

Management of Postop Sensitivity in Class 1 Amalgam Restorations: A Clinical Study Evaluating the Efficacy among Bonded Amalgam, the Use of Cavity Varnish and Conventional Amalgam Restoration

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ABSTRACT

Aim: To investigate which lining material is responsible for decreased post operative sensitivity among bonded amalgam, cavity varnish and conventional silver amalgam filling in class 1 amalgam restoration

Methods: This study was carried out at Nishtar Institute of Dentistry from 1-7-2016 to 30-9-2016. A total number of 51 patients were selected after oral examination having black's class 1 cavity in mandibular molars. Patients were divided in three groups. Group I got amalgam filling with zinc phosphate lining. Group II got the amalgam restoration with cavity varnish coating and group III received bonded amalgam restorations.

Results: The results rejected the null hypothesis (Ho) which denotes that all the restorations would present similar findings in reducing the post operative sensitivity. There is difference among all three modes of restorations which was confirmed by Tukey HSD test.

Conclusion: The post operative sensitivity in class 1 cavity can be minimized by the bonded amalgam restoration. The use of cavity varnish is also of positive value minimizing the post operative sensitivity.

Keywords: Post operative sensitivity, Cavity varnish, Dentine Bonding agent, Hybrid layer,

INTRODUCTION

Currently a number of restorative materials have been evolved in dentistry making the older ones out of running. These restorative materials are utilized according to the form and structure of the cavity. Amalgam is considered as one of the oldest restorative materials. Although it has some controversy regarding mercury toxicity yet to date there has been little agreement on that and can probably fill the bill. It accommodates almost 75% of all the restorative materials used by the dentists.¹ It has high compressive strength and corrosive properties. This corrosion by products seals the gaps between the tooth and cavity with the passage of time. There is no chemical bond formed to the tooth and the retention is merely obtained by the design of cavity and the macro mechanical retention. To overcome this lacking of bond with tooth, some researchers have developed the bonded amalgam technique in which an unfilled resin is applied in the walls of cavity surrounding enamel and dentine after etching the tooth. The rationale is the sealing the gaps till the corrosion is initiated. A key aspect of bonded amalgam is improved marginal integrity. According to Chadwick RG who worked on the bonded amalgam, concluded that sealed amalgam performed superior longevity than that of unbonded

amalgam². Since amalgam is a metallic material, a proper insulation of the dentine is necessary before the placement of material. Zinc phosphate is considered as good insulating material used as base under the amalgam restorations. The other material includes glass ionomer cement, calcium hydroxide cement reinforced type and zinc oxide eugenol cements. Glass ionomer is difficult to manipulate and is radiolucent while zinc oxide eugenol cement has low compressive strength. Zinc phosphate is a better option applied in thick consistency in which there is less acidic fluid content to act as irritant to pulp³.

It has been observed that restoring a tooth with amalgam, sometimes causes post operative sensitivity. There is an increasingly important area in the restorations that have to get on the ball. Recent developments in the field of biomaterials have heightened the need for most suitable material. While in amalgam restoration, the floor of the cavity is kept just below the dentine enamel junction unless the residual caries are present. The dentine has the nerve endings responsible for the sensation.³ This post operative sensitivity has been advocated by many researchers indicating it a common phenomena complained by the patients⁴.

PATIENTS AND METHODS

This study was conducted at Nishtar Institute of Dentistry from 01-07-2016 to 30-09-2016. While considering our main focus is the post operative

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sensitivity in amalgam restoration, three types of restoration protocols were performed. A total number of 51 patients having ages between 20 to 40 were selected having Black's class 1 cavity in mandibular molars. Among them 20 were females and 31 were males. The selected patients had no other sensitivity problem and were having good oral hygiene and periodontal health. All the patients were divided in three groups with 17 patients in each group randomly. One group received the zinc phosphate base under the amalgam restoration, the second group received silver amalgam restoration along cavity varnish application and the third one received the bonded silver amalgam. The cavity was prepared with the air turbine having plenty of water irrigation. All the materials were applied according to manufacturer's instructions and keeping isolation to the preparation. The post operative sensitivity was checked by the visual analogue scale (VAS) with air jet and cold water using triple syringe. Each case was

observed three times at one month interval to give an accurate scale and mean was taken. The null hypothesis (H_0) say that all the treatments are same while the alternate hypothesis (H_a) say that there is difference between the treatment sets.

RESULTS

The value of q is determined from the Tukey chart. The Df is 48 (within group) with 3 groups of treatments. It finds to be 3.42 with alpha 0.05 in the Chart. By putting the values in Tukey HSD equation we get the value of 0.97. It connotes that any two means that are more than 0.97 are significantly different. F statistic obtained is greater than 3.42. So the null hypothesis is rejected suggesting that one or more treatments are significantly different. Further analysis of Tukey HSD test denotes the difference between the three sets of regimes (Table 1).

Table 1: Comparison of different groups

Treatments	Ag Amalgam with Zn Phosphate bas(A)	Ag Amalgam with Cavity varnish (B)	Bonded Ag Amalgam(C)	Total
Observations N	17	17	17	51
Sum $\sum xi$	119.0000	10.0000	58.0000	277.0000
Mean \bar{x}	7.0000	5.8824	3.4118	5.4314
Sum of squares $\sum x^2i$	857.0000	606.0000	222.0000	1,685.0000
Sample variance s^2	1.5000	1.1103	1.5074	3.6102
Sample Std. Dev s	1.2247	1.0537	1.2277	1.9001
Std. dev. of mean	0.2970	0.2556	0.2978	0.2661

Analysis of Variance (ANOVA)

Groups	Sum of squares SS	degrees of freedom v	Mean Square	F statistic	P Value
Between	114.6275	2	57.3137	41.7571	< 0.001
Within	65.8824	48	1.3725		
Total	180.5098	50			

$HSD = q \cdot MS_{within} / n = 3.42 \cdot 1.3725 / 17 = 0.97$
 $X_A - X_B = 7.0000 - 5.8824 = 1.1176$
 $X_A - X_C = 7.0000 - 3.4118 = 3.5882$
 $X_B - X_C = 5.8824 - 3.4118 = 2.4706$

DISCUSSION

The layer of a material applied in thin sections beneath the restorative material is called the lining. In other words a liner may be a thin layer of cement that is used to protect the dental pulp. Another term used is base having a purpose of dental pulp protection but applied in more thickness⁵. A lot of lining and base materials have been developed. Considering the amalgam restorative material, the most commonly given lining is that of zinc phosphate cement. However, a common presenting complaint by the patient is that of sensitivity after the restoration has been placed. The sensitivity which is observed shortly after the placement of amalgam is mostly due to the micro leakage at tooth restoration interface. There are a lot of protocols that are used to reduce the post operative sensitivity for the application of the liners and base materials. Different materials have different properties. Whenever a cavity is prepared

for restoration purpose, there still a gap may be present at the tooth restoration interface. Through this gap the micro organisms can penetrate into the cavity by capillary action of oral fluids⁶. This is called micro leakage. Other theories also suggest that the postoperative sensitivity is due to the fluid movement between the gaps of tooth and restoration⁷.

The pain may also be due to the bacteria and their by products. Our oral cavity harbours a lot of bacteria. So there are also chances of causing infection to pulp by ingress of bacteria into restored cavity through these micro gaps. The bonded amalgam is one of techniques to overcome this problem. It has an edge over the conventional amalgam restoration in aspect of reduced sensitivity and micro leakage. Bonded amalgam has greater longevity as compared to non bonded amalgam restorations without any meaningful conclusion about post operative sensitivity.⁸ What we know about

bonded amalgam is largely based upon empirical studies that investigate the root cause of mechanism. When we apply dentine bonding agent after etching it, there is formation of a hybrid layer in the dentine. This hybrid layer reduces the permeability and thus sensitivity⁹. There is sealing of the tubules that reduces the sensitivity¹⁰. There is no evidence that the dentine bonding agent is harmful to the pulpal tissue. Subay et al¹¹ speculated that no pulpal inflammatory response was observed histologically after the application of the dentine bonding agent.

However in case pulpal exposure the application of the dentine bonding agent on the pulpal tissue may cause pulpal inflammation¹². Al Jazairy et al¹³ evaluated the effects of bonded amalgam and concluded that bonded amalgam showed reduced sensitivity and microleakage as compared to copalite varnish or no lining. Another group of researchers reported that amalgam restoration is a predictive factor of post operative sensitivity in addition to female and younger patients⁴. Researches also highlight that restoration receiving liners showed less post operative sensitivity in class 1 amalgam restoration as compared to unlined restorations. The liners were included dentine bonding agents and cavity varnish¹⁴. The complications of micro leakage include marginal discoloration, recurrent caries, pulpal inflammation and pulp necrosis¹⁵. Tukey HSD signifies the bonded amalgam to be having greater efficacy in reducing the post operative sensitivity followed by cavity varnish and the conventional amalgam restorations with zinc phosphate lining. This is in accordance to recent study of Ghavamnasiri et al¹⁶ and other investigators have also be proved it to reduce the micro leakage and post operative sensitivity¹⁷.

Since cavity varnishes are used in very thin films, so they are not used as lining material. Zinc phosphate has low pH and therefore can cause post operative sensitivity. But this can be minimized by placing the cavity varnish occluding the dentinal tubules and preventing the acid penetration. A small scale study by some researchers points out that no amalgam bonding is mandatory in sense of restoration survival rate compared to non bonded amalgam and post operative sensitivity was not a significant factor^{18,19}.

CONCLUSION

Far and away the bonded amalgam not only increases the amalgam retention but also seals the dentinal tubules. This sealing effect is of positive

value regarding the decrease in post operative sensitivity caused in amalgam restorations. Moreover the formation of corrosion by-products in later stages superimposes the sealing of tooth restoration interface. However much uncertainty still exists about the relation of bonded amalgam to the tooth regarding decrease in post operative sensitivity.

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