Clinical and radiological analysis of the causes for endodontic treatment failure

Jelena Nešković, Milica Jovanović-Medojević, Slavoljub Živković
University of Belgrade, Faculty of Dental Medicine, Department of Restorative Odontology and Endodontics, Belgrade, Serbia

SUMMARY
Introduction Development of inflammatory lesions or their persistence after primary treatment is considered endodontic failure. The reason for failure can be complex anatomy of the canal system and numerous iatrogenic factors. The objective of this study was to analyze, clinically and radiographically, the causes of primary endodontic treatment failure and assess possibilities for retreatment of teeth with failed endodontic treatment.
Method The study included 79 teeth (36 multirooted and 43 single-rooted tooth) indicated for repeated endodontic treatment. Based on the radiographic assessment of the status of periapical structures, teeth were divided into two groups. The first group included teeth without periapical lesions, i.e. the healthy periodontal tissues (PAI score of 1 and 2) in which retreatment was required for prosthodontic reason due to the poor quality of obturation (28 teeth), and the second group included teeth with visible signs of periapical tissue damage (PAI scores 3, 4 and 5) (51 teeth). In both groups, quality of obturation, coronal sealing and the presence or absence of clinical symptoms was analyzed.
Results The most common radiographic finding of definitive obturation was short filling (65.8% of cases); “forgotten” canals (25.3%); non-homogeneous obturation with correct length (5.1%) and fractured instrument (3.8%). There was significant difference between healthy periodontal ligament and adequate restoration (P < 0.001). In 95% of patients with symptoms, changes in the periapical tissue were observed. Also, there was significant difference in the presence of symptoms after primary treatments, between the teeth with healthy apical periodontal tissue and teeth with periapical lesions (P = 0.019).
Conclusion The outcome of the root canal treatment is significantly affected by the quality (density) of obturation and the presence and quality of coronal restoration. In patients with symptoms there were changes in the periapical tissue.
Keywords: endodontic failure; obturation; coronal restoration; retreatment

INTRODUCTION
Healing of periapical lesions presented as reduction or disappearance of existing periapical radiolucency is expected after adequately conducted endodontic treatment. However, there are situations when bone repair is absent and there is no reduction in periapical radiolucency, often qualified as endodontic failure [1]. The success rate of endodontic treatment ranges from 53% - 97% [2–5]. Higher percentage indicates that almost every endodontic treatment is successful, while lower limit interval suggests that every other is unsuccessful.

Despite the undoubted frequency in everyday clinical practice, there is still no exact definition of endodontic treatment failure. Many clinicians came to the consent that lack of pain and other clinical symptoms or maintained function of endodontically treated teeth are important parameters of successful endodontic treatment [6]. The failure of endodontic treatment includes radiographic appearance of inflammatory lesions in the periapical tissue, which had not existed before or persistence of or enlargement of the radiolucency after undertaken primary treatment [6, 7].

The most common reasons for failure are: inadequate control of aseptic conditions [8–15], small access cavity (making difficult to locate all canals so some of them remain “forgotten”); inadequate instrumentation of the root canal, complications during endodontic treatment in the form of perforation of the root canal or separated instruments [16], inadequate obturation (short, non-homogeneous or overextended) [17–20] or microleakage of temporary or definitive coronal restoration [21, 22, 23].

Sometimes failure can occur even if endodontic treatment was properly managed and all procedures are fully respected. The reason for this is the complex anatomy of the canal system and numerous ramifications and anastomoses between the main and accessory canals that cannot be adequately treated or obturated using contemporary instruments, materials and techniques. Noninstrumented region of endodontic space can contain bacteria and necrotic tissue, even when not visible on the X-ray [12, 24].

There are factors outside the root canal, within the inflamed periapical tissue that could adversely affect post-operative healing of periapical lesions. Persistence of asymptomatic periapical radiolucency after thorough endodontic therapy can be caused by extra-radicular in-
Infection, true cysts, foreign bodies, the presence of cholesterol crystals or scar healing of the tissue [25].

The aim of this study was to analyze, clinically and radiographically, the causes of primary endodontic treatment failure and assess possibilities for retreatment of teeth with failed endodontic treatment.

METHOD

The study was conducted at the Clinic of Restorative Odontology and Endodontics, Faculty of Dental Medicine, University of Belgrade, Serbia. All participants signed consent to voluntary participation in the study after introducing with objectives and expected outcomes of the research.

67 patients of both genders, aged 24-79 years, and 79 teeth (36 multirooted and 43 single-rooted tooth) indicated for repeated endodontic treatment were included in the study. One operator carried out clinical trial, while two researchers interpreted the assessment of radiographic outcome.

All 79 teeth had inadequate radiographic obturation and that was the key criterion in the assessment of the failure of endodontic treatment. 52 teeth had short filling while 4 teeth had non-homogeneous filling. “Forgotten” canals were found in 20 teeth while 3 teeth had separated instruments (Table 1). In 36 teeth restoration was adequate or had valid prosthetic restorations, 5 teeth were without fillings a longer period of time, and 43 teeth had inadequate restoration.

Periapical status of each tooth prior to the re-treatment was assessed radiographically using PAI (periapical index) system as follows [26]:

1. PAI normal periapical structures
2. PAI small changes in bone structures that is not pathognomonic for apical periodontitis
3. PAI changes in bone structure with decalcification, characteristic for apical periodontitis
4. PAI periodontitis with clearly defined zone of radiolucency
5. PAI advanced periodontitis with signs of exacerbation and expansion of bone.

PAI score was determined for each tooth individually. X rays were analyzed on the light box using magnifying lens. Multirooted teeth were evaluated according to the maximum damage of periodontal structures in any of the roots. Based on the state of periapical structures, teeth

| N | Quality of obturation | Quality of coronal restauration |
|---|-----------------------|--------------------------------|
| 14 | Short filling | Adequate |
| 14 | Nonhomogenous filling | Adequate |
| 16 | Separated instrument | Adequate |
| 16 | Zaboravljen instrument | Adequate |
| 12 | Missed canals | Adequate |
| 2 | Zaboravljeni kanal | Adequate |
| 5 | Inadequate | Neadekvatno |
| 9 | Inadequate | Neadekvatno |
| 20 | Inadequate | Neadekvatno |

Table 1. Distribution of teeth with endodontic failure in relation to the quality of obturation, coronal restoration and PAI index values.

Table 2. Distribution of teeth in relation to the presence of clinical symptoms in the group of teeth with healthy periapical tissue and the group with periapical lesions

| Clinical symptoms Klinički simptomi | Teeth with healthy periapical tissue Zubi sa zdravim parodontičnjom | Teeth with periapical lesions Zubi sa periapikalnim lezijama |
|------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Yes Da | No Ne | N | % | N | % |
| Pain Bol | Yes Da | 0 | 100% | 9 | 36% |
| No Ne | 15 | 100% | 25 | 64% |
| Sensitivity to percussion Perkutorna osjetljivost | Yes Da | 0 | 0,0 | 3 | 12% |
| No Ne | 15 | 100% | 31 | 88% |
| Swelling Otok | Yes Da | 0 | 0,0 | 3 | 12% |
| No Ne | 15 | 100% | 31 | 88% |
| Sinus tract Fistula | Da | 0 | 0,0 | 3 | 12% |
| Ne | 15 | 100% | 31 | 88% |
were divided into two groups. The first group included teeth without periapical changes (PAI score 1 and 2) where retreatment was necessary for prosthetic reasons and poor quality of definitive obturation (28 teeth). The second group included teeth with visible signs of periapical tissue damage (PAI scores 3, 4 and 5) and included 51 teeth.

The second parameter in the analysis was the existence of clinical symptoms after the initial treatment. The first group included cases without clinical symptoms (diagnosed as incidental findings), and the second group included teeth with present clinical symptoms: pain, swelling, sensitivity to percussion, present sinus tract and others (Table 2).

**RESULTS**

Results are presented in Figures 1-4 and Tables 3-6.

Periodontal tissues were found healthy (PAI 1 and 2) in 35.4% of cases, while some changes in periapical tissue (PAI 3, 4 and 5) were recorded in 64.6% of cases. Short obturation was recorded in 65.8% of cases, while “forgotten” canals that were detected in 25.3% of teeth. Non-homogenous filling with correct length was noted in 5.1% of teeth and fractured instrument was found in the root canal of 3.8% of analyzed teeth (Table 3).

The quality of the coronal seal was inadequate in 54.5% of cases, while in 45.5% of cases coronal restorations had satisfactory quality (Table 4). Most of teeth with healthy

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![Figure 1.](image1.jpg)  
**Figure 1.** a) Maxillary first molar on the left with inadequate obturation (short, non-homogeneous and forgotten buccomesial canals); b) Final obturation after finished re-treatment; c) After 2 years- complete healing

![Figure 2.](image2.jpg)  
**Figure 2.** a) Mandibular first molar on the left with inadequate obturation and forgotten mesial canals. The tooth presented clinical symptoms of swelling and tenderness; b) Final obturation after finished re-treatment; c) Complete healing after 2 years

![Figure 3.](image3.jpg)  
**Figure 3.** a) Mandibular first molar on the left side with short root canal filling in the distal canal and forgotten mesial canals; b) Final obturation after finished re-treatment; c) Complete healing after 2 years

![Figure 4.](image4.jpg)  
**Figure 4.** a) Maxillary second molar on the left with inadequate obturation (short, non-homogeneous and forgotten mesial canals); b) Final obturation after finished re-treatment; c) After 2 years- complete healing
periapical tissue (1, 2 PAI) were adequately restored (75%), while 70.6% of the teeth with apical periodontitis (PAI 3, 4, 5) had inadequate coronal restoration (Table 5).

χ2 test showed high association between healthy periodontal tissue and adequate restoration on one side and micro leakage of inadequate restoration and periapical changes (P <0.001) (Table 5).

In regards to the symptoms, 24% of patients had persistence of the symptoms after the initial endodontic therapy, while the remaining 76% of cases were asymptomatic. Out of all asymptomatic patients 95% had some changes in the periapical tissue. Fisher’s exact test showed association between the presence of symptoms after initial treatments and teeth with periapical lesions (P = 0.019) (Table 6).

**DISCUSSION**

This clinical study was conducted with the aim to analyze the outcomes and causes of the failure of primary endodontic treatments and to facilitate planning for clinicians how to perform retreatment. All cases were selected from everyday clinical practice at the Clinic of Restorative Odontology and Endodontics, School of Dental Medicine, University of Belgrade. A single therapist carried out retreatments.

Consent to participate in the study was signed by 37 patients of both genders, aged 24 to 79 years. Based on the clinical and radiographic examination they required repeated endodontic therapy. The study did not include patients with general diseases and those taking antibiotics in the last 3 months, and teeth with extensive decay destruction or poor periodontal status.

Primary endodontic treatment was done in 2 cases within a year, in 17 cases (34.7%) 1-5 years before the diagnosis of failure of previous treatment, while in 30 teeth (61%) primary endodontic treatment was done more than 5 years ago. Endodontically treated teeth have long survival rate in general. In fact, over 60% of root canal treated teeth are functional for more than 5 years. Salehrabi and Rotstein (2004) carried out an extensive epidemiological study in the United States on 1,462,936 teeth. After 8 years, 97% of teeth were still present in the oral cavity [4]. On the other hand, other epidemiological studies [27, 28, 29] in the recent years indicated that over 30% of endodontically treated teeth were diagnosed with chronic periapical lesions (apical periodontitis) or according to Friedman- “post-treatment endodontic disease” [1].

From a total of 79 teeth, 35% of the teeth had no visible signs of periapical bone destruction, while in 65% of teeth the presence of chronic periapical lesions was registered. PCR analysis of the samples taken from the root canals of these teeth after removing old canal filling identified microorganisms in all teeth that had changes
in the periapical tissues. The most frequently identified microorganism, *E. faecalis*, was detected in 94% of the root canals with chronic periapical lesions.

Only 24% of patients had clinical symptoms such as pain, swelling, the existence of a sinus tract, or sensitivity to percussion and pain on biting. Most prevalent symptoms were sensitivity to percussion (59%) as a sign of chronic inflammation of the periapical tissue, and pain (47% of cases) as a sign of acute exacerbation of chronic periapical lesion.

All 79 tooth treated in our study had inadequate obturation. Most frequently registered was short filling in 65% of cases, “forgotten canals” (25%), clinically non-homogeneous filling (5.1%) and the presence of fractured instruments in 3.8% of canals. Whether inadequately obturated root canal is going to cause the failure of endodontic treatment depends primarily on the presence of bacteria in the root canal. If the vital pulp was treated and coronal restoration properly sealed, impermeable to bacteria, changes in the periradicular tissue will most likely not occur. However, if the canal was infected, an empty space in the apical part of the root will probably cause persistent intraradicular infection or maintain periradicular inflammation after completion of endodontic therapy [8-15].

In addition to the length of the apical canal filling, density ie. hermetic canal filling is an important factor for successful endodontic treatment. Unfortunately, micro computed tomographic studies have shown that even the most modern materials and techniques of instrumentation and obturation are not able to obturate root canal non-porously or to be impermeable to bacteria. Hammad i al. (2009) and Zogheib et al. (2013) measured the volume percentage of voids and trapped air in the apical third of the root canal obturated with Thermafil technique (gutta-percha and Topseal) and RealSeal technique (Resilion and RealSeal 1). After scanning and measurement of the volume of voids and unfilled space in obturated root canals, with respect to their total volume, they came to the conclusion that no technique of obturation provides absolute hermetic sealing of the endodontic space. Furthermore, the difference in the percentage of empty space between the novel adhesive endodontic materials and gutta-percha as gold standard was not statistically significant [30, 31].

It is obvious that the quality of obturation affects the outcome of endodontic treatment but this is not the only prerequisite for success. In our study all patients with inadequate obturation were referred to endodontic retreatment, even though 17.7% of teeth did not have any changes in the periapical tissues (PAI 1), while at 17.7% of teeth there was slightly enlarged periodontal membrane (which is not pathognomonic finding of apical periodontitis) (PAI 2). In these cases, the retreatment was needed due to prosthetic reconstruction (intraradicular post). Such teeth were adequately restored in 75% of cases (21 out of 28 teeth) that provided good coronal seal, reduced microleakage and prevented (re) infection of the root canal and periapical tissues. Only one tooth with healthy periapical tissue did not have an adequate restoration and showed signs of acute infection (not visible changes on the x ray). Ray and Trope demonstrated that defective coronal restoration and adequate obturation have higher percentage of failures compared to the teeth with appropriate crown restoration and inadequate obturation [23]. Only 9% of teeth with adequate coronal filling and root canal obturation showed failure, in contrast to the teeth where obturation and coronal restoration were defective where the ratio was 82%. Gillen et al. (2011) conducted a systematic review of available literature about the effect of coronal restoration and root canal obturation and concluded that success of endodontic treatment would be higher if both, endodontic treatment and coronal restoration were done properly [21].

Out of all teeth with changes in the periapical tissue, 84% had inadequate restoration, and 50% of them had symptoms indicating the importance of good marginal seal. Similar findings were reported by Liang et al. (2011)
who used periapical radiography and CBCT to analyze factors required for successful endodontic treatment. Two years after pulpectomy, periapical radiography showed the presence of periapical lesions in 12.6%, while CBCT detected two times more chronic periapical changes (25.9%). Interestingly, 80% of root canal fillings radiographically determined as “short”, on CBCT were up to the apical terminus. They also concluded that density and apical extension of the root canal obturation significantly affected the outcome of endodontic treatment as judged by periapical radiographs. By analyzing data obtained by CBCT, for the success of the root canal treatment critical factors were density of the root canal filling and the quality of the coronal restoration [22].

Teeth with healthy periodontal tissue were sent to endodontic retreatment due to radiographically inadequate obturation (part of the preparation for prosthodontic rehabilitation) or were detected as incidental finding. Dilemma of whether teeth with inadequate obturation, healthy periapical tissue and without clinical signs and symptoms, should be retreated, is always current among endodontists. If tooth has already adequate restoration, it can be monitored by regular check-ups. However, if the tooth is planned to support fixed prosthodontic construction, with intraradical post, retreatment is strongly recommended [32]. Success of repeated endodontic treatment relies on: proper diagnosis of the endodontic failure (periapical radiography, CBCT), adequate decontamination and repeated cleaning and shaping of the canal (the expertise of the therapist, instruments and materials), high quality three-dimensional hermetic obturation of the root canal system, and timely and adhesive restoration placement after retreatment is finished.

CONCLUSION

The outcome of the root canal treatment is significantly affected by the quality (density) of root canal obturation and the presence and good quality of the coronal restoration. Most teeth with healthy periodontal tissue at the time of diagnosis of the failure of primary endodontic treatment were adequately restored. However, most teeth with changes in the periapical tissue had inadequate coronal restoration. Teeth in patients who had symptoms mostly had visible changes in the periapical tissue.

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Uzroci neuspeha endodontskog lečenja zuba

Jelena Nešković, Milica Jovanović-Medojević, Slavoljub Živković
Univerzitet u Beogradu, Stomatološki fakultet, Klinika za bolesti zuba i endodonciju, Beograd, Srbija

KRATAK SADRŽAJ

Uvod
Neuspehom endodontskog lečenja smatra se pojava radiografskog nalaza inflamatorne lezije, odnosno njeno perzistiranje ili uvećanje posle preduzete primarne endodontske terapije. Razlog za neuspeh mogu biti kompleksna anatomija kanalnog sistema, ali i bronji jarotveni faktori. Cilj ovog rada je da se kod zuba sa neuspešnim endodontskim lečenjem klinički i radiografski analizira uzrok neuspeha primarnog endodontskog tretmana i procene mogućnosti za ponovni endodontski zahvat.

Metod rada
U ovo istraživanje je uključeno 79 zuba (36 višekorenih i 43 jednokorenog zuba) indikovanih za ponovljeni endodontski tretman. Na osnovu radiografske ocene stanja peripapikalnih struktura zubi su podeljeni u dve grupe: prvu grupu su činili zubi bez peripapikalnih promena, tj. sa zdravim parodoncijumom (PAI skor 1 i 2) kod kojih je retretman bio neophodan iz protetskih razloga – zbog lošeg kvaliteta definitivne opturacije (28 zuba), a drugu zubi sa vidljivim znacima oštećenja apektnog parodoncijuma (PAI skor 3, 4 i 5) (51 zub). U obe grupe analiziran je kvalitet opturacije, kvalitet kruničnog zaptivanja i prisustvo ili odsustvo kliničkih simptoma.

Rezultati
Najčešći radiografski nalazi kvaliteta definitivne opturacije kanala bili su: kratko punjenje (65,8% slučajeva), “zaboravljeni” kanali (25,3%), klinički nehomogeno punjenje uz korektnu dužinu definitivnog punjenja (5,1%) i frakturiran instrument (3,8%). Nade- na je statistički visoka značajna razlika između adekvatne restauracije i zdravog parodoncijumima, odnosno pojavile mikrocurenje zbog neadekvatne restauracije i peripapikalnih promena (p < 0,001). Kod 95% pacijenata sa simptomima uočene su promene u apektnom parodoncijumu. Takođe, nađena je statistički značajna razlika u prisustvu simptoma nakon primarne endodontske terapije između zuba sa zdravim parodoncijumom i zuba sa peripapikalnim lezijama (p = 0,019).

Zaključak
Na ishod endodontskog lečenja značajno utiču kvalitet (hermetičnost) opturacije kanala, odnosno prisustvo simptoma i kvalitet koronarne restauracije. Kod pacijenata sa simptomima uglavnom su postojale i promene u apektnom parodoncijumu nakon endodontskog lečenja.

Ključne reči: endodontski neuspeh; opturacija; restauracija

UVOD
Nakon adekvatno sprovedenog endodontskog tretmana očekuje se zagorjanje, odnosno smanjenje ili isčeđenje stanja postojčeg rasvetljenja iznad vrha korena na kontrolnim radiografijskim planovima. Međutim, postoje situacije kada očekuje se neuspeh endodontskog lečenja [1]. Uprošćeno, uzrok je adekvatna restauracija, klinički nehomogena opturacija, klinički korak između adekvatne restauracije i zdravog parodoncijuma [8–15]. Ponekad je postojala, odnosno njeno perzistiranje ili uvećanje posle preduzete primarne endodontske terapije. Razlog za neuspeh mogu biti kompleksna anatomija kanalnog sistema, ali i bronji jarotveni faktori. Cilj ovog rada je bio da se kod zuba sa neuspešnim endodontskim lečenjem klinički i radiografski analizira uzrok neuspeha primarnog endodontskog tretmana i procene mogućnosti za ponovni endodontski zahvat.

METOD RADA

Studija je sprovedena na Klinici za bolesti zuba i endodonciju Stomatološkog fakulteta Univerziteta u Beogradu. Nakon što su upoznati sa ciljevima i očekivanim ishodima istraživanja, svi učesnici su potpisali pristanak da dobrovoljno učestvuju u istraživanju.

U ovo istraživanje je uključeno 67 pacijenata oba pola, stari od 24 do 79 godina, odnosno 79 zuba (36 višekorenih i 43 jednokorenog zuba) indikovanih za ponovljeni endodontski tretman...
tretman. Kliničko ispitivanje je sprovedeno od strane jednog operatera, dok su radiografsku procenu ishoda lečenja tumačila dva istraživača.

Svih 79 zuba imalo je radiografski nalaz neadekvatne op-turacije jer je to bio ključni kriterijum u oceni neuspeha endodontskog lečenja. S obzirom na to da su sve opturacije bile nezadovoljavajućeg nivoa, njihov kvalitet je ocijenjen kao kratko punjenje (52 zuba), nehomogeno punjenje (četiri zuba), prisustvo „zaboravljenih“ kanala (20 zuba) i zalomljeni instrumenti (tri zuba) (Tabela 1). Kod 36 zuba uočeno je adekvatna restauracija ili validna prototska nadoknada, pet zuba je bilo bez ispuna duži vremenski period, a kod 43 zuba je uočena neadekvatna restauracija.

Periapikalni status svakog zuba pre početka retretmana procjenjivan je radiografski pomoću PAI (periapikalni indeks) sistema za skoriranje na sledeći način [26]:

PAI 1 – normalne periapikalne strukturi
PAI 2 – male promene u strukturi kosti koje nisu patognomonične za apikalni periodontitis
PAI 3 – promene u koštanjoj strukturi sa dekalcifikacijom karakterističnom za apikalni periodontitis
PAI 4 – periodontitis sa jasno definisanim zonom rasvjetlenja
PAI 5 – uznepredovao periodontitis sa znacima egzacerbacije i ekspanzije kosti.

PAI skor je određen za svaki zub pojedinačno, a radiografski nalaz je analiziran na negatoskopu uz primenu uveličavajuće lupe. Višekoreni zubi su ocijenivani u skladu sa najvećim oštećenjem parodontalnih struktura na jednom od korenova.

Na osnovu radiografske ocene stanja periapikalnih struktura zubi su podešeni u dve grupe. U prvu grupu su svrstani zubi bez periapikalnih promena, tj. sa zdravim parodoncijumom (PAI skor 1 i 2), kod kojih je retretman bio neophodan iz protetskih razloga – zbog lošeg kvaliteta definitivne opturacije (28 zuba). Drugu grupu, koju je obuhvatila 51 zuba, činili su zubi sa vidljivim znacima oštećenja apskog parodoncijuma (PAI skor 3, 4 i 5).

Drugi parametar u analizi bio je postojanje kliničkih simptoma nakon inicijalnog retretmana. Prvu grupu su činili slučajevi bez kliničkih simptoma (dijagnoza postavljena slučajnim nalazom), a drugu slučajevi sa kliničkim simptomima u vidu bolja, otoka, perkutorne osetljivosti, odnosno postojanja fistule (Tabela 2).

REZULTATI

Dobijeni rezultati prikazani su u tabelama 3–6 i slikama 1–4.

Parodontalna tkiva su notirana kao zdrava (PAI 1 i 2) u 35,4% slučajeva, dok su destruktivne promene u periradikularnim parodontalnim tkivima (PAI 3, 4 i 5) zabeležene u 64,6% slučajeva.

Najčešći radiografski nalaz kvaliteta definitivne opturacije kanala zatečen u momentu dijagnostikovanja neuspeha endodontskog lečenja bio je kratko punjenje, koje je zabeleženo u 65,8% slučajeva, a zatim slede „zaboravljeni“ kanali, koji su detektovani u 25,3% zuba. Klinički nehomogeno punjenje uz korektnu dužinu definitivnog punjenja nađeno je kod 5,1% zuba, dok je u 3,8% slučajeva na radiografiji uočen frakturirani instrument u kanalu korena (Tabela 3).

Kvalitet kruničnog zaptivanja, odnosno restauracije zuba u momentu dijagnoze neuspeha endodontskog lečenja je u 54,5% slučajeva bio neadekvatno, dok su u 45,5% slučajeva krunični ispuni bili zadovoljavajućeg kvaliteta (Tabela 4). Većina zuba sa zdravim parodoncijumom (PAI 1, 2) bila je adekvatno restaurirana (75%), dok je 25% zuba za obolelim apektinskim parodoncijumom (PAI 3, 4, 5) imalo neadekvatne krunične restauracije (Tabela 4).

U grupi zuba sa zdravim parodontalnim tkivima 75% zuba je imalo adekvatnu koronarnu restauraciju, dok kod 25% krunično rubno zatvaranje nije bilo zadovoljavajuće kvaliteta. Kod zuba sa hroničnim promenama u apskom parodoncijumu 70,6% koronarnih restauracija je u momentu dijagnostikovanja neuspeha endodontske terapije nije bilo adekvatno, dok je krunično zaptivanje bilo zadovoljavajuće u 29,4% zuba sa HAF-om (Tabela 5).

Analizom kvaliteta kruničnog zaptivanja i pojave promena u apskom parodoncijumu, χ2 testom dobijena je statistički značajna razlika između adekvatne restauracije i zdravog parodoncijuma, odnosno pojave mikrocurenja zbog neadekvatne restauracije i periapikalnih promena (p < 0,001) (Tabela 5). Kada se sumiraju podaci o pojavi simptoma kod ovih pacijenata, 24% pacijenata je bilo neki od simptoma zabeleženih nakon inicijalne endodontske terapije, dok je preostalih 76% slučajeva bilo asimptomatsko. Među pacijentima koji su imali simptome 95% njih je iz grupe zuba sa promenama u apskom parodoncijumu. Fišerovim testom tačne verovatnoće dobijena je statistički značajna razlika u prisustvu simptoma nakon primarno-endodontske terapije između zuba sa zdravim parodoncijumom i zuba sa perikliplanim lezijama (p = 0,019) (Tabela 6).
strane, druge epidemiološke studije poslednjih godina (Boucher i sar. 2002. godine u Francuskoj [27]; Duglas i sar. 2003. godine ne Kanadi [28]; Farzenah i sar. 2004. godine u Toronto [29]) ukazuju da preko 30% endodontski tretiranih zuba pokazuje postojanje hronične periapikalne lezije (apikalnog periodontitisa) ili, po Friedmanu, „post-treatment endodontic desease“ [1].

Od ukupno 79 zuba, 35% zuba nije imalo vidljive znake destrukcije periapikalne kosti, dok je kod 65% zuba registrovan pravouzorčno hronične periapikalne lezije. PCR analizom uzoraka uzetih iz kanala korena ovih zuba identifikovani su mikroorganizmi u svim uzorcima iz zuba sa promenama u periapikalnim tkivima. Najčešće identifikovani mikroorganizam bio je E. Faecalitis, detektovan u 94% kanala korena zuba sa hroničnim periapikalnim lezijama.

Ukoliko bi se kao kriterijum (ne)uspeha primarnog endodontskog tretmana uzela pojava kliničkih simptoma u vidu böl, otoka, postojanja fistule, perkutorne osetljivosti ili bolova na zagoj, onda bi to obuhvatio svega 24% pacijenata. Najčešći simptomi su bili osetljivost na perkusiju (59% simptomatskih slučajeva), kao znak hroničnog zapaljenja periodontalnog ligma menta u apik兰oj regiji, i bol (47% slučajeva), kao znak akutne egzacerbacije hronične periapikalne lezije.

Kada je u pitanju kvalitet opturacije kao faktor uspeha endodontske terapije, kod 79 zuba obrađenih u ovom istraživanju registrirano je 14% pravouzorčno zapreminu došli su do zaključaka da nijedna tehnika opturacije (gutaperka i Topseal) i tehnikom opturacije RealSeal (Resilion i Trope) nije statistički značajna [31].

Osim apikalne ekstenzije kanalnog punjenja do 25% zuba, “zaboravljeni kanali” (25% kanala), klinički nehomogeno punjenje (5,1%) i prisustvo frakturiranog zuba podrazumeva perzistiranje intrakanalnog infekcija, odnosno održavanje periradikularne inflamacije nakon završetka endodontske terapije [8–15].

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ZAKLJUČAK

Na ishod endodontskog lečenja značajno utiču kvalitet (hermetičnost) opturacije kanala korena, prisustvo i kvalitet koronarne restauracije. Većina zuba sa zdravim parodoncijumom, u momentu postavljanja dijagnoze neuspeha primarnog endodontskog lečenja bila je adekvatno restaurirana, dok je većina zuba sa obolelim apektnim parodoncijumom imala neadekvatne krunične restauracije. Kod pacijenata sa simptomima uglavnom su postojale promene u apektnom parodoncijumu endodontski lečenih zuba.