

## BÖLÜM 4

### CERRAHİ OL MAYAN TEKRARLAYAN ENDODONTİK TEDAVİLER

Gülsen KİRAZ<sup>1</sup>

#### GİRİŞ

Kanal tedavisinin başarısız olduğu durumlarda, cerrahi olmayan tekrarlayan endodontik tedaviler, periradiküler cerrahi ve çekim tedavi seçenekleri arasındadır. Ancak, cerrahi olmayan tekrarlayan endodontik tedaviler (retreatment), en konservatif metot olmasından dolayı günümüzde ilk seçenek olarak görülmektedir.<sup>1</sup>

Retreatment tedavilerindeki en önemli faktör, kök kanal dolgusunun uzaklaştırılıp kök kanalının ideal olarak temizlenebilmesidir. Bu yüzden güta-perkaları uzaklaştırmak için birçok yöntem ve materyal kullanılmaktadır. Bunlardan bazıları; sıcak yöntemler, solventler, lazer, ultrasonikler, mekanik yöntemler ve bütün bunların kombinasyonlarıdır. Ayrıca, farklı dizayndaki nikel titanyum (NiTi) döner aletler de güta-perkanın daha etkili uzaklaştırılması için geliştirilmiştir.<sup>2-4</sup>

Başarısız kök kanal tedavileri genellikle kök kanal sisteminin yetersiz dezenfeksiyonundan, yetersiz veya taşkın kök kanal dolgularından ve yetersiz koronal restorasyonlardan kaynaklanabilmektedir.<sup>5-8</sup>

İlk kez yapılan kök kanal tedavilerinde başarı oranları oldukça yüksektir ancak az da olsa başarısız olma olasılığı (%12-19) vardır. Başlıca başarısızlık nedenleri perforasyonlar, bulunamayan kanallar, kistik lezyonlar, iatrojenik hatalar ve kök kırıklarıdır.<sup>9-11</sup>

Bazı çalışmalara göre; retreatment tedavisi sonrasında dişlerdeki radyolusensi, kök kanal dolumunun kalitesi ve perforasyonlar incelenerek değerlendirilen başarı oranının %62-82 arasında olduğu gözlemlenmiştir.<sup>10, 11</sup>

Tekrarlayan tedavilerin birçoğunu öne geçilmesi mümkündür. Bunun için ilk tedavide başarı koşulları dikkatlice yerine getirilmeli ve temel endodonti kurallarına bağlı kalınmalıdır.

<sup>1</sup> Dr. Öğr. Üyesi, Kütahya Sağlık Bilimleri Üniversitesi Diş Hekimliği Fakültesi Endodonti Anabilim Dalı , gulsen.kiraz@ksbu.edu.tr

## SONUÇ

Endodontik tedavilerin yenilenmesinde, vakaya uygun olarak seçilen teknikle kök kanal dolgusu söküldükten sonra, kanalların yeniden endodontik prensiplere uygun bir şekilde temizlenmesi ve preperasyonu, sonrasında ise sızdırmaz bir şekilde doldurulması ile başarı sağlanabilmesi mümkündür. Retreatment tedavileri, ilk yapılan tedavilerden birçok noktada farklılık gösterirler. NiTi döner aletleri ile kök kanalının temizliği kolaylaşsa da, kanalın tamamen artıklardan arındırılması imkansızdır. Kök kanal tedavisinin başarısında pek çok faktör rol almaktadır. Bu başarısızlık sebeplerinin en başında mikrobiyal faktörler yer alır. Bu yüzden kök kanal tedavisinde bir sorun varsa, öncelikle kanal içi mikrobiyal faktörler düşünlümelii ve tedavinin yenilenmesi için dış incelenmelidir. Retreatment yapılacak dışın başarılı olması için en önemli faktör yeterli dezenfeksiyonun sağlanmasıdır. Retreatment uygulamaları içerisinde cerrahi olmayan retreatment en fazla tercih edilen tedavi şeklidir. Eğer cerrahi olmayan retreatment uygulanamıyorsa veya başarılı olunamamışsa cerrahi yöntemlere başvurulabilir.

**Anahtar Kelimeler:** Endodonti, güta-perka, kök kanal tedavisi, retreatment

## KAYNAKLAR

1. Lovdahl P. Endodontic retreatment. *Dental Clinics of North America*, 1992; 36 (2), 473-490.
2. Rôças IN, Jung I-Y, Lee C-Y, Siqueira JF. Polymerase chain reaction identification of microorganisms in previously root-filled teeth in a South Korean population. *Journal of Endodontics*, 2004; 30 (7), 504-508.
3. Friedman S, Stabholz A, Tamse A. Endodontic retreatment—case selection and technique. Part 3. Retreatment techniques. *Journal of Endodontics*, 1990; 16 (11), 543-549.
4. Gu LS, Ling JQ, Wei X, Huang XY. Efficacy of ProTaper Universal rotary retreatment system for gutta-percha removal from root canals. *International Endodontic Journal*, 2008; 41 (4), 288-295.
5. Hülsmann M, Stotz S. Efficacy, cleaning ability and safety of different devices for gutta-percha removal in root canal retreatment. *International Endodontic Journal*, 1997; 30 (4), 227-233.
6. Silva EJNL, Orlowsky NB, Herrera DR, Machado R, Krebs RL, Coutinho-Filho TdS. Effectiveness of rotatory and reciprocating movements in root canal filling material removal. *Brazilian Oral Research*, 2015; 29 (1), 1-6.
7. Rödig T, Reicherts P, Konietschke F, Dullin C, Hahn W, Hülsmann M. Efficacy of reciprocating and rotary NiTi instruments for retreatment of curved root canals assessed by micro-CT. *International Endodontic Journal*, 2014 ;47 (10), 942-948.
8. Zamin C, Silva-Sousa YTC, Souza-Gabriel AE, Messias DF, Sousa-Neto MD. Fracture susceptibility of endodontically treated teeth. *Dental Traumatology*, 2012; 28 (4), 282-286.
9. Saunders W, Saunders E. Coronal leakage as a cause of failure in root-canal therapy: a review. *Dental Traumatology*, 1994; 10 (3), 105-108.
10. de Chevigny C, Dao TT, Basrani BR et al. Treatment outcome in endodontics: the Toronto study—phase 4: initial treatment. *Journal of Endodontics*, 2008; 34 (3), 258-263.
11. Farzaneh M, Abitbol S, Friedman S. Treatment outcome in endodontics: the Toronto study. Phases I and II: Orthograde retreatment. *Journal of Endodontics*, 2004; 30 (9), 627-633.

12. Lin LM, Skribner JE, Gaengler P. Factors associated with endodontic treatment failures. *Journal of Endodontics*, 1992; 18 (12), 625-627.
13. Nair PR, Sjögren U, Figdor D, Sundqvist G. Persistent periapical radiolucencies of root-filled human teeth, failed endodontic treatments, and periapical scars. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 1999; 87 (5), 617-627.
14. Siqueira J. Aetiology of root canal treatment failure: why well-treated teeth can fail. *International Endodontic Journal*, 2001; 34 (1), 1-10.
15. Nair P. On the causes of persistent apical periodontitis: a review. *International Endodontic Journal*, 2006; 39 (4), 249-281.
16. Lin LM, Ricucci D, Lin J, Rosenberg PA. Nonsurgical root canal therapy of large cyst-like inflammatory periapical lesions and inflammatory apical cysts. *Journal of Endodontics*, 2009; 35 (5), 607-615.
17. Stamos DE, Stamos DG, Perkins SK. Retreatment and ultrasonics. *Journal of Endodontics*, 1988; 14 (1), 39-42.
18. Kakehashi S, Stanley H, Fitzgerald R. The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats. *Oral Surgery, Oral Medicine, Oral Pathology*. 1965; 20 (3), 340-349.
19. Siqueira JF, Rôças IN. Clinical implications and microbiology of bacterial persistence after treatment procedures. *Journal of Endodontics*. 2008; 34 (11), 1291-1301.
20. Rôças IN, Siqueira JF, Aboim MC, Rosado AS. Denaturing gradient gel electrophoresis analysis of bacterial communities associated with failed endodontic treatment. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2004; 98 (6), 741-749.
21. de Paz LC, Svensäter G, Dahlén G, Bergenholtz G. Streptococci from root canals in teeth with apical periodontitis receiving endodontic treatment. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2005; 100 (2), 232-241.
22. Chu FC, Leung WK, Tsang PC, Chow TW, Samaranayake LP. Identification of cultivable microorganisms from root canals with apical periodontitis following two-visit endodontic treatment with antibiotics/steroid or calcium hydroxide dressings. *Journal of Endodontics*. 2006; 32 (1), 17-23.
23. Vianna M, Horz HP, Conrads G, Zaia A, Souza-Filho F, Gomes B. Effect of root canal procedures on endotoxins and endodontic pathogens. *Oral Microbiology and Immunology*. 2007; 22 (6), 411-418.
24. Gomes BP, Pinheiro ET, Jacinto RC, Zaia AA, Ferraz CC, Souza-Filho FJ. Microbial analysis of canals of root-filled teeth with periapical lesions using polymerase chain reaction. *Journal of Endodontics*. 2008; 34 (5), 537-540.
25. Ricucci D, Siqueira JF. Fate of the tissue in lateral canals and apical ramifications in response to pathologic conditions and treatment procedures. *Journal of Endodontics*. 2010; 36 (1), 1-15.
26. Lin LM, Pascon EA, Skribner J, Gängler P, Langeland K. Clinical, radiographic, and histologic study of endodontic treatment failures. *Oral Surgery, Oral Medicine, Oral Pathology*. 1991; 71 (5), 603-11.
27. Siqueira JF, Araújo MC, Garcia PF, Fraga RC, Dantas CJS. Histological evaluation of the effectiveness of five instrumentation techniques for cleaning the apical third of root canals. *Journal of Endodontics*. 1997; 23 (8), 499-502.
28. Siqueira JF, Rôças IN, Alves FR, Santos KR. Selected endodontic pathogens in the apical third of infected root canals: a molecular investigation. *Journal of Endodontics*. 2004; 30 (9), 638-643.
29. Câmara AC, Aguiar CM, de Figueiredo JAP. Assessment of the deviation after biomechanical preparation of the coronal, middle, and apical thirds of root canals instrumented with three Hero rotary systems. *Journal of Endodontics*. 2007; 33 (12), 1460-1463.
30. Tang G, Samaranayake LP, Yip H-K, Chu FC, Tsang PC, Cheung BP. Direct detection of *Actinomyces* spp. from infected root canals in a Chinese population: a study using PCR-based, oligonucleotide-DNA hybridization technique. *Journal of Dentistry*. 2003; 31 (8), 559-568.

31. Rôças IN, Siqueira JF, Santos KR. Association of Enterococcus faecalis with different forms of periradicular diseases. *Journal of Endodontics*. 2004; 30 (5), 315-320.
32. Chu FC, Tsang CP, Chow TW, Samaranayake LP. Identification of cultivable microorganisms from primary endodontic infections with exposed and unexposed pulp space. *Journal of Endodontics*. 2005; 31 (6), 424-429.
33. Sedgley C, Buck G, Appelbe O. Prevalence of Enterococcus faecalis at multiple oral sites in endodontic patients using culture and PCR. *Journal of Endodontics*. 2006; 32 (2), 104-109.
34. LeCorn DW, Vertucci FJ, Rojas MF, Progulske-Fox A, Bélanger M. In vitro activity of amoxicillin, clindamycin, doxycycline, metronidazole, and moxifloxacin against oral Actinomyces. *Journal of Endodontics*. 2007; 33 (5), 557-560.
35. Sundqvist G, Figdor D, Persson S, Sjögren U. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 1998; 85 (1), 86-93.
36. Molander A, Reit C, Dahmen G, Kvist T. Microbiological status of root-filled teeth with apical periodontitis. *International Endodontic Journal*. 1998; 31 (1), 1-7.
37. Hancock H, Sigurdsson A, Trope M, Moiseiwitsch J. Bacteria isolated after unsuccessful endodontic treatment in a North American population. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2001; 91 (5): 579-586.
38. Pinheiro E, Gomes B, Ferraz C, Teixeira F, Zaia A, Souza Filho F. Evaluation of root canal microorganisms isolated from teeth with endodontic failure and their antimicrobial susceptibility. *Oral Microbiology and Immunology*. 2003; 18 (2), 100-103.
39. Chandra SS, Miglani R, Srinivasan M, Indira R. Antifungal efficacy of 5.25% sodium hypochlorite, 2% chlorhexidine gluconate, and 17% EDTA with and without an antifungal agent. *Journal of Endodontics*. 2010; 36 (4): 675-678.
40. Rôças IN, Hülsmann M, Siqueira JF. Microorganisms in root canal-treated teeth from a German population. *Journal of Endodontics*. 2008; 34 (8): 926-931.
41. Waltimo T, Ørstavik D, Siren E, Haapasalo M. In vitro susceptibility of Candida albicans to four disinfectants and their combinations. *International Endodontic Journal*. 1999; 32 (6): 421-429.
42. Sunde PT, Olsen I, Debelian GJ, Tronstad L. Microbiota of periapical lesions refractory to endodontic therapy. *Journal of Endodontics*. 2002; 28 (4): 304-310.
43. Xia T, Baumgartner JC. Occurrence of Actinomyces in infections of endodontic origin. *Journal of Endodontics*. 2003; 29 (9): 549-552.
44. Ricucci D, Siqueira JF. Apical actinomycosis as a continuum of intraradicular and extraradicular infection: case report and critical review on its involvement with treatment failure. *Journal of Endodontics*. 2008; 34 (9): 1124-1129.
45. Nair P, Sjögren U, Schumacher E, Sundqvist G. Radicular cyst affecting a root-filled human tooth: a long-term post-treatment follow-up. *International Endodontic Journal*. 1993; 26 (4), 225-233.
46. Chandra A. Discuss the factors that affect the outcome of endodontic treatment. *Australian Endodontic Journal*. 2009; 35 (2), 98-107.
47. Imura N, Kato A, Hata GI, Uemura M, Toda T, Weine F. A comparison of the relative efficacies of four hand and rotary instrumentation techniques during endodontic retreatment. *International Endodontic Journal*. 2000; 33 (4), 361-366.
48. Friedman S, Stabholz A. Endodontic retreatment—case selection and technique. Part 1: criteria for case selection. *Journal of Endodontics*. 1986; 12 (1), 28-33.
49. Stabholz A, Walton RE (2018). Evaluating success and failure. *Principles and practice of endodontics* (2nd ed, pp.324-35). Philadelphia: WB Saunders.
50. Nair PR, Sjögren U, Krey G, Sundqvist G. Therapy-resistant foreign body giant cell granuloma at the periapex of a root-filled human tooth. *Journal of Endodontics*. 1990; 16 (12), 589-595.
51. Simon JH, Chimenti RA, Mintz GA. Clinical significance of the pulse granuloma. *Journal of Endodontics*. 1982; 8 (3), 116-119.

52. Koppang HS, Koppang R, Solheim T, Aarnes H, Stølen SØ. Cellulose fibers from endodontic paper points as an etiological factor in postendodontic periapical granulomas and cysts. *Journal of Endodontics*. 1989; 15 (8), 369-372.
53. Smith DE, Zarb GA. Criteria for success of osseointegrated endosseous implants. *The Journal of Prosthetic Dentistry*. 1989; 62 (5): 567-572.
54. Ørstavik D. Time-course and risk analyses of the development and healing of chronic apical periodontitis in man. *International Endodontic Journal*. 1996; 29 (3), 150-155.
55. Taintor J, Ingle J, Fahid A. Retreatment versus further treatment. *Clinical Preventive Dentistry*. 1982; 5 (5), 8-14.
56. Kvist T, Reit C, Esposito M, Mileman P, Bianchi S, Pettersson K, et al. Prescribing endodontic retreatment: towards a theory of dentist behaviour. *International Endodontic Journal*. 1994; 27 (6), 285-290.
57. Kvist T. Endodontic retreatment. *Swedish dental journal. Supplement*. 2001; 144, 1-57.
58. Friedman S. Prognosis of initial endodontic therapy. *Endodontic Topics*. 2002; 2 (1), 59-88.
59. Bender I, Seltzer S, Soltanoff W. Endodontic success—A reappraisal of criteria: Part I. *Oral Surgery, Oral Medicine, Oral Pathology*. 1966; 22 (6), 780-789.
60. Bender I, Seltzer S, Soltanoff W. Endodontic success—A reappraisal of criteria: Part II. *Oral Surgery, Oral Medicine, Oral Pathology*. 1966; 22 (6), 790-802.
61. Strindberg LZ. *The dependence of the results of pulp therapy on certain factors: an analytic study based on radiographic and clinical follow-up examinations*: Mauritzon; 1956.
62. Friedman S, Mor C. The success of endodontic therapy healing and functionality. *The Journal of the California Dental Association*. 2004; 32 (6), 493-503.
63. Gutmann J, Pitt Ford T. (1992). Problems in the assessment of success and failure. *Problems solving in endodontics* (2nd ed, pp. 1-11). St Louis: Mosby-Year Book. 1992:1-11.
64. Crump M. Differential diagnosis in endodontic failure. *Dental clinics of North America*. 1979; 23 (4), 617-635.
65. Friedman S. Considerations and concepts of case selection in the management of post-treatment endodontic disease (treatment failure). *Endodontic Topics*. 2002; 1 (1), 54-78.
66. Cantatore G, Berutti E, Castellucci A. Missed anatomy: frequency and clinical impact. *Endodontic Topics*. 2006; 15 (1), 3-31.
67. Lambrianidis T. Ledging and blockage of root canals during canal preparation: causes, recognition, prevention, management, and outcomes. *Endodontic Topics*. 2006; 15 (1), 56-74.
68. Schäfer E, Dammaschke T. Development and sequelae of canal transportation. *Endodontic Topics*. 2006; 15 (1), 75-90.
69. Clauder T, Shin SJ. Repair of perforations with MTA: clinical applications and mechanisms of action. *Endodontic Topics*. 2006; 15 (1), 32-55.
70. Cheung GS. Instrument fracture: mechanisms, removal of fragments, and clinical outcomes. *Endodontic Topics*. 2007; 16 (1), 1-26.
71. Aryanpour S, Van Nieuwenhuysen JP, D'Hoore W. Endodontic retreatment decisions: no consensus. *International Endodontic Journal*. 2000; 33 (3), 208-218.
72. Ruddell C, Cohen S, Burns R. (2002). *Pathways of the pulp* (pp. 231-291) St Louis, USA: Mosby.
73. Gutmann J, Dumsha T, Lovdahl P. Problem-solving challenges in the revision of previous root canal procedures. *Problem Solving in Endodontics: Prevention, Identification and Management* (4th ed, pp. 239-279). St Louis: Elsevier Mosby.
74. Stuart CH, Schwartz SA, Beeson TJ, Owatz CB. Enterococcus faecalis: its role in root canal treatment failure and current concepts in retreatment. *Journal of Endodontics*. 2006; 32 (2), 93-98.
75. Kvist T, Molander A, Dahlén G, Reit C. Microbiological evaluation of one-and two-visit endodontic treatment of teeth with apical periodontitis: a randomized, clinical trial. *Journal of Endodontics*. 2004; 30 (8), 572-576.
76. Möller A. Microbiological examination of root canals and periapical tissues of human teeth. Methodological studies. *Odontologisk Tidskrift*. 1966; 74 (5), Suppl: 1.

77. Gilmore MS. The enterococci: pathogenesis, molecular biology, and antibiotic resistance: *Zondervan*. 2002.
78. Koch S, Hufnagel M, Theilacker C, Huebner J. Enterococcal infections: host response, therapeutic, and prophylactic possibilities. *Vaccine*. 2004; 22 (7), 822-830.
79. Tendolkar P, Baghdayan A, Shankar N. Pathogenic enterococci: new developments in the 21st century. *Cellular and Molecular Life Sciences*. 2003; 60 (12), 2622-2636.
80. Siqueira JF, Rôças IN, De Uzeda M, Colombo AP, Santos KR. Comparison of 16S rDNA-based PCR and checkerboard DNA-DNA hybridisation for detection of selected endodontic pathogens. *Journal of Medical Microbiology*. 2002; 51 (12), 1090-1096.
81. Tanrıverdi F, Esener T, Erganis O, Belli S. An in vitro test model for investigation of disinfection of dentinal tubules infected with *Enterococcus faecalis*. *Brazilian Dental Journal*. 1997; 8 (2), 67-72.
82. Siqueira JF, Rôças IN, Souto R, de Uzeda M, Colombo AP. Actinomyces species, streptococci, and *Enterococcus faecalis* in primary root canal infections. *Journal of Endodontics*. 2002; 28 (3), 168-172.
83. Stewart PS. Theoretical aspects of antibiotic diffusion into microbial biofilms. *Antimicrobial Agents and Chemotherapy*. 1996; 40 (11), 2517-2522.
84. Costerton JW, Stewart PS, Greenberg EP. Bacterial biofilms: a common cause of persistent infections. *Science*. 1999; 284 (5418), 1318-1322.
85. Donlan RM, Costerton JW. Biofilms: survival mechanisms of clinically relevant microorganisms. *Clinical Microbiology Reviews*. 2002; 15 (2), 167-193.
86. Negm MM. Biologic evaluation of SPAD: II. A clinical comparison of Traitement SPAD with the conventional root canal filling technique. *Oral Surgery, Oral Medicine, Oral Pathology*. 1987; 63 (4), 487-493.
87. Gound TG, Marx D, Schwandt NA. Incidence of flare-ups and evaluation of quality after retreatment of resorcinol-formaldehyde resin ("Russian Red Cement") endodontic therapy. *Journal of Endodontics*. 2003; 29 (10), 624-626.
88. Schwandt NW, Gound TG. Resorcinol-formaldehyde resin "Russian Red" endodontic therapy. *Journal of Endodontics*. 2003; 29 (7), 435-437.
89. Vranas RN, Hartwell GR, Moon PC. The effect of endodontic solutions on resorcinol-formalin paste. *Journal of Endodontics*. 2003; 29 (1), 69-72.
90. Döner DRFN-T, Yöntemlerinin A. Eğri Köklerde Kanal Tedavisi Tekrarı Etkinliklerinin İncelenmesi. Endodonti Anabilim Dalı İstanbul Üniversitesi, *Sağlık Bilimleri Enstitüsü*. 2007.
91. Lee FS, Van Cura JE, BeGole E. A comparison of root surface temperatures using different obturation heat sources. *Journal of Endodontics*. 1998; 24 (9), 617-620.
92. Saunders E. In vivo findings associated with heat generation during thermomechanical compaction of gutta-percha. Part II. Histological response to temperature elevation on the external surface of the root. *International Endodontic Journal*. 1990; 23 (5), 268-274.
93. Lipski M, Woźniak K. In vitro infrared thermographic assessment of root surface temperature rises during thermafil retreatment using system B. *Journal of Endodontics*. 2003; 29 (6), 413-415.
94. Friedman S, Moshonov J, Trope M. Residue of gutta-percha and a glass ionomer cement sealer following root canal retreatment. *International Endodontic Journal*. 1993; 26 (3), 169-172.
95. de Mello JE, Cunha RS, da Silveira Bueno CE, Zuolo ML. Retreatment efficacy of gutta-percha removal using a clinical microscope and ultrasonic instruments: part I—an ex vivo study. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2009; 108 (1), 59-62.
96. Krell KV, Neo J. The use of ultrasonic endodontic instrumentation in the re-treatment of a paste-filled endodontic tooth. *Oral Surgery, Oral Medicine, Oral Pathology*. 1985; 60 (1), 100-102.
97. Jeng H-W, ElDeeb ME. Removal of hard paste fillings from the root canal by ultrasonic instrumentation. *Journal of Endodontics*. 1987; 13 (6), 295-298.

98. Boutsioukis C, Noula G, Lambrianidis T. Ex vivo study of the efficiency of two techniques for the removal of mineral trioxide aggregate used as a root canal filling material. *Journal of Endodontics*. 2008; 34 (10), 1239-1242.
99. Wilcox LR. Endodontic retreatment: ultrasonics and chloroform as the final step in reinstrumentation. *Journal of Endodontics*. 1989; 15 (3), 125-128.
100. Ladley RW, Campbell AD, Hicks ML, Li S-H. Effectiveness of halothane used with ultrasonic or hand instrumentation to remove gutta-percha from the root canal. *Journal of Endodontics*. 1991; 17 (5), 221-224.
101. Wennberg A, Ørstavik D. Evaluation of alternatives to chloroform in endodontic practice. *Dental Traumatology*. 1989; 5 (5), 234-237.
102. Zakariasen K, Brayton S, Collinson D. Efficient and effective root canal retreatment without chloroform. *Journal of the Canadian Dental Association*. 1990; 56 (6): 509-512.
103. de Oliveira DP, Barbizam JVB, Trope M, Teixeira FB. Comparison between gutta-percha and resilon removal using two different techniques in endodontic retreatment. *Journal of Endodontics*. 2006; 32 (4), 362-364.
104. McDonald MN, Vire DE. Chloroform in the endodontic operatory. *Journal of Endodontics*. 1992; 18 (6), 301-303.
105. Vajrabhaya L-o, Suwannawong SK, Kamolroongwarakul R, Pewklieng L. Cytotoxicity evaluation of gutta-percha solvents: Chloroform and GP-Solvent (limonene). *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2004; 98 (6), 756-759.
106. Barbosa SV, Burkard DH, Spångberg LS. Cytotoxic effects of gutta-percha solvents. *Journal of Endodontics*. 1994; 20 (1), 6-8.
107. Kaplowitz GJ. Evaluation of gutta-percha solvents. *Journal of Endodontics*. 1990; 16 (11), 539-540.
108. Wourms DJ, Campbell AD, Hicks ML, Pelleu GB. Alternative solvents to chloroform for gutta-percha removal. *Journal of Endodontics*. 1990; 16 (5), 224-226.
109. Hunter KR, Doblecki W, Pelleu GB. Halothane and eucalyptol as alternatives to chloroform for softening gutta-percha. *Journal of Endodontics*. 1991; 17 (7): 310-312.
110. Uemura M, Hata G-i, Toda T, Weine FS. Effectiveness of eucalyptol and d-limonene as gutta-percha solvents. *Journal of Endodontics*. 1997; 23 (12): 739-741.
111. Hülsmann M, Bluhm V. Efficacy, cleaning ability and safety of different rotary NiTi instruments in root canal retreatment. *International Endodontic Journal*. 2004; 37 (7): 468-476.
112. Hansen MG. Relative efficiency of solvents used in endodontics. *Journal of Endodontics*. 1998; 24 (1), 38-40.
113. Kaplowitz GJ. Using rectified turpentine oil in endodontic retreatment. *Journal of Endodontics*. 1996; 22 (11), 621.
114. Keçeci D, Çelik D. Endodontide Akut Alevlenmeler (Flare-up). *Acta Odontologica Turcica*. 2004; 21 (1), 61.
115. Whitworth J. Methods of filling root canals: principles and practices. *Endodontic Topics*. 200; 12 (1), 2-24.
116. Brady JM, Carlos E. Corrosion of endodontic silver cones in humans: a scanning electron microscope and X-ray microprobe study. *Journal of Endodontics*. 1975; 1 (6), 205-210.
117. Goldberg F. Relation between corroded silver points and endodontic failures. *Journal of Endodontics*. 1981; 7 (5): 224-227.
118. Whitworth J, Boursin E. Dissolution of root canal sealer cements in volatile solvents. *International Endodontic Journal*. 2000; 33 (1), 19-24.
119. Nagai O, Tani N, Kayaba Y, Kodama S, Osada T. Ultrasonic removal of broken instruments in root canals. *International Endodontic Journal*. 1986; 19 (6), 298-304.
120. Spriggs K, Gentleman B, Messer HH. Evaluation of a new method for silver point removal. *Journal of Endodontics*. 1990; 16 (7), 335-338.
121. Gentleman BH, Spriggs KA, ElDeeb ME, Messer HH. Removal of canal obstructions with the Endo Extractor. *Journal of Endodontics*. 1991; 17 (12), 608-611.

122. Hülsmann M. The retrieval of silver cones using different techniques. *International Endodontic Journal*. 1990; 23 (6), 298-303.
123. Matthews JD. Pink teeth resulting from Russian endodontic therapy. *The Journal of the American Dental Association*. 2000; 131 (11): 1598-1599.
124. Chong B, Pitt Ford T, Hudson M. A prospective clinical study of Mineral Trioxide Aggregate and IRM when used as root-end filling materials in endodontic surgery. *International Endodontic Journal*. 2003; 36 (8), 520-526.
125. Main C, Mirzayan N, Shabahang S, Torabinejad M. Repair of root perforations using mineral trioxide aggregate: a long-term study. *Journal of Endodontics*. 2004; 30 (2), 80-83.
126. Nair P, Duncan H, Pitt Ford T, Luder H. Histological, ultrastructural and quantitative investigations on the response of healthy human pulps to experimental capping with mineral trioxide aggregate: a randomized controlled trial. *International Endodontic Journal*. 2008; 41 (2), 128-150.
127. Torabinejad M, Watson T, Ford TP. Sealing ability of a mineral trioxide aggregate when used as a root end filling material. *Journal of Endodontics*. 1993; 19 (12), 591-595.
128. Machtou P, Sarfati P, Cohen AG. Post removal prior to retreatment. *Journal of Endodontics*. 1989; 15 (11): 552-554.
129. Masserann J. The extraction of instruments broken in the radicular canal: a new technique. *Acta Odont Stomatol*. 1959; 47, 265-274.