

Three-Year Clinical and Radiographic Healing Following Nonsurgical Root Canal Treatment of a Maxillary Lateral Incisor with Symptomatic Apical Periodontitis: A Case Report

Abstract

Apical periodontitis is an inflammatory disease of periapical tissues caused by microbial infection of the root canal system and represents one of the most common indications for root canal treatment. Contemporary irrigation activation and obturation protocols have been introduced to enhance root canal disinfection and improve treatment outcomes. This report describes the clinical management and long-term outcome of a maxillary lateral incisor with symptomatic apical periodontitis. This case report demonstrates successful long-term healing of symptomatic apical periodontitis following contemporary nonsurgical root canal treatment.

Key words:-

Apical periodontitis; Endodontics; Intracanal heating; Root canal treatment; Treatment outcome; Ultrasonic irrigation

Introduction:-

Apical periodontitis is an inflammatory disorder of the periapical tissues caused by microorganisms colonizing the root canal system and their by-products. The primary objective of root canal treatment is to eliminate or substantially reduce the intracanal microbial burden while preventing reinfection through adequate sealing of the root canal system, thereby allowing healing of the periapical tissues [1].

Although contemporary nickel–titanium instruments have considerably improved the efficiency and predictability of root canal preparation, mechanical instrumentation alone cannot completely debride the complex internal anatomy of the root canal system. Anatomical irregularities, fins, lateral canals, and dentinal tubules frequently remain inaccessible to endodontic instruments, emphasizing the essential role of chemical disinfection [2].

Sodium hypochlorite remains the irrigant of choice because of its antimicrobial activity and ability to dissolve organic tissue [3]. However, conventional syringe irrigation has limited effectiveness in delivering fresh irrigant throughout the entire root canal system. Consequently, several irrigation activation techniques have been proposed to improve irrigant penetration and chemical efficacy. Among these, intracanal heating followed by ultrasonic activation of sodium hypochlorite (IHAN) has been proposed as a contemporary approach to enhance root canal disinfection [4].

Following effective cleaning and disinfection, long-term treatment success depends on achieving a well-adapted three-dimensional root canal filling. The Hot Modified Technique combines thermoplasticized gutta-percha with a bioceramic sealer and has been proposed as a contemporary root canal obturation protocol capable of improving adaptation of filling materials to the prepared root canal system [5].

Long-term clinical and radiographic follow-up remains the most reliable method of evaluating endodontic treatment outcomes. This case report presents the management of a maxillary lateral incisor diagnosed with symptomatic apical periodontitis using contemporary irrigation activation and obturation protocols and documents complete healing after three years of follow-up.

Case Presentation:-

Patient Information

A 55-year-old patient, presenting with pain associated with the maxillary lateral incisor. The patient's medical history was non-contributory and revealed no contraindications to endodontic treatment. Written informed consent was obtained before treatment and publication of this case report.

Clinical Examination and Diagnosis

Clinical examination revealed tenderness to vertical percussion and tenderness to palpation of the soft tissues overlying the periapical region of the maxillary lateral incisor. The tooth responded negatively to pulp vitality testing. Periodontal probing depths were within physiological limits, and no abnormal mobility or root fracture was

50 detected. Periapical radiographic examination demonstrated a well-defined periapical radiolucency associated with
51 the maxillary lateral incisor (**Figure 1**).
52



53 **Figure 1.** Preoperative clinical and radiographic examination demonstrating symptomatic apical periodontitis
54 associated with the maxillary lateral incisor.
55
56

57 The diagnosis was established as:

58 **Pulpal diagnosis:** Necrotic pulp.

59 **Apical diagnosis:** Symptomatic apical periodontitis.

60 Conventional nonsurgical root canal treatment was selected.
61

62 *First Visit*

63 After administration of local anesthesia, the tooth was isolated under rubber dam. Access cavity preparation was
64 performed using a high-speed handpiece and a round diamond bur under water cooling. Initial canal negotiation was
65 performed using K-files 10/.02 (MANI Inc., Tochigi, Japan). Working length was established at the anatomical
66 apical foramen using an electronic apex locator Propex Pixi (Dentsply Maillefer, Ballaigues, Switzerland). A glide
67 path was established using a size 10/.02 K-file. Chemomechanical preparation was then completed using the
68 ProTaper Ultimate system (Slider, Shaper, F1, F2, F3, and Finisher X) (Dentsply Maillefer, Ballaigues,
69 Switzerland) operated with a VDW Gold (VDW GmbH, Munich, Germany) endodontic motor at 400 rpm and 4
70 N·cm torque. Throughout instrumentation, the canal was irrigated with 5.25% sodium hypochlorite. Following
71 mechanical preparation, 17% EDTA was activated ultrasonically using the UltraSmart AI device (COXO Medical
72 Instrument Co., Ltd., Foshan, China). Final irrigation was subsequently performed according to the intracanal
73 heating and ultrasonic activation of sodium hypochlorite (IHAN). Sodium hypochlorite was heated intracanal to
74 180°C for 5 seconds with the heat carrier positioned approximately 5 mm short of the working length and
75 subsequently activated ultrasonically for 20 seconds. This sequence was repeated three times. Following final
76 irrigation with distilled water, the canal was dried and calcium hydroxide was placed. The access cavity was
77 temporarily restored.
78

Second Visit

Two weeks later, the patient returned completely asymptomatic.

Following rubber dam isolation, the temporary restoration and calcium hydroxide dressing were removed. Canal irrigation was repeated using ultrasonically activated 17% EDTA, followed by three additional IHAN cycles using 5.25% sodium hypochlorite. Final irrigation with distilled water was performed before drying the canal.

Obturation was completed using the Hot Modified Technique. A master gutta-percha cone with tug-back approximately 0.5 mm short of the working length was fitted. The canal was filled with Ceraseal bioceramic sealer (Meta Biomed Co., Ltd., Cheongju, Republic of Korea). Down-packing was performed using Fast Pack PRO (Eighteenth Medical Technology Co., Ltd., Changzhou, China) at 150°C, terminating approximately 6 mm short of the working length, followed by backfilling with Fast Fill (Eighteenth Medical Technology Co., Ltd., Changzhou, China). The postoperative radiograph demonstrated satisfactory obturation of the root canal with extrusion of obturation material beyond the apical foramen (**Figure 2**).



Figure 2. Immediate postoperative radiograph after root canal obturation.

Following obturation, post-space preparation was performed while preserving the apical seal, and a cast metal post and core was cemented before referral for definitive coronal rehabilitation.

Follow-up

Clinical and radiographic examinations were performed after one year and four months and again after three years. The tooth remained functional and asymptomatic throughout the observation period. At one year and four months, radiographic examination demonstrated substantial reduction of the periapical radiolucency (**Figure 3**).



Figure 3. One-year and four-month follow-up demonstrating marked reduction of the periapical radiolucency.

Three years after treatment, complete radiographic healing was observed with re-establishment of the periodontal ligament space and lamina dura despite minor extrusion of obturation material beyond the apex (**Figure 4**).



Figure 4. Three-year follow-up demonstrating complete radiographic healing of the periapical lesion with re-establishment of normal periapical structures.

Discussion:-

Apical periodontitis is an inflammatory disease caused by microbial infection of the root canal system and represents the principal indication for root canal treatment [6]. The primary objective of treatment is the elimination or substantial reduction of intracanal microorganisms while preventing reinfection, thereby creating conditions that allow healing of the periapical tissues [7]. In the present case, complete clinical and radiographic healing was observed after three years, supporting the effectiveness of conventional nonsurgical root canal treatment when meticulous treatment protocols are followed.

Mechanical instrumentation is essential for removing infected dentin and facilitating irrigant penetration; however, it is well established that endodontic instruments contact only part of the root canal walls because of anatomical irregularities that remain untouched after preparation. Consequently, irrigation plays a critical role in eliminating microorganisms and organic tissue remnants from areas inaccessible to mechanical instrumentation.

Sodium hypochlorite remains the irrigant of choice because of its broad antimicrobial activity and its unique ability to dissolve organic tissue. In the present case, irrigation was enhanced using intracanal heating and ultrasonic activation of sodium hypochlorite (IHAN) [4]. Previous studies have shown that intracanal heating increases the tissue-dissolving capacity and antimicrobial effectiveness of sodium hypochlorite, whereas ultrasonic activation enhances irrigant exchange through acoustic streaming. Although the present report cannot determine the independent contribution of this protocol to the treatment outcome, enhanced irrigant activation represents a contemporary adjunct intended to optimize chemical disinfection.

Calcium hydroxide was used as an intracanal medicament between appointments because of its prolonged antimicrobial action and its widespread use in cases presenting with apical periodontitis [8]. Resolution of clinical symptoms before the second appointment suggested favorable control of the intracanal infection and supported completion of root canal obturation.

Obturation was performed using the Hot Modified Technique in combination with a premixed bioceramic sealer [5]. Contemporary thermoplasticized obturation techniques aim to improve adaptation of gutta-percha to the prepared canal system while bioceramic sealers provide favorable sealing properties and biocompatibility [9]. In the present case, minor extrusion of obturation material beyond the apical foramen was observed on the postoperative radiograph. Nevertheless, complete radiographic healing occurred during the follow-up period, suggesting that limited extrusion did not adversely affect the treatment outcome. This observation is consistent with previous reports indicating that long-term healing primarily depends on adequate elimination of intracanal infection rather than the radiographic extent of obturation material beyond the apex [10].

An important strength of the present report is the long-term follow-up. While the one-year and four-month radiograph demonstrated marked reduction of the periapical lesion, complete radiographic healing was evident after three years with re-establishment of the periodontal ligament space and lamina dura. Long-term observation is essential because healing of apical periodontitis is a dynamic biological process that may continue for several years following successful root canal treatment [10].

The principal limitation of this report is that it describes a single clinical case. Consequently, no conclusions can be drawn regarding the superiority of any individual irrigation activation or obturation technique. Instead, the favorable outcome should be interpreted as the result of careful diagnosis, meticulous chemomechanical preparation, effective irrigation, appropriate intracanal medication, and adequate three-dimensional obturation. Additional prospective clinical studies are required to determine the individual contribution of contemporary irrigation activation protocols to treatment success.

Clinical Significance:-

This case demonstrates that conventional nonsurgical root canal treatment performed according to contemporary endodontic principles can achieve complete long-term healing of symptomatic apical periodontitis while preserving the natural tooth. Contemporary irrigation activation and obturation protocols may serve as valuable adjuncts to conventional treatment and contribute to predictable clinical and radiographic outcomes when meticulous treatment procedures are followed.

Conclusion:-

Within the limitations of a single clinical case, nonsurgical root canal treatment successfully resolved symptomatic apical periodontitis and resulted in complete clinical and radiographic healing after three years of follow-up. The treatment protocol combined thorough chemomechanical preparation with enhanced irrigation using intracanal heating and ultrasonic activation of sodium hypochlorite, calcium hydroxide intracanal medication, and obturation using the Hot Modified Technique. Although the individual contribution of each treatment step cannot be determined, this case demonstrates that contemporary endodontic procedures can provide favorable long-term outcomes and support preservation of teeth affected by apical periodontitis.

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