

EFEITO DO SELAMENTO DENTINÁRIO IMEDIATO NA RESISTÊNCIA À FRATURA E MODO DE FALHA DE ENDOCROWNS ANTERIORES

Yasmin Gomes de Freitas¹

Daniel Carlos Zanon²

Priscilla Cardoso Lazari-Carvalho³

Marco Aurélio de Carvalho⁴

ABSTRACT

The restoration of severely compromised endodontically treated teeth remains a challenge in contemporary dentistry. The risk of catastrophic root fractures can be reduced by using approaches without intraradicular posts, such as endocrowns, which have recently been studied even for anterior teeth. Because these are innovative approaches, the first studies on anterior endocrowns are laboratory-based, which may influence the measured fracture resistance. Optimized adhesion to dentin through immediate dentin sealing (IDS) is particularly important for endocrowns, as micromechanical retention plays a key role in restoration stability. This study aimed to evaluate the influence of the timing of dentin hybridization on the fracture resistance and failure mode of anterior endocrowns in severely compromised roots. Twenty bovine roots were divided into two groups (n = 10): immediate dentin sealing (IDS) and delayed dentin sealing (DDS). In the IDS group, dentin was hybridized immediately after tooth preparation, whereas in the DDS group dentin was hybridized only at the time of final cementation. All roots were restored with CAD/CAM

nanoceramic-resin endocrowns. Groups underwent fracture resistance testing at 1 mm/min,

with a load applied at 30 degrees using a flat resin surface with three-quarters contact on the

incisal edge of the endocrown. Failure mode was classified as repairable (fracture limited to the restoration), possibly restorable (root fracture above the acrylic base insertion), or

¹ Graduanda em Odontologia, Curso de Odontologia da Universidade Evangélica de Goiás yasmingff0@outlook.com

² Pós-graduando em Odontologia, Curso de Odontologia da Universidade Evangélica de Goiás dczanon@hotmail.com

³ Professora Doutora, Curso de Odontologia e Programa de Pós Graduação em Odontologia da Universidade Evangélica de Goiás, priscilla.lazari@docente.unievangelica.edu.br

⁴ Professor Doutor, Curso de Odontologia e Programa de Pós Graduação em Odontologia da Universidade Evangélica de Goiás, marco.carvalho@docente.unievangelica.edu.br

catastrophic (root fracture extending below the acrylic base insertion). Means of fracture resistance under static loading were compared with Student’s t-test. The IDS group showed higher fracture resistance (IDS: 400 N ± 55.6; DDS: 291 N ± 48.7), whereas the DDS group had fewer catastrophic fractures. We conclude that the timing of dentin hybridization influences the fracture resistance of anterior endocrowns.

Keywords: Dental crown; Non-vital tooth; Dentin bonding; Fracture resistance.

INTRODUCTION

Endodontically treated teeth are commonly affected by large coronal destructions and often require extensive preparations, such as full crowns. In some cases a coronal remnant, known as a ferrule, is still present (1).

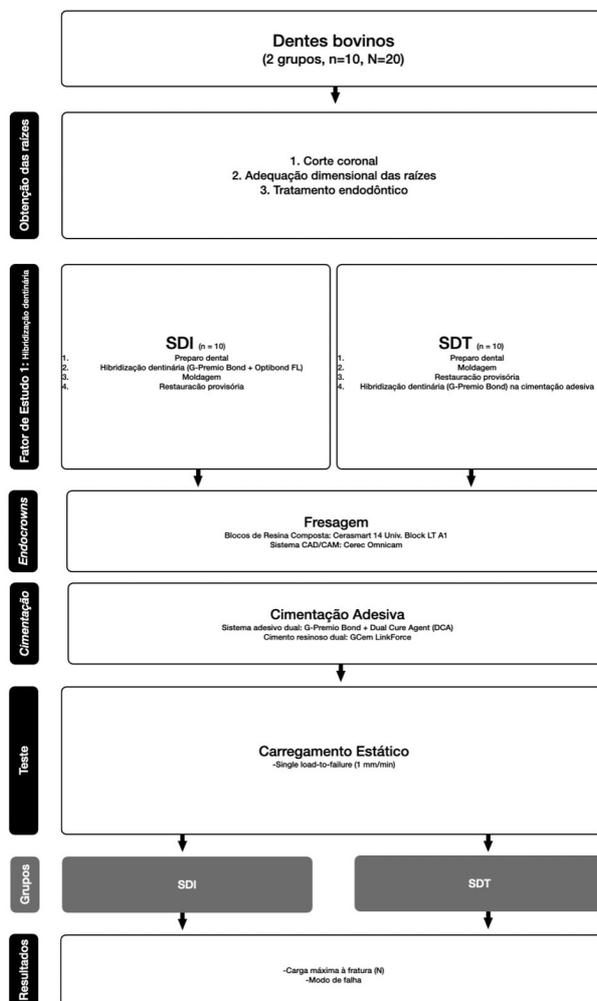
It is known that the more dental structure is removed, the less resistant the tooth becomes. When the remaining tooth structure is insufficient to provide retention

for a core build-up, the root canal can be

used to aid retention with an intraradicular post. Therefore, in teeth with limited coronal remnant, cores and posts are commonly required (2). However, with the advent of adhesive dentistry, the classic concept of the mandatory intraradicular retainer has been questioned (3). An alternative is bonding to the walls of the pulp chamber of endodontically treated teeth by means of a monoblock indirect restoration, known as an endocrown (4). An endocrown is a full crown bonded to an endodontically treated tooth on

the internal portion of the pulp chamber and on the cavity margins, providing additional retention to prevent displacement under occlusal forces.

METODOLOGIA



METHODOLOGY

This study comprised the steps of sample preparation, biomechanical testing, and results acquisition as seen in Figure 1.

Inferior mandibular bovine teeth (N = 20) were selected, their crowns removed, and the roots embedded. Endodontic treatment of the roots was performed, followed by preparation for endocrown restorations. Samples were then divided into two groups (n=10, N=20): IDS, with immediate dentin sealing, and DDS, with delayed dentin sealing. For the IDS group, immediately after finishing the preparation with a multilaminated bur, dentin hybridization was performed followed by application of a liner, characterizing the immediate dentin sealing technique prior to impression taking and provisionalization. For the DDS group, dentin hybridization occurred only at the time of adhesive cementation, after impression taking and provisionalization.

For IDS, immediately after finishing the preparation, the self-etch universal adhesive

G-Premio Bond (GC Corporation, Tokyo, Japan) was applied, followed by a hydrophobic

liner with a high inorganic filler content, OptiBond FL Adhesive (Kerr Dental, Orange, USA). For DDS, hybridization occurred only at the adhesive cementation stage.

Preparations were scanned (CEREC Omnicam, Dentsply Sirona, Charlotte, USA), and prefabricated blocks were used to fabricate the endocrown restorations. The selected block was Cerasmart 14 for CEREC Block LT A1 (GC Corporation, Tokyo, Japan), a

nanoceramic-resin material.

The prepared dentin—previously hybridized (IDS) or not (DDS)—was initially cleaned with a microbrush and pumice, then micro-abraded with 30- μ m aluminum oxide for 10 s at 2

bar pressure and 10 mm distance. A mixture of G-Premio Bond with the dual-cure activator in a 1:1 ratio (G-Premio Bond DCA) was applied for 10 s to the preparation. After 20 s, clean, oil-free air was used for 5 s. The preparation was then loaded with the dual-cure resin cement G-CEM LinkForce, and the restoration was seated with light pressure. Excess cement was removed, and light curing was performed for 40 s on the facial surface and another 40 s on the lingual surface. After 24 h of storage in distilled water at 37°C, the specimens were subjected to fracture resistance testing. Samples were loaded to fracture at 1 mm/min in a universal testing machine (ElectroPuls E3000; Instron, Norwood, USA). Maximum load values at fracture (Newtons) were recorded for group comparisons. After static loading, each specimen was visually evaluated to classify the failure mode as: repairable (fracture restricted to the restoration), possibly restorable (root fracture above the acrylic base), or catastrophic (root fracture extending apically below the insertion into the acrylic base).

Data were analyzed with Jamovi (The jamovi project 2024) at a 5% significance level. Normality (Shapiro–Wilk) confirmed normal distribution for maximum load at fracture ($W = 0.921$ for IDS and $W = 0.940$ for DDS; $p = 0.364$ and $p = 0.558$, respectively). Student's t-test was used to compare mean maximum loads between IDS and DDS. Failure mode frequencies were plotted across the three classifications.

RESULTADOS

Fracture-resistance values (Newtons) were obtained for both IDS and DDS groups. Given the normal distribution, means and standard deviations were compared. The IDS

group showed higher fracture resistance (mean = 400; SD = 55.6) than the DDS group (mean = 291; SD = 48.7), with $p < 0.001$ in the independent-samples Student's t-test.

Despite the lower mean fracture resistance, the DDS group presented a higher frequency of repairable and possibly repairable failures, whereas the IDS group had a higher frequency of catastrophic failures. Table 1 presents descriptive statistics for the groups and the response

variable. Figure 1 shows the distribution of fracture-resistance data in box plots. Figure 2

shows the failure-mode frequencies.

Descriptive statistics for the SDI and SDT groups and the fracture-resistance response variable (Newtons).

Table 1. Descriptive statistics for the SDI and SDT groups and the fracture-resistance response variable (Newtons).

Grupo	n	Resistência à fratura (DP)	p, Shapiro wilk	p, t de Student
SDI	10	400 ($\pm 55,6$)	0,364	<.001
SDT	10	291 ($\pm 48,7$)	0,558	

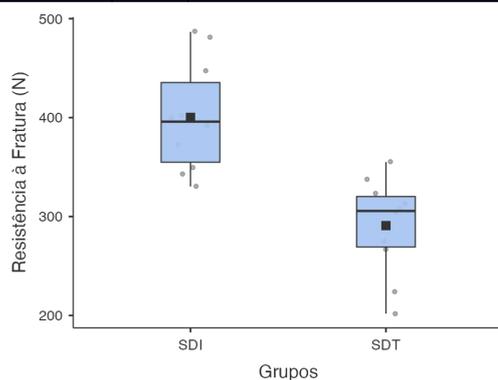


Figure 1. Box plot showing the distribution of fracture-resistance data for the SDI and SDT groups.

Source: author.

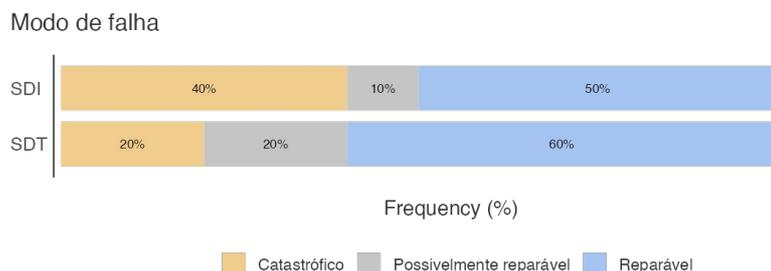


Figure 2. Failure mode frequency for both study groups.

Source: author.

CONCLUSION

Within the limitations of this in vitro study, it can be concluded that:

- Immediate dentin sealing increases the fracture resistance of anterior endocrowns in severely destroyed teeth;
- Higher fracture resistance is associated with an increased frequency of catastrophic failures, observed more often when immediate dentin sealing is performed.

REFERENCES

Dietschi D, Duc O, Krejci I, Sadan A. Biomechanical considerations for the restoration of endodontically treated teeth: a systematic review of the literature--Part 1. Composition and micro- and macrostructure alterations. Quintessence Int. 2007 Oct;38(9):733–43.

1. Meyenberg K. The ideal restoration of endodontically treated teeth - structural and esthetic considerations: a review of the literature and clinical guidelines for the restorative clinician. Eur J Esthet Dent. 2013;8(2):238–68
2. Carvalho MA de, Lazari PC, Gresnigt M, Del Bel Cury AA, Magne P. Current options concerning the endodontically-treated teeth restoration with the adhesive approach. Braz Oral Res. 2018 Oct 18;32(suppl 1):e74.
3. Sedrez-Porto JA, Rosa WL de O da, da Silva AF, Münchow EA, Pereira-Cenci T. Endocrown restorations: A systematic review and meta-analysis. J Dent. 2016 Sep;52:8–14