BONDED AMALGAM RESTORATION: A BOON TO LESS PRIVILEGED DENTISTRY IN NEPAL

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ABSTRACT:

Silver amalgam restorative material is here to remain, because of its durability, low cost and ease of manipulation; defying the claims that it will not survive as a restorative material into the new millennium. A major observation though with endodontically treated teeth or teeth with large restoration has been the resultant fracture and undue loss of the teeth. Well proven long term performance of amalgam combined with an adhesive material resulting in a Bonded Amalgam Restoration may be a solution to this when patient is unable to go for a more protective restoration like crown. A Bonded Amalgam Technique using luting Glass Ionomer Cement [GIC] and Silver amalgam is suggested here with definite advantages.

KEYWORDS

Bonded amalgam restoration, access preparation, biomechanical preparation, inlay, resin composite.

INTRODUCTION

Dental hard tissue diseases are one of the most prevalent disease in the world and our country is no exception to it. But because of increased awareness, improved standard of living and improved access to the dental health care personnels more of the endodontically involved teeth are being saved than before. These endodontically treated teeth function better and are economic to any substitute thereof. But inherent weakening of the tooth structure resulting from the access preparation and biomechanical preparation of the tooth sometime predisposes the tooth to fracture. Full coverage crown of the tooth is suggested but due to economic constraint it may not be feasible for all the patients. Alternatively a bonded amalgam restoration technique is advocated for better resistance to fracture and retention.

The long term performance of amalgam is well documented (1,2) when compared to other restorative materials. Bonded amalgam restorations were introduced in the late 1980's in an attempt to combine the advantages of new adhesive materials with proven performance of amalgam(3). The one using luting GIC with amalgam was introduced by Prof. Dr. K.S.Bhat, Dean and Head department of conservative dentistry and endodontics, College of Dental Surgery Manipal in late 1990's in an effort to minimize tooth reduction, yet provide additional retention to compromised tooth structure eliminating elaborate methods of mechanical retention.

Resin composites and indirect restorations in the form of inlays and onlays are the other alternatives but are more expensive, time consuming, technique sensitive and indirect restorations require that more tooth structure be removed and the durability of resin composites is yet to unfold(4).

PROCEDURE

After a cavity is prepared properly with adequate resistance and retention form as dictated by the lesion site and size, Type I Glass Ionomer Cement is mixed to a luting consistency and using an applicator it is applied to the walls and floor of the cavity and silver amalgam condensed directly on to it ,amalgam is condensed in increments, carved , burnished and finished in usual manner. For class II lesion involving proximal walls a suitable matrix band is selected and lubricated with petroleum jelly, to prevent the amalgam and GIC from adhering to the matrix band, additionally it protects the GIC during early stages of setting .

PROPOSED MECHANISM FOR THE ADHESION OF GIC TO THE SILVER AMALGAM IN GIC BONDED AMALGAM RESTORATIONS

GIC Liquid – Poly Acrylic Acid **(PAA)** + Powder (Al_2O_3, SiO_2, NaF, CaF_2 etc)

$\longrightarrow$ POWDER attacked by liquid $\xrightarrow[\text{of}]{\text{Release}}$ Ca^{++}, Al^{+++} and other ions from the powder.

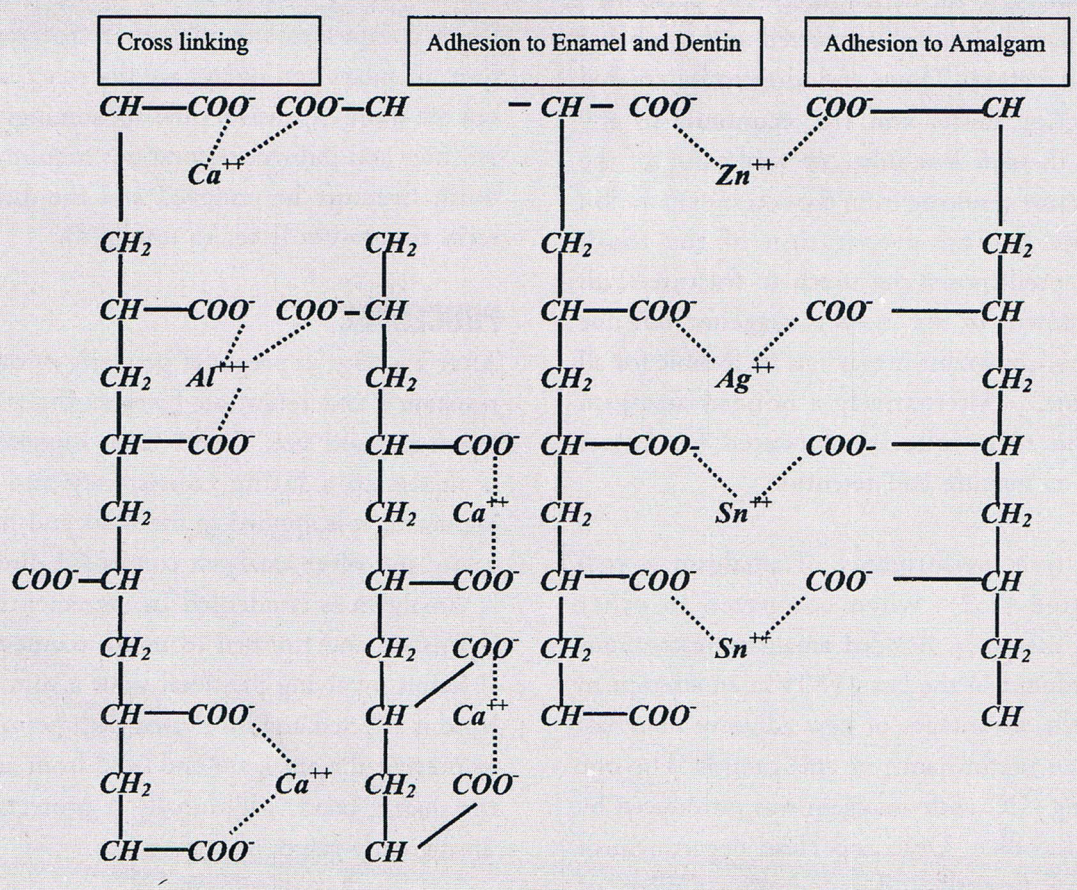
Free Carboxyl group (COO^-) from Polyacrylic acid (PAA) interacts with these positively charged ions $\xrightarrow[\text{in}]{\text{Resulting}}$ Cross linking.

Also COO^- groups reacts with Ca^{++} (abundant) and others ions in Enamel and Dentin

$\xrightarrow{\text{Results In}}$ Chemical bonding to the tooth.

Some free COO^- groups may react with Sn^{++}, Ag^{++} and Zn^{++} etc present in the Alloy

$\xrightarrow{\text{Results In}}$ adhesion of GIC to the amalgam.



DISCUSSION

As of today many bonded amalgam restoration systems have evolved using different adhesive systems [such as 4-META (4-Methacryloxy Ethyl Trimellitate Anhydride), DenTASTIC Amalgam Bonding Kit etc] but one discussed here has some distinct advantage over others and hence advocated.

GIC has affinity to bond with calcium ions in the enamel and dentine(5) and it acts as a matrix to micromechanically bond amalgam to dentin and enamel minimizing microleakage. Also flouride released act as an anticariogenic agent reducing secondary caries.

When used for vital teeth it is mild to the pulp because the pH of the cement rises rapidly, large molecular size of Poly Acrylic Acid, thus less penetration and acid being neutralized by the action of calcium and other salt in dentine(5).

Easy availability, all the materials required are normal constituent of a dental clinic set up and no additional equipment or material is required than those used in normal practice. No modification of cavity is needed as in inlay and yet inlay like advantage is achieved with even better retention because of cavity design with undercut and luting cement. Set amalgam acts as an inlay cemented to the tooth. Studies have shown that when compared to resin composites the bond of bonding agent to the tooth is not likely to fail under amalgam any more than under composites(6).

Even when a crown is planned amalgam has the lowest failure rate compared to resin composites and GIC when used as a core material(7). Even further, owing to the good strength of amalgam it has been used as a dowel and core build up material in posterior teeth(8). The effect of bonded amalgam restoration in improving the fracture resistance of teeth is well supported (9,10,11) and ability of GIC to bond amalgam to the tooth structure with minimal gaps comparable to other adhesive system(12) makes GIC bonded amalgam restoration a good choice.

In the two years period authors have done more than 600 GIC bonded amalgam restorations in the People's Dental College And Hospital, Nayabazar and though preliminary results are very promising further follow up is required before any statistically significant claims can be made.

The drawbacks include cement being flown interproximally and sticking to the matrix band in case of class II cavity thus fracturing the restoration interdentally. To avoid this prior application of a petroleum based lubricant to the band is advised. Interproximal cement can be carved carefully and final finishing done after 24 hours with finishing strips.

It has been shown that bonded restorations greatly enhance the fracture resistance of the endodontically treated teeth(13) thus avoiding undue loss and unwanted sacrifice of the tooth which has been saved with great efforts from the dentist and at the time and expense of the patient, however basic principles of cavity preparation should be adhered to, to maximize its longevity, and bonded restorations should not be considered to compensate for the operators inefficiency.

CONCLUSION

An alternative to the post endodontic crown restoration is suggested here with definite advantages in the form of bonded amalgam restoration. It should not be considered an ideal substitute to the Full coverage crown though , wherever clinical situation demands a full coverage crown should be advised and patient explained about it , after placement of a bonded amalgam restoration.

But in most of the case where patient is unable to or does not opt for full coverage crown ,bonded restoration must play an important role in supporting and extending tooth saving strategy of Endodontics, however long term in vivo results of the GIC bonded amalgam restoration needs to be evaluated .

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REFERENCES

1. Osborne JW, Norman RD , Gale EN : A 14 year clinical assessment of 12 amalgam alloys. *Quintessence International* 22:857-864 , 1991.
2. Osborne JW, Norman RD :13 year clinical assessment of 10 amalgam alloys. *Dent MaterJ* 6: 189-194 ,1990.
3. Setcos JC , Staninec M, Wilson NHF: Bonding of amalgam restorations: Existing Knowledge and future prospects. *J Oper Dent* 25: 121-129, 2000.
4. Momoi Y, Iwase H, Nakano Y, et al. Gradual increases in marginal leakage of resin composite restorations with thermal stress. *J Dent Res*, 69: 1659-1663, 1990.
5. Philips RW:Skinner's Science of Dental Materials: Dental Cements for restorations. Cavity varnishes, Liners and Bases. W. B. Saunders Company, Philadelphia, 9th edn: 452-463, 1992.
6. Smith DC : Dental Cements, *Dent Clin North Am* 15(1) :3, 1971.
7. Kovarik RE, Breeding LC, Caughman WF . Fatigue life of three core materials under simulated chewing conditions. *J Prosthet Dent* 68: 584-590, 1992.
8. Nayyar A, Walton RE, Leonard LA. An amalgam coronal radicular dowel and core technique for endodontically treated posterior teeth. *J Prosthet Dent* 43: 511-515, 1980.
9. Oliveira JP, Cochran MA, Moore BK. Influence of bonded amalgam restorations on the fracture strength of teeth. *J Oper Dent* 21:110-115, 1996.
10. Eakle WS, Staninec M, Lacy AM. Effect of bonded amalgam on the fracture resistance of teeth. *J Prosthet Dent* 68: 257-260, 1992.
11. Chen RS, Liu CC, Cheng MR, Lin CP. Bonded amalgam restorations: using glass ionomer as an adhesive liner *J Oper Dent* 25(5): 411-417, Sep-Oct 2000.
12. Abraham MM, Sudeep PT, Bhat KS, Comparative quantitative and qualitative assessment of bonded amalgam restorations using luting glass ionomer and 4-META adhesive liner under a scanning electron microscope. An in vitro study. *Indian J Dent Res* 10(2):43-53,Apr-Jun 1999.
13. Ausiello P, De Gee AJ, Rengo S, Davidson CL. Fracture resistance of endodontically treated premolars adhesively restored. *Am J Dent* 10(5): 237-241,Oct 1997.