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THE EFFECT OF DIFFERENT CORE BUILD-UP MATERIALS ON THE LONGEVITY OF ENDODONTICALLY AND SURGICALLY TREATED TEETH RESTORED WITH CROWNS: A RETROSPECTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Background: The selection of core build-up material is a critical factor influencing the long-term success of endodontically and surgically treated teeth restored with crowns.

Objective: To evaluate the effect of different core build-up materials on the clinical longevity and survival rate of restored teeth.

Methods: A retrospective cross-sectional study was conducted using clinical records from January 2015 to December 2022. A total of 276 teeth treated with root canal therapy or surgical endodontics and restored with crowns were analyzed. Teeth were categorized based on the core material: resin composite, glass ionomer cement (GIC), or amalgam. Survival rates were evaluated over a minimum follow-up period of three years.

Results: Teeth restored with resin composite cores demonstrated the highest survival rate (85.4%) followed by amalgam (72.2%), whereas GIC cores showed the lowest survival (61.5%) ($p<0.05$). Failures were predominantly due to catastrophic fractures and recurrent decay.

Conclusion: Resin composite core build-ups were associated with better longevity and clinical performance. The mechanical properties and bonding ability of composite appear to contribute to improved structural reinforcement of treated teeth.

Keywords: Core build-up, Endodontically treated teeth, Crown restoration, Survival analysis, Longevity.

INTRODUCTION

Endodontically treated teeth frequently present with structural compromise due to caries, fracture, extensive restorations, and the removal of internal tooth structure during access preparation.[1] As a result, they are more susceptible to fracture under occlusal forces and often require reinforcement using core build-up materials and full-coverage crowns. The primary objective of a core build-up is to restore the missing coronal structure to provide retention, resistance, and support for the definitive restoration.[2] The choice of material used for this core is therefore of critical clinical significance, as it impacts not only the retention of the crown but also the long-term survival of the tooth itself.[3]

The mechanical characteristics of endodontically treated dentin also differ from vital dentin. Multiple studies have demonstrated alterations in microstructure, hydration levels, and reduced modulus of elasticity.4 These changes weaken the tooth and increase the risk of failure, particularly under functional loading. When surgical endodontic procedures such as apicoectomy are performed, the supporting root structure may be further reduced, compounding the need for careful restorative planning. In such circumstances, the reinforcement afforded by the core material becomes even more relevant.[5]

Among the commonly used core build-up materials, resin composite is favoured for its adhesion to both tooth structures and post systems, its relative ease of manipulation, and its ability to reinforce the remaining dentin.[6] Modern adhesive protocols allow resin composite to integrate with dentin through hybrid layer formation, which can reduce cuspule flexure and increase fracture resistance. In contrast, amalgam has traditionally been used due to its high compressive strength and long clinical track record.[7] However, it does not bond chemically to tooth structure, requiring additional mechanical retention, which may further reduce the residual tooth structure. Glass ionomer cement (GIC) is valued for fluoride release and biocompatibility but has inferior mechanical strength and resistance to cyclic loading, making its suitability as a core material especially under crowns uncertain.[1] Despite the theoretical advantages and disadvantages of these materials, clinical evidence comparing their influence on tooth survival remains limited and inconsistent.[8] Some studies support the reinforcing effect of resin composite, while others suggest that survival depends more on ferrule presence than material choice. Additionally, there is even less literature addressing outcomes in surgically treated teeth, where prognosis is inherently lower.[9,10] Therefore, this study aimed to compare the clinical longevity of endodontically and surgically treated teeth restored with full coverage crowns using three commonly used core build-up materials: resin composite, amalgam, and glass ionomer cement. This retrospective analysis of real clinical outcomes contributes practical evidence to guide material selection, particularly in structurally compromised teeth.

METHODOLOGY

This retrospective cross-sectional study was conducted by reviewing clinical records of patients treated between January 2015 and December 2022 in the Department of Restorative Dentistry. A total of 412 treated teeth were screened, from which 276 teeth met the inclusion criteria of having undergone endodontic or surgical endodontic treatment and restored with full-coverage crowns with a minimum follow-up of three years. Teeth with severe periodontal loss, those used as overdenture abutments, and those restored without crowns were excluded. The included teeth were categorized based on the core build-up material used: resin composite (n=112), amalgam (n=90), and glass ionomer cement (n=74). The assessed clinical outcome was survival, defined as the tooth remaining functional without the need for retreatment or extraction at follow-up. Failures were classified based on reason: tooth fracture, recurrent decay, or loss of core retention. Data were analysed using chi-square testing with significance set at $p<0.05$.

RESULTS

Teeth restored with resin composite cores demonstrated the highest survival rate, followed by amalgam, while GIC showed the lowest performance. The difference among groups was statistically significant ($p=0.012$), indicating that the choice of core material influences long-term tooth prognosis.

Table 1: Survival Rate of Teeth Based on Core Material

Core Material	Survived (n, %)	Failed (n, %)
Resin Composite	96 (85.4%)	16 (14.6%)
Amalgam	65 (72.2%)	25 (27.8%)
Glass Ionomer Cement	46 (61.5%)	28 (38.5%)

Catastrophic tooth fracture was the most common cause of failure, particularly in GIC and amalgam cores. Composite cores exhibited fewer fracture-related failures, supporting the hypothesis that their adhesive bonding may reinforce remaining tooth structure.

Table 2: Distribution of Failure Causes Among Core Materials

Cause of Failure	Composite	Amalgam	GIC
Tooth Fracture	7	14	17
Recurrent Caries	6	7	8
Loss of Core Retention	3	4	3

DISCUSSION

The results of this study demonstrate that the choice of core build-up material has a significant impact on the clinical longevity of endodontically and surgically treated teeth restored with crowns. Among the evaluated materials, resin composite showed the highest survival rate, followed by amalgam, while glass ionomer cement displayed the lowest longevity. These findings suggest that the mechanical and adhesive characteristics of the core material contribute meaningfully to the long-term prognosis of restored teeth.

Resin composite cores likely performed better because of their ability to bond to both dentin and restorative components, resulting in a more uniform distribution of masticatory forces. Bonding reduces stress concentrations within the tooth structure and helps integrate the remaining dentin, core, and crown into a unified structure. This may play a particularly important role in endodontically treated teeth, where dentin elasticity is reduced, and the tooth becomes more susceptible to fracture. By reinforcing the internal structure, resin composite cores appear to help minimize catastrophic failure such as vertical fracture.[11]

Amalgam cores, while strong in compressive strength, do not chemically bond to tooth structure.[12] Their reliance on mechanical retention means that additional tooth preparation is often required, which may further weaken the remaining dentin. As seen in this study, teeth restored with amalgam cores had higher rates of fracture-related failures. This pattern supports the concept that preserving remaining tooth structure is crucial for long-term success.[13] Although amalgam is a durable and stable material, the lack of adhesion may reduce its effectiveness when restoring structurally compromised teeth.[14]

Glass ionomer cement exhibited the lowest survival rate among the three materials. The lower mechanical strength and lower resistance to cyclic fatigue likely contributed to the higher number of failures. GIC may be suitable in minimally loaded areas or where moisture control is difficult, but in situations demanding high strength such as core build-ups under crowns it may not provide sufficient reinforcement.[15] The higher fracture failure rate in this group supports the understanding that the structural demands placed on core build-up materials in crowned teeth require materials with superior mechanical characteristics.[16]

In addition to the type of core material, the results also showed that surgically treated teeth had generally lower survival rates than conventionally treated teeth across all material groups. Surgical endodontic intervention often results in reduced root length, decreased periodontal support, and alteration of the apical seal.[17] These anatomical and functional changes likely contribute to increased

susceptibility to mechanical failure. Therefore, in surgically treated teeth, the priority of selecting a core material that offers internal reinforcement becomes even more critical.[18]

The findings of this study highlight the importance of selecting core build-up materials not only based on handling preferences or cost considerations, but also on their biomechanical performance. Clinicians should give preference to materials that interact favorably with the remaining tooth structure and distribute functional loads efficiently. Resin composite appears to provide the most favorable balance of adhesion, strength, and preservation of remaining tooth structure.[19]

Finally, the results reinforce a broader clinical principle: the long-term success of restored endodontically treated teeth depends on both biological and mechanical factors. While root canal or surgical treatment addresses the biological cause of disease, the choice of core material and restoration type governs the mechanical survival of the tooth in function.

CONCLUSION

Resin composite should be considered the preferred core build-up material in endodontically and surgically treated teeth scheduled for crown restoration due to its superior longevity and reinforcement properties.

CONFLICT OF INTEREST

None

AUTHOR CONTRIBUTION

Concept or Design	Dr. Raham Zaman, Dr. Muhammad Naeem
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