

Case Report

USES OF HIGH COPPER AMALGAM ALLOYS IN DENTISTRY

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ABSTRACT

A filling is the repair of a damaged or decayed tooth, restoring it back to its normal shape, appearance and function. Amalgam Restoration is an example of the material giving its name to the process. Amalgam fillings are made up of mercury, powdered silver and tin. They are mixed and packed into cavities in teeth where it hardens slowly and replaces the missing tooth substance. The high copper have become material of choice as compared to low copper alloys nowadays because of their improved mechanical properties, corrosion resistance, better marginal integrity and improved performance in clinical trial. The high copper amalgam was used as a restorative material. The application of high copper amalgam was found to be much more useful than low copper amalgam. High copper had much more strength, corrosion resistance, durability and resistance to tarnish as compared to low copper amalgams. No marked expansion or condensation was noted in the amalgam restoration after its setting after 24 hrs. By using the high copper alloy, the chances of creep were also minimized in the restored tooth. No discomfort or any kind of odd sensation in the tooth was noted after few days of amalgam restoration in the tooth.

Keywords: Amalgam, High copper use, Tarnish and corrosion, Creep.

INTRODUCTION

A dental restoration is also called a filling. It is the repair of a damaged or decayed tooth, restoring it back to its normal shape, appearance and function. The name of the material that is used to repair a tooth is often the name given to the repair process.¹ Amalgam Restoration is an example of the material giving its name to the process. High copper amalgams contain more than 6 % copper, in fact there are 2 main groups, one containing around 12-13 % copper, and the other containing up to 30 % copper.² The additional copper helps to increase the formation of gamma 1 (silver-tin) and prevent the formation of a weak phase of dental amalgams, named gamma-2 (tin-mercury) and thus the strength of the final product is higher.³ Therefore, the high copper amalgams have a

higher compressive strength and in general, better mechanical properties.^{4,5}

For many years, the amalgamation of silver with mercury to produce a condensable mixture which could be used to restore carious defects in teeth followed a tortuous path of negative results.⁴ However, at the turn of the century, amalgam alloys having acceptable characteristics for successful clinical use emerged. From that point on, silver amalgam was widely accepted as the material of choice for low-cost, easily placed, and durable restorations.⁶ It is still considered a material of choice for some fillings in the back teeth, the use of amalgams has been decreasing in recent years, because it is not tooth-colored and does not adhere to the surface of the tooth. Alternative tooth-colored filling materials have become increasingly popular. Not only do these materials look better, but they require the dentist

to remove less tooth material and they do not contain mercury also. Amalgam fillings (silver fillings) are made up of mercury, powdered silver and tin.⁷ They are mixed and packed into cavities in teeth. It hardens slowly, and replaces the missing tooth substance. Amalgam fillings are held in place by the shape of the prepared cavity. The cavity has to have an undercut to prevent the filling from falling out. The amalgam is then slotted into the cavity. It is still commonly used, despite an ongoing debate about mercury toxicity. High-copper amalgam was developed in 1962 by the addition of silver-copper eutectic particles to traditional silver-tin lathe-cut particles in an attempt to dispersion strengthen or dispersion harden the alloy.⁸ A high copper containing amalgam alloy was used for the purpose of tooth restoration. The high copper alloy contained sufficient amount of silver (40% min), tin (32% max), copper (30% max); mercury (3% max), zinc (2% max) and some other elements in trace amounts. The particles were spherical in shape and smaller in diameter. The mix was prepared using hand mixing/ trituration and condensed properly in the prepared tooth cavity with use of amalgam condenser.⁹ The application of high copper amalgam was found to be much more useful than low copper amalgam. High copper had much more strength, corrosion resistance, durability and resistance to tarnish as compared to low copper amalgams. By using the high copper amalgam, the gamma 2 phase of amalgamation reaction was eliminated/minimized resulting in enhanced/ better result of the amalgam restoration in the prepared tooth cavity. No marked expansion or condensation was noted in the amalgam restoration after its setting after 24 hrs.¹⁰

MATERIAL AND METHODS

A high copper containing amalgam alloy was used for the purpose. The high copper alloy contained sufficient amount of silver (40% min), tin (32% max), copper (30% max), mercury (3% max), zinc (2% max) and some other elements in trace amounts. The particles were spherical in

shape and smaller in diameter. The mix was prepared using hand mixing/ trituration. Firstly the measured amount of powder was mixed with measured quantity of liquid in a mortar than mixed together with the help of pestle which was moved in a circular fashion. Mixing was stopped after getting a homogenous mix in mortar. This mix was then transferred to squeezing cloth with the help of plastic filling instrument. The excess mercury content from the mix was removed using pressure from cotton held in tweezer around the squeeze cloth. The excess mercury was disposed of accordingly. The remaining homogenous mix was then collected in amalgam carrier and filled in the prepared cavity which already had proper isolation done to it. Isolation can be done using rubber dam, cotton rolls or cotton pellets. A suction tip connected to suction machine is also needed with use of cotton pellets or rolls but it can also be used with other isolation objects. A proper condensation with hand using amalgam condenser was done. In case of class 2 cavity, proper matrix band placement was done by properly adapting the wedges either plastic or wooden and the retainer. The excess band was cut using straight scissor and curved scissor were excess was not proper for using straight scissor. Amalgam was condensed in small increments to avoid any chances of voids occurrence and leaving the cavity unfilled at some places. The filled amalgam was then pre-burnished using ball burnisher to remove excess amalgam from the cavity. Proper anatomy of tooth was restored using carvers namely hollen-beck carver, diamond carver, discoid clieoid carver and ward's carver. The carved restoration was then burnished properly with the help of ball burnisher to get a smooth and shiny surface of the restoration. All the disposable materials like cotton roles, excess material etc were disposed off properly.

RESULT AND DISCUSSION

The application of high copper amalgam was found to be much more useful than low copper amalgam. High copper had much more strength,

corrosion resistance, durability and resistance to tarnish as compared to low copper amalgams. Use of smaller diameter of particle size enhanced the strength of the set amalgam after 24 hrs of amalgam application in the tooth cavity. This all was also aided by the use of high condensation forces during application of amalgam in the prepared cavity. By using the high copper amalgam, the gamma 2 phase of amalgamation reaction was eliminated/minimized resulting in enhanced/ better result of the amalgam restoration in the prepared tooth cavity. No marked expansion or condensation was noted in the amalgam restoration after its setting after 24 hrs. By using the high copper alloy, the chances of creep were also minimized in the restored tooth. No discomfort or any kind of odd sensation in the tooth was noted after few days of amalgam restoration in the tooth.

CONCLUSION

High copper containing amalgam was found to be much better than low copper alloy containing amalgam in respect to strength, corrosion resistance, durability and resistance to tarnish. The tooth restored with high copper amalgam did not had any kind of marked expansion or condensation after its setting after 24 hrs. By using the high copper alloy, the chances of creep were also minimized in the restored tooth. No discomfort or any kind of odd sensation in the tooth was noted after few days of amalgam restoration in the tooth. The use of high copper amalgam was found to be more beneficial than low copper amalgam.

REFERENCES

1. Mosby, CV and Robert, GC (1992), "*Restorative Dental Materials*", 8th Ed.
2. Phillips, W and Saunders, WB (1994), "*Skinner's Science of Dental Materials*", 9th Ed.
3. Smith (1986), "*The Clinical Handling of Dental Materials*", Wright and Brown PSG Wright.
4. Marzouk (1985), "*Operative Dentistry - Modern Theory and Practice*", Simonton and Gross Ishiyaku Euroamerican Publishers.
5. Reese, JA and Valega, TM (1985), "*Restorative Dental Materials - An Overview*", Federation Dentaire Internationale, Vol.1.
6. Anderson, M and McCoy, R (1993) "*Dental Amalgam: The State of the Art and Science*", Dental Clinics of North America, Vol. 37.
7. Anderson, MH and McCoy, RB (1993), "*Dental amalgam: The state of the art and science*", 3rd Ed. Philadelphia.
8. <http://www.amalgam.com/>
9. Ferracane, Jack L (2001), "*Materials in Dentistry: Principles and Applications*", Lippincott Williams & Wilkins.
10. Davis, JR (2003), "*Handbook of Materials for Medical Devices*", ASM International.