

QUALITY OF ROOT CANAL FILLINGS IN A BOSNIAN ADULT POPULATION TREATED IN PUBLIC AND PRIVATE DENTAL CLINICS

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KVALITET PUNJENJA KANALA KORENA KOD ODRASLOG STANOVNIŠTVA U BOSNI I HERCEGOVINI LEČENIH U DRŽAVNIM I PRIVATNIM STOMATOLOŠKIM KLINIKAMA

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ABSTRACT

The aim of this study is to examine the technical quality of root canal fillings in an adult population in the Republic of Srpska, Bosnia and Herzegovina, who were treated in public dental institutions and private dental clinics.

Radiographs of faculty patients, aged 25-60 years old, who came for the first time were examined for the technical quality of root canal fillings. Patients with endodontically-treated teeth were invited for an interview to reveal the providers of the endodontic treatment.

The percentages of teeth with adequate length ($p < 0.01$) and taper ($p < 0.01$) in institutions of public health cases were significantly greater than those in private clinic cases. In addition, the frequency of teeth with adequate root canal fillings in patients treated in public dental institutions was significantly greater than those treated in private dental clinics ($p < 0.01$).

A significantly higher percentage of adequate canal fillings is present in teeth where endodontic treatment was performed in public dental institutions compared to private dental clinics. This result indicates the need to improve the quality of endodontic treatment through more intensive training for dentists in private practice.

Keywords: endodontic treatment, quality of root canal fillings, radiographic evaluation, adults

SAŽETAK

Cilj ove studije je da se ispita kvalitet punjenja kanala korena endodontski lečenih zuba kod odraslog stanovništva u Republici Srpskoj, Bosna i Hercegovina, koji su lečeni u državnim stomatološkim ustanovama i privatnim stomatološkim klinikama.

Na radiografskim snimcima pacijenata koji su se prvi put javili na fakultet, starosti 25-60 godina, analiziran je kvalitet punjenja kanala korena. Pacijenti sa endodontski lečenim zubima su pozvani na intervju kako bi se utvrdilo mesto sprovođenja endodontskog tretmana.

Procenat zuba sa adekvatnom dužinom ($p < 0.01$) i koničnošću ($p < 0.01$) kanalnog punjenja bio je znatno veći kod zuba koji su lečeni u državnim u poređenju sa privatnim stomatološkim klinikama. Pored toga, učestalost zuba sa adekvatnim kanalnim punjenjem kod pacijenata lečenih u državnim ustanovama bila je znatno veća, od onih koji su lečeni u privatnim stomatološkim klinikama ($p < 0.01$).

Znatno veći procenat adekvatnog kanalnog punjenja je prisutan kod zuba čiji je endodontski tretman sproveden u državnim stomatološkim ustanovama u poređenju sa privatnim. Ovakav rezultat ukazuje na potrebu za poboljšanjem kvaliteta endodontskog lečenja kroz intenzivnije obuke stomatologa u privatnoj praksi.

Ključne reči: endodontsko lečenje, kvalitet kanalnog punjenja, radiografska procena, odrasli

INTRODUCTION

The goal of endodontic treatment is to eliminate, or at least significantly reduce, bacterial population from the root canal space to levels that are compatible with periradicular tissue healing (1).

Numerous studies have shown that the success of endodontic treatment of teeth without periapical changes is very

high, up to 95% (2-4). Results of these studies are most often related to the treatment outcome performed in university-based or teaching hospital-based settings. A markedly lower success rate (65 to 75%) was recorded in general dental practices (5, 6). This discrepancy in success rate may reflect the possible difference in the quality of the endodontic treatment.



It is expected that the root canal filling provide a hermetic seal of the canal system and prevent reinfection. Epidemiological studies revealed that technically satisfactory endodontic treatments were performed in 14 to 65% of cases (7-13). Data on the technical quality of root canal treatments are needed to evaluate the endodontic status of the population, since it is known that the prognosis of endodontic treatment depends on the quality of root canal filling (7, 9, 11-13).

The large majority of cross-sectional studies evaluating the quality of root canal fillings have been performed in Europe and the USA (7-12, 14-17). However, for Bosnia and Herzegovina, only limited information is available (18).

The aim of this study is to examine the technical quality of root canal fillings in an adult population in the Republic of Srpska, Bosnia and Herzegovina, who were treated in public dental institutions and private dental clinics.

MATERIALS AND METHODS

The sample for this cross-sectional study included 275 adult patients who consecutively presented for the first time seeking routine dental care (not emergency care) at the Faculty of Medicine, University of East Sarajevo, Republic of Srpska, Bosnia and Herzegovina, between 2013 and 2014. In order to be enrolled in the study, the patients had to be older than 18 years, have more than nine natural teeth and possess a panoramic radiograph or full-mouth series of periapical radiographs. When only a panoramic radiograph was present, supplemental periapical radiographs were taken of all endodontically-treated teeth. All patients were contacted by telephone and were invited to an interview. Since most of the patients had been enrolled as active patients at the faculty clinic, they were interviewed during a dental visit. Other patients were contacted by telephone and invited to an interview. General information and data about the place where the endodontic treatment of teeth was completed were collected during the interview: public dental institutions (clinics, hospitals and faculties) or private dental clinics. All patients were informed about the survey, and they gave written informed consent.

Two endodontic specialist examiners evaluated all the radiographs. Calibration of the examiners was carried out on 30 periapical radiographs (not related to the study samples) representing teeth with root canal fillings. Inter- and intra-examiner agreement for length, density, taper and adequacy of the root canal filling were measured by Cohen's kappa coefficient. The value of the coefficient for all examined canal filling parameters was greater than 0.77 and 0.81 for inter- and intra-examiner agreement, respectively. Then, the examiners independently analysed periapical radiographs of endodontically-treated teeth, utilizing a magnifying lens and an X-ray viewer.

The quality of root canal fillings was assessed according to the length, density and taper (19).

Length of the canal filling was assessed as follows:

- "Adequate" – root filling ending ≤ 2 mm short of the radiographic apex;
- "Underfilled" – root filling ending > 2 mm short of the radiographic apex;
- "Overfilled" – root filling ending beyond the radiographic apex.

Density of the root canal filling was estimated as:

- "Acceptable" – uniform density of the root canal filling without voids and the canal space is not visible;
- "Poor" – non-uniform density of the root canal filling with a clear presence of voids and the canal space is visible.

Taper of the canal filling was assessed as follows:

- "Acceptable"- consistent taper from the coronal to the apical part of the filling, with good reflection of canal shape,
- "Poor"- inconsistent taper from the coronal to the apical part of the filling.

The quality of endodontic treatment was estimated as:

- "Adequate" – adequate length, density and taper of the canal filling;
- "Inadequate" – underfilled and/or overfilled and/or poor density and/or poor taper.

In multi-rooted teeth, the root with the worst treatment quality was used.

SPSS 19.0 for Windows (IBM Corp., Armonk, NY, USA) was used for data processing and statistical analysis. The χ^2 test was applied to look for differences in the treatment quality between the two groups. A probability level of 0.05 was used as the criterion for statistical significance.

RESULTS

A total of 275 patients (103 women) were examined, with a mean age 35.68 ± 5.13 years. Out of the 502 endodontically-treated teeth, 218 were from private dental clinics and 284 were from public dental institutions.

Adequate canal filling lengths were found in 286 out of a total of 502 teeth (57%). A significantly higher percentage of teeth with adequate filling length (65.5%) was registered in a group where the treatment was performed in public compared to private dental clinics (45.9%) ($p < 0.01$) (Table 1).

An acceptable density of root canal fillings was found in 397 teeth; 232 of them were treated in public institutions and 165 were treated in private dental clinics (Table 2).

An acceptable taper of root canal fillings was present in 71.1% of treated teeth, and a significantly greater percentage of teeth with acceptable taper was registered in cases coming from public institutions (77.8%) in comparison to private clinical cases (62.4%) ($p < 0.01$) (Table 3).

Adequate root fillings, defined as having adequate filling length, acceptable density and acceptable taper, were



Table 1. Length of the root canal filling in relation to the facility where endodontic treatment was performed

| Endodontic treatment | Number of teeth | Length of root canal filling | | |
|----------------------------|-----------------|------------------------------|-------------|------------|
| | | Adequate | Underfilled | Overfilled |
| Public dental institutions | 284 | 186 (65.5%) | 76 (26.8%) | 22 (7.7%) |
| Private dental clinics | 218 | 100 (45.9%) | 100 (45.9%) | 18 (8.3%) |
| Total | 502 | 286 (57.0%) | 176 (35.1%) | 40 (8.0%) |

p<0.01

Table 2. Density of root canal filling in relation to the facility where endodontic treatment was performed

| Endodontic treatment | Number of teeth | Density of root canal filling | |
|----------------------------|-----------------|-------------------------------|-------------|
| | | Acceptable | Poor |
| Public dental institutions | 284 | 232 (81.7%) | 52 (18.3%) |
| Private dental clinics | 218 | 165 (75.7%) | 53 (24.3%) |
| Total | 502 | 397 (79.1%) | 105 (20.9%) |

seen in more than half of the teeth (51.2%). The percentage of root canals with adequate filling in public cases (59.9%) was significantly greater than that in private clinic cases (39.9%) (p<0.01) (Figure 1).

DISCUSSION

This study investigated the technical quality of root canal fillings in an adult population who were treated in public institutions and private dental clinics in the Republic of Srpska, Bosnia and Herzegovina. The results of this study indicate that there were more root canal fillings with adequate length, density and taper in patients coming from public institutions.

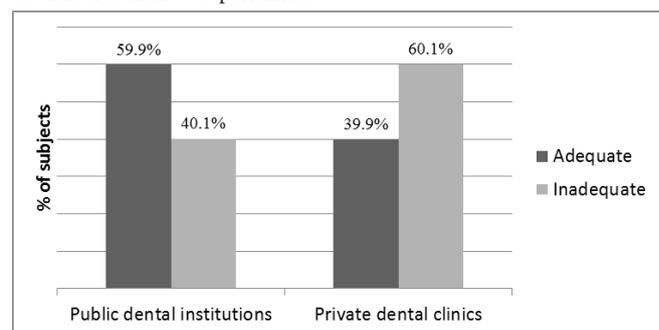
Periapical radiographs were used in this study, as in many other similar studies (12, 18, 15). The criteria for scoring endodontic quality vary among studies. Some of them adopted length as the only criterion for evaluation of endodontic treatment technical quality (9, 20, 21), some used both the length and the density (22, 23), or, in addition to these two factors, taper can be used as well (19, 24, 25). This study used all three parameters for radiological assessment (19).

In this study, an adequate filling length was found in 57.0% of 502 treated teeth, which is similar to findings from Chueh et al. (61.7%) (15). The percentage of canal fillings with an adequate length is higher in comparison to the results of Lupi-Pegurier et al. (38.7%) (26), as well as the study of Boltacz-Rzepakowski and Pawlicka (48.9%) (27),

but was slightly lower compared to the results of Adebayo et al. (71%) (14). Our results show that a significantly higher percentage of adequate length was found in teeth treated in public dental institutions (65.5%) in comparison to private clinics (45.9%). A similar difference was observed in the study from Chueh et al. (15) where the percentage of adequate length was found to be longer in public clinics (66.9%) compared to private clinics (57.9%).

Density of the root canal filling is an important factor for assessing the outcome of endodontic therapy (23, 28, 29). In our study, 79.1% of canal fillings were assessed as having an acceptable density, which is in accordance with the results of Elemam et al. (75.8%) (30), and was much higher in comparison to Adebayo et al. (58.1%) (14) and Chueh et al. (38%) (15). In this study, an acceptable density of the filling was present in 81.7% of the public cases and 75.5% of cases from private clinics. Similarly, in an adult population in Taiwan, a smaller percentage of acceptable fillings was recorded in private clinics (31.6%) compared to public institutions (46.8%). However, this percentage is lower compared with our research (15). The differences can be attributed to the fact that, according to the Bureau of National Health Insurance regulations, greater importance is attributed to filling length than obturation density regarding root canal treatment payments (15).

Figure 1. Quality of root canal filling in relation to the facility where endodontic treatment was performed



p<0.01

Table 3. Taper of root canal filling in relation to the facility where endodontic treatment was performed

| Endodontic treatment | Number of teeth | Taper of root canal filling | |
|----------------------------|-----------------|-----------------------------|-------------|
| | | Acceptable | Poor |
| Public dental institutions | 284 | 221 (77.8%) | 63 (22.2%) |
| Private dental clinics | 218 | 136 (62.4%) | 82 (37.6%) |
| Total | 502 | 357 (71.1%) | 145 (28.9%) |

p<0.01



Acceptable tapering is seen in 71.1% of cases of this study; this corroborates with the findings of Román-Richon et al. (71%) (31) and Fonseca et al. (82%) (32). A high percentage of acceptable tapers is presented in both samples of our research (77.8% in public and 62.4% in private dental clinics).

More than half (51.2%) of endodontically-treated teeth met the criteria for an adequate canal filling. Kulic et al. (18) found adequate canal fillings in 51.6% of teeth treated by dental students in the Republic of Srpska. In the general population in Serbia, adequate root canal fillings were found in 44.1% of teeth (13). In other studies, adequate root canal fillings were recorded in 14-65% of cases (7-13). The discrepancy in results can be attributed to the use of different parameters for evaluation of root canal filling quality. The length of the root filling (9, 20, 21) or length and density (22, 23) were used as parameters for the assessment of root canal filling quality in most of the studies. However, some also included the taper of the root canal filling (19, 24, 25). Moreover, different criteria have been used for assessing the length, density and taper (15, 30). Regardless of the parameters used, the quality of canal filling that was analysed in our research can be considered to be poor.

In our study, the quality of canal fillings performed in public institutions (59.9%) was significantly better than those performed in private clinics (39.9%). In the study by Chueh et al. (15), more adequate root canal fillings were also recorded in public clinics (38.1%) in comparison to private ones (24.3%). Epidemiological studies have shown that there was a significant difference in the outcome of endodontic treatment carried out by endodontic specialists and general dentists (5, 6, 33). In our study, public institutions included clinics, faculties and hospitals where endodontic therapy is usually carried out by endodontic specialists or dentists under the mentorship of endodontic specialists. However, according to the study conducted by Bjorndal et al. (34), general dentists are more focused on the appearance of clinical symptoms and factors determining appearance during root canal filling, than on the microbiological status of the teeth and the technical quality of canal filling. Moreover, studies also emphasize the importance of continuous training of general dentists in order to improve the quality of endodontic treatment (35). This can partly explain a difference of almost 20% in the quality of root canal filling between those from public dental institutions and from private dental clinics, as indicated in our research. The obtained results also indicate the need for improving the knowledge and skills related to endodontic procedures in order to increase the quality of endodontic treatment. This is primarily related to the knowledge and skills of clinicians practicing in private dental clinics.

CONCLUSION

In this study, the quality of endodontic treatment was evaluated as adequate in more than half of the endodontically-treated teeth. A significantly higher percentage of adequate canal filling was present in endodontically-treated

teeth in public dental institutions compared to private dental clinics. This result suggests the necessity of an improvement in the quality of endodontic treatment in private practice.

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