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THE EFFECT OF ENDODONTICS AND CROWN RESTORATION TECHNIQUES ON THE PROGNOSIS OF TREATMENT NON-VITAL TEETH

WPŁYW TECHNIK ENDODONTYCZNYCH I TECHNIK ODBUDOWY KORONY NA ROKOWANIE W LECZENIU ZĘBÓW Z MARTWĄ MIAZGĄ

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ABSTRACT

Introduction: It is generally accepted that the prognosis of endodontic treatment positively correlates with the technical quality of root filling. This seems logical in the sense that the root filling is intended to create a bacterial tight seal on the root canal, so oral bacteria cannot reach the periapical tissues and cause disease. The materials that are available to seal the root canal system are not flawed, and a number of studies using different methods have suggested that even seeming adequate root fillers may not be effective over time. **The aim** of the study was to evaluate the possible relationship between the quality of restorative crown of the tooth, obturation of the root canal and the periapical status of the teeth that were subjected to endodontic treatment.

Materials and methods: A series of X-ray images of randomly selected outpatient cards from patients in the dental department of the Dnipropetrovsk State Medical Academy clinic were investigated. A total of 1001 teeth that were subjected to endodontic treatment, restored by permanent restoration, were evaluated independently by two experts. According to the predetermined set of radiological criteria, the quality of filling the root canals of the tooth was assessed as good (GE), or poor (PE). In turn, the quality of the tooth crown restoration was also evaluated and recognized as good (GR) or poor (PR). Subsequently, the roots of the teeth and surrounding tissues were investigated, and according to existing or present abnormalities, the outcome of treatment was determined to be either successful or unsuccessful.

Results: The successful outcome of endodontic treatment among all the teeth tested was found at 66.4% (n = 1001). The positive result of treatment of teeth with root posts reached 72.7% (n = 527), the success of treatment of teeth without pins was 64.6% (n = 472). The effectiveness of dental treatment, where the technically satisfactory endodontics was found to be the highest. Thus, in combination with technically satisfactory restorations, the success rate reached 82% (GE + GR), and when the restoration was technically unsatisfactory, positive results of treatment were observed in 72% of cases (GE + PR). At the same time, in those groups where endodontics was considered technically unsatisfactory, the positive result of treatment was observed significantly less often, in combination with unsatisfactory restoration, only 55% (PE + GR). If restorations were satisfactory, then somewhat more often, in 57% of the examined teeth (PE + PR).

Conclusions: Thus, according to the results of the X-ray assessment of non-vital teeth, it became clear that in order to achieve a positive result, technically qualitative endodontics is more important, with the same characteristic of restoration of the crown of the tooth.

KEY WORDS: periapical tissues, tooth crown, endodontic treatment, post construction

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INTRODUCTION

It is generally accepted that the prognosis of endodontic treatment positively correlates with the technical quality of root filling [1,2,3,4]. This seems logical in the sense that the root filling is intended to create a bacterial tight seal on the root canal, so oral bacteria cannot reach the periapical tissues and cause disease. The materials that are available to seal the root canal system are not flawed, and a number of studies using different methods have suggested that even seeming adequate root fillers may not be effective over time [5,6,7,8,9]. Thus, in one of the in vitro studies of coronal leakage of root crops with absent coronal restorations, bacterial products were found on the apex of the teeth after 3 weeks [10]. Undoubtedly, a well-sealing corona restoration is important for protecting the root fill-

ing from the effects of the oral environment. Ray & Trope [11] in a 1995 study attempted to determine the relative importance of root filling and crown repair in establishing and maintaining periapical health in combination with endodontic teeth. Probably somewhat unexpectedly, in their material they found that the quality of crown repair was significantly more important for the long-term success of endodontic treatment than the quality of the root filling itself [11,12,13].

This study is important because it is directly related to clinical therapy. At least to some extent, the results undermine the fundamental understanding in endodontics that it is the root filling that creates a tight seal of the bacteria and that restoring the crown maximally protects the root filling and completes the restoration of the tooth in order

to function [14,15,16]. Thus, it is considered that this issue is important enough, and it should be reviewed again. The aim of this study was to duplicate Ray & Trope's work [11] as much as possible, in order to again study the relationship between the quality of crown restoration, root filling and periapical health of endodontic teeth.

MATERIALS AND METHODS

A cross-sectional study was performed by examining full mouth radiographs from randomly selected patient charts studied in the dentistry department of the clinic of the Dnipropetrovsk State Medical Academy. The radiographs of the first 1001 endodontically treated teeth with a permanent restoration were evaluated. Two independent observers examined the radiographs using a X-ray viewer with 2X magnification. Teeth with and without posts were examined. Multirooted teeth were categorized by the root with the most incomplete root filling. The teeth were grouped according to the radiographic qualities of the root filling and the coronal restoration as follows:

Good endodontics: All canals obturated. No voids present. Root filling ending between 2 mm short of and 1 mm beyond radiographic apex.

Poor endodontics: Root filling ending more than 2 mm from radiographic apex. Root filling with voids or canals not filled. Root filling poorly dimensioned or poorly condensed.

Good restoration: Any permanent restoration that appeared intact radiographically.

Poor restoration: Any permanent restoration with radiographic signs of overhangs, recurrent decay or open margins.

The radiographic appearance of the root and surrounding structures was then evaluated and categorized as follows:

Success: Normal width of periodontal ligament space. Normal appearance of surrounding bone.

Failure: Periradicular radiolucency.

Three observers (KA, LD, IP) were calibrated according to the system of Halse & Molven [13]. The evaluation criteria were discussed before initiation of the study. Forty-seven roots were used for calibration in order to establish a uniform understanding and application of the criteria. One observer selected the roots and 2 observers examined the radiographs independently. Agreement was reached in 61,7%. Dis-agreement was dealt with by joint discussion. If consensus was not reached, the third observer made the final decision. After the study, 44 of the first roots that were examined were re-examined. Agreement was reached in 79,5%. After joint discussion there was 100% agreement.

Differences between the groups were examined statistically using the chi-square test. A *P*-value ≤ 0.01 was considered to indicate statistically significant differences.

RESULTS AND DISCUSSION

The success rate for all endodontically treated teeth ($n=1001$) was 66.4%. Teeth with root canal posts ($n=528$) had a success rate of 72% and teeth without posts ($n=473$) had a success rate of 64%. The difference between the

groups with and without posts was not statistically significant (Table I).

The treatment was rated as Good Endodontics (GE) in 506 teeth. In this group the success rate was 78%. The group with Poor Endodontics (PE) had a success rate of 55%. The difference between the 2 groups was statistically significant (Table II). 664 teeth were found to have Good Restorations (GR). The endodontic success rate in this group was 72%. The group with Poor Restorations (PR) consisted of 338 teeth and the endodontic success rate in this group was 64%. The difference between the 2 groups was statistically significant.

When the groups with Good Endodontics and Good Restorations (GE=GR, $n=364$) were combined, the success rate was 82%. When the groups Good Endodontics and Poor Restorations (GE=PR, $n=142$) were combined, the success rate was 72%. The difference between the 2 groups was statistically significant (Table III).

The teeth with Poor Endodontics combined with the teeth with Good Restorations (PE=GR, $n=299$) gave a success rate of 55% whereas the combination of Poor Endodontics and Poor Restorations (PE=PR, $n=196$) resulted in a success rate of 57%. The difference between the success rate with Good Endodontics and Poor Endodontics was statistically significant regardless of the quality of the coronal restoration.

The results of the combined groups in teeth with posts and without posts are shown in Tables IV and V. The presence of a post did not affect the endodontic success rate negatively in any of the combinations. The lowest success rate (48%) was found in the combination Poor Endodontics and Poor Restorations (PE=PR) in teeth without posts (Table V).

The present study is a cross-sectional study based on evaluation of radiographs. Such a study has certain limitations (13 ± 16), but misinterpretations and misdiagnoses are known to be fairly equally distributed so that the results will be meaningful [17]. Also, the reliability of the present results was strengthened by the fact that a large material was studied.

The overall endodontic success rate was 66.4%. This was in good agreement with the results of other studies of this nature [11, 15, 18,19]. Of considerable clinical interest was the fact that the presence of root canal posts did not negatively affect the outcome of the endodontic treatment [20]. Because of this, the groups of teeth with posts and without posts were grouped together in the study of the relationship between the quality of the coronal restoration and the root filling and periapical health.

Not unexpectedly the highest success rate (82%) was found in the teeth diagnosed with Good Endodontics and Good Restorations (GE+GR). In the teeth diagnosed with Good Endodontics and Poor Restorations (GE+PR) the success rate dropped 10% to 72%. This difference was statistically significant. Thus, the importance of a well sealing coronal restoration for lasting success of endodontic treatment that was stressed by the findings of Ray & Trope [11] was evident in this study as well.

Table I. Success of endodontic treatment in a cross sectional study.

	n	Failure	Success	Success in percent
Entire material	1001	326	665	66.4%
Teeth with posts	528	154	374	72.0%*
Teeth without posts	473	172	301	64.0%*

*The difference between the success rate of teeth with root canal posts and teeth without posts was not statistically significant (P=0.025).

Table II. Periradicular status of groups of teeth with good endodontic treatment, poor endodontic treatment, good coronal restorations and poor coronal restorations

Endodontic treatment	Coronal restoration	n	Failure	Success	Success in percent
GE	Any	506	111	395	78%*
PE	Any	495	216	279	55%*
Any	GR	664	201	462	72%**
Any	PR	338	126	212	64%**

GE=Good Endodontics; PE=Poor Endodontics; GR=Good Restoration; PR= Poor Restoration; Any=Any Quality.

*The difference between the success rate of teeth with Good and Poor Endodontics was statistically significant (P<0.001).

**The difference between the success rate of teeth with Good and Poor Restoration was statistically significant (P<0.001).

Table III. Success rate of endodontic treatment of good or poor quality in teeth with good or poor coronal restorations

Endodontic treatment	Coronal restoration	n	Failure	Success	Success in percent
GE	GR	364	72	294	82%*
GE	PR	142	41	101	72%*
PE	GR	299	131	168	55%*
PE	PR	196	85	111	57%*

GE=Good Endodontics; PE=Poor Endodontics; GR=Good Restoration; PR= Poor Restoration.

*The difference between the success rate with Good Endodontics and Poor Endodontics was statistically significant (P<0.0001) regardless of the quality of the coronal restoration (GR or PR).

Table IV. Periradicular status of the various groups of teeth with root canal posts.

Endodontic treatment	Coronal restoration	n	Failure	Success	Success in percent
GE	GR	205	33	172	84%*
GE	PR	72	21	49	72%*
PE	GR	154	66	87	55%*
PE	PR	98	33	65	66%*

GE=Good Endodontics; PE=Poor Endodontics; GR=Good Restoration; PR= Poor Restoration.

*The difference between the success rate with Good Endodontics and Poor Endodontics was statistically significant (P<0.0001) regardless of the quality of the coronal restoration (GR or PR).

Table V. Periradicular status of the various groups of teeth without root canal posts.

Endodontic treatment	Coronal restoration	n	Failure	Success	Success in percent
GE	GR	157	37	120	76%*
GE	PR	72	21	51	72%*
PE	GR	145	64	82	57%*
PE	PR	98	51	47	48%*

GE=Good Endodontics; PE=Poor Endodontics; GR=Good Restoration; PR= Poor Restoration.

*The difference between the success rate with Good Endodontics and Poor Endodontics was statistically significant (P<0.0001) regardless of the quality of the coronal restoration (GR or PR).

In the literature there is a consistent association between periapical radiolucency and root canal fillings of poor quality (for review, see Friedman S [21]). This was confirmed by the present results. In the teeth diagnosed with Poor Endodontics the success rate dropped and was the same regardless of the quality of the coronal restoration (PE+GR, 55% and PE+PR, 57%). Thus, if the root canal was not properly obturated, the quality of the coronal restoration had no bearing on the outcome of the endodontic treatment. This finding was in agreement with a recent study from Lithuania [22]. However, it was in clear contrast to the findings of Ray & Trope [11] who conclude that the quality of the coronal restoration is significantly more important than the quality of the root filling in securing periapical health.

CONCLUSION

The reasons for the discrepancies in the results of the two studies are not immediately clear. We tried to compare the results of patient surveys in Ukraine with other countries (in the dentistry department of the clinic of the Dnipropetrovsk State Medical Academy versus foreign dental clinics). Certain differences in clinical technique might exist, but since the evaluation criteria were very simple (Good Endodontics vs Poor Endodontics and Good Restoration v. Poor Restoration) it is unclear whether this would have any bearing on the outcome of the studies. In any case, the findings of this study were clear. The quality of the root filling was the most important factor for the outcome of endodontic treatment. If the quality of the root filling was good, a good restoration improved on the endodontic success rate. However, if the quality of the root filling was poor, the quality of the coronal restoration was of no importance for the outcome of the endodontic treatment.

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