

COMPARISON OF MARGINAL BREAKDOWN IN BONDED AND CONVENTIONAL AMALGAM RESTORATION

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ABSTRACT

Aim of the study was to assess the fracture resistance of bonded & non bonded amalgam filling.

Amalgam is the material of choice for posterior restorations because of its strength, longevity as compared to other materials. In spite of all these advantages of being cost effective, ease of manipulation, its inability to bond to tooth structure is a major problem. This makes an amalgam restoration to undergo micro leakage and subsequently secondary caries, marginal ditching and failure of restoration occurs. Scientific research has concluded that marginal breakdown is the factor which leads ultimately to the fracture of entire restoration.

To improve the mechanical retention and ultimately the marginal breakdown and fracture resistance a new bonding amalgam has been introduced. The bonded amalgam needs to be evaluated and compared with conventional amalgam in respect of marginal integrity.

It was concluded that there was no difference in marginal break down of conventional and bonded amalgam fillings and it was suggested that their use in traditional amalgam cavity preparations should not be recommended until proven clinical benefits have been demonstrated.

Key Words: Marginal breakdown, Bonded Amalgam.

INTRODUCTION

Amalgam is the best posterior restorative material in respect of its longevity as compared to other materials.¹ Fracture of amalgam restoration is one of the biggest problems.² Scientific research has concluded that marginal breakdown is the factor which leads ultimately to the fracture of entire restoration.³ Several generations of amalgam were developed to overcome

this problem and several studies have been conducted to evaluate the different composition of amalgam alloys.⁴ The bonded amalgam is one of the latest developments in amalgam restorations and needs to be evaluated and compared with conventional amalgam in respect of marginal integrity. The result of this study can help a lot in decision making while choosing the bonded or conventional amalgam for a posterior restoration.

For more than 150 years dental amalgam was, and in many countries continues to be, the mainstay of operative dentistry treatments. This has especially been the case in the United Kingdom where the use of dental amalgam has historically underpinned large elements of NHS dental care,⁵ and it has many advantages over other restorative materials. Its inability to bond to tooth structure is one of the major problem.⁶ This makes an amalgam restoration to undergo micro leakage and subsequently secondary caries, marginal ditching and failure of restoration occur.⁷ Extensive use of amalgam as restorative material in dentistry began with investigations by GV Black in 1890s.⁸ Black extensive investigations were based on comparison of composition of amalgam alloy and its manipulative characteristics; the composition suggested by Black was 68.5% Silver, 25.5% tin, 5% gold and 1% zinc.⁹

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Nowadays dental amalgam is considered as material of choice for large posterior restorations, due to its adequate mechanical properties, proven longevity and good wear resistance. However, marginal breakdown, metallic look and failure due to fracture are the troublesome shortcomings.^{10,11} Both corrosion and creep have been identified as possible contributors to fracture of the amalgam, the stresses that may include the creep may arise from the continued setting expansion of the material.¹²

To improve the mechanical retention and ultimately the marginal breakdown and fracture resistance a new bonding amalgam has been introduced.¹³ There are various evidences from vitro studies that bonding amalgams has improved retention, tooth reinforcement and decrease marginal microleakage.¹⁴ Studies done to investigate stiffness of restored teeth with bonded amalgam versus traditional amalgam reveals that teeth restored with bonded amalgam recovered their original stiffness.¹⁵ Detachment of bonded amalgam restoration without undercuts was tested against the restoration with undercuts and it was concluded that bonded amalgam restoration has higher resistance to dislodgment than restoration with undercuts.¹⁶

Bonded amalgam has shown great promise in last few years but the efficacy of bonded amalgam has not yet been tested over longer term. Results of clinical trials reported two years after bonding had been quite favorable.¹⁷ In a study done by Segsen and Aslan, the effect of bonded restoration on the fracture resistance of root filled teeth was determined. The study concluded that group restored with conventional amalgam had weaker resistance to fracture, than the bonded restoration.¹⁸ while, in a recent systematic review, authors concluded that there was no evidence to either claim or refute a difference in survival between bonded and non-bonded amalgam restorations.¹⁹

Several studies have been done to check the micro leakage in conventional and bonded amalgam restorations and it was concluded that cavity size and direction of sections were not significant factors for micro leakage, while substrate and inter mediate materials had significant effect in the sealing ability of restoration. Aim of the study was to assess the marginal break down of bonded and non bonded amalgam fillings.

METHODOLOGY

The study was conducted in the department of operative dentistry at Multan Medical and Dental College during 2013-14. Non- probability purposive sampling was done. A total of eighty patients, age between eighteen to forty five years having at least two class-1 carious lesions were marked as suitable candidates for inclusion into the study. While patients having poor oral hygiene or those who were suffering from any systemic disease, malocclusion, or any other dental anomaly were excluded from the study. Patients were divided into two groups A & B. Informed consent

was taken and history of the patient was followed by the detailed oral examination. After matching and controlling for various confounders like patients and operator variations, teeth were restored in pairs, consisting of bonded and non-bonded amalgam. Conventional non bonded amalgam fillings were done in group A patients while bonded amalgam (Adhesive Amalgam bond) was used in cavities of group B patients. Only one operator filled all the teeth. Paired fillings were placed in each patient. All the fillings were filled and carved using routine instruments.

After 24 hours, the restorations were polished using the SHOFU polishing system. The patients were tested for postoperative sensitivity after two weeks using the structured questionnaire. After 3 months, patients were recalled and both the restorations were examined according to the criteria. Patients were called after 6 months for the follow up and fillings were assessed for the marginal breakdown using the criteria.

RESULTS

Age of the patients was between 18 to 45 years, mean age being 27 ± 7.5 years. The sample was predominately comprised of younger participants. Approximately 50% participants were between 18-25 years, 32.5% were between 26-30 years, 10% were between 41-45 years, while remaining 7.5% were between 31-40 years.

Maximum number of teeth selected for the filling were first molars i.e 44, 32 were second molars and only 2 of them were third molars while 2 premolars were also selected. 97.5% of the patients reported on first recall at three months and 92.5% of the patients reported on second recall at six months. The percentages of exposed teeth requiring restorations in conventional unbounded amalgam group were 1st Molar (75%), 2nd molar (25%). Similarly, the percentages of exposed teeth requiring restorations in bonded amalgam group were 1st Molar (35%), 2nd molar (55%), 3rd molar (5%) and 2nd premolar (5%). Postoperative sensitivity was observed in only 10% and 5% teeth in conventional and bonded amalgam group respectively.

No difference in number of fillings showing marginal breakdown was noticed at 3rd month recall and P value of 1.00 was observed (Table 1) while at 6th months recall there was a slight difference in number of fillings showing marginal break down in the two groups.

However the P value was 0.799 and hence the difference was insignificant (Table 2). No differences were observed in surface discoloration between conventional and bonded amalgam at 3 months and 6 months recall with p-values of 0.965 and 0.854 respectively.

DISCUSSION

The hypothesis is there is a difference in marginal breakdown of conventional amalgam and bonded amalgam restorations, however the results of the study refuted the hypothesis and showed that there was no difference in marginal breakdown of conventional and

TABLE 1: DISTRIBUTION OF TEETH WITH RESTORATIONS

Restorative technique	Conventional unbounded Amalgam		Bonded Amalgam	
	No.	Per-cent	No.	Per-cent
1st Molar	30	75%	14	35%
2nd Molar	10	25%	22	55%
3rd Molar	0	0	2	5%
2nd Pre Molar	0	0	2	5%

TABLE 2: POSTOPERATIVE SENSITIVITY ACCORDING TO RESTORATIVE TECHNIQUE

Restorative Technique	Sensitivity present		Sensitivity absent	
	No.	Per-cent	No.	Per-cent
Conventional Amalgam	4	10.0	36	90.0
Bonded Amalgam	2	5.0	38	95.0

bonded amalgam restorations. Mahler and his coworkers evaluated the bonded and unbonded restorations, basing their research on clinical performance and results of their study are consistent with the present study.¹⁰ Grossman and Matejka evaluated the amalgam marginal quality by comparing seven different methods and percentage length of marginal discrepancy was used to access marginal quality of amalgam restorations.¹²

A research was done to evaluate the microleakage and wall adaptation of different restorative materials and it was concluded that sealed restorations had less microleakage than unsealed restorations. The results of the study are not consistent with the present study.¹¹

The integrity of bonded amalgam restoration was searched out by Mach and Regent, who concluded that bonded and unbonded amalgam restorations yielded similar results in conventional preparations. These results are consistent with the current study.¹⁷

However, in spite of the strong linkage of the results of the current study to the previous studies there were few limitations of the study like fillings were done in class 1 cavity design only. Using other cavity designs may have revealed different results. Similarly only one kind of bonding agent was used and only high copper amalgam alloy was used, other bonding agents or low copper amalgam alloy may act differently. Maximum recall time was six months while an amalgam filling may last for years in oral cavity, and hence prolonged time may have led to different results.

CONCLUSION

No difference was noticed in marginal break down of conventional and bonded amalgam fillings. Bonding agents add to the cost of treatment and pose some technical problems. It is suggested that their use in traditional amalgam cavity preparations should not be recommended until proven clinical benefits have been demonstrated.

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