Six-month Healing of a Mandibular First Molar with Complex Anatomy Using a Novel Endodontic Procedure

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Abstract

Many a time, the endodontic treatment of a necrotic mandibular first molar with aberrant canal configuration can be diagnostically and technically challenging. This case report presents a mandibular first molar that was diagnosed with necrotic pulp and symptomatic apical periodontitis. The mesiobuccal and mesiolingual root canals of the subject tooth exhibited an intricate anatomy with inter-canal ramifications. The subject tooth was instrumented to a final size of #20/.07. The tooth was treated in a single-visit appointment using the GentleWave® System (Sonendo, Laguna Hills, CA). The canals were obturated utilizing a warm vertical technique with gutta percha and AH Plus. The patient reported no post-operative pain. Radiographs revealed healing within 6-months after the GentleWave® Procedure. Non-instrumented areas and a lateral canal were also completely obturated after the GentleWave Procedure.

Keywords: Necrotic; Mandibular first molar; Periodontitis; Inter-canal communication; Healing; GentleWave;

Introduction

Endodontic success depends on adequately debriding and obturating the entire root canal system using chemo-mechanical techniques [1]. However, the complexity in the anatomy of the root canal system poses a challenge to the success of endodontic treatments [2]. Grossman et al. (1988) described mechanical cleaning as the most important step in root canal treatment to allow for treatment fluids to reach these otherwise inaccessible areas [3].

Eliminating microbial infection from the entire root canal system allows for healing of apical or radicular periodontitis [4]. In order to eradicate bacteria and remove tissue debris, current protocols rely on both mechanical and chemical methods of disinfection [5]. However, conventional and contemporary chemo-mechanical methods leave persistent biofilm in the root canal system [5]. The remaining biofilm is the reason for endodontic failure as these microbes can be entombed in inter-canal communications and ramifications such as lateral fins, apical deltas, and isthmi [4-6].

Recently, a novel endodontic procedure using the

GentleWave® System (Sonendo®, Laguna Hills, CA) was launched into the market. The GentleWave System delivers procedure fluids to root canals by utilizing a combination of acoustics and advanced fluid mechanics [7-10]. The purpose of this clinical report is to demonstrate the healing of a mandibular first molar with complex anatomy using the GentleWave System.

Case Report

A 36-year-old male was referred for evaluation to a private endodontic clinic. The patient had a chief complaint of spontaneous pain on the left side of the mouth. No temperature sensitivity was reported by the patient. His medical history was normal and was not contradictory to any dental procedure. The patient had been taking ibuprofen (200 mg PRN three times a day) for a month.

Initial radiographic examination showed that the left mandibular first molar - tooth #19 - had a large filling on the occlusal and distal aspects of the tooth. Radiolucency was seen around both roots of the subject tooth with a larger lesion on the mesial root. Clinical examination revealed a fracture line on the distobuccal cusp. The subject tooth exhibited mild pain response to both palpation and percussion as well as class I mobility. The response of the subject tooth to cold thermal pulp vitality test was negative. After clinical and radiographic examinations, the subject tooth was diagnosed as necrotic pulp with symptomatic apical periodontitis. The clinical condition was explained to the patient and endodontic procedure was proposed and accepted.

The GentleWave® Procedure

Standard anesthesia (2% Lidocaine with 1:100,000 epinephrine) was administered. The subject tooth was isolated using a dental dam. Caries and existing restoration were removed. Using a dental operating microscope (Leica M320, Leica, Wetzlar, Germany) the tooth was conservatively accessed, and clinical examination revealed three distinct orifices, two located mesially and one distally. Pulp stones were observed and removed. Patency was confirmed with #10 and #15 K-type files (MANI K-files, Utsunomiya, Japan) and the working length was estimated using an electronic apex locator (SybronEndo,

Redmond, WA). The working length was defined as 1 mm from the apical foramen and was confirmed via radiographic analysis.

The subject tooth was instrumented with the use of hand files up to size ISO #20 and rotary files ProTaper® S1 and F1 (Dentsply, Tulsa Dental Specialties, Tulsa, OK). Irrigation with sterile water was used between each instrument to prevent the buildup of debris. Orifice openers were not utilized to conserve dentinal structure within the coronal third. The tooth was prepped for the GentleWave Procedure followed by placement of the GentleWave Procedure Instrument onto the coronal surface of the tooth with entry into the endodontic access of the subject tooth. The GentleWave Procedure was then performed [8-10]. Canals were subsequently dried with absorbent paper points. The dried canals were obturated using a warm vertical technique with fine-medium feather tip cones (Maillefer, Dentsply, Ballaigues, Switzerland) or with F1 ProTaper® gutta percha cones and AH Plus® sealer (Dentsply, Tulsa Dental Specialties, Tulsa, OK). The pulp chamber floor was sealed with resin based filling material and the tooth restored with Cavit™ (3M Deutschland GmbH). The patient was sent to the referring general dentist for final restoration. The patient did not report any post-operative pain or discomfort and was not prescribed any new analgesics. Recalls were scheduled at 3-months, 6-months, 9-months, 12-months, and 18-months post-GentleWave Procedure.

Results

Figure 1 shows the initial radiographs pre- and post-GentleWave Procedure. As shown in the figure, the mandibular first molar has a complex root canal system with at least two visible inter-canal isthmi and a lateral canal.

At the 3-month recall, the radiograph shows evidence of healing with a reduction in the size of the periradicular lesion. At the 6-month recall, radiographs revealed complete healing of apical periodontitis. The time-lapse radiographs of healing up to 18 months after the GentleWave Procedure are shown in Figure 2.

Discussion

Mandibular first molars are frequently indicated for endodontic treatments [9]. Chourasia et al. (2015) demonstrated that the mandibular first molars usually have a mesial root that exhibits diverse complex anatomies where as their distal root is frequently one independent canal [11]. The present case study was performed on a mandibular first molar with a mesial root with intricate root canal anatomy- whereas the distal root has a single independent canal.

Further, Peiris et al. (2008) showed that the incidence of isthmi in the mesial root of the mandibular first molar are 30% [12]. These frequently occurring isthmi and inter-canal communications necessitate the efficient cleaning of these inaccessible areas. Failure to access, debride, and disinfect such complex anatomy might directly affect the healing time and the subsequent treatment success. Alternatively, clinicians resort to a multiple-visit endodontic treatment by incorporating an

inter-appointment anti-bacterial medication such as calcium hydroxide in an attempt to disinfect such complex anatomical regions [13]. However, multiple visit treatments have been shown to be inconvenient to both the patient and the clinician [14]. The present case study was treated with the GentleWave System in a single visit. As shown in Figure 1, a complex root canal system with at least two visible inter-canal isthmi and a lateral canal that were not initially instrumented was evident after the GentleWave Procedure.

Ng et al. (2007) performed a random-effects meta-analysis that revealed low healing rates at six months [15]. On the contrary, in the present case study, healing of the subject tooth was shown to begin within three-months after GentleWave Procedure.

Molina et al. (2015) showed that the GentleWave System efficiently cleans isthmi and apical thirds [8]. The present case study exhibits the cleaning efficiency of the GentleWave System. Three-month radiographs following the GentleWave Procedure indicates a reduction of radiolucency in the periradicular region whereas 6-month radiographs following the GentleWave Procedure demonstrate the absence of this radiolucency in periradicular region.

Sigurdsson et al. (2016), in a multi-center and prospective study, showed that the healing rates of molars that were treated with the GentleWave System were 97.4% and 97.3% at a 6-month and 12-month follow-up, respectively [9-10].

Figure 1: The figure shows the radiographs (A) pre- and (B) post-GentleWave Procedure.

Figure 2: The figure shows the radiographs (A) 3-months, (B) 6-months, (C) 12-months, and (D) 18-months after the GentleWave Procedure.

Charara et al. (2015) showed that the GentleWave System resulted in a negative pressure at the apex and demonstrated zero extrusion in the periapical area [16]. Post-operative pain is usually associated with positive pressure and extrusion [9-10, 17]. In the present case study, the use of the GentleWave System resulted in no post-operative pain for the patient. Further, Sigurdsson et al. (2016), in the multi-center and prospective study, reported that 3.8% of the patients experienced only moderate post-operative pain within 2-days and there was no incidence of pain at 14-days, 6-months and 12-months post therapy with the GentleWave System [9-10].

In summary, in the present case study, the left mandibular first molar with intricate canal anatomy was minimally instrumented and the GentleWave System was utilized for cleaning and disinfection of the complex root canal system in a single-visit appointment. Complete healing of the periradicular lesion was observed within the first six months after the GentleWave Procedure.

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