

Radiological Assessment of the Quality of Root Canal Fillings in Teeth Endodontically Treated at Students' Practical Sessions

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SUMMARY

Introduction The main goal of obturation is prevention of reinfection of the root canal system and consequently appearance of periapical lesion. Epidemiological studies have confirmed high prevalence of periapical lesions in endodontically treated teeth with inadequate root canal fillings. The aim of this study was to assess the quality of root canal fillings in teeth treated at students' practical sessions. Iatrogenic errors during endodontic interventions were also assessed.

Methods Two hundred dental records of the patients treated by students in the study program Dentistry at the School of Medicine in Foca during the academic year 2010/2011 were randomly chosen. The length and homogeneity of the fillings or the presence of iatrogenic errors were recorded. A root canal filling was considered adequate if it had correct length and homogeneity in the absence of iatrogenic errors. Two students' curricula V₁ and V₂ were evaluated for the treatment outcome.

Results Out of 128 endodontically treated teeth, adequate length of the canal filling to the physiological apex was observed in 57% of teeth, homogeneity in 78.9%, while both of these criteria were satisfied in 66 teeth (51.6%). Better quality of root canal fillings was achieved by students of the study curricula V₂ and the difference between these two programs was significant ($p < 0.05$). Better quality of root canal fillings in both study programs was recorded for incisors and canines as compared to premolars.

Conclusion The quality of endodontic treatment performed by students was considered adequate in 51.6% of cases. The type of curriculum for endodontic course had a significant impact on the quality of endodontic treatment performed by students.

Keywords: dental students; endodontics; quality of root canal filling; iatrogenic errors

INTRODUCTION

Endodontic treatment is very complex procedure which includes preparation for endodontic treatment, biomechanical instrumentation and final obturation. Some longitudinal studies have shown that the average success of endodontic treatment may be greater than 90% [1]. Although the prognosis of endodontic treatment depends on many factors, one of the most important is the quality of root canal filling. The primary objective of obturation is prevention of reinfection of the root canal system and consequently appearance of periapical lesion [2]. Epidemiological studies have confirmed high prevalence of periapical lesions in endodontically treated teeth with inadequate root canal fillings [3, 4].

According to the consensus of the European Association of Endodontists, a root canal filling is considered adequate if no voids between canal filling and canal walls could be detected [5]. Also, in the apical region, root canal filling should reach 0.5 to 2 mm to the radiological apex of

a tooth to prevent complications after the treatment [5]. Research showed that the failure of endodontic treatment is less frequent in teeth where root canal fillings end at the distance of 0 to 2 mm from the radiological apex, than if that distance is greater than 2 mm, or when canal filling is extruded through the apex [1, 6]. Also, a homogeneous filling with no associated voids lowers the risk of endodontic treatment failure [7].

During endodontic treatment, some procedural errors, such as canal blockade with dentin chips, ledging, curvature loss, transportation, perforation or instrument separation can compromise cleaning and shaping of the root canal and result in incomplete root canal filling jeopardizing the outcome of treatment [8]. Of these complications, most commonly analyzed are iatrogenic perforation and instrument separation.

Data about the quality of canal fillings in endodontically treated teeth as well as the frequency of iatrogenic errors during endodontic treatment almost does not exist in Republika Srpska. That information is, on the other

hand, of great importance for assessing the success of dental care, but also planning the dental curriculum for endodontic course.

The aim of this study was to assess the quality of root canal fillings in teeth treated at students' practical sessions. Iatrogenic errors in endodontic treatment were also assessed.

MATERIAL AND METHODS

Two hundred dental records of patients treated by students in the study program Dentistry at the School of Medicine in Foca, University of East Sarajevo, during the academic year 2010/2011 were randomly chosen. The criteria for inclusion in the study were: persons older than 20 years; primary endodontic treatment carried out in anterior teeth and premolars; the existence of at least 3 periapical radiographs of the treated tooth (preoperative, working length determination and final obturation); good quality of the radiographs. Final sample included 128 endodontically treated teeth.

Taking into account the fact that students of V year were attending endodontic course according to the two different curricula, the quality of endodontic treatment was analyzed in regards to the curriculum. The first group (V_1) included students who had attended endodontic course during the terms 9 and 10 with 6 hours of clinical practice per week. The second group (V_2) was composed of students who had attended endodontic course during the term 8 (6 hours of clinical practice per week) and the term 9 (4 hours of clinical practice per week). Students from the second group also attended the pre-clinical endodontic course for one term (2 hours per week of pre-clinical practice). The quality of endodontic treatment in both groups was analyzed and compared in regards to the morphological group of treated teeth.

The concept of endodontic treatment in both groups was identical and included aseptic conditions, mandatory working length determination radiographically, "step-back" instrumentation technique using hand instruments and irrigation with 0.5% sodium hypochlorite. Final obturation was performed using gutta-percha and modified lateral compaction technique.

The quality of endodontic treatment and possible presence of iatrogenic errors were examined by two examiners, both specialists in endodontics. Radiographs were analyzed using the magnifying glasses and transparent ruler with accuracy of 0.1 mm. The quality of root canal fillings was assessed according to the length, homogeneity and the presence of iatrogenic errors.

Length of the canal filling was assessed as follows:

- "Satisfactory" – canal filling has reached 0-2 mm from the radiological apex;
- "Underfilled" – canal filling was located at the distance greater than 2 mm from the radiological apex, within the canal;
- "Overfilled" – canal filling is extruded through the apex.

Homogeneity of root canal filling was judged as:

- "Homogenous" – uniform root canal filling opacity and no voids could be detected inside the filling or the filling and root canal walls;
- "Non-homogenous" – one or more voids present within the filling or between the filling and root canal walls.

Radiographs were also analyzed for possible presence of iatrogenic errors: perforation of pulp chamber and/or canal walls or instrument separation. Perforation was diagnosed if obturation material was detected outside the walls of the chamber and/or canal walls. The presence of separated instrument was detected as a fragment within root canal or periapical area.

The quality of endodontic treatment was judged as:

- "Adequate" – adequate length and homogeneity of the canal filling in the absence of iatrogenic errors; and
- "Inadequate" – underfilled and/or overfilled and/or inadequate homogeneity and/or presence of iatrogenic errors.

Statistical analysis was performed in SPSS program (version 11.5) for Windows. For statistical evaluation of the data χ^2 -test was applied. Values of $p < 0.05$ were considered statistically significant.

RESULTS

The study included 128 endodontically treated teeth, of which 43 were incisors (33.6%), 22 canines (17.2%) and 63 premolars (49.2%).

Adequate canal filling was recorded in 51.6% of teeth (Table 1). In the group of students who were attending V_2 program 61.7% of endodontically treated teeth satisfied

Table 1. Quality of root canal filling according to the study program
Tabela 1. Kvalitet punjenja kanala korena zuba u odnosu na studijski program

Study program Studijski program	Number of teeth Broj zuba	Root canal filling Punjenje kanala korena	
		Adequate Adekvatno	Inadequate Neadekvatno
V_1	68	29 (42.6%)	39 (57.4%)
V_2	60	37 (61.7%)*	23 (38.3%)
Total Ukupno	128	66 (51.6%)	62 (48.4%)

* $p < 0.05$

Table 2. Quality of root canal filling according to the morphologic groups of teeth

Tabela 2. Kvalitet punjenja kanala korena u zavisnosti od morfološke grupe zuba

Group of teeth Grupa zuba	Number of teeth Broj zuba	Root canal filling Punjenje kanala korena	
		Adequate Adekvatno	Inadequate Neadekvatno
Incisors Sekutići	43	29 (67.4%)	14 (32.6%)
Canines Očnjaci	22	12 (54.5%)	10 (45.5%)
Premolars Premolari	63	25 (39.7%)	38 (60.3%)

Table 3. Length and homogeneity of root canal filling according to the study program**Tabela 3.** Dužina i homogenost punjenja kanala korena zuba u odnosu na studijski program

Study program Studijski program	Number of teeth Broj zuba	Length of root canal filling Dužina kanalnog punjenja			Homogeneity of root canal filling Homogenost kanalnog punjenja	
		Adequate Adekvatno	Underfilled Nedovoljno	Overfilled Prebačeno	Homogenous Homogeno	Non homogenous Nehomogeno
V ₁	68	33 (48.5%)	25 (36.8%)	10 (14.7%)	55 (80.9%)	13 (19.1%)
V ₂	60	40 (66.7%)	14 (23.3%)	6 (10.0%)	46 (76.7%)	14 (23.3%)
Total Ukupno	128	73 (57.0%)	39 (30.5%)	16 (12.5%)	101 (78.9%)	27 (21.1%)

Table 4. Length and homogeneity of root canal filling according to the morphologic group of teeth**Tabela 4.** Dužina i homogenost punjenja kanala korena u zavisnosti od morfološke grupe zuba

Group of teeth Grupa zuba	Number of teeth Broj zuba	Length of root canal filling Dužina kanalnog punjenja			Homogeneity of root canal filling Homogenost kanalnog punjenja	
		Adequate Adekvatno	Underfilled Nedovoljno	Overfilled Prebačeno	Homogenous Homogeno	Non homogenous Nehomogeno
Incisors Sekutići	43	30 (69.8%)	7 (16.3%)	6 (14.0%)	36 (83.7%)	7 (16.3%)
Canines Očnjaci	22	14 (63.6%)	5 (22.7%)	3 (13.6%)	20 (90.9%)	2 (9.1%)
Premolars Premolari	63	29 (46.0%)	27 (42.9%)	7 (11.1%)	45 (71.4%)	18 (28.6%)

criteria for adequate canal filling, while in the group V₁ this percentage was 42.6%. The difference was statistically significant ($p < 0.05$). The highest percentage of adequate canal fillings was recorded in incisors (67.4%) and the lowest in premolars (39.7%), but this difference was not statistically significant (Table 2).

The results showed that adequate length of canal filling had 57% of endodontically treated teeth, while fillings were homogenous in 78.9% of teeth. Higher percentage of teeth with adequate length of canal filling was recorded in V₂ program, while students in the program V₁ achieved more homogeneous fillings; however, this difference was not statistically significant (Table 3).

By morphological group of teeth, adequate filling of a root canal was achieved in 69.8% of incisors, 63.6% of canines and 46% of premolars. Also, higher percentage of homogeneous fillings with no voids was recorded in canines (90.9%) and incisors (83.7%) than premolars (71.4%) (Table 4). Statistical analysis did not show significant difference in length and homogeneity of canal fillings in different morphological groups of teeth treated by the students of different programs.

The frequency of iatrogenic errors is shown in Table 5. Perforation of crown and/or canal walls was diagnosed in 4 teeth, while instrument separation was registered in 3 endodontically treated teeth.

Table 5. Presence of iatrogenic errors according to the study program**Tabela 5.** Učestalost lekarskih grešaka u odnosu na studijski program

Study program Studijski program	Number of teeth Broj zuba	Iatrogenic errors Lekarske greške	
		Perforation Perforacija	Instrument separation Prelom instrumenta
V ₁	68	2 (2.9%)	2 (2.9%)
V ₂	60	2 (3.3%)	1 (1.7%)
Total Ukupno	128	4 (3.1%)	3 (2.3%)

DISCUSSION

To check the quality of endodontic treatment, periapical radiographs of the patients treated by students at the School of Medicine in Foca, study program Dentistry, were used. Although radiographic method is most commonly used to assess the quality of endodontic treatment, it should be noted that this analysis has some limitations. Two-dimensional image of three-dimensional structures, as well as the superposition with adjacent anatomical structures, especially in the region of maxillary molars, makes radiographs difficult to interpret [9, 10]. Therefore, to reduce the possibility of erroneous radiographic analysis, this study did not include radiographs of molars, as well as those that did not meet the basic technical quality requirements.

There are different criteria which have been used in epidemiological studies for categorizing the quality of root canal fillings. The most common basic parameter is the length of canal filling, as well as homogeneity and adaptation of obturation material to the walls of the canal [11-15], and presence of iatrogenic complications [8, 11]. In the current study, multirooted teeth (premolars) were considered as a whole and even if one canal was inadequately filled, the tooth was categorized as failure.

The results of the current study showed that about 51% of endodontically treated teeth fulfilled criteria for an adequate canal filling. Similar results were obtained in research done by Eleftheriadis and Lambrianidis [8] (55%) and Barrieshi-Nusair et al. [14] (47%). On the other hand, smaller percentage of adequate canal fillings performed by students was reported in the studies of Hayes et al. [16] (17%) and Balto et al. [17] (23%). However, direct comparison of these studies and the current study is difficult because of methodological differences in applied criteria.

According to the morphological group of teeth, the highest percentage of adequate fillings was recorded in

incisors (67.4%) and the lowest in premolars (39.7%). These results are consistent with other studies because these teeth have relatively simple canal systems [8, 14]. Lower percentage of successful endodontic treatment in premolars and molars is mainly due to the complex anatomy of the root canal system.

In the current study, adequate length of the canal filling was recorded in 57% of teeth. Although it was difficult to compare results of the current study with other studies, the percentage of canal fillings with adequate length was higher in the current study than in the studies done by Lupi-Pegurier et al. [12] (38.7%) and Boltacz-Rzepkowska and Pawlicka [13] (48.9%), but it was slightly lower than the results of Barrieshi-Nusair et al. [14] (61.3%). Better results in these studies may be due to the fact that students used several radiographs to obtain adequate working length.

Inadequate homogeneity of the filling can also lead to the failure of endodontic treatment due to appearance of microleakage along the canal walls [18]. Periapical lesions are also more common in teeth with non-homogeneous fillings [19]. In the current study, 78.9% of the fillings were homogenous, in contrast to other studies where percentage was lower. The homogeneity of fillings was adequate in 35% of teeth in the study done by Balto et al. [17], in 64% of teeth in the study of Mousssa-Bardan et al. [20], and in 70% of teeth in the study of Er et al. [21]. High percentage of homogeneous fillings in the current study can be attributed to the fact that modified lateral compaction technique with additional gutta-percha points provides good quality and homogeneity of the root canal filling.

The quality of canal fillings in students who attended V₂ program of study (61.7%) was significantly higher than in V₁ group of students (42.6%). Specifically, students of the groups V₁ and V₂ attend the endodontic course for one year only, unlike other dental faculties where it takes two [11, 14] or three years [20], and prior clinical work those students also attend pre-clinical course. According to the findings of this study, introduction of pre-clinical course in endodontics in the study program V₂ had significant impact on improving the quality of endodontic treatment performed by students, but also demonstrates that the level of knowledge and skills acquired during studies in the field of endodontics need to be continuously improved.

Iatrogenic errors in teeth treated by students were observed in seven teeth, perforations were recorded in four teeth, and instrument separation in three. Similar results were obtained in the study of Dadresanfar et al. [22], where lateral wall perforation was identified in 16 of 400 teeth (4%), while instrument separation was found in 4 canals. Low incidence of iatrogenic errors can be explained by the fact that molars were not included in the current study, and also, in case of any complication, a patient was referred to a specialist in endodontics and the treatment was not completed by a student.

Numerous factors could have impact on low percentage of adequate canal filling in this study: study design, sample size, methodological criteria, chemo mechanical instrumentation and obturation of canals, clinical factors, and the curricula for endodontic course. Although the quality

of endodontic therapy has a significant impact on treatment outcome, it is not crucial for the success of therapy. Antiseptic conditions, adequate canal instrumentation, materials, medication and obturation of root canals are also important prognostic factors that can affect outcome of endodontic treatment [23].

CONCLUSION

The quality of endodontic treatment performed by students was satisfactory in 51.6% of cases. The quality of canal fillings performed by students of V₂ study program who had previously attended pre-clinical course in endodontics was significantly higher than in students of V₁ program. Detected difference in the quality of canal fillings performed by students of different curricula indicates a significant impact of endodontic curriculum on the quality of endodontic treatment, but also suggests that these programs must be constantly improved.

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Radiološka procena kvaliteta punjenja kanala korena endodontski lečenih zuba na studentskim vežbama

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KRATAK SADRŽAJ

Uvod Opturacija kanala korena zuba vrši se radi prevencije ponovne infekcije kanalnog sistema i obezbeđivanja uslova za efikasno ozdravljenje periapexnog tkiva. Epidemiološke studije su ukazale na visoku stopu prevalencije periapexnih promena kod endodontski lečenih zuba sa neodgovarajućim punjenjem kanala. Cilj rada bio je da se proverí kvalitet punjenja kanala korena endodontski lečenih zuba na studentskim vežbama i ustanove lekarske greške nastale tokom endodontske intervencije.

Materijal i metode rada Za potrebe istraživanja metodom slučajnog uzorka odabrano je 200 kartona pacijenata kojima je vršen endodontski tretman na studentskim vežbama koje su u okviru studijskog programa Stomatologija izvođene na Medicinskom fakultetu u Foči tokom 2010/2011. školske godine. Parametri posmatranja bili su dužina i homogenost punjenja kanala i postojanje lekarskih grešaka tokom zahvata. Adekvatnim se smatralo punjenje kanala koje ima odgovarajuću dužinu i homogenost i bez lekarskih grešaka. Analizirana su dva studentska programa iz oblasti endodoncije (V_1 i V_2) i utvrđen ishod lečenja obolelih zuba.

Rezultati Od 128 endodontski lečenih zuba, odgovarajuća dužina punjenja kanala do fiziološkog suženja utvrđena je u 57% uzoraka, homogenost u 78,9% uzoraka, dok su oba ova kriterijuma bila zadovoljena kod ukupno 66 zuba (51,6%). Kvalitetnije punjenje kanala korena uradili su studenti programa V_2 , a razlika između dva studentska programa bila je statistički značajna ($p < 0,05$). Kvalitetna opturacija kanala u oba studentska programa zabeležena je kod sekutića i očnjaka u odnosu na premolare.

Zaključak Kvalitet endodontskog lečenja na studentskim vežbama bio je odgovarajući u nešto više od polovine slučajeva. Kurikulum iz oblasti endodoncije ima značajan uticaj na kvalitet endodontskog lečenja na studentskim vežbama.

Ključne reči: studenti stomatologije; endodoncija; kvalitet opturacije; lekarske greške

UVOD

Endodontski tretman podrazumeva vrlo složen i delikatan kompleks radnji koje obuhvataju pripremu za endodontsko lečenje i aktivnu fazu obrade endodontskog prostora i njegovu adekvatnu opturaciju. Neke dugoročne studije su pokazale da prosečan uspeh endodontskog lečenja može biti veći od 90% [1]. Iako prognoza endodontskog tretmana zavisi od raznih faktora, jedan od najznačajnijih je kvalitet endodontskog punjenja. Primarni cilj opturacije kanala korena zuba je prevencija ponovne infekcije kanalnog sistema i obezbeđivanje uslova za efikasnu reparaciju periapexnih tkiva [2]. Nalazi epidemioloških studija ukazuju na visoku stopu prevalencije periapexnih promena kod endodontski lečenih zuba sa neadekvatnim punjenjem kanala [3, 4].

Prema konsenzusu Evropskog udruženja endodontista, odgovarajući endodontski tretman, uz radiografsku kontrolu, podrazumeva opturaciju preparisanog kanala korena zuba bez postojanja prostora između kanalnog punjenja i zidova kanala [5]. Takođe, granica punjenja kanala treba da se nalazi 0,5-2 mm od radiološkog apeksa korena zuba, kako bi se sprečile komplikacije nakon intervencije [5]. Istraživanja pokazuju da je neuspeh endodontskog lečenja manji ukoliko se punjenje kanala završava na rastojanju do 2 mm od radiološkog vrha korena, nego kada je to rastojanje veće od 2 mm ili kada kanalno punjenje prelazi preko vrha korena zuba [6, 1]. Takođe, homogeno punjenje kanala korena zuba bez praznih prostora je povezano s manjim rizikom od neuspeha endodontskog lečenja [7].

Tokom endodontske terapije proceduralne greške, kao što su blokada kanala opiljcima zuba, formiranje stepenika, ispravljanje

krivine kanala, transportacija, perforacija komore ili kanala korena i prelom instrumenata, mogu da ugroze čišćenje i oblikovanje kanala korena, da dovedu do nepotpunog punjenja kanala i utiču na željeni ishod lečenja [8]. Od svih ovih komplikacija najčešće su analizirane jatrogene perforacije i prelom endodontskih instrumenata.

Podataka o kvalitetu punjenja kanala endodontski lečenih zuba i o učestalosti specifičnih lekarskih grešaka tokom endodontske terapije u Republici Srpskoj skoro da i nema. Ovakva istraživanja su, međutim, veoma značajna za procenu uspešnosti stomatološke zaštite, ali i za planiranje dentalnih kurikuluuma iz oblasti endodoncije.

Cilj istraživanja bio je da se ispita kvalitet punjenja kanala korena endodontski lečenih zuba na studentskim vežbama i ustanove lekarske greške koje su se desile tokom endodontske intervencije.

MATERIJAL I METODE RADA

Metodom slučajnog uzorka odabrano je 200 kartona pacijenata koji su podvrgnuti endodontskom lečenju na studentskim vežbama koje su u okviru studijskog programa Stomatologija izvođene na Medicinskom fakultetu u Foči Univerziteta u Istočnom Sarajevu tokom 2010/2011. školske godine. Kriterijumi za uključivanje u studiju bili su: osobe starije od 20 godina; primarni endodontski tretman izveden na prednjim zubima i premolarima; postojanje najmanje tri retroalveolarna radiograma lečenog zuba (preoperacioni, rendgenski snimak odontometrije, rendgenski snimak konačne opturacije); i dobar tehnički

kvalitet rendgenograma. Konačan uzorak sastojao se od 128 endodontski lečenih zuba.

Imajući u vidu činjenicu da studenti pete godine stomatologije nastavu iz endodoncije pohađaju po dva različita plana i programa, kvalitet endodontskog lečenja analiziran je u zavisnosti od kurikuluma. Prvu grupu (V_1) činili su studenti koji su praktičnu nastavu iz endodoncije pohađali tokom 9. i 10. semestra sa šest časova kliničkih vežbi nedeljno. Drugu grupu (V_2) činili su studenti koji su praktičnu nastavu iz endodoncije pohađali tokom 8. i 9. semestra, sa šest časova, odnosno četiri časa kliničkih vežbi nedeljno. Studenti druge grupe su pri tom pohađali i pretkliničku endodontsku nastavu tokom jednog semestra, sa dva časa vežbi nedeljno. Kvalitet endodontskog lečenja analiziran je i u pogledu morfološke grupe lečenih zuba.

Koncept endodontskog lečenja koje su izvodile dve grupe studenata bio je isti, a obuhvatio je primenu aseptičnih uslova rada i obavezan odontometrijski postupak, koji je realizovan pomoću rendgenografije. Kod svih zuba kanali korena su preparisani tzv. *step-back* tehnikom i ručnim instrumentima uz irigaciju rastvorom natrijum-hipohlorita od 0,5%. Konačna opturacija kanala urađena je primenom modifikovane tehnike lateralne kompakcije gutaperke.

Kvalitet endodontskog lečenja i postojanje lekarskih grešaka ispitivala su dva istraživača, specijalisti endodoncije. Rendgenogrami su analizirani na negatoskopu pomoću lupe i providnog lenjira sa preciznošću od 0,1 mm. Kvalitet punjenja kanala procenjen je na osnovu dužine kanalnog punjenja, njegove homogenosti i eventualnih lekarskih grešaka.

Dužina punjenja kanala korena ocenjivana je na sledeći način:

- „zadovoljava” – kanalno punjenje je udaljeno 0-2 mm od radiološkog vrha korena;
- „nedovoljno punjenje” – kanalno punjenje se nalazi na rastojanju većem od 2 mm od radiološkog vrha korena;
- „prebačeno punjenje” – kanalno punjenje je prešlo vrh korena zuba.

Homogenost punjenja kanala korena ocenjivana je na sledeći način:

- „homogeno” – radiološka homogenost je uniformna i ne postoje prazni prostori unutar samog punjenja ili punjenja i zidova kanala korena; i
- „nehomogeno” – postoji prazan prostor unutar samog punjenja ili između punjenja i zidova kanala korena.

Na rendgenogramima je utvrđivano da li postoje perforacije komore, odnosno korena, i prelom instrumenta (lekarske greške). Perforacija je dijagnostikovana ukoliko je bilo ekstruzije materijala za opturaciju izvan unutrašnjih zidova komore krunice, odnosno korena, a prelom instrumenta je ustanovljavan kada je deo instrumenta uočen unutar kanala korena ili je prebačen u periapexsko područje.

Kvalitet endodontskog lečenja ocenjivan je na sledeći način:

- „adekvatno” – odgovarajuća dužina i homogenost punjenja kanala bez lekarskih grešaka; i
- „neadekvatno” – nedovoljno punjenje, „prebačeno” punjenje ili neadekvatna homogenost punjenja, odnosno postojanje lekarskih grešaka.

Statistička obrada podataka izvršena je u programu SPSS (verzija 11.5) za Windows. Za statističku procenu dobijenih podataka primenjen je χ^2 -test. Vrednosti p manje od 0,05 smatrale su se statistički značajnim.

REZULTATI

Tokom istraživanja ispitano je 128 endodontski lečenih zuba, od čega 43 sekutića (33,6%), 22 očajnika (17,2%) i 63 premolara (49,2%).

Adekvatno punjenje kanala utvrđeno je kod 51,6% zuba (Tabela 1). Kod studenata V_2 programa studija 61,7% endodontski lečenih zuba zadovoljavalo je kriterijum adekvatnog kanalnog punjenja, a kod studenata programa V_1 42,6%. Razlika je bila statistički značajna ($p < 0,05$). Najveći procenat adekvatnog punjenja kanala zabeležen je kod sekutića (67,4%), a najmanji kod premolara (39,7%), ali ta razlika nije bila statistički značajna (Tabela 2).

Zadovoljavajuća dužina punjenja kanala utvrđena je kod 57% endodontski lečenih zuba, a zadovoljavajuća homogenost kod 78,9% zuba. Veći procenat zuba sa zadovoljavajućom dužinom punjenja kanala zabeležen je u grupi studenata V_2 programa studija, dok je kod studenata programa V_1 uočen veći broj homogenih, ali ta razlika nije bila statistički značajna (Tabela 3).

U pogledu morfološke grupe zuba, kanalno punjenje imalo je zadovoljavajuću dužinu kod 69,8% sekutića, 63,6% očajnika i 46% premolara. Homogenost kanalnog punjenja, bez postojanja praznih prostora, zabeležena je kod 90,9% očajnika, 83,7% sekutića i 71,4% premolara (Tabela 4). Analiza nije ukazala na statistički značajne razlike između tipova zuba kada su u pitanju dva posmatrana parametra.

Učestalost lekarskih grešaka prikazana je u tabeli 5. Perforacije krunice i korena zuba dijagnostikovane su kod četiri zuba, dok je prelom instrumenta utvrđen kod tri endodontski lečena zuba.

DISKUSIJA

Za proveru kvaliteta endodontskog lečenja u ovom istraživanju korišćeni su retroalveolarni radiogrami pacijenata kojima su zubi lečeni na studentskim vežbama na Medicinskom fakultetu u Foči (studijski program Stomatologija). Iako se za ocenu kvaliteta endodontskog lečenja najčešće primenjuje radiografska metoda, treba imati u vidu da ova analiza ima i određena ograničenja. Dvodimenzionalni prikaz trodimenzionalnih struktura i superpozicija sa susednim anatomskim strukturama, posebno u regiji maksilarnih molara, uzrokuju poteškoće prilikom interpretacije rendgenskih snimaka [9, 10]. Stoga, da bi se smanjila mogućnost pogrešne radiografske analize, istraživanjem nisu obuhvaćeni rendgenogrami lečenih molara, kao ni snimci koji nisu zadovoljavali osnovne tehničke zahteve.

U epidemiološkim istraživanjima koriste se različiti kriterijumi za kategorizaciju kvaliteta opturacije kanala. Najčešće je osnovni parametar dužina kanalnog punjenja, ali se analiziraju i homogenost, odnosno adaptacija materijala za opturaciju za zidove kanala [11-15], i postojanje jatrogenih komplikacija [8, 11]. U ovom istraživanju je kod višekorenih zuba (premolara) zub posmatran kao celina, te je neadekvatno ispunjen jedan kanal označen kao neuspešno izlečen zub.

Rezultati istraživanja pokazuju da je nešto više od polovine endodontski lečenih zuba zadovoljavalo kriterijum adekvatnog kanalnog punjenja. Slični rezultati dobijeni su i u istraživanjima Eleftheriadisa (*Eleftheriadis*) i Lambrijanidisa (*Lambrianidis*)

[8] (55%) i Bariješi-Nusaira (*Barrieshi-Nusair*) i saradnika [14] (47%). S druge strane, znatno manji procenat adekvatnog kanalnog punjenja na studentskim vežbama zabeležen je u studijama Hejsa (*Hayes*) i saradnika [16] (17%) i Baltoa (*Balto*) i saradnika [17] (23%). Ipak, direktna poređenja pomenutih studija i našeg istraživanja teško je izvesti zbog razlike u metodološkim kriterijumima koji su primenjivani.

U pogledu morfološke grupe zuba, najveći procenat adekvatnog punjenja utvrđen je kod sekutića (67,4%), a najmanji kod premolara (39,7%). Ovi rezultati su u skladu s nalazima drugih istraživanja, jer su ovo zubi s relativno jednostavnim kanalnim sistemom [8, 14]. Manji procenat uspešnosti endodontskog lečenja premolara i molara uglavnom je posledica složene anatomije kanala ovih zuba.

Adekvatna dužina kanalnog punjenja ustanovljena je kod 57% zuba ispitanih u našem istraživanju. Mada je teško poređiti rezultate ove studije sa drugim, procenat kanalnih punjenja s odgovarajućom dužinom veći je u odnosu na rezultate dobijene u studiji francuskih [12] (38,7%) i poljskih autora [13] (48,9%), ali je nešto manji u poređenju s rezultatima jordanjskih istraživača [14] (61,3%). Bolji nalazi u pomenutim studijama mogu biti rezultat činjenice da su studenti u ovim istraživanjima tokom postupka odontometrije koristili nekoliko radiografskih snimaka.

Neadekvatna homogenost punjenja takođe može da dovede do neuspeha endodontskog lečenja zbog pojave mikrocurenja duž zidova kanala [18], a uočena je i češća pojava apeksnih parodontitisa kod zuba s nehomogenim punjenjem [19]. U našem istraživanju 78,9% kanalnih punjenja bilo je homogeno, za razliku od drugih istraživanja, gde je taj procenat bio niži. Homogenost punjenja bila je adekvatna kod 35% zuba u studiji Baltoa i saradnika [17], kod 64% zuba u studiji Musa-Bardana (*Moussa-Bardan*) i saradnika [20], odnosno kod 70% zuba u studiji Era (*Er*) i saradnika [21]. Visok procenat homogenih kanalnih punjenja u našem istraživanju može se pripisati činjenici da je modifikovana tehnika lateralne kompakcije sa više gutaperkapoena uticala na kvalitet punjenja kanala korena.

Kvalitet punjenja kanala korena zuba koje su vršili studenti V₂ programa studija (61,7%) bio je značajno bolji od onog koje su izveli studenti programa V₁ (42,6%). Naime, studenti dve grupe kliničku praksu iz endodoncije pohađaju samo tokom jedne godine, za razliku od drugih stomatoloških fakulteta, gde ona traje dve [11, 14], odnosno tri godine [20], a pre kliničkog

rada ti studenti pohađaju i pretkliničku nastavu. Prema nalazima našeg istraživanja, uvođenje pretkliničke endodoncije u nastavni plan i program studija studenata grupe V₂ značajno je uticalo na poboljšanje kvaliteta endodontskog lečenja na studentskim vežbama, ali i ukazalo na potrebu da se nivo znanja i veština koji se stiče na studijama stomatologije iz oblasti endodoncije mora stalno unapređivati.

Lekarske greške na studentskim vežbama uočene su kod sedam zuba; kod četiri je zabeležena perforacija, a kod tri zuba prelom instrumenta. Slični rezultati dobijeni su u studiji Dadresanfara (*Dadresanfar*) i saradnika [22], gde su lateralne perforacije zida korena ustanovljene kod 16 od 400 zuba (4%), dok se prelom instrumenta dogodio u četiri kanala. Mala incidenca lekarskih grešaka može se objasniti činjenicom da molari nisu bili obuhvaćeni istraživanjem, kao i da se u slučaju pojave ovih komplikacija pacijenti obično upućuju specijalistima endodoncije, tako da lečenje ne završavaju studenti na vežbama.

Mnogi faktori mogu biti razlog malom procentu adekvatnog punjenja kanala u ovom istraživanju: dizajn studije, veličina uzorka, metodološki kriterijumi, tehnike hemomehaničke obrade i opturacije kanala, klinički faktori i kurikulum iz oblasti endodoncije. Iako kvalitet endodontske intervencije ima značajan uticaj na ishod lečenja obolelog zuba, on sigurno nije presudan za uspeh terapije. Obezbeđivanje antiseptičnih uslova rada, kvalitet preparacije kanala, materijali korišćeni tokom hemomehaničke obrade, medikacije i opturacije kanala takođe su značajni prognostički faktori koji mogu uticati na ishod endodontskog lečenja [23].

ZAKLJUČAK

Kvalitet endodontskog lečenja koje su izveli studenti na vežbama bio je dobar u više od polovine slučajeva. Procenat adekvatnog kanalnog punjenja u grupi studenata V₂ programa studija koji su prethodno pohađali nastavu iz pretkliničke endodoncije bio je značajno veći nego kod studenata programa V₁. Ova razlika u kvalitetu punjenja kanala korena zuba na studentskim vežbama studenata različitih nastavnih planova i programa ukazuje na značajan uticaj kurikuluma iz oblasti endodoncije na kvalitet endodontske terapije, ali i na činjenicu da se ovi programi moraju stalno unapređivati i usavršavati.