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Comparison of microleakage in bonded amalgam restrorations using different adhesive materials: An *invitro* study

Anuj Jain*[1], Deepesh Agarwal[2] and Deepak Kumar Sharma[1]

Department of Conservative Dentistry & Endodontics, Jaipur Dental College, Jaipur[1]
Department of Orthodontics, Jaipur Dental College, Jaipur[2]

ABSTRACT

The objective of the this study was to comparatively evaluate the micro leakage in cavities prepared on the sample tooth with and without application of intermediate adhesive systems before condensation of amalgam, and to compare the sealing efficiency of different adhesive material in preventing the amount of micro leakage. Forty freshly extracted human teeth were collected and the samples were maintained and stored in normal saline until subjected to experimental procedure. Samples were randomly divided into control group and experimental groups. Control group (Groups-1) with no intermediate adhesive material. Group-2 is experimental group with copal varnish. Group-3 contains vitrebond as intermediate adhesive material and Group – 4 consist of clearfil-SE. After application of adhesive material, amalgam was condensed on the sample. Specimen was then immersed in .5% methylene blue dye for 8 hrs and sectioned in (B-L) plane for steriomicroscopic study. The results were drawn and tabulated using ANOVA test. Microleakage was found to be maximum in control group with no intermediate adhesive material. In experimental groups microleakage was maximum in group-II (Copal varnish) followed by group-IV (Clearfil-SE) and the least amount of microleakage was seen in group-III (Vitribond). Hence this study concludes that application of intermediate adhesive material before condensation of amalgam can act as an efficient barrier for microleakage.

Keywords : Microleakage, dye penetration, copal-varnish, vitrebond, clearfil-SE.

INTRODUCTION

Amalgam is dentistry's main therapeutic agent for restoring decayed teeth. The oldest written record of the use of amalgam in dentistry is a publication in 1528. Approximately three out of four restorations of individual teeth are of amalgam. This preeminence has been attained during

the last hundred years and reflects the many developments that have made dental amalgam a remarkable metallurgical achievement (ADA guide, 1976).

An amalgam restoration is initially plastic and within a few minutes after mixing becomes hard. During hardening little or no change in volume occurs. Properly condensed amalgam restoration exhibit compressive strength values as high as that attained with some cast iron. The amalgam restorations can withstand the corrosive oral environmental and blend into the host. The combination of all these properties makes amalgam the most universally used restorative material (ADA guide, 1976).

Microleakage around dental restorative materials is a major problem in clinical dentistry. It may be defined as clinically undetectable passage of bacteria, fluids molecules, or ions between cavity walls and the restorative material applied to it. Seepage can cause of hypersensitivity of restored tooth, tooth discoloration, recurrent caries, pulpal injury, and accelerated deterioration of some restorative material.

Copal varnish is considered an important dentin sealant in period between placement of restoration and formulation of amalgam corrosion by products, which are capable, of sealing the tooth restoration interface. Penetration of secondary caries along the interface has been found to inhibited by bonding. Various studies have demonstrated that bonded amalgam have advantage of improved retention and tooth reinforcement and decreased marginal microleakage and secondary caries.

Present study "comparison of microlekage in bonded amalgam restoration using different adhesive material was done to compare the micro leakage between conventional and bonded amalgam restoration using different adhesive systems.

MATERIALS AND METHODS

Fourty freshly extracted human teeth were used as they have enough moisture and organic content to prevent them from being brittle. The sample were thoroughly washed in water so that these are free of blood, saliva, debris, and calculus, attached to them and were stored in normal saline till further use.

Samples were divided into four main groups:
Control Group-I: Consisted of 5 samples where no intermediate adhesive material was applied and amalgam was directly condensed in the cavities.

Experimental Group
Group-II: Consisted of 5 samples on which Copal Varnish was applied as intermediate adhesive materials and amalgam was condensed after that.
Group-III: Consisted of 5 samples on which Vitrebond was applied as intermediate adhesive materials and amalgam was condensed after that.
Group-IV: Consisted of 5 samples on which Clearfil SE was applied as intermediate adhesive materials and amalgam was condensed.

Standard cavities were prepared on middle third of buccal surface using high-speed air rotor hand piece. The preparations were square in shape with (3x3x2x) size. Cavity preparations were rinsed with water spray and air dried for 30 seconds. In the control group no intermediate adhesive material was used and respective intermediate adhesive materials were placed in different experimental groups. Amalgam was condensed into the prepared cavities of the sample teeth of both control and experimental groups.

Samples of different groups were placed in 0.5% methylene blue dye for 8 hours. After taking the sample out of the dye they were sectioned longitudinally into two halves and viewed under a stereomicroscope using 10 x magnifications. The amount of dye penetration was measured by standard ranking. The samples were assessed for microleakage and sealing efficiency of different intermediate adhesive materials.

Microleakage assessment:

Microleakage in bonded amalgam restoration using different adhesive materials was assessed in the samples of different experimental groups after sectioning them buccolingually. With the stereomicroscope under 10 x magnification, micro leakage in the sample was observed and photographs were obtained, with a help of photographs measurement of micro leakage was done. The reading obtained was then analyzed for amount of microleakage in the bonded amalgam restorations with different adhesive materials.

The degree of microleakage at both enamel and dentin margins was evaluated using a standard ranking.

RESULTS

microleakage score in the different groups

	Group I	**Group II**	**Group III**	**Group | IV**
Number of teeth	5	5	5	5
Mean Score of microleakage	2.6000	1.8000	0.6000	1.0000
S.E	0.1633	0.2108	0.2236	0.2604

Analysis of variance of microleakage score in the different groups

Source of variation	**Degree of freedom**	**Sum of square**	**Mean sum of square**	**Variance ratio "F"**
Between the groups	5	25.733	5.147	F=11.117
Error	54	25.000	0.463	'p' <0.001
Total	**59**	**50.733**		

The results were drawn and tabulated using ANOVA test. Microleakage was found to be maximum in control group with no intermediate adhesive material. In experimental groups microleakage was maximum in group-II (Copal varnish) followed by group-IV (Clearfil-SE) and the least amount of Microleakage was in group-III (Vitribond). Hence it can be summarized in the oder of: Group I (Maximum)>Group II>Group IV>Group III (Minimum).

Microleakage as determined through statistical analysis

DISCUSSION

In dentistry, the term amalgam denotes a type of restorative material that is prepared by mixing a powdered alloy, basically composed of silver and tin, with mercury. The resultant plastic mass can then be placed directly into the prepared cavity in the tooth where it rapidly hardens. Amalgam restorations constitute the majority of permanent fillings placed by dentists to repair the ravages of dental caries. Well designed, properly condensed, carved and smoothly polished amalgam restorations can provide the patient with lasting functional restorations, and the clinician with a great pride of accomplishment (Reibick, 1982).

Microleakage is a phenomena which has been cited in literature since 1912. It is described as the the movement of oral fluids between the tooth and restoration interface. Microleakage is used as a measure by which clinician and researchers can predict the performance of a restorative material, and one of the goals of an ideal restoration is to prevent microleakage.

Bonding of amalgam restorations has proved to enhance the strength and reduce the microleakage of the bonded amalgam restorations compared to the non-bonded or conventional amalgam restorations. The bonding agent's viscosity also plays an important role in the increased retention by means of an interlocking mechanism. The amalgam mix produces interlocking projections into the bonding agents for improved mechanical retention and also amalgam bonding agents have clinically proven that they ar capable of reducing microleakage associated with conventional restorations.

Considering that there is several kind of dental adhesive systems and cements which can be used for bonded amalgam restoration so, there is a need for more studies to comparatively evaluate them. Therefore, the present study comparison of micro leakage in bonded amalgam restorations using different adhesive materials an in vitro study was conducted to compare micro leakage between conventional and bonded amalgam restoration using different adhesive systems.

In the present study maximum mean micro leakage was observed in Group I (Control) in which no intermediate adhesive material was used, and amalgam was directly condensed over the prepared cavity as compared to other experimental groups in which intermediate adhesive material was used. These values show that placement of intermediate adhesive material is helpful in reducing microleakage in bonded amalgam restorations and this reduction as shown by the results was statistically significant (mean microleakage scores Group-I 2.6000, Group-II 2.0000, Group-III 0.5000, Group-IV 1.7000, Group-V 1.2000, Group-VI 1.4000).

CONCLUSION

It can be concluded that use of bonding agent as intermediate adhesive material before the condensation of amalgam, acts as an efficient barrier to micro leakage.

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