COMPARATIVE EVALUATION OF RETENTION OF TWO DIFFERENT TEMPORARY RESTORATIVE MATERIALS AFTER BRUSHING SIMULATION - AN IN VITRO STUDY

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ABSTRACT:

INTRODUCTION: Temporary restoration is a temporary filling of a prepared tooth until permanent restoration is carried out. Brushing simulator machines are capable of running programmable three-dimensional brushing patterns. The aim of the current study is to evaluate the retention of two different temporary restorative materials after brushing simulation. **MATERIALS AND METHODS:** In the present study eight teeth which include maxillary and mandibular first and second molar teeth were collected. Class 1 cavity preparation was done in the collected natural teeth and restored with two types of different temporary restorative materials such as zinc oxide Eugenol and IRM. Once the restoration was completed for all 8 samples, they were subjected to brushing simulation. Toothbrush simulator ZM3.8 was used for brushing simulation. Soft toothbrushes were used and a fluoridated toothpaste was applied on the surface of the restoration. 1500 cycles of brushing simulation was done and the results were collected and the retention were compared photographically. Statistical Data was analyzed with SPSS version (22.0). Descriptive statistics as percent were calculated to summarise qualitative data. **RESULTS:** IRM showed 22.70% no surface coverage, zinc oxide eugenol showed 22.2% no surface coverage. IRM showed 72.7% partial surface coverage, zinc oxide eugenol showed 74.04% partial surface coverage which is significant when compared to IRM. IRM and zinc oxide eugenol showed about 4.6% of complete surface coverage. **CONCLUSION**: Zinc oxide eugenol has better retention when compared with intermediate restorative material after brushing simulation.

KEYWORDS: Temporary restoration, innovative measurement, brushing, zinc oxide eugenol, intermediate restorative material

INTRODUCTION

Temporary restoration is a temporary filling of a prepared tooth until permanent restoration is carried out. It is used to cover the prepared part of the tooth, in order to maintain the occlusal space and the contact points, and insulation of the pulpal tissues and maintenance of the periodontal relationship. Besides avoiding bacterial percolation, temporary fillings may help to protect weakened coronal tooth tissue from fractures when they have adhesive properties. Conversely, fillings that expand during or after setting, due to hygroscopic expansion, may cause cusp deflection or fractures. (1)(2) Characteristically, restorative materials undergo degradation in contact with water, such as leaching of components that may weaken their structure.(3) In addition, the oral environment is inhospitable for restorative materials, with extremes of thermal and mechanical challenges. The mechanical action of toothbrushing might also abrade the materials. Brushing simulator machines are capable of running programmable three-dimensional brushing patterns. Various brushing movements can be simulated using the machine. Several temporary filling materials with different microstructures, compositions and setting mechanisms are available commercially.(4,5)

Cavit (3M; ESPE, St. Paul, MN, USA) is a pre-manipulated eugenol free material that sets in contact with moisture, but has given conflicting marginal sealing results.(6) Among the temporary restorative materials, zinc oxide eugenol (ZOE) is presumably one of the most commonly used temporary material for endodontics and restorative dentistry because of its sedative effect on sensitive teeth, low cost, ease of removal, and excellent seal against leakage. When zinc oxide is mixed with eugenol, in the presence of a small amount of water, a chelation reaction takes place and results in a set mass of unreacted zinc oxide parti- cles in a matrix of zinc eugenolate. Unfortunately, this reaction is reversible, when the set cement contacts water, the eugenolate at the surface hydrolyzes to liberate eugenol.(7) IRM/Intermediate restorative material is designed for intermediate restorations intended to remain in place for up to one year. The eugenol content in the polymer-reinforced zinc oxide-eugenol composition gives the material sedative-like qualities on hypersensitive tooth pulp and is a good thermal insulator as well. IRM may also be used as a base under cements and restorative materials that do not contain resin components, such as amalgams, and inlays and onlays. Its strength properties approach those of zinc phosphate cement. IRM has excellent abrasion resistance, good sealing properties and low solubility.(8) Discrepancies between studies still raise concerns about the capacity of temporary filling materials with different compositions to avoid bacterial percolation that could lead to post-treatment disease.(9) As these materials have different setting mechanisms, different reactions with moisture and variable dimensional stability, there is a potential for them to produce different marginal sealing abilities. The aim of the current study is to evaluate the retention of two different temporary restorative materials after brushing simulation.

MATERIALS AND METHODS

In the present study eight teeth which include maxillary and mandibular first and second molar teeth were collected. Class 1 cavity preparation was done in the collected natural teeth and restored with two types of different temporary restorative materials such as zinc oxide Eugenol and IRM.(Fig 1 and 2) Once the restoration was completed for all 8 samples, they were subjected to brushing simulation. Toothbrush simulator ZM3.8 was used for brushing simulation. Soft toothbrushes were used and a fluoridated toothpaste was applied on the surface of the restoration.(Fig 3 and 4). 1500 cycles of brushing simulation was done and the results were collected and the retention were compared photographically.

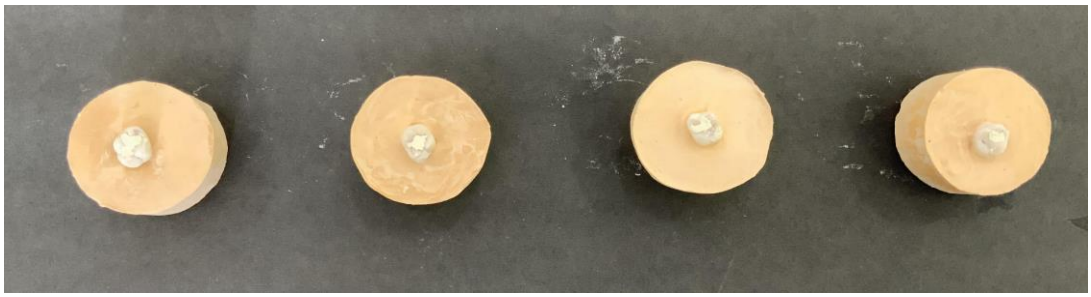

Fig 1: representing the natural teeth restored with zinc oxide eugenol

Fig 2: representing the natural teeth restored with IRM restorative material

Fig 3: representing the natural teeth restored with two different restorative materials were loaded for brushing simulation.

Fig 4: representing the brushing simulation process

RESULTS

In the present study, after 1500 cycles of brushing simulation, we compared the significant breakdown of the restorative materials using an index. Where 0 - indicates no surface coverage, 1 - indicates partial surface coverage and 2 - indicates complete surface coverage. Comparison between IRM and Zinc oxide eugenol were photographically assessed. From the overall photographical comparison it was found that ZOE has shown better post retention 2% Data was analyzed with the SPSS version (22.0). Descriptive statistics as percent were calculated to summarise qualitative data. The statistical analysis states that the post retention of Zinc oxide

eugenol shows more retention when compared to IRM. To determine the post retention the amount of surface coverage has been taken as comparison, the statistical analysis states IRM showed 22.70% no surface coverage, zinc oxide eugenol showed 22.2% no surface coverage. IRM showed 72.7% partial surface coverage, zinc oxide eugenol showed 74.04% partial coverage which is statistically significant when compared to IRM. Intermediate restorative material showed about 4.6% of complete surface coverage and zinc oxide eugenol also showed 4.6% of the complete coverage. (Table 1 and fig 5)

Table 1: Representing the distribution of surface coverage among two different temporary restorative materials (zinc oxide eugenol and IRM).

SURFACE COVERAGE	IRM	ZOE
ZERO SURFACE COVERAGE	22.7%	22.2%
PARTIAL SURFACE COVERAGE	72.7%	74.04%
COMPLETE SURFACE COVERAGE	4.6%	4.6%

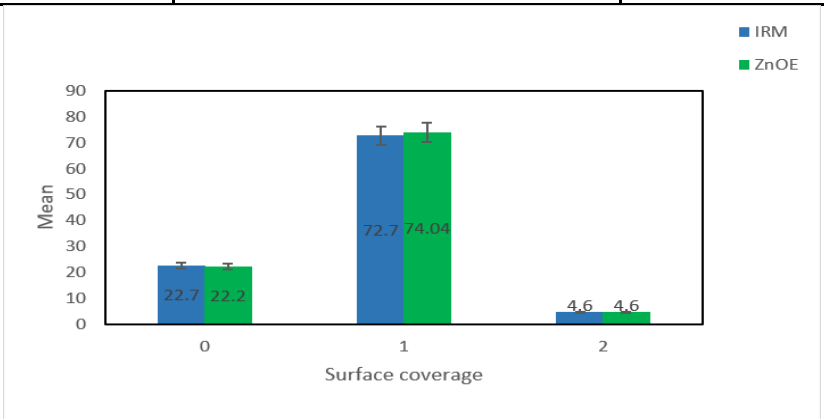

Fig 5: Bar graph representing the percentage of retention among two different temporary restorative materials (ZOE and IRM). Blue denotes IRM and green denotes ZOE, in which x -axis denotes the surface coverage and the y- axis denotes the mean. Zinc oxide eugenol had better retention after brushing simulation.

DISCUSSION

Our team has extensive knowledge and research experience that has translated into high quality publications (10–19),(20–23),(24–28)(29). Basic properties of dental materials for restorative treatment, such as mechanical, physical and bonding properties, have been greatly improved as a

result of numerous investigations, and many of recent products on the market exhibit excellent/acceptable clinical performance. Such improvement of restorative materials has contributed to the recovery of ideal anatomical form and function with less removal of tooth structure, leading the way to aesthetic restorative treatments and minimal intervention dentistry. Among the many other applications are: emergency placement prior to complete treatment, endo access openings, pedo teeth that will soon exfoliate, and caries management programs. Zinc oxide-eugenol (ZOE) cements are widely used as temporary filling materials. However, eugenol has earlier been shown to have a detrimental effect on both resin composites and dentin-bonding systems. ZOE would also reduce the efficacy of relatively new dentin-bonding systems.(30,31)
In this study, after 1500 cycles of brushing simulation in linear, clockwise and anticlockwise direction with the minimum frequency of oscillations around 40Hz, we compared the significant breakdown of the restorative materials. The statistical analysis states that the post retention of zinc oxide eugenol shows more retention when compared to IRM. In a similar study, GC Caviton showed least microleakage and least water absorption followed by IRM and Cavit G, and there was no statistical difference found in all the groups with respect to retention.(32). In another study, disc-shaped specimens of different temporary restorative materials were prepared. The specimens were ultrasonically cleaned (MaxiClean 750; Unique, Indaiatuba, SP, Brazil) The pre-brushing mass (m1) was obtained by weighing the specimens every 24 h until a constant mass was achieved. The abrasion test was carried out in a multi-station brushing device. Cavit group had the greatest watersorption and solubility. Loss of mass after brushing was higher for Cavit, followed by Bioplic, IRM and Vidrion R. Cavit and Vidrion R brands were most affected by brushing.(33) The present study shows minute differences in retention and the limitation of the present study is less sample size. In the future, an extensive study with a large sample size and different restorative materials can be used to assess the retention after brushing and chewing simulation.

CONCLUSION

Results obtained from the present study states that zinc oxide eugenol has better retention when compared with intermediate restorative material after brushing simulation. More studies with large sample sizes should be conducted to know the efficacy of temporary restorative materials and the influence of brushing simulation on the restorative materials.

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CONFLICT OF INTEREST: The authors would like to declare no conflict of interest in the present study.

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