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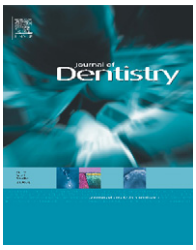

Up to 17-year controlled clinical study on post-and-cores and covering crowns

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ABSTRACT

Objective: The aim of this long-term follow-up was to collect up to 17-year survival data of different metal post-and-core restorations with a covering crown.

Methods: At initiation of the study, a controlled clinical trial, single tooth was provided with an artificial covering crown, by 18 operators. Restorations under investigation were the post-and-core restorations: cast post-and-core restorations, prefabricated metal post and resin composite core restorations, and post-free all-composite core restorations. Before treatment allocation, the recipient tooth was categorized according to the expected dentin height after tooth preparation. A tooth was assessed to have ''substantial dentin height'' (Trial 1) or ''minimal dentin height'' (Trial 2). The study sample consisted of 257 patients that received 307 core restorations. The performance of the restorations was based on data collected from the files of the current dentists monitoring the oral health of the patients. The survival probability was analyzed at different levels: on the restoration level (S_R), and on the level of the tooth carrying the restoration (S_T). Kaplan Meier analyses were used to compare survival probabilities.

Results: ''Type of post-and-core restoration'' showed no influence on the survival probability (at both levels) in both trials (P-value > 0.05). The 17-year survival rates at restoration level varied from 71% to 80%, and at tooth level from 83% to 92%.

Conclusions: The results of this study showed no difference in survival probabilities among different core restorations under a covering crown of endodontically treated teeth. The preservation of substantial remaining coronal tooth structure seems to be critical to the long-term survival of endodontically treated crowned teeth.

1. Introduction

The traditional way to restore an endodontically treated tooth is a cast (metal) post-and-core and an artificial covering crown. Since their introduction in the 1970s, prefabricated metal posts and composite (as a core material) have been used on a large scale as an alternative method to build-up endodontically treated teeth.[1–3]

Long-term clinical studies with a follow-up ≥5-year on metal post-and-core restored teeth are scarce. Reported survival rates vary from 50% to 99% in retrospective studies with a follow-up period of around 10 years,[4–6] and 89% to 94%

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in prospective studies with a follow-up period of 7–10 years.[7,8] Data based on long-term clinical studies are essential for the general practitioner for clinical decision making. Preferred information is derived from prospective comparative clinical studies, the most decisive are randomized controlled clinical trials. In the comparison of various clinical studies on post-and-core restored teeth, two structured literature reviews showed a lack of well-designed randomized controlled clinical trials.[9,10]

Crown coverage has been argued as an important factor in the survival of endodontically treated teeth. Some authors suggest that the survival probability of endodontically treated teeth is positively influenced by crown placement.[11,12] Another aspect related with tooth longevity after endodontic treatment is the remaining tooth-crown material (dentin height).[13–15] A greater amount of remaining dentin might increase survival probability. It has been suggested that sufficient ferrule (2 mm) of the covering crown makes the type of build-up restoration trivial in the longevity of endodontically treated teeth.[13] In a literature review on the ferrule-effect it was concluded that a ferrule of 1.5 mm is desirable, but should not be provided at the expense of the remaining tooth/root structure.[16]

The aim of present long-term clinical follow-up was to collect up to 17-year survival data of different post-and-core restorations with a covering crown. The hypothesis to be tested is that there is no difference in long-term survival probability between different types of core restorations, with or without posts. It is also hypothesized that the amount of remaining dentin has no influence on the survival probability.

2. Materials and methods

2.1. Trial design

The present study was a follow-up of two clinical trials on various types of core restorations that were made between January 1988 and June 1991. The design of the trials, the patients involved, and the materials used have been described in detail in previous reports.[17–19] For convenience of the reader the main conditions will be described briefly.

The trials were organized in a multi-practice setting. Eighteen operators were involved, 17 dentists practicing in their own clinic in the Nijmegen area and one dentist at the university clinic of the College of Dental Science of the Radboud University Nijmegen Medical Centre. The study protocol was screened and approved on its ethical acceptability by the Committee on Experimental Research on Man of the Radboud University Nijmegen. The ethical committee approved an addendum for the present follow-up as well.

Restorations under investigation were the core build-up restorations according to: cast post-and-core restorations (CPC, control), prefabricated metal post and direct resin composite core restorations (M/C), and post-free all-composite core restorations (C). All teeth were provided with a metal or metal–ceramic crown (+C).

Before treatment allocation, the recipient tooth was categorized by the operator according to the expected dentin height after tooth preparation. A tooth was predicted to have remaining ''substantial dentin height'' (Trial 1) or ''minimal dentin height'' (Trial 2) after preparation. ''Substantial dentin height'' was defined as: >75% of the circumferential dentin wall has minimal 1 mm thickness and at least a height of 1 mm above gingival level; less than 25% of the circumference has less than 1 mm above the gingiva, but a ferrule of 1–2 mm could be achieved. ''Minimal dentin height'' was defined as: <75% of the circumferential dentin wall has at least 1 mm above gingival level; more than 25% of the circumference has less than 1 mm above the gingiva, or no ferrule of 1–2 mm could be achieved.

In Trial 1 the three types of core restorations were made. In Trial 2 only the types with a post were made (CPC + C, M/C + C). Within each trial, the type of core restoration to be made was assigned by balanced randomization. Table 1 describes the materials and the distributions of the post-and-core restorations per trial.

2.2. Study sample

The study sample consisted of 257 adult patients (159 female, 98 male, aged 17–71 years at intake (mean age 36 years)). They received 307 core restorations, 204 in the upper jaw, 103 in the lower jaw. All reconstructed teeth were single restorations (abutment teeth for fixed partial dentures or removable partial dentures were excluded). The majority of the patients (211) received one core restoration, 46 patients received more than one, but with a maximum of four core restorations.

2.3. Evaluation

Survival data up to 17 years were collected. Due to a 3-year intake period at baseline and the data collection period (started 15 years after the first clinical treatments, and taking also about 3 years) the available data varied from 15 to 17 years. The performance of the restorations was evaluated based on data collected from the files of the current dentists monitoring the oral health of the patients. To check whether patient records of the dental practices provided valid data, a convenient sample of 56 reconstructed teeth (18% of all 307 teeth) was clinically examined and cross-checked with the patient records. The data appeared to be reliable and therefore no further checks were done.

A restoration was recorded as having survived if the restoration was still present in its original form at the moment of evaluation. The survival probability was analyzed at different levels: on the restoration level (S_R), and on the level of the tooth carrying the restoration (S_T).

Endpoints for the survival level S_R were intervention due to caries at the margins of the restoration, re-cementation or replacement of the post-and-core and crown, and loss or extraction of the tooth (due to peri-apical problems, caries, fracture of the root/tooth, trauma, combination of problems, or unknown reason). Re-cementations of the crown only, inclusion of the tooth into an abutment for a bridge, endodontic revisions, and extractions due to periodontal problems were accounted as censored data for this survival level, because the restoration is not present in its original form anymore. Maintenance treatments (*e.g.* polishing and finishing or adding composite after chipping of small fragments of