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Crown vs. composite for post-retained restorations: A randomized clinical trial☆

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ABSTRACT

Objectives: This randomized clinical trial compared the survival of composite resin restorations and metal-ceramic crowns on endodontically treated teeth that received a glass fiber post using 2 different cementation methods.

Methods: Forty-seven patients (age 42.5 ± 11.5) with fifty-seven endodontically treated teeth with extensive coronal damage but always with one intact surface were randomly allocated according to the type of coronal restoration: metal-ceramic crown or composite resin. In case of crown restoration, a core buildup was performed with microhybrid composite resin. The dentin bonding agent and composite resin used were the same for both direct and indirect restorations. Descriptive analysis was performed using FDI clinical criteria and survival of restorations/teeth analyzed using Kaplan-Meier statistics and log-rank tests.

Results: 57 restorations (30 composite resin and 27 crowns) were made in 47 patients. The recall rate was 100% and follow up time ranged between 1 and 5 years. One tooth was extracted 11 months post-restoration due to root fracture (composite group). Eight composite restorations and one crown had reparable failures, all due to secondary caries or restoration fracture. The overall annual failure rate (AFR) was 0.92% after 50 months for success of the restorations, with 1.83% for the composite group and 0.26% for the metal-ceramic crown group. The log-rank test showed no difference for survival according to the type of restoration ($p = 0.344$). However, for success rates, metal-ceramic crowns demonstrated better performance ($p = 0.022$).

Conclusions: Indirect restorations provided higher acceptable clinical performance and lower need for re-intervention, but both types of restorations presented good survival rates. (NCT01461239).

Clinical significance: When endodontically treated teeth with at least one intact surface must be restored, composite resin restorations and metal-ceramic crows are acceptable alternatives to achieve good survival and success rates.

1. Introduction

The restorative clinical success of endodontically treated teeth is influenced by the use of posts [1,2], the type of the coronal restoration [3,4] or its design [1,2,5]. Even different strategies of using similar materials influence restoration survival [6–8]. Understanding the limitations and advantages of materials and techniques may act as a guideline for clinicians in restoring endodontically treated teeth.

Based on a minimally invasive concept, where pre-fabricated glass fiber posts in combination with a resin composite core

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restoration preserve sound dental structure, the risk of root fracture may be reduced and the retention of restorations enhanced [9,10]. The last step in this process is the choice of type of final restoration. Although a covering crown could be considered the standard reconstruction of a severely compromised tooth [11], numerous studies reported good results for large direct composite resin restorations in vital teeth [12–14]. Advantages of direct restorations are lower cost, preservation of sound dental tissue, short chair time and greater options for repair, if necessary.

Although direct composite restorations and (metal and/or ceramic) crowns are very different approaches, there is very little evidence to guide the clinician in their choice of restoration in endodontically treated teeth. For teeth with sufficient ferrule, composite resins as well as metal-ceramic crowns were reported to have high survival rates [3,7,15]. However, the choice for either restoration is guided by clinical success factors like the amount of remaining tooth material. Therefore, comparing the performance of different restoration types by combining different studies using various clinical configurations is not informative [16,17].

Thus, the aim of this study was to compare in a randomized clinical trial the survival of composite resin restorations and metal-ceramic crowns used to restore endodontically treated teeth.

2. Materials and methods

2.1. Experimental design

The present study is registered at ClinicalTrials.gov (NCT01461239) and was a parallel group randomized controlled clinical trial. The study was approved by the Research and Ethics Committee (Protocol 122/2009) of the Federal University of Pelotas, and described according to the CONSORT recommendations and based on an assumption of equivalence of treatments.

Teeth were restored with a glass fiber post cemented with regular or self-adhesive resin cement, composite core and a direct or indirect restoration, according to the randomization process. Patients were recalled up to 60 months for clinical and radiographic examination. Survival curves were created and the type of failure was evaluated.

2.2. Sample size calculation

Sample size calculation was based on the fact that previously published papers with similar design showed no differences between direct and indirect restorations for endodontically treated teeth [3,18–22]. In that sense, if there is truly no difference between the standard (crown) and experimental treatment (direct composite resin), and considering that the average tooth survival rate after 5 years would be of 96%, 30 teeth per group would be required to be 90% sure that the limits of a two-sided 90% confidence interval will exclude a difference between the standard and experimental group of more than 18% (considered to be a clinically significant threshold), based on the equivalence of the treatments, and taking into account a possible 20% patient loss.

2.3. Inclusion and exclusion criteria

Adult patients seeking treatment in the Federal University of Pelotas, in need of endodontic and restorative treatment in teeth with at least one entire coronal wall remaining after endodontic procedures, were selected. In addition, patients should have good oral and general health and bilateral occlusal posterior contacts. Patient exclusion criteria were: financial limitations; untreated temporomandibular joint disorder; or extensive removable partial/complete dentures in the opposing jaw. Tooth exclusion criteria were: tooth mobility; periodontally compromised condition; or a periapical lesion that did not resolve after endodontic treatment. All participants signed written informed consent before being accepted into the study.

2.4. Randomization procedures

All teeth were randomized and assigned to each group using a computer-generated list of random numbers. Each number was written on a white paper and placed into brown envelopes, by a researcher not involved in the study according to the treatment previously randomized. As a result, the clinician and the patient (double-blind study design) only knew which type of restoration was going to be the final restoration (direct or indirect) after cementing the post and making the resin composite restoration. Allocation only occurred after making the restoration, when the envelope was opened and if the paper had “crown” written, the crown preparation was performed. If the paper had “resin” written, no preparation was performed and the resin composite restoration was finished and polished. The randomization sequence was stratified by tooth type, anterior, premolar or molar. Due to the slow uptake of patients, blocks of 10 patients were randomized after one year of the clinical trial to minimize unbalancing.

2.5. Clinical procedures

All root canal treatments were performed under rubber dam isolation and all materials were used according to the manufacturers’ instructions. Trained undergraduate and graduate students performed all procedures, including restorative reconstruction.

A crown-down technique was performed (2.5% sodium hypochlorite as irrigant) using files in ascending sizes. The root canals were filled with gutta-percha points (Coltene/Whaledent, Langenau, Germany) and cement (Endo-fill, Dentsply/Maillefer, Petrópolis, Brazil) by lateral and vertical condensation. The gutta-percha was immediately partially removed with a heated spreader and a #2 Gates-Glidden drill, leaving 4 mm of apical seal. Where appropriate a waiting period with temporary restoration was observed, to evaluate peri-apical healing. The post space was prepared using a calibrated bur corresponding to the glass fiber post number (#0.5 or 1, White Post DC, FGM, Joinville, SC, Brazil). After checking the fit, the posts were cleaned with alcohol and pretreated with silane (ProSil, FGM) [23], and luted according to protocol for the assigned cement. For the regular resin cement (RelyX ARC, 3 M ESPE, St Paul, USA), the dentinal walls of the post space was acid-etched using 37% phosphoric acid (Condac, FGM) and an adhesive system was applied (Adper Single Bond or ScotchBond Multi Purpose—3 M ESPE) followed by insertion of the resin cement using Centrix syringe (DFL Indústria e Comércio S.A., Rio de Janeiro, Brazil). Digital pressure was applied for 5 min excess of cement was removed and light-cured for 40 s/surface. The same procedures were performed for self-adhesive resin cement (RelyX U100, 3 M ESPE), but without the adhesive. After post cementation, radiographs were taken to check the location of the post. All heads of the posts were 2 mm sub-occlusal.

Direct restorations were made using a microhybrid resin composite (ScotchBond Multi Purpose + Filtek Z250, 3 M ESPE) with an incremental technique. Each increment was light-cured for 40s. All restorations were immediately finished with fine and ultra-fine diamond finishing-burs (KG Sorensen, Barueri, SP, Brazil) under water spray, and polished with Sof-Lex discs (3 M ESPE) and 0.1 μm particle size diamond paste 1–7 days later.

For indirect restorations, the core restoration was made with Scotchbond MP and Filtek Z250 using an incremental technique (curing 40 s/layer) with at least 2 mm composite covering the post. For the metal-ceramic crown preparation diamond burs were used. All margins were at gingival level and finished with a chamfer