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Поступила 29.03.18

UDC 616.314.11-089.004.66: 616.314.16/17

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CONDITION OF PERIAPICAL TISSUES IN ENDODONICALLY TREATED TEETH

ABSTRACT

The aim of the study was to evaluate the possible relationship between the quality of restoration of the tooth crown, root canal obturation and periapical status of endodontic teeth. A series of X-ray images from randomly selected patient cards was studied at the Dental Faculty of the Dnepropetrovsk Medical Academy. A total of 1001 endodontically treated teeth restored by permanent restoration were evaluated independently by two experts. According to a predetermined set of radiographic criteria, the technical quality of filling the root canals of the tooth was assessed as good (GE) or poor (PE). In turn, the technical quality of restoration of the tooth crown was also evaluated as good (GR), or poor (PR). Then, the roots of the teeth and the surrounding tissues were evaluated, and according to the available treatment result were classified as successful or unsuccessful. The success rate for all endodontic teeth was 66.4 % (n ‰ 1001). Teeth with root pins had a success rate of 72.7 % (n ‰ 527), the success rate of dental treatment without pins was 64.6% (n ‰ 472). The two groups with technically good endodontics had the highest success rates. In combination with technically good restorations, the success rate was 82% (GE + GR, 82 %), in the case of technically weak restorations, the success rate was 72 % (GE + PR, 72 %). Two groups with technically bad endodontics combined with good restorations or poor restorations had significantly lower success rates (PE + GR, 55 % and PE = PR, 57 %). When assessing the periapical status of endodontic teeth, it was found that the quality of endodontic treatment, evaluated radiographically, is much more important than the quality of restoration of the crown of the tooth.

Key words: *apical periodontitis; dental treatment; endodontic treatment; periapical repair*

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СТАН ПЕРІАПІКАЛЬНИХ ТКАНИН ЗУБІВ ПІСЛЯ ЕНДОДОНТИЧНОГО ЛІКУВАННЯ

Метою дослідження була оцінка можливого зв'язку між якістю відновлення коронки зуба, обтурацією кореневого каналу і періапикальним статусом ендодонтично лікованих зубів. Були досліджені серії рентгенівських знімків з випадково вибраних карток пацієнтів на стоматологічному факультеті Дніпропетровської медичної академії. В цілому 1001 ендодонтично лікованих зубів, відновлені постійною реставрацією, оцінювалися незалежно двома експертами. Згідно заздалегідь обраного набору рентгенологічних критеріїв, технічну якість заповнення кореневих каналів зуба оцінювали як добру (GE), або погану (PE). У свою чергу, технічна якість відновлення коронки зуба так само оцінювалася як добра (GR), або погана (PR). Потім коріння зубів і навколишні тканини були оцінені, і відповідно до наявного результату лікування класифікувалися як успішні або неуспішні. Показник успіху для всіх ендодонтично лікованих зубів склав 66,4% (n ‰ +1001). Зуби з кореневими штифтами мали показник успіху 72,7% (n ‰ 527), успішність лікування зубів без штифтів склала 64,6% (n ‰ 472). У двох груп з технічно доброю ендодонтією були найвищі показники успіху. У поєднанні з технічно добрими реставраціями показник успіху становив 82% (GE + GR, 82%), в разі ж технічно поганих реставрацій показник успіху становив 72% (GE + PR, 72%). Дві групи з технічно поганою ендодонтією, в поєднанні з добрими реставраціями, або поганими реставраціями мали значно нижчі показники успіху (PE + GR, 55% і PE = PR, 57%). При оцінці періапикального статусу ендодонтично лікованих зубів з'ясувалося, що якість ендодонтичного лікування, що оцінюється рентгенологічно значно важливіше, ніж якість відновлення коронки зуба.

Ключові слова: *періодонтит; стоматологічне лікування; ендодонтичне лікування; періапикальне відновлення.*

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СОСТОЯНИЕ ПЕРИАПИКАЛЬНЫХ ТКАНЕЙ ЗУБОВ ПОСЛЕ ЭНДОДОНТИЧЕСКОГО ЛЕЧЕНИЯ

Целью исследования была оценка возможной связи между качеством восстановления коронки зуба, обтюрацией корневого канала и периапикальным статусом эндодонтически леченных зубов. Были исследованы серии рентгеновских снимков из случайно выбранных карточек пациентов на стоматологическом факультете Днепропетровской медицинской академии. В общей сложности 1001 эндодонтически леченных зубов, восстановленные постоянной реставрацией, оценивались независимо двумя экспертами. Согласно заранее определенному набору рентгенологических критериев, техническое качество заполнения корневых каналов зуба оценивалось как хорошее (GE), или плохое (PE). В свою очередь, техническое качество восстановления коронки зуба так же оценивалось как хорошее (GR), или плохое (PR). Затем корни зубов и окружающие ткани были оценены, и в соответствии с имеющимся результатом лечения классифицировались как успешные или неуспешные. Показатель успеха для всех эндодонтически леченных зубов составил 66,4 % (n ‰ 1001). Зубы с корневыми штифтами имели показатель успеха 72,7 % (n ‰ 527), успешность лечения зубов без штифтов составила 64,6 % (n ‰ 472). У двух групп с технически хорошей эндодонтией были самые высокие показатели успеха. В сочетании с технически хорошими реставрациями показатель успеха составлял 82% (GE + GR, 82%), в случае же технически слабых реставраций показатель успеха составлял 72 % (GE + PR, 72%). Две группы с технически плохой эндодонтией в сочетании с хорошими реставрациями, или плохими реставрациями имели значительно более низкие показатели успеха (PE + GR, 55

% и PE = PR, 57 %). При оценке периапикального статуса эндодонтически леченных зубов выяснилось, что качество эндодонтического лечения, оцениваемое рентгенологически значительно важнее, чем качество восстановления коронки зуба.

Ключевые слова: *периодонтит; стоматологическое лечение; эндодонтическое лечение; периапикальное восстановление.*

Introduction. It is generally accepted that the prognosis of endodontic treatment positively correlates with the technical quality of root filling [1-4]. 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 [5-9]. Thus, in one of the in vitro studies of coronary 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 filling 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].

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 [12]. Thus, it was 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.

Table 1

Success of endodontic treatment in a cross sectional study of dental school patients, Dnipropetrovsk Medical Academy

	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).

Material and methods. A cross-sectional study was performed by examining full mouth radiographs from randomly selected patient charts at the prosthetic dentistry department, Dnipropetrovsk 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 ap-plication 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. 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 1).

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 2). 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 3).

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.

Table 2

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 stastistically significant (*P*<0.001).

Table 3

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).

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 4 and 5. 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 5).

Table 4

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 5

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).

Discussion. 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, 16, 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 be-tween 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.

In the literature there is a consistent association between periapical radiolucency and root canal fillings of poor quality [for review, see 21]. This was con-firmed 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 select a material as similar to the American material as we could (dental school patients, Dnipropetrovsk Medical Academy versus dental school patients, Temple University). 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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The article was submitted to the editorial office 09.04.18