

SURVIVAL RATE OF ENDODONTICALLY TREATED TEETH IN RELATION TO CONSERVATIVE VS POST INSERTION TECHNIQUES – A RETROSPECTIVE STUDY

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Abstract

Aims and methods: The purpose of this retrospective, non-randomised cohort study was to evaluate the success rate of 775 endodontically treated teeth depending on the restoration type.

A total of 508 patients with 775 endodontically treated teeth were examined during at least 12 months. The radiographic controls, time span between root canal filling and definitive restoration, restoration material type, inserted post system type and the occurrence of possible endodontically as well as restorative post-operative complications were recorded.

Results: 18.3% of the 775 investigated teeth were incisors and canines, 33.5% were premolars and 48.2% molars. Pre-fabricated and casted metal post systems were used only in 15.6% of the endodontically treated teeth (18.4% incisors and canines, 44.8% premolars, 36.8% molars). 6.6% of the teeth had endodontically related symptoms or severe complications, whereas in 13.2% of the teeth restored with metal posts showed complications, such as root or crown fractures. The Cox-Regression analysis showed that teeth restored with a post system had a statistically significant higher failure rate ($p = 0.044$) than those which had been restored without posts.

Conclusions: The results showed a high success rate for endodontically treated teeth when the final restoration was placed within a short period of time (two weeks). A higher tooth loss was observed when metal post systems were employed suggesting that precaution is recommended when these types of posts are inserted.

Key words: Definitive restoration, post system, success/failure, retrospective study.

INTRODUCTION

In recent years an increasing demand for endodontic treatment has been observed in many industrialized western European countries [15, 18]. This tendency is mainly due to improvements in both endodontic treatment procedures and dental materials [29]. Other factors, which might have contributed to the increase in endodontic treatment are a growing health consciousness within the population and numerous preventive programs offered at different institutions [14, 35]. When taking into consideration the high success rate of endodontic treatments over recent years [4, 7,

10, 28], the importance of the final restoration following an endodontic treatment should be carefully considered. At present, there is a controversial discussion concerning the type of final restoration after the endodontic treatment and the time-span between the root canal filling and final restoration [2, 3, 5, 6, 8, 9, 13, 17, 23, 24, 25, 27, 31]. Moreover, differing opinions also exist with respect to the possible brittleness of the tooth structure after pulp removal [11, 26, 30].

The success rate of endodontically treated teeth with insertion of pre-fabricated and casted metal post insertion was of particular interest in this research. Such systems have proven post-operative complications, such as root fracture and post dezementation [32].

Presently the use of root canal post-systems with adhesive techniques in the root canal appears to be a promising alternative to the established metal post systems. The advantages of the resin based adhesive materials are its elasticity similar to dentine, the easier handling of the post-insertion technique and the possibility of stabilisation of the remaining dentine [21, 12].

The objective of this retrospective cohort study was to evaluate the success of endodontically treated teeth depending on the restoration type employed. Special attention was given to the time-span elapsed between the endodontic treatment and the placement of the final restoration as well as the teeth survival rate in case of metal post insertion.

MATERIALS AND METHODS

In the present retrospective study a total of 775 teeth from 508 patients (261 male, 247 female) that were endodontically treated and received their final restorations at the dental school of the University of Mainz, were investigated. The examined teeth included maxillary and mandibular incisors, canines, premolars and molars (third molars were excluded). Exclusion criteria from this study were patients with systemic and general diseases, pregnancy, advanced periodontal disease and long term medication. The root canal treatments and placement of the final restorations (patients age: 16-78 years) were performed by operators with at least 5 years of experience. Observation parameters comprised the time elapsed between endodontic treatment and final restoration placement, clinical symptoms of

endodontic origin, endodontic complications such as the presence of apical radiolucencies or fistulae and the occurrence of caries or fractures which lead to tooth extraction.

The clinical and radiographic diagnosis of the teeth were recorded. The endodontic treatment and subsequent definitive restoration with and without posts were protocolled on questionnaire specially designed for this purpose. In this study different conventional pre-fabricated and casted metal post systems were inserted, only in case that the amount of remaining tooth structure did not provide sufficient retention for the crown abutment.

Control radiographs were taken immediately after and approximately every 6 months after completion of the endodontic treatment and placement of the final restoration. The root canal treatment was rated as successful, when a radiologically normal periradicular space and lamina dura were observed on the diagnose and control radiographs or periradicular and apical changes, as seen on the radiographs at the onset of treatment, had completely healed, or when a previous detectable periradicular radiolucency showed substantial reduction in size within six to twelve months. The time elapsed between completion of the endodontic treatment and placement of the final restoration, and the type and extent of the final coronal restoration were also documented. Complications such as post and / or crown dislodgement, root or crown fracture were also recorded.

Statistical Analysis. The medians and quartiles of the recorded parameters were used to analyze the research variables by category description based on the absolute and relative frequencies. The Cox-Regression Analysis was used to assess the statistical significance (p -value <0.05). The final restoration type (with or without post-insertion), the root canal filling method, type of teeth (incisors and canines, premolar, molar) and the time-span between root canal treatment and the placement of the final restoration were defined as primary factors of influence. A summary of the Cox-Regression was done with the aid of p -values of Likelihood Ratio-Tests (p -value <0.05). In order to be able to illustrate the clinical relevance of a significant influ-

ential factor, the differences between groups as for the treatment modalities were additionally depicted with the aid of Kaplan-Meier graphs.

RESULTS

A total of 508 patients (775 teeth) between 12 and 78 years of age (mean: 52 years, SD \pm 13years) were examined. A relative small number of patients (0.8%) were up to 20 years, 20.8% between 20 and 40, 42.9% between 40 and 60 years and 35.5% of the patients were over 60 years.

From the 775 endodontically treated teeth 93.4% showed no radiographical changes and clinical symptomatology after 12 months. 18.3% were incisors and canines (13.6% maxillary and 4.7% mandibular), 33.5% were premolars (19% maxillary, 14.5% mandibular) and 48.2% were molars (25% maxillary and 23.2% mandibular); 57.6% were maxillary and 42.4% mandibular. The time-span between the endodontic treatment and final restoration was one to three weeks in 58.2% of the cases. In 15.3% the time-span was one month, three months in 10.3%, one year in 2.8%, and in 6.2% more than one year.

Following completion of the endodontic treatment 48.2% of the incisors and canines were restored with composites, and 36.7% with either gold or porcelain crowns. 11.5% of the anterior teeth were integrated into a bridge framework, 2.2% served as abutments for telescopic crowns, 1.4% were restored with complete porcelain crowns and 1% with porcelain veneers. 25.9% of the premolars were restored with composites, 46.5% with gold casted crowns, 20.1% served as bridge abutments, 2.8% were restored with gold onlays, 1.9% with full ceramic crowns, 1.2% served as abutments for telescopic crowns abutments, while 1.6% were restored with other different materials (amalgam, ceramic-inlays). 55.5% of the molars were restored with gold casted crowns, 17.2% with composites, 12.9% served as abutments for bridgeworks, 9.1% were restored with gold onlays 4,1% with complete ceramic crowns, while other restoration methods (amalgam and ceramic-inlays) were employed in 1.5% of the cases (Fig. 1).

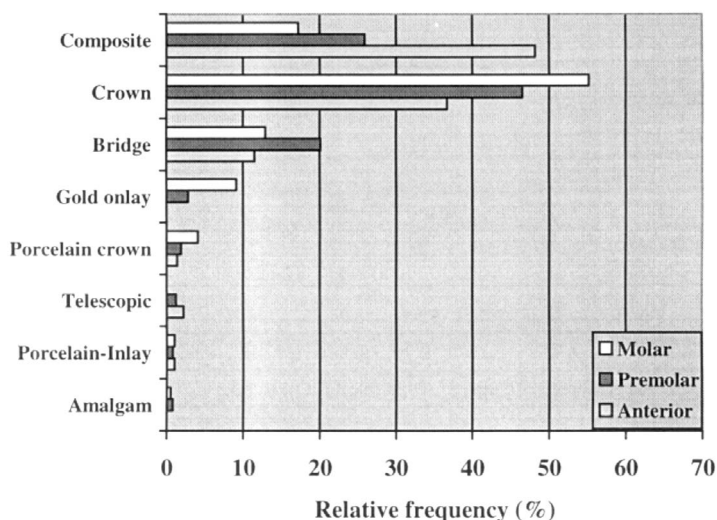


Fig. 1. Tooth distribution and definitive restoration type after endodontic treatment.

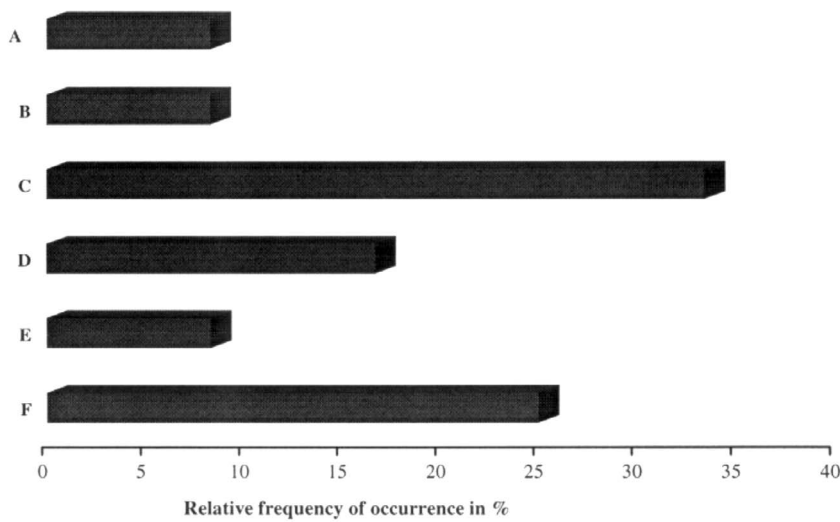


Fig. 2. Complication type of endodontically treated teeth after post insertion. A: Pain occurrence with or without radiological changes B: Radiological changes in the periapical area C: Radiological lesion without clinical symptomatology. D: Crown and root fracture E: Root fracture F: Crown fracture

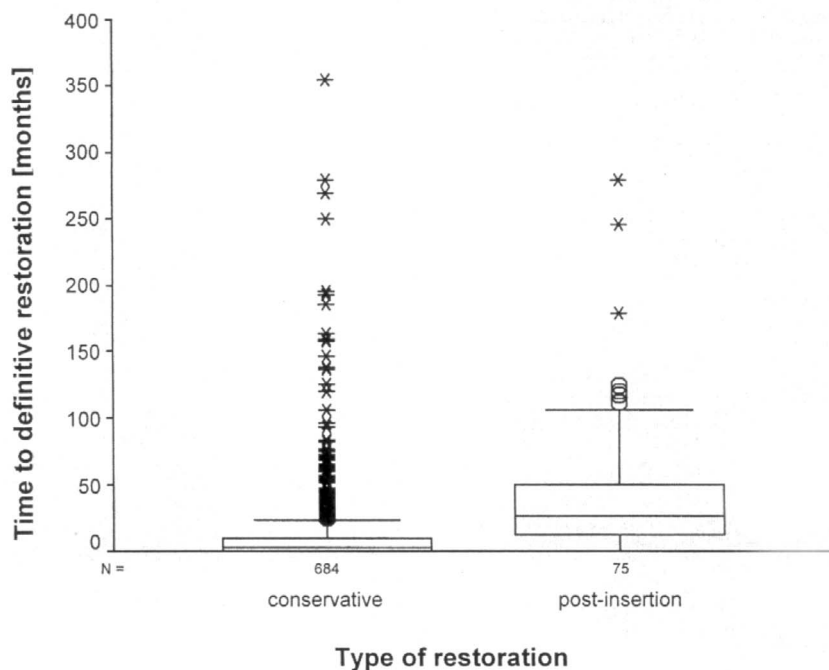


Fig. 3. Time elapsed between endodontic treatment and definitive restoration (month / stratification) without (conservative) and with post insertion. Horizontal lines indicate medians and quartiles, whiskers indicate the minima and maxima, circles / asterisks indicate statistical outliers and extreme values with deviations of more than two to three times from the median.

Pre-fabricated metal post-systems such as Radix Anker, Cytco, RS Root Post system or casted posts were inserted in 15.6% of the teeth; 18.4% were incisors and canines, 44.8% premolars and 36.8% molars. Most post restored teeth were maxillary (60%) and 40% mandibular. A total of 6.6% of the investigated teeth showed clinical inflammation symptomatology and/or radiological complications. Teeth restored with pre-fabricated or casted metal posts showed clinical symptoms and radiological changes in 13.2% (Fig. 2), 68% of which were maxillary and 32% mandibular (26% incisors and canines, 24% premolars, and 50% molars).

The Cox-Regression revealed a statistically significant higher failure rate ($p=0.044$) for the post insertion modality when compared to teeth restored without posts (Fig. 3). The complication risk following post insertion is by 115% higher than in the event of teeth restored without a post. A long time-span between endodontic treatment completion and final

restoration placement also lead to a statistically significant higher failure rate ($p=0.003$) (Fig. 4). The complication risk increases by 3% per additional month. A mean survival of 66 months (95% confidence, range 54 - 78 months) was observed for teeth with posts and 93 months (95% confidence, range 90 - 96 months) for teeth without post insertion.

DISCUSSION

The success and survival rate of endodontically treated teeth depends on the careful endodontic treatment and subsequent definitive restoration. An endodontic treatment can only be considered to be completed when the tooth has received a final coronal restoration and has achieved full functionality [34]. Several studies have also shown that a short time-span between endodontic treatment and the final restoration leads to a statistically significant favourable prognosis. It has

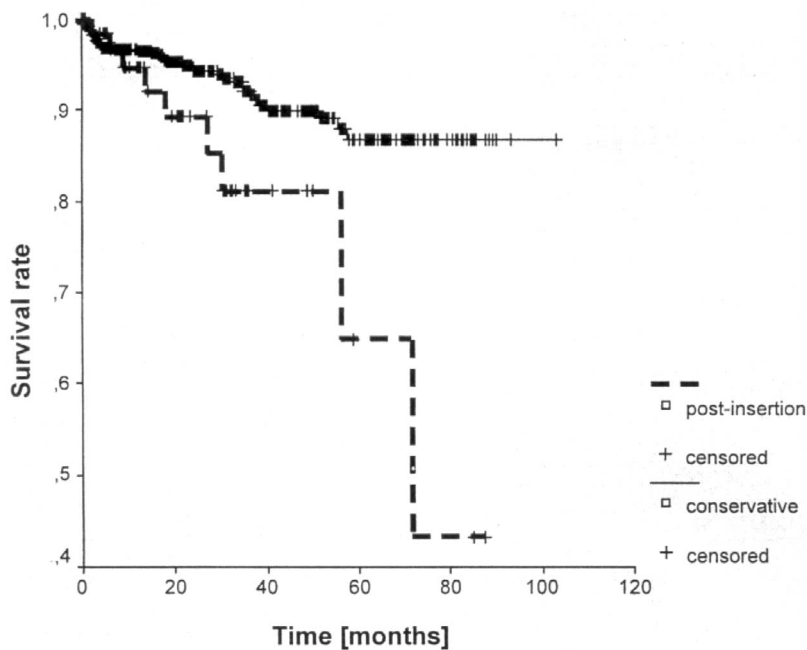


Fig. 4. Time elapsed between endodontic treatment completion and restoration placement (with and without post insertion). Kaplan-Meier estimates for the survival rate of endodontically treated teeth without and with post insertion in dependence of the observation time after restoration placement.

been demonstrated that possible causes of failure were coronal leakage as well as temporary post insertions [1, 16, 19]. There is evidence that the use of resin based materials as a definite restoration material prevents marginal leakage; thus, possible reinfection from coronal after root canal treatment and fracture caused by provisional filling materials can be prevented.

When reconstructing endodontically treated teeth, both, the amount of remaining tooth structure and the extent of the crown defect have to be considered. Additional retention by means of a post should be considered only when extensive crown destruction is present. The relatively high failure rate after post insertion found in this study is in agreement with the one reported by Stockton et al. [32] in which the success and possible failure causes after post insertion were investigated.

While secondary caries is the most common failure reason, post dislodgement and the restoration type (provisional or definitive) are also considered to influence the failure rate as also shown in this study. Furthermore, root fracture, post dislodgement and coronal restoration fractures are also among the relevant failure factors of endodontically treated teeth that have been restored with a post [22, 20]. Vertical fractures are classified as the most severe complication type, since such teeth have to be extracted in its majority. The frequency of root fracture occurrence following a metal post insertion reported in the literature varies between 2 and 4% [21, 33]. In this study post insertion indication was restricted only for retention purposes in case of an extensive tooth destruction. Thus the higher root fracture rate (7%) in this study can be explained through the teeth selection criteria. The 775 investigated teeth showed a high endodontic treatment success rate (93.4%) similar to that of other studies [4, 7, 10, 28]. The restriction of non-randomised study design needs to be considered. In the present retrospective cohort study, endodontically treated teeth restored with pre-fabricated or casted metal posts

showed a statistically significant higher failure prognosis. A longer time-span between the endodontic treatment and final restoration showed also a statistically significant higher failure prognosis. Thus, the success rate of endodontically treated teeth can be favourably influenced through a rapid definitive restoration in order to prevent bacterial reinfection of the root canal system. The results suggest that the prognosis of endodontically treated teeth could be favourably enhanced if the insertion of pre-fabricated and casted metal posts is avoided.

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