

INTRODUCTION

Teeth indicated for cuspal coverage restorations often have a history of repeated pulpal stress and a greater potential for developing pulpal involvement after crown preparation. The incidence of endodontic treatment required after tooth preparation ranges from 3% to 23% and it is estimated that 20-50% of endodontic cases involve teeth with complete coverage crowns.¹

A systematic review in 2016 reported there was no protocol identified for improving the fracture strength of endodontically accessed and repaired all-ceramic crowns. Grit size, cutting speed, irrigation, and pressure influence surface damage that can lead to a reduction in the overall strength of the restoration.²

A survey conducted by Trautman in 2000 found that 93% of practitioners always or frequently restore and maintain endodontically accessed crowns. Eighty-three percent of providers prefer resin as their restorative material for repairing the endodontic access of all-ceramic crowns.³

Schubert (2022) assessed the fracture strength of 3Y zirconia crowns of 1mm-1.5mm occlusal thickness after endodontic access and repair. The findings of this study suggest that treating the endodontic access with the APC protocol prior to the resin repair reinforced the crown to its original strength, and resulted in significantly greater load to failure than samples restored with a two-step self-etch dentin adhesive.⁴

The purpose of this study is to determine the effect of the resin repair protocols on the fracture strength of endodontically accessed 0.6mm thick zirconia crowns (3Y-TZP).

METHODS



LEARNING OBJECTIVES

Upon review of this material, the observer will be able to:

1. Understand incidence of endodontic treatment required after tooth preparation.
2. Know the protocol for accessing zirconia crowns to prevent fracture and chipping.
3. Know the methods of repairing an endodontically accessed zirconia crown with composite resin.

RESULTS

After endodontic access, 4 samples (20%) showed visible fracture lines consistent with thermal shock. (Figure 1).

The mean load to fracture of the intact control group was 2789 +/- 473 (N). The samples with a repaired endodontic access had a mean load to fracture of 2507 +/- 659 (N) for Group A, and 2419 +/- 553 (N) for Group B. The one-way ANOVA indicated no significant difference in the load to failure among any of the sample groups (p=0.32). The post-hoc Tukey test revealed statistically similar fracture strengths of the intact control group when compared to repaired samples in Group A (p=0.52), and the repaired samples in Group B (p=0.33). The method of repairing an endodontic access did not significantly affect the fracture strength (p=0.94) (Figure 3).

Fracture strength analysis

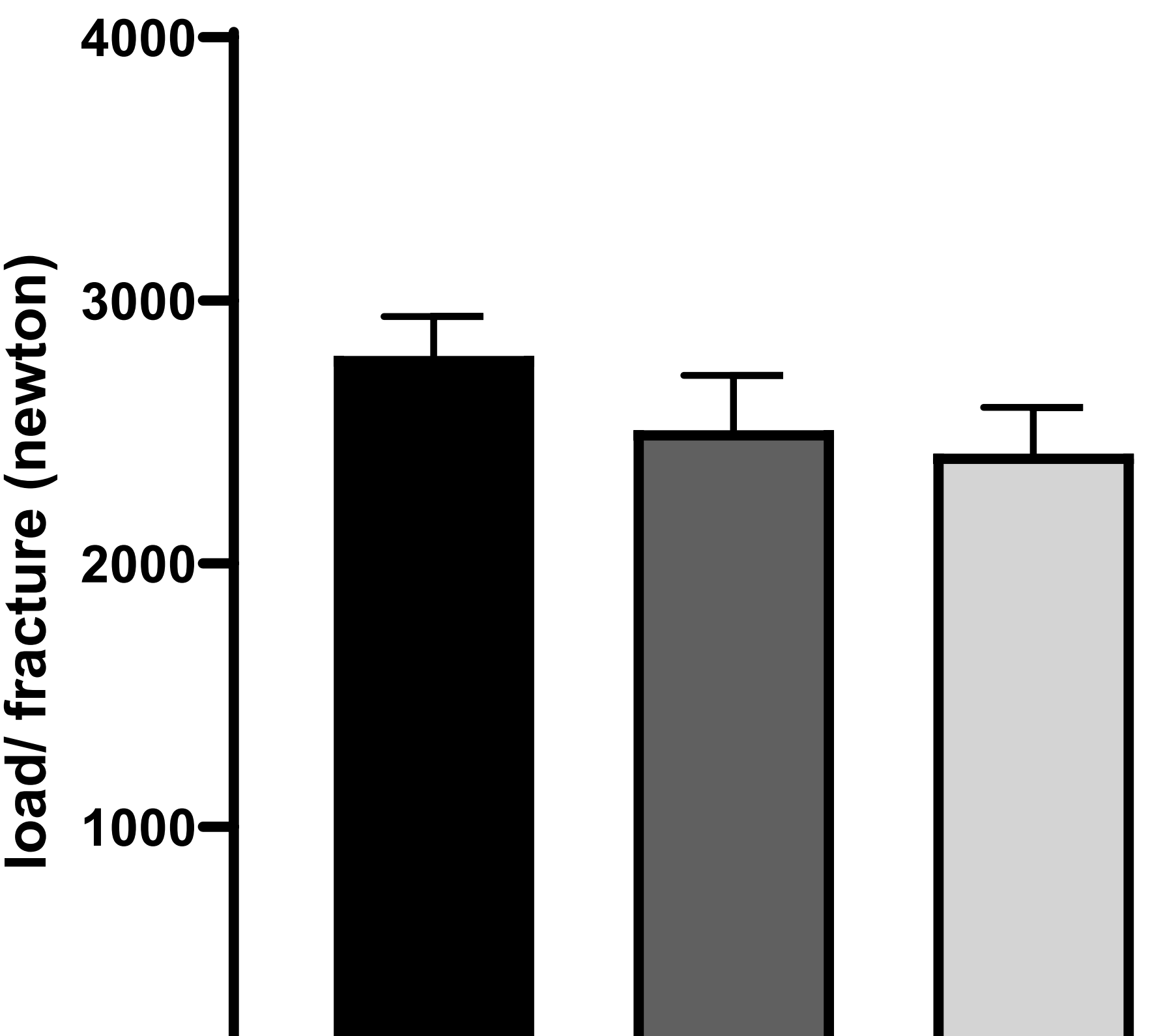


Figure 1. Fracture during endodontic access

DISCUSSION / CONCLUSION

There are several items a clinician may evaluate prior to repairing an endodontically accessed zirconia crown: The aperture of the endodontic access, the occlusal thickness of the restorative material, the method of endodontic access, the yttria (Y2O3) of the zirconia, whether the restoration was bonded to the tooth, and the repair material used.

The results of this study suggest that conservative repair with composite resin and preservation of the existing zirconia crown may be indicated after endodontic access, which concurs with other in vitro studies that have evaluated the fracture strength of accessed and repaired zirconia crowns.^{4,5,6,7} This has significant implications including reduced costs, less chair time, and fewer resources. Additionally, the biological cost to the tooth and surrounding periodontal structures is minimized.

Future studies may evaluate the effects of thermocycling or cyclic loading on the fracture strength of endodontically accessed zirconia crowns to better replicate intraoral conditions and function. Additionally, assessing the durable bond between the resin and zirconia interface may have implications on overall endodontic success and the ability to maintain a coronal seal.

Based on limitations imposed by the methods of this study, the following conclusions may be made:

1. The fracture strength of a minimal thickness zirconia crown is not significantly reduced after endodontic access regardless of the resin repair protocol.
2. To reduce the risk of fracture during access it is suggested to use a new fine diamond bur, light pressure, copious irrigation, and replace the bur if any debris accumulates on the bur head.

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REFERENCES