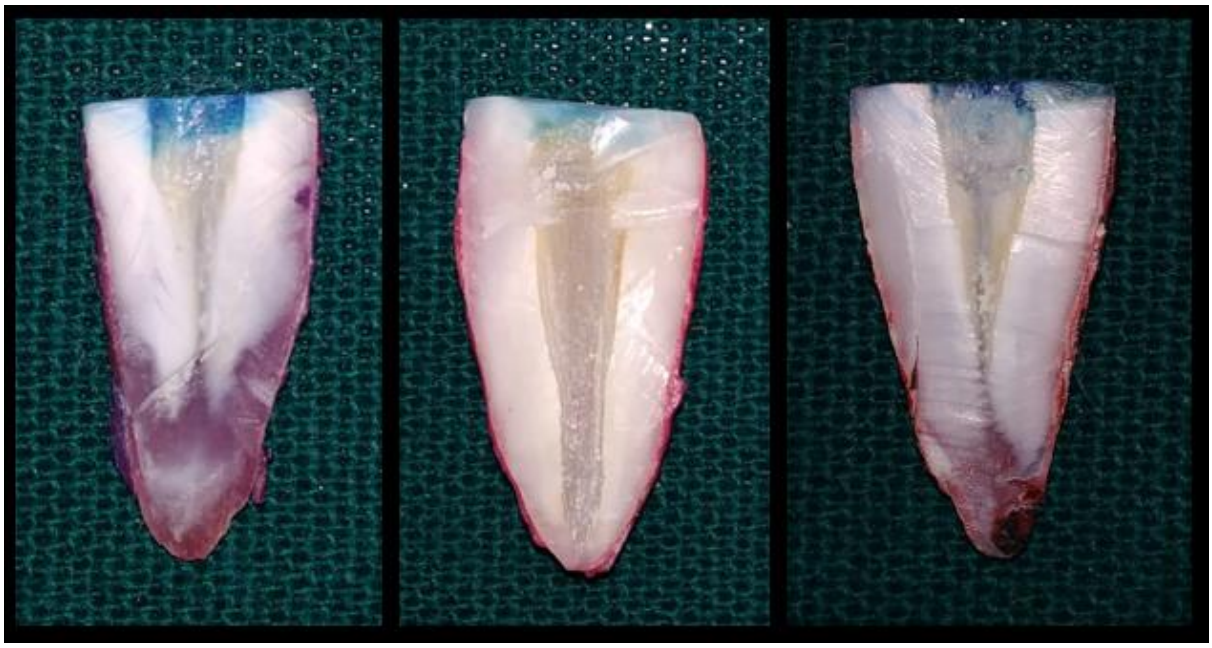


Fig-3: Dye penetration in Group 1-3

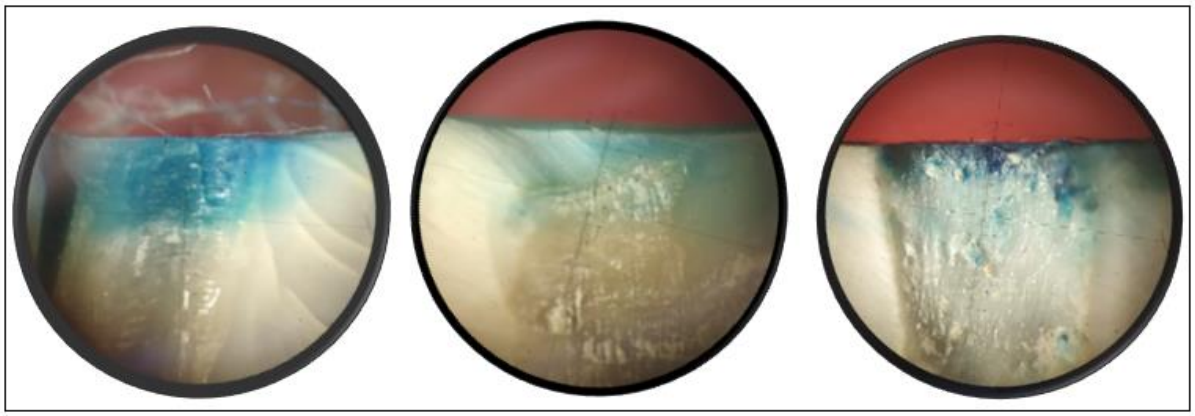
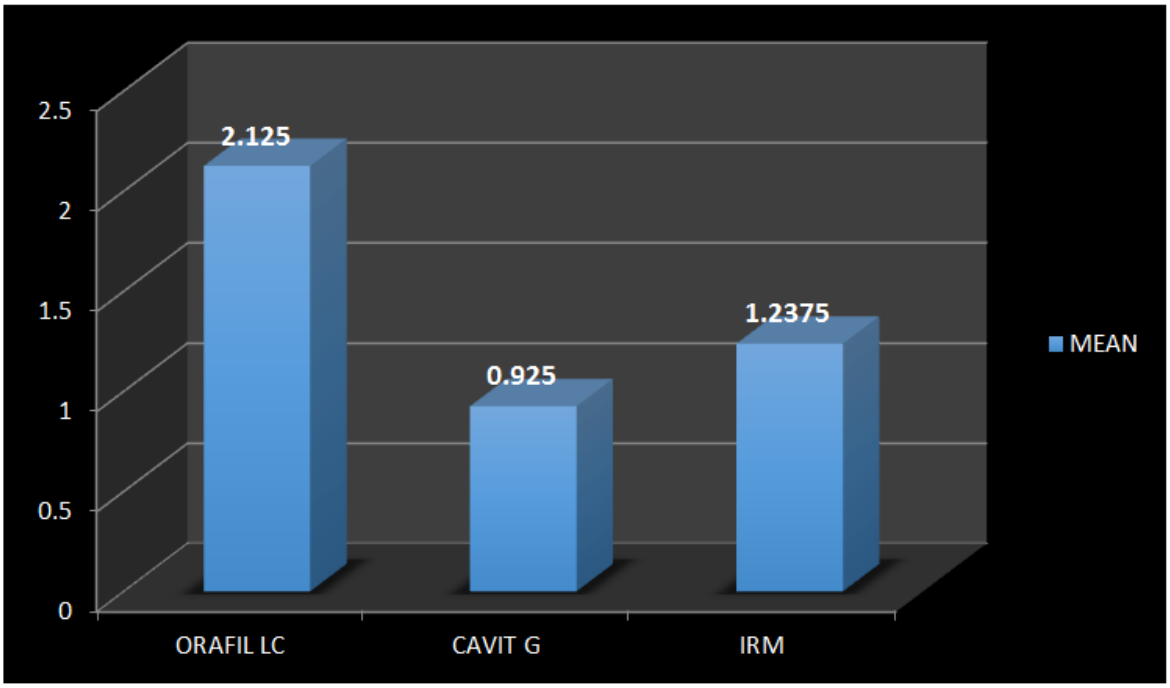


Fig-4: Groups 1-3 under 4x stereo microscope.

RESULTS AND ANALYSIS

The dye penetration was observed in all experimental groups. The lowest mean leakage was in Cavit G followed by (in ascending order of dye penetration) IRM, Orafil LC (Graph-1 and Table-1). There is highly significant difference in the micro leakage between Cavit G with Orafil LC and IRM with Orafil LC. There is no significant difference within the Cavit G group samples and IRM samples but slightly Cavit G shows less micro leakage than IRM (Table-2).



Graph-1: Comparison of mean leakage between Groups

Table-1: Mean leakage between Groups

	Mean	Standard Deviation	F	Sig.
Orafil LC	2.1250	.57508	22.080	**0.000 (H.S)**
Cavit G	.9250	.21213		
IRM	1.2375	.21339		

Table-2: Inter Group comparison of micro leakage

		Mean Difference	Standard error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Orafil LC	Cavit G	1.20000*	.18736	**.000 (H.S)**	.7277	1.6723
	IRM	.88750*	.18736	**.000 (H.S)**	.4152	1.3598
Cavit G	IRM	-.31250	.18736	.241 (N.S)	-.7848	.1598

DISCUSSION

Restoration failures are one of the main factors associated with periapical tissue contamination by microorganisms and fluids from the oral cavity, inducing peri-radicular disease propagation. Investigations have confirmed microorganisms and their products are able to go through the whole root canal filling and reach the apical and peri-apical tissues in few days after endodontic filling, if the coronal restoration is deficient [23]. Therefore, it is important to evaluate the sealing ability of restorative materials, to permit their safe use in endodontic clinical practice.

It has been reported that a minimum of 3.5-4 mm of restorative material is necessary to prevent coronal microleakage [11, 18]. All the research specimens in this study received a thickness of 4 mm of restorative material

In this study, we assessed and compared the in vitro sealing ability of a new light-curing temporary material (Orafil LC) to the ones most commonly used in endodontic practice (Cavit G and IRM). The methylene blue dye solution was selected as the tracer due to its good visibility, effective penetration, and excellent contrast.

All experimental groups exhibits some degree of dye penetration. However, the results indicated better sealing ability in Cavit G and IRM than Orafil LC. Infact Orafil LC showed a higher degree of marginal leakage in almost all the samples. There is statistically significant difference in sealing ability among the experimental groups, Hence null hypothesis is rejected.

In the present study Cavit G exhibited the least degree of marginal leakage when compared to IRM and Orafil LC and this could be attributed to its high linear expansion during setting [19], and good sealing properties [20-22].

The coefficient of linear expansion for cavit was almost double that of ZnOE, which explains its effectiveness as a temporary filling material.

According to the results of the present study the scores for leakage of Orafil LC specimens had high statistical significant difference compared with Cavit G and IRM, indicating lack of effective sealing against marginal leakage.

However the invitro condition of the study limits the clinical relevance due to variability in the study design and restorative protocol.

The specimens being not subjected to thermocycling process may be another limitation of our study which would have mimic the variations in the clinical situation.

CONCLUSION

Dye penetration was observed in all the samples. Cavit G exhibited minimal dye penetration when compared to IRM and Orafil LC. Within the limitation of the present study Cavit G is considered to be a promising option for the provisional restoration of endodontically treated teeth.

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