

No Shaping Endodontic Treatment of a Mandibular Canine Utilizing the GentleWave Procedure: A Case Report

Randy W Garland DDS*

Garland Endodontics, Encinitas, California, USA

Abstract

Introduction: One of the main goals of root canal therapy is to remove pulp tissue, layers of infected dentin and biofilms attached to the root canal surface, yet this requires enlargement of root canals for mechanical instrumentation and access of irrigants. Reports indicate that larger size files and file tapers allow for increased penetration of irrigants albeit at the greater risk of complications including ledge formation, instrument separation, perforation, and root fracture.

Background: In this case report, a mandibular right cuspid presented with sensitivity to percussion and a deep coronal restoration.

Methods: The tooth was conservatively accessed and then patency and working length were established utilizing a size 10/.02 hand file. For preservation of tooth structure, maintenance of original canal anatomy, and to decrease the risk of complications normally seen in standard endodontics, a no shaping endodontic treatment utilizing the GentleWave® Procedure was performed. No shaping with endodontic files was performed. Only the GentleWave Procedure was employed to clean and disinfect the root canal system. The canal was obturated using a single cone technique with gutta-percha and BC Sealer™.

Results: Post-procedure radiographs of the non-shaped canal show no voids and a flush fill depicting a clinically significant obturation.

Discussion: This case report demonstrates the ability of the GentleWave Procedure to clean anterior teeth without the use of instrumentation for shaping thereby conserving the natural tooth structure and decreasing the chance of complications as seen in standard endodontic treatment.

Keywords: Uninstrumented canal; GentleWave Procedure; Multi-sonic Ultracleaning; No shaping; Anterior

Introduction

Due to limitations in standard endodontic therapy there have been great endeavors to effectively clean, shape and disinfect the root canal system while preserving the natural anatomy of the tooth [1]. Maintaining the natural canal anatomy and preservation of tooth structure has been correlated to higher clinical success rates [2-5]. A major issue in tooth preservation is the need to maximize cleaning and disinfection. One of the main goals of root canal therapy is to remove pulp tissue, layers of infected dentin and biofilms attached to the root canal surface. Yet this requires enlargement of root canals for mechanical instrumentation and access of irrigants [6,7]. Instrumentation to a minimum of size #35 with larger apical preparations and tapers has been reported as having greater irrigation effectiveness, cleaning and disinfection [3-5,8]. While this level of instrumentation may improve cleaning, it is reported to increase the chance of complications including apical transportation, ledge formation, instrument separation and root fractures [9]. Even still, after mechanical instrumentation, 50% to 65% of the root canal system may remain untouched, regardless of the system used for cleaning and shaping [5,7,10].

In a review of current research, it was shown that utilizing a novel endodontic system, the GentleWave® Procedure (Sonendo®, Laguna Hills, CA), may provide endodontics with a means for maximizing cleaning and disinfecting while preserving the natural anatomy of the tooth. The GentleWave Procedure utilizes Multisonic Ultracleaning™ technology, in which advanced fluid dynamics, acoustics, and tissue dissolution chemistry are applied to clean and disinfect the entire root canal system, even in areas that conventional endodontic treatment cannot reach [11-14]. Haapasalo et al. reported seven times faster tissue dissolution with the GentleWave System than standard root canal techniques, including the use of sonic and ultrasonic devices

[14]. 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 [12,15]. In addition, the GentleWave System has been reported to be effective in removing separated hand files from the apical and middle thirds of molar root canal systems without the need for increased dentin removal [16]. Clinical studies evaluating the GentleWave Procedure have demonstrated high success rates of 97% at 6 and 12-months post GentleWave Procedure [17,18]. In this case report, maximum conservation of tooth structure was employed on a mandibular canine utilizing a no shaping endodontic treatment with the GentleWave Procedure.

History

A 57-year-old male presented for root canal therapy evaluation. Previous azithromycin prescription was taken one month prior. The patient's medical history was non-contributory.

Diagnosis

Upon clinical examination of the subject tooth, the mandibular right cuspid (#27), was found to have a deep existing composite filling

*Corresponding author: Randy W Garland DDS, Garland Endodontics, Encinitas, California, USA, Tel: 760-944-0048; E-mail: dr.rwgarland@gmail.com

Received: March 29, 2016; Accepted: April 13, 2017; Published: April 18, 2017

Citation: Garland RW (2017) No Shaping Endodontic Treatment of a Mandibular Canine Utilizing the GentleWave Procedure: A Case Report. Oral health case Rep 3: 135. doi:[10.4172/2471-8726.1000135](https://doi.org/10.4172/2471-8726.1000135)

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with anterior crowding. Assessments showed sensitivity to percussion, no painful response to palpation, and no mobility or soft tissue lesions. Radiographic analysis revealed a small periapical lesion on the single root (Figure 1a). Based on the clinical and radiographical findings, a diagnosis of pulpal necrosis and symptomatic apical periodontitis was made.

Procedure

Standard anesthesia protocol was administered via nerve block; (1 carpule carbocaine 3% without epinephrine and 1 carpule articaine 4% with 1:100 epinephrine). The tooth was isolated with a rubber dam with clamping on the right first bicuspid due to crowding. A dental operating microscope was utilized throughout the procedure. A minimal, straight-line, conservative endodontic access was performed with removal of just enough dentin to remove any pulp horns.

Once the pulp chamber was exposed, a single orifice was visualized. Patency was obtained and the working length was determined utilizing hand file size 10/.02. After working length measurements were taken, it was determined that the canal size was adequate for obturation and no further instrumentation was required prior to the GentleWave® Procedure (Sonendo®, Laguna Hills, CA). In an attempt to preserve tooth structure, maintain as much of the original canal anatomy as possible, and reduce the possibility of complications associated with standard endodontics, no shaping was utilized for this case. This could be accomplished due to the ability of the GentleWave Procedure to provide complete cleaning and disinfection without entering the root canal. A temporary build-up was placed utilizing a gingival protectant (Kool-Dam™, PulpDent®, Watertown, USA) to maintain a sealed environment for optimum MultiSonic™ Ultra Cleaning during the GentleWave Procedure. During the procedure, the GentleWave Procedure Instrument merely rests on top of the temporary build-up while pulp tissue remnants, debris, smear layer, and bacteria are removed from the entire root canal system (Figure 2).



Figure 1: Radiographs of tooth #27 (a) Pre-Procedure and (b) Post-Procedure.

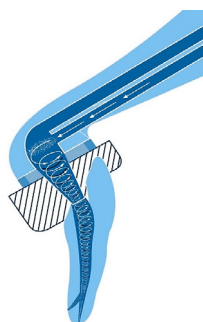


Figure 2: Schematic of the GentleWave® Procedure Instrument in use.

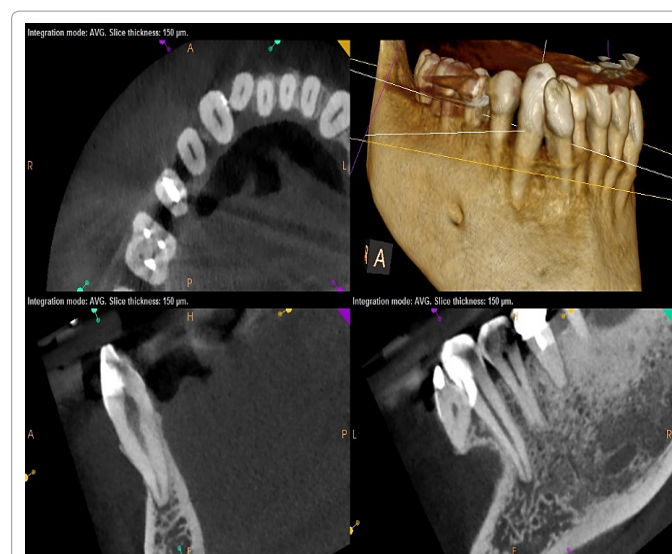


Figure 3: Cone-beam computed tomography (CBCT) images of tooth #27 pre-procedure.

After the GentleWave Procedure, visualization through the microscope revealed a clean pulp chamber and canal that was free of debris and tissue which was subsequently dried with paper points. Obturation was completed utilizing a single cone technique with gutta-percha and BC Sealer (Brasseler USA®, Savannah, GA). A coronal seal was placed and the cavity was filled with composite. The patient was advised to return to their general dentist for comprehensive dental care.

There was no reported discomfort during or after the procedure. After two-days, the patient was contacted for a follow-up inquiry and indicated that they experienced no post procedure discomfort.

Results

A pre-procedure radiograph of tooth #27 exhibits a deep composite filling along the distal portion of the crown (Figure 1a). A small radiolucent area surrounding the periapical region is visible radiographically and on cone-beam computed tomography (Figures 1a and 3). Endodontic therapy was completed without the use of files or instrumentation for shaping as the GentleWave Procedure was applied for cleaning and disinfection of the entire root canal system. After implementation of the Multisonic Ultracleaning technology through the system, a patent canal was observed and subsequently obturated. A post-procedure radiograph of the non-instrumented canal is shown in Figure 1b with no voids and a flush fill depicting a clinically significant obturation [19,20].

No discomfort was reported by the patient during the procedure or during the following two-days post-procedure.

Discussion

Standard endodontic treatment methods may not be adequate for debridement and disinfection of the root canal system [3,21,22]. After instrumentation, the root canal system typically contains tissue remnants, bacteria, and dentin shavings that inhibit the ability of irrigants to reach all areas of the root canal system, especially in the apical 3 mm [23]. Although these irrigants have limited access to the apical third with standard root canal treatment, reports indicate that larger size files and tapers allow for increased penetration of irrigants, albeit at a greater risk of complications [3,4]. Ledge formation is one

of the most commonly observed procedural errors during root canal instrumentation with incidences of up to 52% [24,25]. The formation of a ledge may exclude the possibility of achieving an adequately shaped canal that reaches the ideal working length causing insufficient shaping and disinfection of the root canal system, as well as incomplete obturation of the canal. Consequently, there is a reported causal relationship between ledge formation and unfavorable endodontic outcomes [25-30]. Even after decades of innovation, instrument separation still continues to challenge endodontics with reported worldwide rates of 5% [31]. As separated instruments typically block the apical third of the canal, they impede the cleaning and disinfection of the root canal system thereby limiting the success of endodontic treatment [16]. Weakening of the root is also common in endodontics, especially when the root canal is oval shaped making it difficult to instrument [32,33]. In analysis of endodontically treated teeth, vertical root fractures were the reason for extraction in up to 13.4% of teeth [34,35]. Root perforations, which occur in 2% to 12% of endodontically treated teeth, are shown to be one of the eminent causes of endodontic failures [36-39]. Bacterial infection from the root canal system or the periodontal tissues prevents healing and promotes inflammatory sequela where the supporting tissues have been exposed through the perforation and may cause eventual loss of the tooth [37,38]. As the level of complications has been shown to increase when the size and taper utilized for shaping of the root canal system increases, alternative methods, such as the GentleWave Procedure, should be employed for cleaning and disinfection while preserving the natural anatomy of the tooth.

In this case report, a mandibular canine which presented with tenderness to percussion and extensive coronal restoration was cleaned during a no shaping endodontic treatment using the GentleWave Procedure. This case report demonstrates the ability of the GentleWave Procedure to clean anterior teeth without the use of instrumentation for shaping, thereby conserving the natural tooth structure and decreasing the chance of complications as seen in standard endodontic treatment. Additional recall with the patient may be warranted to assess long-term healing and clinical outcomes. Further research is needed to provide evidence for a larger population in no shaping endodontic treatment with the GentleWave Procedure.

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