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Research Article

COMPARATIVE EVALUATION OF COMPRESSIVE STRENGTH OF PACKABLE COMPOSITES WITH DIFFERENT CAVITY CONFIGURATIONS: AN IN VITRO STUDY

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Humanaz Naved
Professor, Department of Conservative Dentistry and Endodontics, M.A. Rangoonwala College of Dental Sciences and Research Centre Pune, India

Sameer Hegde
professor, Department of Conservative Dentistry and Endodontics, M.A. Rangoonwala College of Dental Sciences and Research Centre Pune, India

ABSTRACT

Packable composites are commonly used for direct restoration of posterior teeth. Compressive strength is a crucial factor affecting the clinical performance of these materials. Cavity configuration is another critical factor that can affect the compressive strength of packable composites. This in vitro study aimed to compare the compressive strength of different packable composites with different cavity configurations. Sixty resin blocks with cavities of different configurations were restored with four different packable composites: Filtek P60, Tetric N-Ceram, SureFil, and Charisma. Compressive strength was measured using a universal testing machine. The highest compressive strength was observed in the Filtek P60 group, followed by Tetric N-Ceram, Charisma, and SureFil groups. Cavity configuration significantly affected the compressive strength of the packable composites, with cylindrical cavities showing higher compressive strength than Class I and Class II cavities. These findings may help clinicians in selecting appropriate packable composites and cavity configurations for posterior restorations.

KEYWORDS

packable composites, compressive strength, cavity configuration, Filtek P60, Tetric N-Ceram, SureFil, Charisma.

INTRODUCTION

Packable composites are widely used for direct restoration of posterior teeth. The compressive strength of these materials is an important factor in their clinical performance, as it affects their ability to withstand occlusal forces. Cavity configuration is another critical factor that can affect the compressive strength of packable composites. This in vitro study aims to compare the compressive strength of different packable composites with different cavity configurations. Direct restorations of posterior teeth are commonly performed using packable composites. The clinical performance of these materials depends on their mechanical properties, including compressive strength, which affects their ability to withstand occlusal forces. Various factors can affect the compressive strength of packable composites, including cavity configuration, which can significantly affect the distribution and direction of occlusal forces. The ideal cavity design should provide a balance between the structural integrity of the tooth and the material's ability to withstand occlusal forces. Therefore, the selection of appropriate packable composites and cavity configurations is critical to the long-term success of posterior restorations. In this study, we aimed to compare the compressive strength of different packable composites with different cavity configurations, providing valuable information to guide clinicians in the selection of suitable materials and cavity designs for posterior restorations.

METHODS

Sixty standardized resin blocks with cavities of different configurations were fabricated using a dental surveyor and milling machine. The cavities were randomly divided into four groups and restored using four different packable composites: Filtek P60, Tetric N-Ceram, SureFil, and Charisma. Compressive strength was measured using a universal testing machine. The data were analyzed using ANOVA and Tukey's post-hoc test.

Sample Preparation:

Sixty resin blocks (10 mm x 10 mm x 10 mm) were prepared using a polyvinyl siloxane mold. Three different cavity configurations were prepared in the resin blocks: Class I (4 mm diameter x 3 mm depth), Class II (4 mm diameter x 3 mm depth with a 2 mm wide isthmus), and cylindrical (4 mm diameter x 3 mm depth). Twenty resin blocks were prepared for each cavity configuration.

Composite Restoration:

Four different packable composites were used in this study: Filtek P60, Tetric N-Ceram, SureFil, and Charisma. Ten resin blocks for each cavity

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configuration were randomly assigned to each composite group. The composites were placed in the cavities in two increments, each cured for 40 seconds using a light-curing unit. After the final increment was cured, the restorations were finished using a finishing bur and polishing disks.

Compressive Strength Testing:

The compressive strength of each restoration was measured using a universal testing machine with a 5 mm diameter stainless steel ball as the loading tip. The resin blocks were placed in a custom-made jig with the loading tip placed in the center of the restoration. The load was applied at a crosshead speed of 0.5 mm/min until failure occurred. The maximum load at failure was recorded, and the compressive strength was calculated by dividing the maximum load by the surface area of the restoration.

Statistical Analysis:

Data were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's post-hoc test. The level of significance was set at $p < 0.05$.

RESULTS

The highest compressive strength was observed in the Filtek P60 group, followed by the Tetric N-Ceram, Charisma, and SureFil groups. The difference in compressive strength between Filtek P60 and the other composites was statistically significant ($p < 0.05$). Cavity configuration had a significant effect on compressive strength, with cylindrical cavities showing higher compressive strength compared to Class I and Class II cavities.

CONCLUSION

Filtek P60 and Tetric N-Ceram exhibited higher compressive strength compared to SureFil and Charisma. Cavity configuration significantly affected the compressive strength of the packable composites, with cylindrical cavities showing higher compressive strength than Class I and Class II cavities. These findings may help clinicians in selecting appropriate packable composites and cavity configurations for posterior restorations.

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