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Review Article

Feasibility of Flowable Composite as an Alternative to Resin Cement in Porcelain Veneer Bonding

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Abstract

Resin cement bonded porcelain veneers, a cornerstone of dentistry aesthetics, exhibits superior mechanical and aesthetic properties. However, limitations such as handling challenges, polymerization shrinkage, and marginal discrepancies necessitate exploring other composite alternatives. Flowable composites, originally designed for other restorative purposes, have emerged as a potential alternative for veneer bonding. This study examines the potential of using flowable composites as a substitute for resin cement, assessing their mechanical characteristics, adhesion capabilities, visual results, and practical applications in clinical settings. Evidence suggests that flowable composites provide comparable bond strength, lower viscosity, and financial advantages, while delivering satisfactory aesthetic results. However, further clinical research is required to validate their long-term performance and effectiveness.

Keywords: Flowable Composites; Resin Cements; Porcelain Veneers; Dental Bonding; Aesthetic Dentistry; Restorative Materials

Abbreviations

IBisGMA: Bisphenol A Glycidyl Methacrylate; UDMA: Urethane Dimethacrylate

Introduction

In the past, dental veneers have served the dual purpose of enhancing tooth appearance and providing protective benefits [1]. Veneer restorations provide a valid conservative alternative to complete coverage as they avoid aggressive dental preparation; thus, maintaining tooth structure [2]. Veneers not only enhance the appearance of teeth but also offer practical benefits, such as strengthening and protecting the underlying structure. This has motivated researchers and clinicians to seek continual improvements in the materials and techniques used for veneer bonding. The clinical success of laminate veneers depends on the cementation of the indirect restorations [3].

The development of sophisticated ceramics has significantly expanded the potential for delivering highly aesthetic restorations. However, the success of these veneers relies heavily on the choice of luting material, which must balance mechanical strength, aesthetics, and ease of application. Traditionally, resin cement fulfilled these requirements, offering strong adhesion and excellent color durability. The chemical and physical properties of luting cements are important for the clinical success of indirect restorations. Ideally, these materials should possess the following characteristics: the ability to create a durable bond between the restorative substance and the tooth's surface; strength to withstand pulling and pressing forces; an appropriate level of elasticity; sufficient fluidity to enable the proper thickness of the cement layer and complete seating of the restoration; and compatibility with biological systems [4].

Recently, attention has diverted to flowable composites, which are being optimized with adjusted filler sizes and content to improve their flowability and adaptability. Their low viscosity and ease of use make them an attractive alternative to resin cements in veneer bonding procedures.

This research aims to explore the potential of flowable composites as substitutes to traditional resin cements in bonding porcelain veneers by investigating their effects on bond strength and overall clinical performance.

Comparative bonding performance

Studies comparing the bonding performance of flowable composites and resin cements reveal mixed outcomes, mainly due to the nature of the ceramic affecting the micro-shear bond strength of the luting agent. Hassanien and Tolba demonstrated that flowable composites achieved comparable micro-shear bond strength to resin cements when bonding hybrid CAD/CAM ceramic materials [5]. However, their effectiveness depends on proper adhesive protocols, including surface pretreatments like salinization and the use of universal adhesives [7].

Dikici and Say highlighted that flowable composites perform well in micro tensile bond strength tests when combined with polymer-infiltrated ceramic networks and feldspathic ceramics [6]. The results suggest that their application in porcelain veneers is promising, especially when supported by modern adhesive systems.

Film thickness comparison between resin cement and flowable composite

One critical parameter influencing the performance of luting materials in veneer bonding is the film thickness. Thin film layer facilitates better adaptation to the tooth surface and restoration, minimizing the risk of marginal discrepancies and improving the overall veneer fit. Resin cements, due to their higher viscosity and filler content, generally result in a thicker film layer compared to flowable composites. This increased thickness may compromise the seating of porcelain veneers, especially in cases requiring ultra-thin veneers [5,7]. Flowable composites, on the other hand, are characterized by their reduced filler loading and improved flowability, which results in a thinner and more uniform film layer. Studies suggest that flowable composites can achieve film thicknesses as low as 10-20 microns, compared to 25-50 microns typically achieved with conventional resin cements [6,8].

Additionally, the reduced thickness of flowable composites contributes to enhanced optical properties, as the thin adhesive layer reduces the risk of color mismatches and improves the transmission of light through the veneer. This makes flowable composites particularly advantageous in highly aesthetic cases where translucency and color matching are critical [9,10].

Mechanical and aesthetic considerations

Although various studies have demonstrated flowable composites' mechanical properties, such as fracture toughness and flexural strength, resin cements generally exhibit superior mechanical strength. However, for non-load-bearing restorations such as veneers, the difference is often negligible [7,10]. Additionally, flowable composites have lower polymerization shrinkage, which significantly minimizes marginal discrepancies, leading to improved veneers longevity and enhanced clinical outcomes [9].

Aesthetic outcomes are a critical consideration in veneer bonding. Studies on color durability indicate that flowable composites are comparable to resin cements under accelerated aging conditions [10,11]. Moreover, their availability in a wide range of shades allows better customization, enhancing the final visual outcome [6,9].

Effect on the periodontium: resin cement vs. flowable composite

The interaction of luting materials with the periodontium is a crucial consideration in achieving long-term success in restorative dentistry. Resin cements, due to their chemical composition and higher viscosity, can occasionally lead to overhangs or difficulty in removing excess material. Such conditions may exacerbate plaque accumulation, contributing to gingival inflammation and periodontal issues [11].

Flowable composites, in contrast, exhibit improved flowability and reduced viscosity, allowing better adaptability to the tooth-restoration interface. This characteristic facilitates easier removal of excess material, reducing the likelihood of plaque retention around restoration margins. Moreover, studies have indicated that the smoother finish of flowable composite margins contributes to improved periodontal health outcomes by minimizing bacterial adhesion [9].

Furthermore, the reduced thickness of flowable composites plays a role in limiting the gingival irritation often associated with bulkier luting layers. Their biocompatible formulations also show lower cytotoxicity levels when compared to some resin cements, making them a preferable option for maintaining periodontal health [8].

Limitations and Recommendations

Although flowable composites offer multiple advantages, they also have certain limitations. In some scenarios, their bond strength may be lower than resin cements, particularly without adequate adhesive protocols [6,10]. Residual monomer release can compromise biocompatibility, although this issue is mitigated with high-quality curing and material selection [8]. Additionally, flowable composites lack the availability of try-in pastes, which are commonly used with resin cements to evaluate the fit and color of restorations before final bonding. This limitation may hinder their application in cases requiring precise esthetic matching. Furthermore, the reinforcement properties of flowable composites when bonded to ceramic veneers are not well-documented.

To maximize the feasibility of flowable composites in veneer bonding, the following recommendations are suggested

- **Adhesive Protocols:** Ensure adequate surface preparation, including etching and salinization, to optimize adhesion.
- **Material Selection:** Use highly filled flowable composites for better mechanical properties and lower polymerization shrinkage such as bulk-fill flowable composite.
- **Clinical Trials:** Further long-term studies are needed to validate the clinical performance of flowable composites in veneer bonding.

Conclusion

Flowable composites represent a promising alternative to resin cements in porcelain veneer bonding. Their ease of handling, adaptability, and cost-effectiveness make them increasingly attractive for clinical applications. However, certain limitations, such as the lack of try-in pastes and insufficient documentation on their reinforcement properties with ceramic veneers, highlight the need for further studies. While resin cement continue to be the gold standard for achieving optimal bond strength and mechanical characteristics, advancements in flowable composite formulations and adhesive techniques has demonstrated the potential to narrow the performance gap. Continued research and extended clinical trials are essential to fully elucidate their role in aesthetic dentistry and ensure their clinical acceptance as bonding composite for porcelain veneers.

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Conflict of Interest

The author declares no conflicts of interest regarding the publication of this research.

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