

## Clinical Longevity of Dental Amalgam V/S Resins Based Composites – A Literature Review

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**Abstract:** Dental amalgam restoration represents 150 years of successful history while serving the dental profession. With the advent and increased clinical use of direct aesthetic restorative materials, the popularity of amalgam has decreased over the years. Concerns were raised against amalgam restorations in terms of poor esthetics, need of excessive tooth preparation for restoration, recurrent caries, and lack of adhesion to tooth, mercury toxicity and its disposal from the dental office. Serious clinical and environmental concerns regarding the use of amalgam as a restorative material has led to a decline in its use in many countries and it may be facing a complete ban to be effective in the coming years.

Effective and evolving adhesive bonding solutions with life like aesthetic and mechanical properties have lead to exponential growth in use of resin based composite resins universally. These restorations when performed with utmost clinical superiority can provide excellent service for many years. However, certain drawbacks are associated with resin based composite systems too, including technique sensitivity, degradation of restoration and majorly polymerization shrinkage.

According to World Health Organization the shift from use of amalgam restorations to resin based composites is only possible with the quality improvement of adhesive material systems fulfilling the requirements of conservative dentistry is achieved i.e. form, function and aesthetics. A controversy exists regarding the best performing clinical restorative material with natural tooth like properties. Therefore there is a need to review of scientific literature comparing the effectiveness of both the restorative materials.

**Keywords:** Composite resins, Dental amalgam, Durability, Failure, Esthetics, Longevity

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Date of Submission: 10-05-2019

Date of acceptance: 27-05-2019

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### I. Introduction

According to American Dental Association in recent years, dramatically there is a decrease in clinical application of amalgam restorations from times when more than 100 million dental amalgam fillings were placed. In perspective to Indian dental practice similar findings can be observed regarding declined use of amalgam due to inferior esthetic appearance<sup>1</sup> and other associated clinical drawbacks. In today's contemporary society where esthetics and appearances matters the most, the patients and operating dental surgeons prefer direct tooth colored adhesive restorative materials as preferred choice for restoration, even in posterior region.<sup>2</sup>

The resin based composite materials are made suitable for posterior restorations with series of scientific development in its composition and clinical properties. But still silver amalgam restoration presents as the most widely used restorative material in the developing world.<sup>3,4</sup> Therefore there is a controversy regarding the choice of restorative material to be used hence the current attempt is to critically analyze the two main categories of dental restorative materials i.e. amalgam and resin based composites regarding their longevity in posterior tooth restorations.

### II. Discussion

Dental amalgam stands as the longest serving restorative material in dentistry which is basically an alloy obtained by mixing mercury together with silver, tin, copper and small amounts of zinc. Its clinical indication includes restoration of carious or fractured posterior teeth and replacement of failed restorations. Certain properties of dental amalgam are unique and not been presented by any other restorative material i.e. self sealing of interfacial margins over time,<sup>5</sup> compressive strength is close to that of tooth structure and adequate resistance to fracture.<sup>5</sup> other advantages include easy clinical handling and insertion in cavity, less technique sensitivity and its economic viability. Successful clinical longevity of amalgam restorations are seen for more than 12 years when high copper amalgams when used for restoring defects with large cuspal defects.<sup>6</sup> literature also reports of review of 3500 amalgam restorations reporting the success rate at 5 years with 72% success for the four surface and 65% for the five surface restorations.<sup>7</sup>

However certain drawbacks are also associated with it, like it undergoes a variety of solid state and corrosion reactions,<sup>8</sup> low tensile strength making it brittle in nature,<sup>9</sup> poor esthetic appearance, mechanical bonding to tooth structure which demands proper cavity design providing bulk of at least 1-2mm leading to less conservation of tooth structure, secondary caries, a high incidence of bulk and tooth fracture, cervical overhang, marginal ditching<sup>10</sup> and the most addressed drawback is poor esthetic compliance of material.

Potential drawbacks of amalgam restorations led to development of polymerizing resins as restorative materials in 1950's which opened up new avenues for the clinicians as an alternative to dental amalgam.<sup>2</sup> Composite resin restoration are traditionally a mixture of silicate glass particles within an acrylic monomer that is polymerized during the application.<sup>7</sup> They are referred as "tooth-colored" restorative materials because of their esthetic applications which can be customized to closely match the surrounding tooth structure. Composites resins also exhibit high strength and require minimal tooth preparations due to its adhesive properties. However the disadvantages include technique sensitivity, polymerization shrinkage leading to post operative sensitivity, micro leakage, less clinical durability when compared to amalgam restoration and expensive availability.<sup>2,5,11</sup>

The clinical performance and durability of dental restorations are dependent on many factors, including those related to material composition, the expertise of clinician and the patient. When compared, around 86 million composite restorations were placed in the United States against 71 million amalgam restorations and this was because of improvement in formulations of resin composite materials and public demand for more esthetics.<sup>12</sup> The lifespan of composite restorations in posterior teeth is 3-10 years, with large fillings usually lasting lesser than 5 years.<sup>13</sup>

Studies by Demarco et al have shown that the survival rate of amalgam restorations was 94.4% and that of composite restoration was 85.5%, concluding that amalgam restoration lasted 20% more than similar composite restorations.<sup>14</sup> Similar findings were reported in a 7 year follow up by Bernardo et al stating that the longevity of amalgam restorations was 94.4% and that of composites was at 85.5%, concluding that the mean annual failure rates of composite restorations was almost three times greater than those of amalgam restorations.<sup>15</sup> But composites are being improved constantly so there are newer, stronger and improved materials available.<sup>16</sup>

Simecek et al proved that the caries risk status of the patient and number of surfaces involved are factors affecting the durability of amalgam and composite restorations.<sup>17</sup> Correlating with these finding Opdam et al stated that, in low caries risk group the survival rate of composites was higher whereas in high caries risk group the survival rate of amalgam was higher.<sup>18</sup> Soares et al concluded that composites should be the materials of choice in restorations with margins located in enamel, low caries risk patients, and when complete isolation can be achieved. Amalgams should be preferred in large and complex restorations whose margins are located in dentin or cement and where isolation is deficient.<sup>19</sup>

There is a general belief that amalgam restorations show a higher rate of cusp fracture than composite restorations but studies by Michael et al found that there is no significant difference in the cusp fracture ratio.<sup>20</sup> Most studies have shown that composite restorations are not as durable as amalgam restorations.<sup>21</sup> The main reason for failure in composites is bulk fracture which is 2-3 times more in composites than the control high copper amalgam restoration.<sup>22</sup> At a five year recall period in children, it has been observed that composite restorations have to be replaced or repaired at higher rates than amalgam restorations.<sup>23</sup> A lot of improvement is being made in composite restorations but some dentists still feel that in the large posterior carious defects amalgam restorations are still more durable in comparison with composite restorations.<sup>16</sup> In a study carried out by Kyou et al the clinical longevity of amalgam restorations was found to be better as compared to composite restorations.<sup>24</sup> The materials are improving year by year but some dentists still feel that they are not yet comparable to amalgam for the larger posterior restorations.<sup>14,15</sup> The use of composites in posterior teeth is still not popular in northern Saudi Arabia according to the responses obtained in a survey.<sup>25</sup> A study by Ulla et al found that the longevity of posterior, multisurface composite restorations is comparable with amalgam restorations and another interesting finding reported was that restorations in upper jaw were more durable as compared to those in the lower jaw.<sup>26</sup> According to a review article by Rasines Alcaraz the failure rate of composites is higher than that of amalgam restorations and they have proposed that if a ban on amalgam is effective, there is a need to improve composite materials and the techniques used for placing them.<sup>27</sup>

### **III. Conclusion**

Current review on longevity of amalgam and resin based composite restoration presents that amalgam shows superiority when compared to that of composites and there is a definite shift from amalgam towards composite resins as choice of restorative material. Though amalgam restorations are 3 to 8 times more cost effective than composite restorations, but due to concerns of mercury toxicity and esthetics amalgam is nearly on the verge of extinction. Composite represents the future generation of filling materials with ever evolving technology in terms of better adhesion, aesthetics and mechanical properties. Therefore more emphasis in dental

curriculum and training should be given towards better application of resin based composites in clinical practice as and when compared to amalgam restorations.

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Dr Varsha Uttarwar. "Clinical Longevity of Dental Amalgam V/S Resins Based Composites – A Literature Review" *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 18, no. 5, 2019, pp 62-64.