

## **Evaluating the Efficacy of Resin Modified Glass Ionomer Cement versus Conventional Glass Ionomer Cement in Terms of Success Rate: A Clinical Assessment Exploring the best in between**

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### **ABSTRACT**

**Aim:** To evaluate the success rate of the two types of glass ionomer restorative materials i.e., conventional Glass Ionomer Cements (GIC) and Resin Modified Glass Ionomer Cements (RMGIC)

**Methods:** The study was conducted at Nishtar Institute of Dentistry Multan. Total number of 113 patients got the restorations. 53 received RMGI and 60 got GIC. All the patients were having the age between 25-35 years. Class I cavity in the molars of lower arch was restored. Success ratio was scored according to the evaluation with 8 Levels of score that is used for GIC evaluation. The data was then entered in the record. The conduction period was from 1<sup>st</sup> of January 2016 to 1<sup>st</sup> of June 2016. The final evaluation was done after the five months. The tabulated data was entered using chi square test.

**Results:** The Chi square statistic value obtained with degree of freedom 1 (df) is 5.6689. The null hypothesis was rejected that says that there is no difference among the categories of materials applied. The result is significant at  $p < 0.05$ .

**Conclusion:** RMGI has better retention and efficacy as compared to conventional GIC in the mandibular molars.

**Keywords:** Resin, Polyacid, Bond, Recharge, Hydrogel, Hydroxyapatite, Fluoroapatite

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### **INTRODUCTION**

The Holy Prophet Muhammad (ﷺ) said, "Cleanliness is half of faith" (Sahi Muslim). The diseases which we have are mostly due to the contamination from the micro organisms. These contaminations may further progress to the diseases. If we take the example of oral cavity, it harbours a lot of micro organisms. These may be responsible for different pathologies if the oral hygiene is compromised. The most common oral disease, the caries is due to the poor oral hygiene, plaque formation and thus breakdown of tooth structure. When the oral hygiene is improved, not only it benefits the dentition but also to the whole body systems. While taking in account the carious lesions, the teeth needed to be repaired. This repair may be known as the restoration of the teeth. The purpose of this repair is to restore the morphology, functions and aesthetics, thus bringing the tooth to its original functionality. There are a number of materials available in market which may be helpful in restoring the teeth. Our prime focus is on the two restorative materials, i.e., Glass Ionomer Cements (GIC) and Resin Modified Glass Ionomer Cements (RMGIC).

The GICs have powder and liquids which are mixed together. Liquid is 35%-65% of acid copolymer polyacrylic acid. The earlier solutions had 50% solution of poly acrylic acid. So they were mostly

gelled. A proper powder and liquid consistency is required to get a thick shiny mass of the material with good working time. A capsule form is also available that provides ease for the manipulation and mixing. There is an initial hydrogel phase which causes the initial set followed by the polysalt gel phase. This phase occurs when the final material is set and can continue for several months. One of the unique properties of these materials is their recharging phenomena of fluoride ions. They can replenish the fluorides from the intake fluorides in the form of tooth pastes and fluoride gels<sup>1,2</sup>. They release the fluoride from the reservoir that is present in the unreacted ionomer filler of the matrix. Once whole of the reservoir has released the fluoride ions, it can recharge itself with the topical fluorides and tooth pastes. The fluoride content of the cement is higher as compared to the tooth surface, so there is a transfer of ions from the restorative material to the tooth surface, i.e. from higher concentration to lower concentration.

Like other restorative materials that have been developed, these are also not free of some of the disadvantages. This study was conducted at Nishtar Institute of Dentistry, Multan. Both GIC and RMGIC restorations were placed in the patients but each patient got either one type of restoration. The patients received the both type of restorations. These restorations were then analyzed for the success or the failure comparing the best between them.

### **PATIENTS AND METHODS**

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This study was carried out at Nishtar Institute of Dentistry, Multan from 1<sup>st</sup> of January 2016 to 1<sup>st</sup> of June 2016. The total number of patients was 113 having class I carious lesion in any of molars in the lower arch. All the patients were between the ages of 25 to 35. The teeth under consideration were having sound periodontium and good oral hygiene. The molar relationship was class I in proper interdigitation. Two types of materials were used to find out the efficacy of success between them. One was Resin modified glass ionomer cement (RMGI) and other was conventional cement glass ionomer. The class I cavity was prepared according to Black's principles of cavity preparation using the air turbine and copious water irrigation. The tooth isolation was made with the help of cotton rolls and saliva ejectors. Lack of isolation may raise pain so it is achieved accordingly. In conventional glass ionomer cement, the mixing was done on clean glass slab with the help of stainless steel spatula. Whole of the powder was mixed in the liquid according to ratio as provided by the manufacturer. For resin modified glass ionomer cement, the mixing was done in the same way maintaining the strict isolation of the tooth. After the placement of material in the cavity the RMGI was cured for twenty seconds to get polymerized. The conventional glass ionomer was coated with the petroleum jelly in order to prevent desiccation of the material. After that, the bite was checked in occlusion to remove any of the high spots in occlusion ensuring a good normal interdigitation. The total number of patients receiving the RMGI treatment was 53 while that of receiving conventional GIC were 60. The longevity of the restorative material was assessed with then WHO probe with 0.9mm of ball. The other instruments used were dental explorer and dental mirror along with well illuminated light source. The evaluation was done after five months. The evaluation criteria were according to WHO guidelines having 0-8 scores.<sup>3</sup> The success rate was with score 0, 1 and 2. The failures of restorations were having the score of 3, 4, 5 and 6. Score 7 and 8 included the exclusion of the cases. Chi square test was applied on successful restorations is associated with the type of material used. The level of significance is 0.05

**RESULTS**

The Chi square statistic value obtained with degree of freedom 1 (df) is 5.6689. The p value is 0.017268. The result is significant at p<0.05. We find out that the value in the chi square chart is 3.841. Our statistical value is 5.6689 which is higher than the value in the chi square table (Tables 1-2).

Table 1: Frequency of successful and failure rate

Material	Successful	Failure	Total
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Resin Modified Glass Ionomer (RMGI)Cement	42	11	53
Glass Ionomer Cement (GIC)	35	25	60
Total	77	36	113

Table 2: Comparison of RMGI and GIC

Material	Successful	Failure
RMGI	36.12(0.96)	16.88(2.05)
GIC	40.88(0.85)	19.12(1.81)

**DISCUSSION**

In current era, a lot of dental materials are being used and innovating. All this has been made possible due to latest technologies in the field of biochemical engineering and vast researches in the field of health and medicine. While taking in account the current restorative materials we have, a prestigious choice to do the best for the dental patients. There are a number of dental materials that are being evolved and used successfully in the dental patients. So the one thing that remains the key factor for any of the new development is the good efficacy with longevity and cost effectiveness. Due to this there has always been a desire to create a material with the long standing durability with least chances of failure. In past century, the development of amalgam revolutionized the dentistry in a way as being the most popular material used as restoration in dentistry. But still there were some drawbacks that were associated with that like esthetically compromised, lack of bonding to the tooth structure and mercury toxicity. Still some clinicians thought amalgam as old school. There was a great need to create the material that should be tooth colored having capability to bond with the tooth structure.

The first cement evolved was zinc polycarboxylate cement that used polyacrylate liquid and zinc oxide powder. It was developed by British researcher Dennis Smith in 1963.<sup>4</sup> The rationale of choosing the poly acid was because of its capability to bind to calcium and hydrogen bond to the collagen.<sup>5</sup> The current GIC was invented by Wilson and Kent in 1965. They prepared it by mixing together the silicate glass powder with aqueous solution of various organic acids like polyacrylic acid. They found that the reaction was acid and base reaction. In the beginning of 1980s, another radio-opaque form of GIC was invented. This was done by mixing the silver amalgam particles (12%-14% by volume) in the powder of GIC. It gave strength to the material. Later on ceramic metal glass ionomer was also made by sintered metal and glass compositions. Its advantage was decreased coefficient of friction and thus improving the resistance to abrasion.

Glass Ionomer Cement (GIC) was invented to offset the some of the disadvantages associated

within the amalgam being a good alternate<sup>6</sup>. This cement has two components i.e. powder and the liquid. The powder has the sodium and fluoride salts along calcium and aluminum. The liquid contains the aqueous solution of polyacrylic acid. This is a weak organic acid. On mixing, there is an acid base reaction that leads to the setting of the material in the gel form. GIC has potential to make a chemical bond to the tooth structure. The type of bond formed is the covalent bond which is stronger than the ionic bonds. The other advantage is the esthetically acceptance of the material which makes this material as material of choice in the class III cavities. The other advantages include the recharging capacity of the material from the intake of fluoride. This is of much importance as being very crucial in preventing the carious recurrence. These materials were also having the decreased wear resistance and the fracture toughness with increase chances of fracture<sup>7,8</sup>.

With the passage of time various approaches have been proposed for improvements. A new material named as Resin Modified Glass Ionomer Cement (RMGIC) was invented to enhance the shortcomings stemming from the GIC and fixing it up. It was basically an attempt to combine the properties of GIC and resin composites. Soon RMGIC was got on board with the current manipulations. One problem associated with these materials is the less solubility of modified polyacrylic acid. This problem was overcome by adding the hydroxyethyl methacrylate (HEMA). Its fracture resistance is higher as compared to the GIC. The setting reaction of the material is by both the acid base reaction and the polymerization by the visible blue light. The ratio of the resin added is nearly upto 6%.<sup>9</sup> According to Somani et al<sup>10</sup>, the bond strength of light cure GIC is better as compared to the conventional GIC. Both RMGI and GIC have less micro leakage whether the cavity is performed with the conventional mechanical means or minimally invasive technique.<sup>11</sup> This coincides with our study in which no micro leakage was found around the margins of successful restorations. In addition to the recharging phenomena for fluorides there has also been observed that that the combination of the chlorhexidine with both the Glass ionomer as well as resin modified glass ionomer cements has a good potential to reduce the bacterial biofilm.<sup>12</sup> This contrasts with our study in which there was marginal integration with no plaque. The silica particles are added in the RMGI to improve the compressive strength. It has been observed by the researchers<sup>13</sup>. The successful restorations in our work included decrease wear also. Due to the beneficial effects of preventing the caries recurrence, it is widely used for the cementation of orthodontic bands. According to Shimazu et al<sup>14</sup>, there have been a significant findings elaborating the caries

prevention while using in the orthodontic bands. Not only this but they also found it to be better even than the compomer material in terms of caries prevention and band retentions.

In our study the overall success of the RMGIC is round about 80% while that of conventional GIC is 58%. At the same time total successful ratio is 68% for all the restorations.

## CONCLUSION

We can claim that the resin modified glass ionomer has an edge over the conventional glass ionomer cement in terms of longevity and the retention. Less failure has been observed in the RMGI than the GIC. Moreover there are less chances of carious recurrence in the RMGI as compared to GIC. So the frequent use of RMGIC might be food for thought.

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