



Review article

Endocrown restorations: A systematic review and meta-analysis



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ABSTRACT

Objectives: A systematic review was conducted to evaluate clinical (survival) and in vitro (fracture strength) studies of endocrown restorations compared to conventional treatments (intraradicular posts, direct composite resin, inlay/onlay).

Data: This report followed the PRISMA Statement. A total of 8 studies were included in this review.

Sources: Two reviewers performed a literature search up to February 2016 in seven databases: PubMed, Web of Science, Scopus, BBO, SciELO, LILACS and IBECs.

Study selection: Only clinical trials and in vitro studies that evaluated endocrowns were included. Case reports, case series, pilot studies, reviews and in vitro studies that evaluated properties other than fracture strength of endocrowns were excluded. From the 103 eligible articles, 8 remained in the qualitative analysis (3 clinical trials and 5 in vitro studies), and the meta-analysis was performed for the 5 in vitro studies. A global comparison was performed with random-effects models at a significance level of $p < 0.05$.

Results: Clinical trials showed a success rate of endocrowns varying from 94 to 100%. The global analysis in posterior and anterior teeth demonstrated that endocrowns had higher fracture strength than conventional treatments ($p = 0.03$). However, when comparing endocrowns to conventional treatments only in posterior teeth (subgroup analyses), no statistically significant differences were found between treatments ($p = 0.07$; $I^2 = 62\%$).

Conclusion: The literature suggests that endocrowns may perform similarly or better than the conventional treatments using intraradicular posts, direct composite resin or inlay/onlay restorations.

Clinical significance: Although further studies are still necessary to confirm the present findings, endocrowns show potential application for the rehabilitation of severely compromised, endodontically treated teeth.

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1. Introduction

Rehabilitation of endodontically treated teeth with large coronal destruction is still a clinical challenge, especially due to the loss of strength characteristics associated to the removal of pulp and surrounding dentin tissues [1]. Coronal retention of the restoration is usually compromised, thus intraradicular posts combined or not with core materials may be required [2]. Despite all clinical success achieved with the use of intraradicular posts, one disadvantage of this system is the additional removal of sound tissue needed for fitting the post into the root canal [3];

additionally, this procedure was revealed to affect the overall biomechanical behavior of the restored teeth [4]. Alternatively, other restorative approaches have been suggested, including but not limited to the well-known endocrown restorations.

Endocrowns assemble the intraradicular post, the core, and the crown in one component [5,6], thus representing monoblock restorations [7]. Different from conventional approaches using intraradicular posts, endocrown restorations are anchored to the internal portion of the pulp chamber and on the cavity margins, thereby resulting in both macro- and micro-mechanical retention, provided by the pulpal walls and adhesive cementation, respectively [8–10]. In addition, endocrowns have the advantage of removing lower amounts of sound tissue compared to other techniques, and with much lower chair time needed. Also, the masticatory stresses received at the tooth/restoration interface are more properly dissipated along the overall restored tooth structure

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when endocrowns are placed [11]. Depending on the material chosen, i.e., ceramic or resin composites, the system may become more rigid than the dental structure (in case of ceramics) or biomechanically similar to the tooth (in case of resin composites). Consequently, the type of material may also have influence on the performance of endocrowns [12].

Despite the increased popularity of endocrown restorations, the question that remains is whether clinicians should consider using endocrowns instead of conventional treatments with intraradicular posts. In fact, and from the best of our knowledge, there is still scarce clinical evidence available in the literature, and the existing ones have short follow-up periods, e.g., from 6 to 36 months [5,9,13]. Nevertheless, in vitro evaluations reporting on the fracture strength of endocrowns are fairly available [8,12]; thereby a review of literature taking into account this subject is needed.

Thus, the aim of this study was to systematically review the literature to evaluate clinical and in vitro studies that evaluated endocrown restorations compared to conventional treatments (intraradicular posts, direct composite resin, inlays/onlays). The hypothesis tested was that endocrowns would perform similarly to conventional treatments.

2. Materials and methods

This systematic review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA Statement) [14].

2.1. Search strategies

Two independent reviewers carried out the literature search until February 2016. The following databases were screened: Pubmed (MedLine), Lilacs, Ibecs, Web of Science, BBO, Scielo and Scopus—using the search strategy described in Table 1. The references cited in the included papers were also checked to identify other potentially relevant articles. After the identification of articles in the databases, the articles were imported into Endnote X7 software (Thompson Reuters, Philadelphia, PA, USA) to remove duplicates.

2.2. Study selection

Two review authors independently assessed the titles and abstracts of all documents. The studies were analyzed according to the following selection criteria: clinical trials that evaluated endocrown restorations or in vitro studies that evaluated fracture strength of endocrowns compared to conventional treatments (intraradicular posts, direct composite resin, inlay/onlay). Case

reports, case series, pilot studies, reviews and in vitro studies that evaluated other properties rather than fracture strength of endocrowns and language other than English were excluded. Full copies of all of the potentially relevant studies were identified; those appearing to meet the inclusion criteria or for which there were insufficient data in the title and abstract to make a clear decision were selected for full analysis. The full-text papers were assessed independently and in duplicate by two review authors. Any disagreement regarding the eligibility of included studies was resolved through discussion and consensus or by a third reviewer. Only papers that fulfilled all of the eligibility criteria were included.

2.3. Data extraction

The data were extracted using a standardized form in Microsoft Office Excel 2016 software (Microsoft Corporation, Redmond, WA, USA). If there was any information missing, the authors of the included papers were contacted via e-mail to retrieve any missing data. The reviewers tabulated data of interest for the composition of a spreadsheet in Excel format, with all included studies containing the following: authors, year, number of teeth, type of teeth (anterior or posterior), outcomes, type of cement, groups evaluated, and fracture strength.

2.4. Quality assessment

Two reviewers independently assessed the methodological quality of each included study. Clinical trials were evaluated and classified according to Cochrane guidelines [15] to the following items: selection bias (sequence generation, allocation concealment), performance and detection bias (blinding of operators or participants and personnel), bias due to incomplete data, reporting bias (selective reporting, unclear withdrawals, missing outcomes), and other bias (including industry sponsorship bias). Evidence for each outcome was graded according to the GRADE working group of evidence using Grade Profiler 3.6 [16].

The methodological quality of in vitro studies was assessed as previously described [17,18]. Thus, the quality assessment was performed according to the articles' description of the following parameters: teeth randomization, presence of control group, teeth with similar morphology, data of fracture strength with coefficient of variation lower than 50%, sample size calculation, blinding of the examiner. If the studies presented the parameter, the article had a "Yes" on that specific parameter; if it was not possible to find the information, the article received a "No." Articles that reported on one or two items were classified as having a high risk of bias, three items as a medium risk of bias, and four or five items as a low risk of bias.

Table 1

Search strategy used in electronic databases (Web of Science, PubMed (MEDLINE), Scopus, Scielo, Lilacs and Ibecs).

Search Terms
Web of Science "Endocrown" OR "Endocrowns" OR "depulped restoration" OR "no buildup crown" OR "no build-up crown" OR "no-post buildup" OR "no-post build-up" OR "endo crowns" OR "endo crown" OR "endodontic crown" OR "endodontic crowns" OR "adhesive endodontic crown" OR "adhesive endodontic crowns"
PubMed (MEDLINE) "Endocrown" OR "Endocrowns" OR "depulped restoration" OR "no buildup crown" OR "no build-up crown" OR "no-post buildup" OR "no-post build-up" OR "endo crowns" OR "endo crown" OR "endodontic crown" OR "endodontic crowns" OR "adhesive endodontic crown" OR "adhesive endodontic crowns"
Scopus (Endocrown) OR (Endocrowns) OR (depulped restoration) OR (no buildup crown) OR (no build-up crown) OR (no-post buildup) OR (no-post build-up) OR (endo crowns) OR (endo crown) OR (endodontic crown) OR (endodontic crowns) OR (adhesive endodontic crown) OR (adhesive endodontic crowns)
Scielo, Lilacs and Ibecs (Endocrown) OR (Endocrowns) OR (depulped restoration) OR (no buildup crown) OR (no build-up crown) OR (no-post buildup) OR (no-post build-up) OR (endo crowns) OR (endo crown) OR (endodontic crown) OR (endodontic crowns) OR (adhesive endodontic crown) OR (adhesive endodontic crowns) OR (coroa endodôntica adesiva) OR (coroa endodôntica) OR (corona de endodoncia)

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