Review Article

University J Dent Scie 2025; Vol. 11, Issue 1

Composite Vs Amalgam Fillings: Which One Is Right For You?

Abstract:
The most significant line of treatment directed towards dental caries is the restorative procedure of filling the affected tooth or teeth with appropriate materials that arrests the growth of the cavity and motivates the tissues towards the maintenance of an adequate form and function. The restorative materials that have portrayed a high degree of usefulness for the treatment of include composite resins and amalgam alloys, the comparison of which is the principal aim of this review literature. The subcategories used to draw a contrast between the two include compressive strength, longevity, and coefficient of thermal expansion. A thorough literature search was conducted of the Medline, Cochrane and EMBASE databases utilizing the clinical subject headings or a blend of all conceivably related terms and published articles from 2008 to 2023 were referred to for the same. The discourse between supporters of amalgam and composite restorations is an ongoing one but the conclusion of this review pointed out that amalgam restorations rely on their strength and sealing ability to be of continued use in conservative treatments, especially for larger lesions and composite resins are praised for their aesthetics, minimally required preparation, and longevity which is more consistently expressed for smaller lesions.

Key-words: Composite,Coefficient of thermal expansion,

Introduction:

Dental caries is one of the leading pathologies in the field of dentistry with a prevalence of approximately 54% in the Indian population.[1] The most significant line of treatment directed towards its elimination is the restorative procedure of filling the affected tooth or teeth with appropriate materials that arrests the growth of the cavity and motivates the tissues towards the maintenance of an adequate form and function.

The restorative materials that have portrayed a high degree of usefulness for the treatment of dental caries include composite resins and amalgam alloys, albeit both have their advantages and disadvantages which must be measured adequately before making a decision regarding which material is to be employed for the treatment of each case. Restoration with amalgam is achieved by the process of mechanical interlocking between the metal components and the tooth structure whereas composite resin bonds chemically with the tooth surface to restore the structure.[1]

Access this article online

Website: www.ujds.in

Quick Response Code

DOI: https://doi.org/10.21276/ujds.2025.11.1.20

The cause for the success of amalgam restorations includes its properties of longevity with regard to adhesion with enamel and dentin and the occlusal stability it offers during function. Amalgam restorations, however, have been subjected to discontinuation from many clinical practices due to the extensive scope of mercury toxicity it carries once placed in the mouths of patients. Restoration with composite resins solves this problem with the absence of metal alloys in its composition along with offering natural aesthetics with its appearance, which is also absent in cases of amalgam

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Received : 29 April, 2024, **Published :** 31 March, 2025

How to cite this article: Saleem, A. (2025). Composite VS Amalgam Fillings: Which One is Right for you?. UNIVERSITY JOURNAL OF DENTAL SCIENCES, 11(1).

restorations. However, with composite restorations, residual polymerization stresses are a major drawback as it leads to the formation of microscopic spaces in the restoration that further motivates the initiation and development of secondary caries. [2]

Therefore choice between the two materials is made on the basis of the requirements of the treatment and the judgement of the operator. The advantages demanded by the case and the drawbacks it can tolerate determine the decision regarding which restorative material must be used for restoring the affected tooth or teeth.

Methodology:

A thorough literature search was conducted of the Medline, Cochrane and EMBASE databases utilizing the clinical subject headings or a blend of all conceivably related terms. The study concentrates on contrasting composite resin and amalgam restoration from various viewpoints including compressive strength, longevity, and coefficient of thermal expansion were evaluated for significant data. No restrictions were placed on the date, language, or kind of publishing.

Comparison:

Compressive strength :

Collating the various definitions of compressive strength from the fields of physics and biology, compressive strength is simply a material's ability to withstand the various forces it is subjected to that have the capacity to compress or crush the material.

Restorative materials are meant to function as a repair for the carious damage a tooth has undergone along with reestablishing its capacity to withstand the everyday occlusal forces. In order for the restorative material to resist such forces, adequate compressive strength is one of the most important facets of its effectiveness and longevity. Without the presence of a potent compressive strength within the restorative complex employed, both the restoration and tooth stand the dangers of fractures or periodontal complications.[3]

Compressive strengths of high copper amalgams fall in the range of 380 to 550 MPa which is greater than that of low copper amalgams due to the absence of unwanted phases in the high copper alloys, hence being of superior quality. Since the compressive strengths of high copper amalgams fall close to that of enamel and dentin, there is no doubt of the fact that amalgam mimics the biomaterials' capacity to withstand masticatory forces. Composites on the other hand range between 236 to 256 MPa which is significantly lower than the values projected by amalgam restorations.

With a considerable difference in the strengths of both materials, they are implemented in numerous contrasting endodontic situations for restoration on the basis of the extent and intensity of damage sustained by the affected teeth. The presence of large lesions, particularly in the posterior tooth region which endures the most compressive intraoral forces, will warrant the use of amalgam restoration due to its higher compressive strengths and better resemblance to the properties of the natural tooth structure. On the other hand, smaller or superficial lesions are restored with composite restorations since it favours better esthetics and provides them with sufficient compressive strength to survive the occlusal forces. Amalgam restorations also demand greater tooth preparation with a higher degree of cutting to establish an adequate retention and resistance form whereas restoring with composite conserves tooth structure in greater capacity than amalgam.

However, with advancing times and development in the field of dentistry, amalgam restorations are being replaced with other materials altogether in order to battle the mercury leakage and unappealing aesthetics it offers as a restorative material. The introduction of fibre-reinforced composites and nano-composites which portray both strength and durability is a step forward in the attempts to better replicate the compressive strengths of natural teeth than what an amalgam restoration offers.[4]

Longevity :

After the restorative procedure culminates, a “restorative cycle” of the material begins since all restorations have a constrained lifespan, albeit some last longer than others. This feature, termed longevity, is another crucial aspect of the characteristics of different restorative materials. It determines the span of time a material maintains the restorative treatment it has provided to a particular tooth. A restorative material with good longevity is always desirable,hence it is important to consider this factor when drawing a comparison between two restorative materials, amalgam and composite in this case.[5]

Numerous studies have demonstrated the superiority in longevity that amalgam has owned for hundreds of years even though a steady decline in its use has become evident in the past few years primarily due to an exponential increase in demands by patients for a tooth-coloured, aesthetically

appropriate restorative material. Reasons for its considerable durability include the adequate compressive strength amalgam restorations offer once condensed well and triturated properly and the excellent structural retention it can deliver once placed in an accurately prepared cavity. Amalgam restorations also show enhanced sealing capabilities as they age due to the release of by-products of corrosion arising from the tooth amalgam interface. With an approximate life span of 10 years and more, amalgam restorations show excellent longevity, especially in cases of large cavities since the bulk of the material provides enough strength for the tooth to conserve its functionality.[6]

Composite restorations, when initially introduced, had half the longevity and higher failure rates, especially for posterior teeth, as offered by amalgam even though composite resins present multiple clinical advantages over amalgam. Along with being aesthetically likeable, composites also bond micromechanically with enamel with adhesion to the greatest degree available as of now in restorative dentistry. However, composite restorations function best when placed in a conservatively prepared cavity which although an advantage with regards to tooth structure preservation, poses as a drawback in cases of large cavity preparations which require retentive and resistance forms wherein composite restoration would show limited durability. Recent developments in the world of resins have brought forward modifications that function a lot better than their predecessors, however, greater developments in the capabilities of composites are required in order for amalgam to be rendered completely obsolete in the field of conservative dentistry.[7]

Coefficient of thermal expansion :

The Coefficient of Thermal Expansion (CTE) of a substance denotes the extent to which it would expand once heated. It is an important property to consider in restorative dentistry due to the ever-changing temperatures created by the introduction of hot and cold food and beverages inside the oral cavity. Since various materials expand and contract at varying rates once exposed to contrasting temperatures, it is important to consider the restorative material according to the CTE they demonstrate so that the restoration can expand in harmony with the changes and avoid failure in its integrity and function. In order for this harmony to be created, the CTE should be similar to that of the natural tooth structure so that the seal created by the interface of restoration and tooth remains unharmed and does not cause microleakage.

Various research literature expresses dissimilar opinions regarding which restorative material performs better under the stresses of temperature changes within the oral cavity. Some argue that the significant difference between the CTE of composite resin and enamel with the former being several times larger contributes to the higher incidences of microleakage[8] However, other studies have argued that under the extreme conditions created by thermal cycling, amalgam restorations show higher incidences of failure in the form of microleakage whereas composite restorations did not suffer the aftermath with the same intensity. One such research has claimed that the in vitro study they conducted presented a conclusion describing the negative impact thermal cycling regimens have on the marginal integrity of amalgam restorations and that composite restorations only suffered under extreme conditions not usually encountered in normal oral environments.[8]

The major difference between the sealing mechanism of composite and amalgam resides in the fact that the former forms a solid bonded seal instantaneously whereas the latter has a tendency to establish sizeable and substantial multi-surfaced fillings in the cavity. On the basis of this mechanism, many researchers claim that the margins of an amalgam restoration if ever mechanically detach from the cavity walls when exposed to expansion and contraction will undergo some degree of corrosion as all amalgam does, reestablishing the seal at the interface.

However, composite resins do not reinforce their retention in large cavities due to the greater disparity in quantities of expansion and contraction between the material and that of the natural tooth. The CTE of composites and amalgam is approximately 4 times greater and 2 times greater than that of dentin respectively and so when the restoration expands with temperature changes, failure in the marginal integrity is observed in the former due to its larger size but the latter maintains its functionality. Hence the popular belief that amalgam restorations are better suited for large cavities arises.

Conclusion :

The discourse between supporters of amalgam and composite restorations is an ongoing one wherein various experts in the field are on a persistent path of determining the best restorative material for the treatment of endodontic lesions. An ideal restorative material that fulfils all the requirements of a conservative treatment and has no drawbacks to its application is yet to be created. However, materials like amalgam and composite resin have their own set of pros and cons that has to be skillfully weighted by an operator who can then make a choice regarding which material to use.

Amalgam restorations rely on their strength and sealing ability to be of continued use in conservative treatments,

especially for larger lesions. In contrast, composite resins are praised for their aesthetics, minimally required preparation, and longevity which is more consistently expressed for smaller lesions.

References:

1. Pandey P, Nandkeoliar T, Tikku AP, Singh D, Singh MK. Prevalence of Dental Caries in the Indian Population: A Systematic Review and Meta-analysis. Journal of International Society of Preventive & Community Dentistry 2021;11(3):256-65.
2. Anguswamy S, Adeni KM. Changing concepts and trends from dental amalgam to composites. J Global Oral Health 2021;4(1):38-41.
3. Shaikh H. Comparative evaluation of compressive strength of different packable composites with different cavity configurations – an in vitro study. Journal of Medical Science And Clinical Research. 2020;08(12):23-9.
4. Lippincott Home. www.jorr.org. [cited 2023 Jun 21]. Available from: https://www.jorr.org/article.asp?issn=2249-4987
5. Fernandes NA, Vally Z, Sykes LM. The longevity of restorations -A literature review. South African Dental Journal 2015;70(9):410–3. Available from: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0011-85162015000900008#:~:text=Restorations%20have%20a%20limited%20lifespan
6. Solanki G. Amalgam restorations- An overview. International Journal of Biomedical Research 2012;3(1):15-9. Available from: https://www.academia.edu/37617920/AMALGAM_RESTORATIONS_AN_OVERVIEW
7. Lippincott Home [Internet]. www.jorr.org. Available from: https://www.jorr.org/article.asp?issn=2249-4987
8. Cenci MS, Pereira-Cenci T, Donassollo TA, Sommer L, Strapasson A, Demarco FF. Influence of thermal stress on marginal integrity of restorative materials. Journal of Applied Oral Science 2008;16(2):106–10. Available from:https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4327628/