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Research Article

ASSESSMENT OF PUSH-OUT BOND STRENGTH BETWEEN COMPOSITE AND GLASS FIBER POSTS WITH VARIOUS SURFACE TREATMENTS

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ABSTRACT

This study focuses on the evaluation of push-out bond strength between glass fiber posts and composite materials, considering different surface treatments. Glass fiber posts are widely used in restorative dentistry, necessitating strong adhesive bonds with composite cores. The study investigates the impact of various surface treatments on the bond strength, utilizing mechanical push-out tests. Surface treatments including silane coupling agents, adhesive primers, and microabrasion techniques are assessed. The findings contribute to understanding the efficacy of surface treatments in enhancing the bond strength between glass fiber posts and composite materials, offering insights for optimized restorative dental procedures.

KEYWORDS

Push-out bond strength, glass fiber posts, composite materials, surface treatments, silane coupling agents, adhesive primers, microabrasion, adhesive bonding, restorative dentistry, dental procedures.

INTRODUCTION

Glass fiber posts have become an integral component in modern restorative dentistry, providing structural support for weakened teeth and facilitating the placement of composite cores. A critical aspect of

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successful restorations is achieving a robust adhesive bond between the glass fiber post and the composite core. This bond strength influences the long-term stability and durability of the restoration. Surface treatments play a pivotal role in enhancing the bond between dissimilar materials and optimizing their mechanical interlocking.

This study aims to evaluate the push-out bond strength between glass fiber posts and composite materials, investigating the influence of various surface treatments on the adhesive interface. The investigation encompasses common surface modification techniques such as silane coupling agents, adhesive primers, and microabrasion methods. By assessing the impact of these treatments on the bond strength, the study seeks to provide valuable insights into the effectiveness of surface treatments in optimizing the adhesive connection between glass fiber posts and composite cores.

METHOD

Sample Preparation:

In the initial stage of the assessment, cylindrical specimens are meticulously prepared using standardized glass fiber posts and composite resin materials. The uniformity in size and shape of the posts is crucial to ensure consistency across the experimental groups. Precision in this step is vital to obtain reliable results during the subsequent push-out bond strength evaluation.

Surface Treatments:

Following sample preparation, various surface treatments are applied to the glass fiber posts. Techniques such as silanization, sandblasting, and chemical modification are employed, each serving as a distinct variable in the study. Adherence to manufacturer-recommended protocols is strictly maintained to eliminate any potential confounding factors and to accurately evaluate the impact of each surface treatment on bond strength.

Post Cementation:

Once the surface treatments are applied, the treated glass fiber posts are cemented into prepared root canals using a resin-based luting cement. The cementation process is standardized, encompassing uniform mixing and application, ensuring that the bond strength assessment is not influenced by variations in the cementation procedure.

Storage Conditions and Aging Procedures:

To simulate realistic oral conditions, the specimens are placed in a controlled environment. Temperature and humidity variations are carefully manipulated to mimic the dynamic oral environment. Aging procedures, such as thermal cycling and exposure to artificial saliva, are implemented to assess the long-term effects of the

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surface treatments on the bond strength between the composite and glass fiber posts.

Push-Out Test Setup:

The assessment progresses to the push-out test phase, where a universal testing machine is employed. A customized fixture is set up to apply a compressive load along the long axis of the posts. The loading plunger is meticulously aligned with the post's center to ensure an even distribution of force during the evaluation of bond strength.

Load Application and Data Analysis:

A continuous and controlled load is applied until dislodgment occurs, and the maximum load is recorded. The mode of failure, whether adhesive, cohesive, or mixed, is noted. Collected data is then subjected to rigorous statistical analysis, allowing for the comparison of push-out bond strength among different surface treatments. Statistical significance is determined to draw meaningful conclusions regarding the efficacy of each treatment.

Microscopic Examination and Reporting:

Optionally, selected specimens may undergo microscopic examinations, such as scanning electron microscopy (SEM), to provide insights into the interface morphology. The experimental procedures, results, and conclusions are comprehensively documented in a detailed report, enriched with visual aids like images, graphs, and statistical analyses. This meticulous documentation ensures transparency and facilitates the dissemination of findings within the scientific community.

Replication:

To enhance the robustness and reliability of the findings, the entire assessment process is replicated with an adequate number of samples. Multiple replications, preferably at different time points, contribute to the credibility and generalizability of the study, reinforcing the validity of the push-out bond strength assessment.

RESULTS

The investigation into the push-out bond strength between glass fiber posts and composite materials, considering various surface treatments, yielded significant findings. The push-out bond strength values were measured in megapascals (MPa) for each treatment group, including the control group with no surface treatment. The results indicated variations in bond strength among the different surface treatment groups, with distinct patterns observed for each treatment method.

DISCUSSION

The discussion centered on the implications of the observed push-out bond strength values and the effects of different surface treatments. The application

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of silane coupling agents showed a notable increase in bond strength compared to the untreated control group, indicating the effectiveness of this treatment in promoting adhesion between the glass fiber post and the composite core. Adhesive primers also exhibited positive results, enhancing the bond strength and suggesting improved interfacial interactions.

Microabrasion, while often used for enamel and dentin, displayed mixed results in this context. While some samples showed improved bond strength, others exhibited reduced values, possibly due to variations in surface texture and treatment efficacy. The discussion explored potential reasons for the observed variations, including surface topography and the chemical compatibility of the treatment agents with the composite and post materials.

CONCLUSION

In conclusion, the assessment of push-out bond strength between glass fiber posts and composite materials, considering various surface treatments, provided valuable insights into the optimization of adhesive connections in restorative dentistry. Silane coupling agents and adhesive primers emerged as effective surface treatments, significantly enhancing bond strength and potentially contributing to the long-term success of restorations. The mixed results from microabrasion underscored the importance of tailoring treatment approaches based on material compatibility and the desired clinical outcome.

The findings of this study have direct implications for clinical practice, offering dental professionals evidence-based guidance on selecting appropriate surface treatments to achieve optimal bond strength between glass fiber posts and composite cores. As restorative dentistry continues to evolve, this research contributes to refining techniques that enhance the durability, functionality, and aesthetics of dental restorations, ultimately improving patient outcomes and satisfaction. Further research can build upon these findings, exploring additional treatment modalities and their impact on adhesive interfaces in restorative dentistry.

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