Applications of Ultrasonics in Endodontics

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ABSTRACT: The continuous development of science and technology offered medicine a new perspective in diagnose, treatment and health care facilities. This paper presents a special application of ultrasonics in endodontics, an important specialization in dentistry. One of the most important practice in endodontics is finding the additional canals of the molars, that in the most of the cases general practitioners miss. There are presented two case reports of two patients diagnosed with apical periodontitis and investigated with ultrasonics. A piezo generator unit that uses ultrasonics tips to perform dental treatments, from Morita company (J Morita USA) was used. The ultrasonics procedure permitted to access all the canals for an efficient treatment of the apical periodontitis and patients recovered with no complications. Using the ultrasonics in general dentistry practice, and particularly in endodontics and in the presented cases, the predictable results of the treatments and recovery were improved, comparing to the classical procedures.

KEY WORDS: ultrasonics, endodontics, patient

1. INTRODUCTION

The evolution of medicine is strongly correlated to the development of science and technology. The new technologies allowed physicians to understand in detail how the human body works, being developed new diagnose, treatment and monitor techniques. The ultrasonics defined as waves with frequencies of at least 25 kHz, are one of the most used non-invasive technology facilities in modern dentistry, particularly in endodontics [7]. The ultrasonic techniques are used in prophylactic procedures, scaling and root planing in periodontology, tissue regeneration, piezo and oral surgery techniques [2][4][9][10][11][14].

Endodontics is the field of dentistry that deals with root canals pathologies, lesions of endodontic origin, endodontic surgery and pulpitis pathologies caused by bacterial infection of canal systems[1][13]. A frequent complication of the untreated irreversible pulpitis is apical periodontitis. On radiography, this pathology may appear like a radiolucencies lesion near the tooth apex [5]. At the same time, it may appear an enlargement of the periodontic space. The clinical diagnoses are based on a localised small swelling close to the gingival margin. The swelling is soft, as it is often described with dull and continuous pain that could not be provoked by thermal stimuli [1].

Studies show that the prevalence of apical periodontitis is very common in adult population. The published data show that the prevalence of apical periodontitis may vary between 22 and 80% of the investigated individuals [1]. Prevalence of endodontic treatment failures are assessed in the Scandinavian countries. The statistical studies reported that a high frequency of root fillings failure varies between 25-35% of the endodontic treatment associated with apical radiolucencies. There is a contradiction between what is possible in endodontic therapy (85-95% rate of succes) and what is actually obtained (70-85% rate of succes)[1].

2. MATERIALS AND METHODS

In order to achieve the fourth canal of a right upper molar we used the ultrasonics unit AZULTRASONICS from J Morita (USA) [15]. The anatomy of the tooth, particularly root canals, may vary on a wide range [6]. There are a lot of abnormal anatomy forms of the canals and some of them are hardly found and prepared. The materials used during the treatment process were: EDTA (Ethylenediamine tetra-acetic acid) cream, sodium hypochlorite 5,2%.

The technical principle of producing ultrasounds in the medical equipments is based on the piezoelectric effect. These systems contain a crystal that, when an electrical charge is applied, it vibrates and produces mechanical energy, ultrasounds [8][9].

2.1. Treatment procedure

In order to find the canals we started with a bur with long shank for creating the access to the internal anatomy of the tooth. For this reason we needed to create a pre flared cavity and a straight line access. Without these objectives we could not achieve the result of finding all the canals. A bad access cavity will follow the patient belong entire treatment [3]. After creating the access cavity we started the negotiation of the canal system and we used the endodontic files number 08, 10, 15, 20, 25 and EDTA cream until we established the working length. After we started to clean and shape the canals and we extracted the pulp with copious irrigation with a solution of sodium hypochlorite 5,2% we used different movement of the cream, sodium hypochlorite 5,2%.
this region is not cleaned the endodontic treatment will fail after a while. The endodontic treatment can fail also if a canal that is missed is not treated, cleaned and shaped.

The scientific literature presents that most of the upper 1st molars have the 4th canals in 74% of the cases by Castelucci [3], and 60% of the cases by Bergenholtz et all [1]. Many of the general practitioners find just 3 of the 4 canals and the endodontic treatment usually fails. For this reason we excavated a shoulder of dentine placed on the imaginary line placed between palatal canal (P) and Mesio Buccal 1 (Mb1) for finding the 4th canal called Mesio Buccal 2 (Mb2) (Figure 2). For excavating the dentine we used the Ultrasonics Unit from J Morita (USA) with a special ultrasonic diamond coated tip. The process can be dangerous because the clinicians can create a false pathway if are not respected the guidelines that indicate the existence of the 4th canal. The guidelines are represented by groove with color that unified the other canals and another mineralization of the dentine in the place where the 4th canal need to be. Using a magnification tool (Dental Microscope or Loupes) create better ways to achieve the final results. In the cases presented in this paper were not use magnification tools.

Figure 1. AZULTRASONIC Unit from J Morita (USA). General View.

Anatomy of the 1st upper molar – canals view.

Figure 2. Anatomy of the 1st upper molar, MB 2 at the blue arrow, excavated with the ultrasonic tip.

3. RESULTS

The patients were diagnosed with apical periodontitis.

In the first case report, the patient presented during the anamnesis, a failed previous endodontic treatment. The patient was investigated and therefore there was applied the therapeutical procedure described in the Paragraph 2.1 (Figure 3). After 4 weeks from the first appointment, the patient’s symptoms disappeared.

Four months later, a recall radiography was performed. The lesion that initially appeared on the first radiography decreased and the bone surrounding the tooth apex was completely healed. These results permitted to continue the prosthetic therapy, by inserting a fiber post into the palatal canal of the upper 1st molar. The fiber post was needed for reinforcing the structure of the entire tooth that was affected by the cavity process. In order to fix the metal-ceramic crown, we needed to rebuild the abutment. Finally, we luteinged the crown with a diacrylic cure fixing cement (Figure 4).

In the second case report, the patient presented during the anamnesis, a failed previous endodontic treatment. The patient was investigated and therefore there was applied the therapeutical procedure described in the Paragraph 2.1 (Figure 3). After 4 weeks from the first appointment, the patient’s symptoms disappeared.

Four months later, a recall radiography was performed. The lesion that initially appeared on the first radiography decreased and the bone surrounding the tooth apex was completely healed. These results permitted to continue the prosthetic therapy, by inserting a fiber post into the palatal canal of the upper 1st molar. The fiber post was needed for reinforcing the structure of the entire tooth that was affected by the cavity process. In order to fix the metal-ceramic crown, we needed to rebuild the abutment. Finally, we luteinged the crown with a diacrylic cure fixing cement (Figure 4).

Figure 3. AZULTRASONIC Unit from J Morita (USA). General View.

Anatomy of the 1st upper molar – canals view.

Figure 2. Anatomy of the 1st upper molar, MB 2 at the blue arrow, excavated with the ultrasonic tip.
b) Acces cavity view after obturation;

Figure 3. The 1\textsuperscript{st} case report. Anatomy of the endodontic cavity and all of the 4 canals found before(a) and after(b) obturation with gutaperca.

a) The prosthetic abutment before luting the metal-ceramic crown;

b) Methal-ceramic crown view;

Figure 4. The prosthetic system before(a) and after(b) luting the final restauration.

The second patient was investigated and treated following the same procedures described in the Paragraph 2.1. (Figure 5). The patient presented in the office with an acute pulpitis. The goal of the first step procedure was to eliminate the pain and to save the patient’s tooth. After removing the entire affected dentine and enamel, we achieved an endodontic access cavity with three walls. All the canals were found and after the canal instrumentation the working length was established, so that the chemical and mechanical debridation was done according to the medical protocol.

The 4\textsuperscript{th} canal finding was easily done with the help of ultrasonics, but the instrumentation of the MB2 was hard because it was very curved and it had an abnormal apex anatomy. The canal was prepared step by step with precurved files until the 40 ISO file, part of the first series of files, was used. All the canals were filled with gutaperca and fiber post was inserted in the palatal canal, for reinforcing the tooth walls. In order to create the ferule effect, there was needed a supragingival margin achieved through a gingivectomy procedure. The procedure was done using an electrosurgery. The dental abutment was prepared and the metal-ceramic crown was fixed (Figure 6).
specific laboratory techniques, the crown was prepared and fixed on the patient’s dental abutment.

Follow-up evaluations were considered, and all the lesions were completely healed after the endodontic therapy, in both cases.

4. CONCLUSIONS

The instrumentation of all the canals is very important to be done, so that the failure and all the effects that could appear are avoided and the costs of the treatment decrease. The use of ultrasonic unit permits the investigation of all the root canals, especially the 4th and other additional canals, if it is necessary. This technique permitted to investigate efficiently the 4th canal of the upper molars treated in both cases.

Beside detailed investigation of the endodontic anatomy, it is also necessary the establishment of a rigorous working protocol. The isolation of the tooth that is treated is very important done during the entire procedure, by using a latex rubber dam. During all the procedures the use of adequate files and irrigation solutions with specific concentrations increase the success and the predictable results. Without having in mind the anatomy that varies and predictable outcome of the treatment, the case can be considered compromise from the beginning.

A follow-up evaluation is recommended in order to analyze the efficiency of the endodontic treatments.

5. REFERENCES

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