

CASE REPORT

Maxillary molar healing after treatment of an uninstrumented canal with a novel root canal procedure: a case report

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Introduction

Due to the limitations of standard root canal therapy, clinicians often strive for a balance between effective cleaning, shaping, and disinfection and that of preserving natural tooth structure [1–6]. It has been reported that maintenance of the natural canal anatomy and lack of any aberrations is associated with both preservation of tooth structure and clinical success rate [7]. Yet, studies have shown instrumentation to at least size #35 allows for greater effectiveness of irrigation within the apical third and that greater cleaning and disinfection is achieved with larger apical preparations and increased root canal tapers [8–11].

A recent advance in endodontic technology, the GentleWave[®] Procedure (Sonendo[®], Laguna Hills, CA), offers clinicians the ability to clean areas of the root canal system often untouched or undetected by standard techniques. The GentleWave Procedure utilizes Multisonic Ultracleaning[®] technology, in which advanced fluid dynamics, acoustics, and tissue dissolution chemistry are applied to remove tissue and debris from the entire root

Key Clinical Message

A major cause for endodontic failure is the inability to treat all anatomy. Studies report endodontic retreatments contain 42% missed canals. This case illustrates dentin preservation of a molar with an uninstrumented mesiobuccal-3 canal revealed post-GentleWave Procedure. Efficient cleaning and disinfection with maintained healing to 18 months is demonstrated.

Keywords

GentleWave Procedure, Multisonic Ultracleaning, periapical healing, uninstrumented canal.

canal system simultaneously [12–14]. Haapasalo et al. showed seven times faster tissue dissolution with the GentleWave System than standard modalities of treatment [15]. Additional studies have provided evidence of superior debris, smear layer, and bacteria removal following treatment with the GentleWave Procedure as compared to standard endodontic therapy [14, 16, 17]. Sodium hypochlorite penetration in the apical third was four times more effective with the GentleWave System than active ultrasonic activation, yet the system has been shown to cause minimal dentin erosion [12, 14]. In addition, the GentleWave System has been reported to be effective in removing separated hand files from the apical (61%) and middle (83%) thirds of molar root canal systems without the need for increased dentin removal [18]. Clinical studies evaluating the GentleWave Procedure provide promising results at 6- and 12-month follow-up with a 97% success rate [19, 20]. This case report describes a maxillary molar with periapical lesion treated with the GentleWave Procedure in an attempt to preserve the natural anatomy of the tooth while efficiently cleaning and disinfecting the root canal anatomy.

Institutional review board approval and informed consent was performed in accordance with all applicable laws and regulations including the Declaration of Helsinki prior to data collection.

Case History

A 38-year-old female with a noncontributory medical history presented to the clinic with a chief complaint of cold sensitivity and lingering pain. A large Cerec[®] crown (Sirona Dental, Charlotte, NC) restoration was found upon clinical examination of the right first maxillary molar (#3). Further examination exposed moderate sensitivity to percussion and no painful response to palpation. Vitality testing with Endo-Ice[®] (Coltene[®]/Whaledent, Cuyahoga Falls, OH) revealed an immediate and hypertensive response. Radiographic analysis showed a periapical lesion on the palatal canal and assessment via preoperative Periapical Index (PAI) Score concluded a score of 3 (Fig. 1A) [21]. Based on clinical and radiographic findings, the

diagnosis of irreversible pulpitis and symptomatic apical periodontitis (SAP) was made. Endodontic treatment was recommended and the patient consented for treatment.

Treatment

A standard anesthesia protocol was followed, and the tooth was isolated with a rubber dam. Utilizing a dental operating microscope, the tooth was conservatively accessed with removal of all pulp horns, ledges, and overhangs. Examination of the pulp chamber floor revealed four distinct canals: mesiobuccal, mesiobuccal-2, distobuccal, and palatal canals. Orifice openers were not utilized during the instrumentation process to preserve natural tooth structure. Patency was gained with K-type files size #15, and working lengths (WL) were measured using a Root ZX apex locator (J. Morita, Irvine, CA). Sodium hypochlorite (NaOCl) irrigation (0.5%) was employed for lubrication and to prevent microbial transfer to extraradicular tissue during shaping. Instrumentation up to ProTaper[®] F1

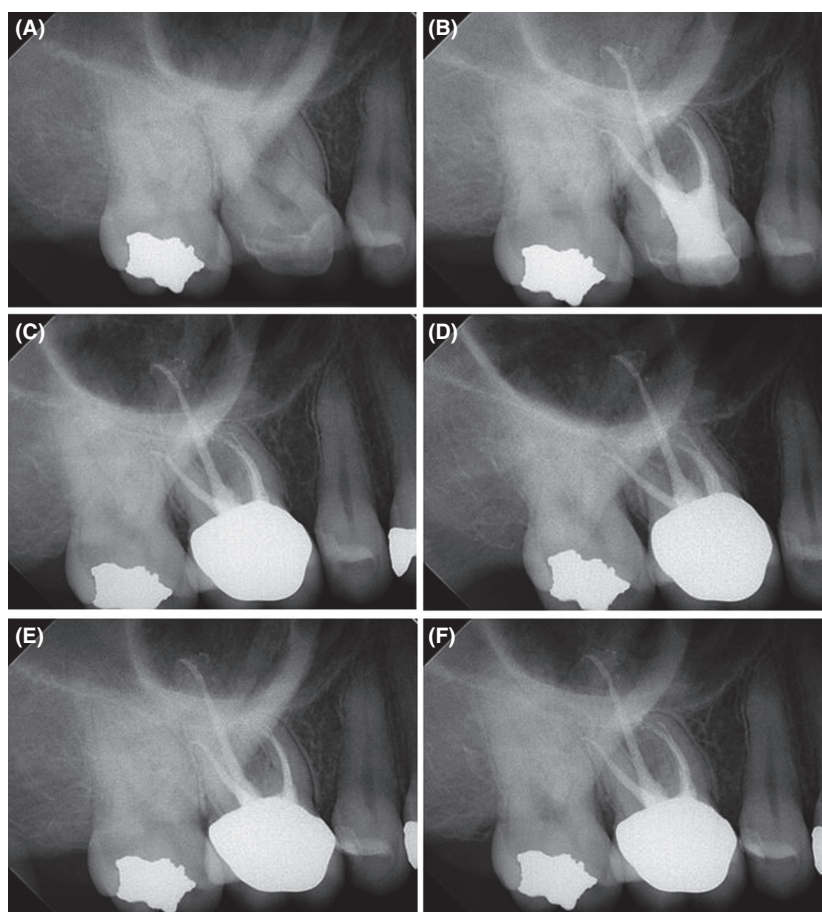


Figure 1. Radiographs (A) pre-GentleWave Procedure depicting periapical lesion on palatal root (B) post-GentleWave Procedure obturated root canal system with five distinct root canals (C) 3-month Post-GentleWave Procedure recall with healing periapical lesion (D) 6-month, (E) 12-month, and (F) 18-month Post-GentleWave Procedure recall with no evidence of periapical lesion.

(Dentsply, Tulsa Dental Specialties, Tulsa, OK) rotary file was performed to enable obturation of the root canal system post-GentleWave Procedure. The GentleWave Procedure only requires a fluid path for simultaneous cleaning and disinfection of all root canals. Following minimal instrumentation, debridement and disinfection were completed utilizing the GentleWave Procedure where distilled water, sodium hypochlorite, and ethylenediaminetetraacetic acid (EDTA) were delivered using Multisonic Ultracleaning technology. After the cleaning process, each canal was dried using sterile paper points. A warm vertical compaction technique employing gutta-percha and AH Plus[®] Sealer (Dentsply, Tulsa Dental Specialties, Tulsa, OK) were utilized during obturation. Postobturation, the mesiobuccal and mesiobuccal-2 canals were found to join within the apical third and a mesiobuccal-3 canal which was uninstrumented was filled. A coronal seal was placed, and the access cavity was sealed with a composite buildup. The patient was advised to return to the referring general dentist for crown placement.

Outcome and Follow-up

Figure 1A shows the subject tooth prior to treatment with the GentleWave Procedure in which a periapical lesion is present on the palatal root. At the time of clinical examination, the tooth was diagnosed with irreversible pulpitis and symptomatic apical periodontitis and showed a Periapical Index (PAI) Score of 3 [21]. A postoperative

radiograph is presented in Figure 1B. The mesiobuccal and mesiobuccal-2 canals, along with the identification of a mesiobuccal-3 canal not previously realized prior to instrumentation or the GentleWave Procedure, are also visualized upon radiographic examination.

At the 3-month recall, the patient was asymptomatic. Upon clinical and radiographic examination, there was no painful response to percussion or palpation, no presence of mobility, fractures, soft tissue lesions, or root resorption (Fig. 1C). The periapical lesion showed evidence of healing and the Periapical Index (PAI) Score was assessed as 1 [21]. On 6-month clinical and radiographic examination, the patient was asymptomatic with no evidence of periapical lesion (Fig. 1D). The tooth remained functional with no painful response to percussion or palpation and no evidence of mobility, furcation involvement, root resorption, or soft tissue lesions. At 12- and 18-month recall, radiographic assessment showed no signs of periapical lesion (Fig. 1E and F). The uninstrumented canal is also visible on CBCT imaging at the 12-month visit (Fig. 2A and B). The patient continued to report no signs of discomfort, and the tooth was assessed as clinically normal with no evidence of sensitivity to percussion or palpation, mobility, furcation involvement, or soft tissue lesions.

Before and after 12-month GentleWave Procedure, cone beam computed tomography (CBCT) images are shown in Figures 2–4. The proximity to the maxillary sinus as well as the complexity of the root canal anatomy are clearly visible.

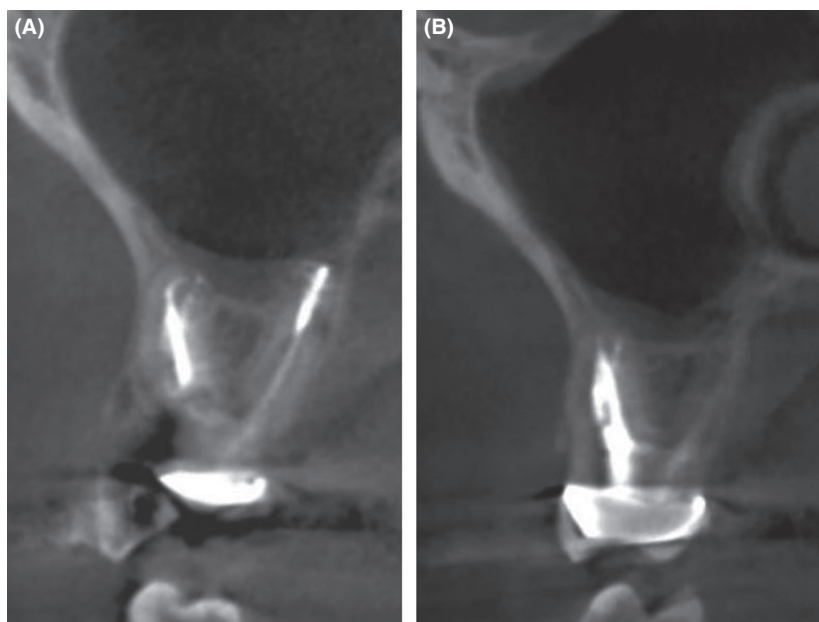


Figure 2. (A and B) 12-month post-GentleWave Procedure with visualization of uninstrumented MB-3 canal.

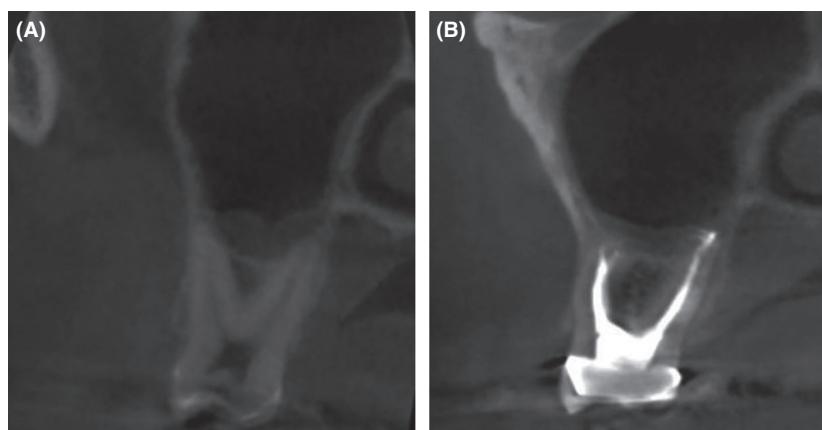


Figure 3. CBCT (A) before (B) and after 12-month GentleWave Procedure MB and DB roots.

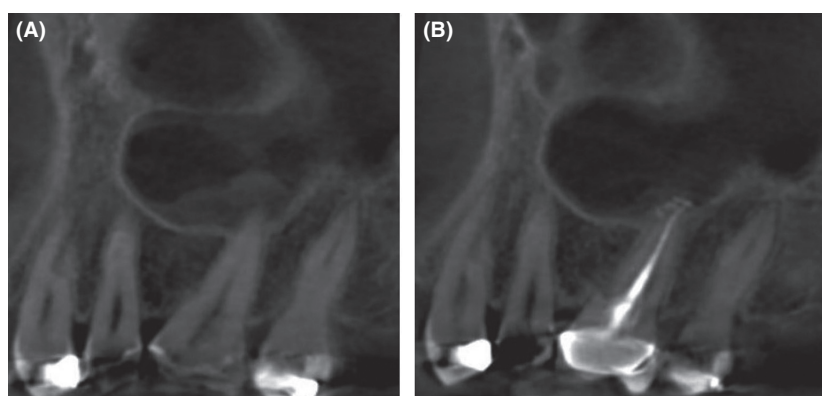


Figure 4. CBCT (A) before and (B) after 12-month GentleWave Procedure P Root.

The patient was advised to continue routine preventative dental care with their general dentist for continued comprehensive dental care.

Discussion

Healing of a periradicular lesion is known to be dependent on the absence or presence of microorganisms within the root canal system [22]. Endodontic failure, associated with lack of healing, is typically due to a bacterial infection which remains behind when a root canal system is unaffected by poorly instrumented or irrigated root canals [23]. With increased complexities of the root canal systems such as isthmi, lateral canals, fins and apical deltas, additional challenges to cleaning and shaping are introduced [4–28]. It has been reported that a major cause for endodontic failure is the inability to find and treat all root canal anatomy and canals [1, 2]. Missed canals, similar to this case with an uninstrumented canal cleaned with only the GentleWave Procedure, have been associated with up to 42% of endodontic retreatments

[3–5]. Whitterspoon et al. reported that 93% of all missed canals were identified in the mesiobuccal root [3]. This failure is most often associated with bacteria located far from the main canal such as dentinal tubules, lateral canals, and apical ramifications [23]. Therefore, it can be assumed that the intricacies of the root canal system can directly affect endodontic success [1, 29]. The GentleWave Procedure has demonstrated success at cleaning the apical third and deep within the dentinal tubules as seen in published results. Ma et al. demonstrated calcium hydroxide ($\text{Ca}[\text{OH}]^2$) removal in the apical third as 77.68% for the GentleWave Procedure as compared to 47.82% for convention irrigation with instrumentation [30]. In addition, studies comparing the GentleWave System to active ultrasonic irrigation showed approximately four times greater sodium hypochlorite penetration in the apical region [14].

Another reported effect of clinical success in endodontics is the maintenance of original canal shape and lack of any canal aberrations [7]. The main goal of root canal therapy is to remove pulp tissue, layers of infected

dentine and biofilms attached to the root canal surface; yet, this requires enlargement of root canals for mechanical instrumentation and access of irrigants [31]. Larger apical preparations and tapers have been related to improvement of disinfection and cleaning procedures [10, 11]. While this is the case for improved cleaning, apical enlargement is known to not only cause various complications including apical transportation, ledges, and instrument separation, but also results in removal of greater natural tooth structure, and can lead to root fractures [32]. Even still, after mechanical instrumentation, a large portion of the root canal system remains untouched, regardless of the system used for cleaning and shaping [33, 34]. Therefore, a more recent goal in endodontics is to use a cleaning system, such as the GentleWave Procedure, that includes irrigants with potent antimicrobial agents that dissolve organic tissues and disinfect the canals [35]. In this case, the GentleWave System was employed as it required only minimal instrumentation to provide a fluid and obturation path. The GentleWave System has shown evidence of superior cleaning as compared to standard root canal treatments, including sonic and ultrasonic devices, and has shown long-term success of 97% in a recent clinical study [14–20].

Although it would be speculative to make assumptions based on a single case of healing, the results suggest that the cleaning process is significant with the GentleWave Procedure. This may be explained by a number of factors, including the presence of less debris from the instrumentation needed with the GentleWave System and its ability to achieve a more rapid tissue dissolution rate and ultimately reduction in biobload [15, 17]. Further research is warranted to provide evidence for a larger population of apical periodontitis and uninstrumented canal healing.

In this case report, a maxillary molar presented with a mesiobuccal-3 canal that was not visualized upon radiographic analysis or during instrumentation. This maxillary molar was cleaned and disinfected during the GentleWave Procedure with no evidence of reinfection, clinical signs, or symptoms present at 18-month recall. This case report demonstrates the ability of the GentleWave Procedure to clean and disinfect maxillary molars with apical periodontitis and uninstrumented canals.

Authorship

EED: presenting author, clinical review, and writing. KTL: treating clinician, investigator, and clinician review and writing.

Conflict of Interest

Dr. Enrico E. DiVito is a consultant for Sonendo Inc.

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