ORIGINAL RESEARCH ARTICLE

COMPARATIVE EVALUATION OF SHEAR BOND STRENGTH OF GLASS IONOMER CEMENT AND COMPOSITE RESIN TO MINERAL TRIOXIDE AGGREGATE

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ABSTRACT

Aim: To evaluate the shear bond strength of glass ionomer cement (GIC) and composite resin (CR) to Mineral trioxide aggregate (MTA).

Methodology: Twenty acrylic blocks, having a central cavity with 4 mm diameter and 2 mm depth were prepared. MTA Angelus was mixed and placed in the prepared cavity after the setting times of 15 minutes. The specimens were then randomly divided into 2 groups. GROUP A: GIC – Glass ionomer cement and GROUP B: CR-Composite resin. The specimens were tested for shear bond strength using universal testing machine and readings were statistically analyzed.

Result: The shear bond strength of CR (0.5357) with MTA was significantly better than GIC with MTA.

Conclusion: Composite resin is preferred material over MTA as it has higher bond strength when compared to GIC.

Keywords: Mineral trioxide aggregate, Glass ionomer cement, Composite Resin, Shear bond strength.

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J Ind Dent Assoc Kochi 2019;1(2)2-5.

INTRODUCTION

Vital pulp therapy is a ministration begun to conserve the tissue that has been compromised by caries, trauma, or restorative procedures[1]. Which aims at stimulation of reparative dentin formation to retain the tooth as a functional unit.[2]

Various materials such as calcium hydroxide, zinc oxide eugenol, calcium phosphate, glass ionomer, resin modified glass ionomers, emdogain, bioglass, biodentine and MTA have been used as pulp capping materials.[3]

MTA after being introduced as a retrograde filling material in 1993 by Torabinejad has gained popularity over other pulp capping materials due to its excellent biocompatibility and in vivo biological performance.[4]

MTA induces dentinogenesis, cementogenesis and hence the pulp heals faster.[5] MTA also has an ability to set in the presence of moisture. Despite several advantages, prolonged setting time, and a need to place wet cotton pellet over MTA to complete the setting reaction is a major drawback that necessitates second visit and increased chair side time.[6]

In order to overcome this drawback a new material MTA Angelus(Angelus, Brazil) with a faster setting time of 15 minutes was used. MTA Angelus contains tricalcium silicate, dicalcium silicate, tricalcium aluminate, calciumsulfate, bismuth oxide.[7]

Since MTA has been commonly used in vital pulp therapy its bond strength to the final restorative material is of prime importance.

Composite Resins and glass ionomer cements (GICs) are very popular in restorative dentistry because of their esthetic and adhesive qualities hence the aim of this study is to compare and evaluate the bond strengths of GIC and composite restorative materials to MTA.

MATERIALS AND METHODS

PREPARATION OF MTA SAMPLES

Twenty acrylic blocks with a central cavity of 4mm diameter & 2mm depth were prepared. MTA Angelus powder (Angelus, Brazil) was mixed with distilled water according to manufacturer's instruction and placed into the prepared cavity. The specimens were then randomly divided into 2 groups: GROUP A: GIC and GROUP B: CR.

To standardize the size, GIC and CR were placed over the MTA surface using cylindrical plastic tubes with an internal diameter of 3mm & height 4mm. In GROUP A GIC (GC corporation, Tokyo)was mixed according to the manufacturer's instruction and placed over MTA and allowed to set. In GROUP Bafter etching with 37% phosphoric acid gel, the bonding agent (Adper Single Bond 2 Adhesive,3M ESPE) was applied & light cured. CR (3M ESPE Filtek Z250 XT) was placed over MTA and light cured for 30 seconds. Plastic tubes were carefully removed after the material was allowed to set. All specimens were stored at 37°C & 100% humidity for 24 hours in an incubator.

SHEAR BOND STRENGTH MEASUREMENT

The specimens were mounted in a universal testing machine. A crosshead speed of 1 mm/min was applied between the restorative material and MTA using a sharp edged steel rod until the bond between the restorative materials and MTA failed. The peak at which the failure of bond occurred was noted. The shear bond strength in Mega Pascal (MPa) was calculated from the peak bond at failure divided by the specimen surface area. Mean and standard deviations for GIC and composite materials were calculated and compared.

GROUPS	MEAN	STANDARD DEVIATION
Max Force COMPOSITE		
GIC	6.7292	3.79941
	2.8906	2.07397
Max Stress		
COMPOSITE	0.5357	0.30250
GIC	0.2301	0.16512

INDEPENDENT SAMPLE t TEST

	t	df	Sig(2-tailed)
Max Force Equal variances assumed	2.536	15	0.023
Max Stress Equal variances assumed	2.535	15	0.023

DISCUSSION

According to AAE, pulp cap is defined as a treatment of an exposed vital pulp by sealing the pulpal wound with a dental material such as calcium hydroxide or mineral trioxide aggregate to facilitate the formation of reparative dentin and maintenance of a vital pulp.[8]

Materials recommended for pulp capping such as calcium hydroxide, MTA simulate growth factors and are used in direct pulp capping of carious and non-carious pulp exposures in asymptomatic teeth.[8,9] The growth factor stimulation can lead to dentin regeneration.[10]

The success of pulp cap procedures with MTA is due to the calcium ions from the MTA.(11) MTA during its setting reaction has shown to release large numbers of calcium ions, which increases dentin regeneration.[9]

The long term prognosis of pulp capping is based on a well-sealed restoration immediately placed after pulp capping as this will provide protection against microleakage and bacterial contamination that can compromise the success of the pulp cap.[11]

In the present study shear bond strength test was used to evaluate the adhesive properties of MTA with conventional glass ionomer cement and composite resin.

In this study GIC was immediately placed over the MTA surface. The porous surface of MTA could be a factor that increases the strength of the MTA-GIC bond. This was in accordance with a study done by Patil A in 2016 who evaluated the interface between the conventional GIC and resin modified GIC over MTA and concluded that GIC when applied over freshly mixed MTA had minimal effects on the MTA.[12] Possible reactions which may occur when a GIC is applied on the surface of MTA are: (a) The COO- of the polyacrylic acid could interact with the calcium of the MTA to form calcium salts (b) the silicate hydrate gel of the MTA could condense with the silicate hydrate gel of the GIC to form by-products.[13]

Following pulp capping procedures in areas where esthetics is of concern composite restorations are advovated. The bonding between composite resin and the pulp capping biomaterial hence has an important role in quality of fillings and treatment outcomes.[14]

In this study composite had shown better bond strength with MTA than with GIC. The results of a study by Tyagi et al in 2016 had shown that superior MTA-composite bond strength can be achieved with etch and rinse adhesives in comparison with one-step self-etch systems.[15]

Lee Seok-Ryun et al.[16], studied the effect of acid-etch procedure on the bond between composite resin and mineral trioxide aggregate. The results showed that acid-etch procedure improved the wettability of MTA surface and the bond strength between MTA and composite resin. The study concluded that acid-etch procedure is essential for a better bond between MTA and composite resin.

Kayhan et al observed that acid etching created surface changes that might have potential to enhance bonding of resinous materials. Phosphoric acid etching significantly enhances the surface energy of the substrate, thereby provides significantly more microretention and potentially increases the bonding effectiveness of resinous materials.[17]

This might be the reason for the superior bond strength of CR with MTA in the present study.

CONCLUSION

In this study we observed that composite resin showed higher bond strength to MTA when compared to GIC.

Within the limitations of this study we conclude that composite resin (CR) is a preferred restorative material over MTA as compared to GIC.

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