ENDODONTICS

Treatment of Bucco-Accessory Root Canal of a Maxillary Incisor with a Combination of Cone Beam Computed Tomography and Continuous Supersonic Wave Condensation

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ABSTRACT

Objective: **A novel treatment for bucco-accessory root canal (bARC), which is difficult to treat by regular endodontic therapy, is discussed.**

Clinical Presentation and Intervention: **A bARC in the maxillary right incisor with symptomatic irreversible pulpitis was detected using cone beam computed tomography (CBCT) after conventional dental radiography. The pulp was extirpated and the canal enlarged using rotary files and chemo-mechanical reagents. The main root canal and bARC were obturated with thermoplastic gutta-percha using continuous wave condensation. Postoperative CBCT revealed a completely treated bARC.**

Conclusion: **A combination of CBCT and continuous wave condensation is ideal for bARCs in incisors.**

KEY WORDS

maxillary incisor, bucco-accessory root canal, cone beam computed tomography, continuous supersonic wave condensation

INTRODUCTION

Three-dimensional obturation is the main goal after finishing the mechanical and chemical root canal preparation for an endodontic treatment. Sealing the root canal three-dimensionally implies sealing even those canals that emerge from the main root canal and communicate with the periodontal ligament. The existence of accessory root canals (ARCs) around the main canal was demonstrated well, thus dentists were aware of the existence of accessory canals but disregarded them because of their small volume. This line of thought led dentists to perform less than optimum endodontic treatments.

Vertucci explained that apical and lateral ramifications of the main root canal are formed when a small gap is left after fragmentation of the developing epithelial root sheath or when blood vessels from the dental sac through the dental papilla persist[1]. In these specific areas, dentinogenesis does not occur and the small canals may contain connective tissue, blood vessels, and nerves. Because of their variability many researchers have proposed several classifications for ARCs. Some researchers such as Kasahara *et al*.[2] and Adorno *et al*.[3] proposed several different ways of classifying small root canals that emerge from the main one. The most modern classification using the aid of CBCT in the palatal root of maxillary first molar was proposed by Matsunaga *et al*. in 2014[4]. A new attempt for classifying ARCs was recently proposed by Ahmed *et al*.[5], which was characterized as being simple and applicable to daily clinical work on any endodontic treatment. Because of the simplicity of this new classification, the ARC in this case would be categorized as $_{1}11_{(a1)}$: "11" being the upper maxillary right central incisor, the left subscript "1" to denote single rooted teeth, and, the right subscript "a1" for an apical ARC[6].

The purpose of this clinical case report is to suggest that the combination of CBCT examination and continuous supersonic wave condensation technique is the ideal way to determine the presence of an apical bucco-accessary root canal (bARC) on a maxillary incisor where the main root seems to be irregular when viewed through conventional dental X-ray examination.

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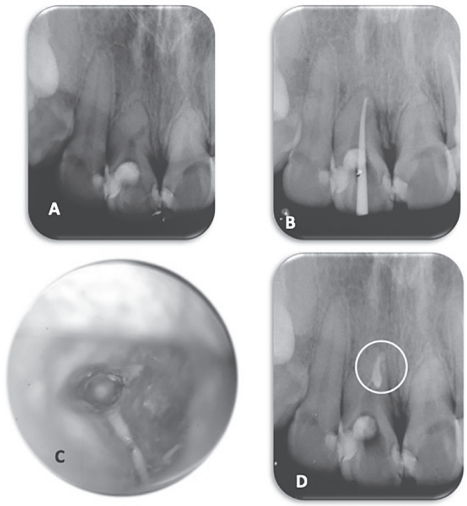

Figure 1. Dental X-ray examination before canal filling
A: Preoperative image: Note an apical curvature on the root canal of the central upper right maxillary incisor. B: Master Cone Trial: A master cone with taper 04 and number 40 was utilized. An ARC was not observed. C. Microscopic view of condensed master cone. D: Dental X-ray image of condensed master cone.

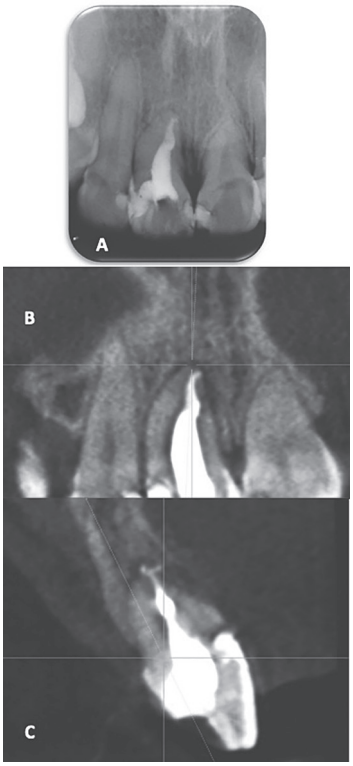

Figure 2. A. Postoperative dental X-ray image. B: Postoperative CBCT image Axial view and C: Sagittal view.

CLINICAL CASE

A twenty-three-year old female patient came to the clinic complaining of an acute spontaneous pain located within the upper right maxillary central incisor. After performing routine examination procedures, it was noted that the tooth suffered from a deep cervical dental carious lesion at the buccal surface. The diagnosis was symptomatic irreversible pulpitis without any symptoms around the periapical region. After cleaning the carious lesion, the cervical cavity was sealed with glass ionomer (Figure 1A). A relatively short and bent radiolucent area of root canal was observed.

After applying local anesthesia with lidocaine as an infiltrative injection, rubber dam multiple teeth isolation was done clamping into the 1st right maxilar premolar using clamp # 2A (Hu- Friedy, US). The premolar was clamped because of the fragility of the incisor at the cervical surface. Then the entire dental pulp was removed using a number 30 hedstrom file. Mechanical preparation was performed using the rotatory Hy-Flex System (Coltene, Germany) up to 04-taper number 40-file. Sodium hypochlorite at 5.25% was used as a chemical disinfectant and was activated using the supersonic tip. After finishing the mechanical and chemical preparation, a master cone 40.04 (Meta Biomed, Korea) was selected and adjusted to the apical constriction (Figure 1B). The discrepancy location between the master cone in the main root canal and the radiolucent area created by the root canal was noted.

Root canal sealer ADSEAL (Meta Biomed, Korea) was inserted into the root canal with pumping movements using the master cone. Later, the master cone was inserted into the root canal to a depth 1 mm less than the working length. E & Q Master (Meta Biomed, Korea), a continuous supersonic wave condensation system, was selected to seal the root canal. The remaining cone at the apical region was vertically condensed through an anterior Schilder Plugger (Maillefer, Dentsply). The condensed cone was confirmed to be in the apical third of the main root canal through an operating microscope ALL3 (Alliance, Brazil) (Figure 1C). The condensed cone was also observed through microscopy and dental X-ray examination. However, a diffuse radiopaque area was also observed (circled area in Figure 1D) between the cone-tip (more radiopaque) and periodontium (radiolucent area between tooth and alveolar bone).

Thermoplastic gutta-percha was injected into the rest of the root canal by using the cordless gun of E&Q master. After each injection, the gutta-percha was vertically condensed by using an anterior Schilder Plugger. Finally, after coronal temporary filling, a postoperative X-ray examination was performed (Figure 2A). However, a radiopaque image suggesting bARC was observed. Thus, CBCT (Galileos, Sirona, Bensheim, Germany) examination was also performed to confirm the anatomical feature of this root canal. Although only a winding root canal filled with gutta-percha was observed in an axial view (Figure 2B), an apical bARC sealed with thermoplastic gutta-percha was confirmed through a sagittal view (Figure 2C).

DISCUSSION

There are several techniques used to observe the internal anatomy of the various human teeth. These include microscopy, radiography, diaphanization or transparency, and a combination of these. Observations made by several researchers such as Vertucci[4] agree that 98 to 100% of maxillary central incisors have only one main root canal. Because of the high complexity of the root canal system, however, many studies have been performed to obtain a better understanding of the complex root canal system on even known teeth with only one main root canal. This root canal system includes the presence of lateral root canals, secondary root canals, and ARCs[3]. Vertucci[4] found that 74% of ARCs on human teeth were located on the apical third, 11 % on the middle third, and, 15% on the cervical third of the root.

In 1990, Kasahara *et al*. studied the root canal system of the maxillary central incisor[7]. Using the transparency method, 510 maxillary central incisors were used to map its internal anatomy and structure. A simple main root canal was found on 38.6% of the samples; 49.1% had only a lateral root canal; 6.7% had only apical ramification; and, 5.6% had both apical and lateral branches. This means that more than 60% of maxillary central incisors have ARCs. In this study, it has also been demonstrated that 80% of these ARCs have the dimension of a Number 10 reamer or less. Taking the results of this study into consideration, we noted that the incidence of the upper central incisor having an ARC is considerably high.

Many studies have shown that high rates of success in endodontic treatments were achieved when the main root canal and its ARCs were disinfected and sealed because they were only infrequently revealed radiographically after root canal filling. However, Acar *et al*. compared the use of Micro-CT and CBCT in the detection of ARCs, and concluded that a Micro-CT could reveal more information about the presence of very small anatomical structures such as ARCs in comparison to CBCT[8]. There are several studies about the anatomical apical structure

of the maxillary incisor. For instance, Adorno *et al*.[3] found that 62% of maxillary central incisors from a Japanese population have ARCs, which was similar to the results previously obtained by Kasahara *et al*[2]. Recent studies reported a higher frequency of ARCs probably because of the newer and more updated imaging methodologies. In another study, Adorno *et al*. reported that most of the ARCs were found on the buccal side of the root[3]. In the present clinical case, the ARC was revealed to be at a buccal position within 3 mm of the apical portion by using CBCT.

There have been numerous studies that showed the high efficacy of thermoplastic condensation techniques in order to seal accessory and lateral root canals. Carvalho-Sousa, *et al*. demonstrated that thermoplastic gutta-percha filling techniques were more accurate in sealing lateral root canals with gutta-percha and sealer or with just sealer as compared to lateral condensation filling techniques[9]. Barbosa *et al*. compared the ability of the hydraulic vertical condensation technique and the continuous supersonic wave condensation technique to fill the canal system. They came to the conclusion that both systems filled the apical root canals, lateral root canals, or ARCs in similar percentages[10]. According to Adorno *et al*.[3], a higher incidence of ramifications was observed in the lingual and buccal directions, implying that a high percentage of ARCs cannot be seen by conventional radiography. In these cases, the only way to see the apical bARC was by means of taking a CBCT via the sagittal view. In addition, it would be hard to see this ARC without sealing material introduced into it.

CONCLUSION

An apical bARC can be treated through the combination of CBCT (sagittal view) and continuous wave condensation technique, even though ARCs cannot be observed clearly with conventional dental X-ray examination.

SIGNIFICANCE OF THE STUDY

The combination of sagittal view examination by cone beam computed tomography and continuous wave condensation technique using thermoplastic gutta-percha is suitable for bucco-accessory root canal in the maxillary incisor.

REFERENCES

1) Vertucci FJ: Root canal anatomy on the human permanent teeth. Oral Surg Oral Med Oral Pathol 1984;58:589-599.
2) Kasahara E, Yasuda E, Yamamoto A, *et al*: Root canal system of the maxillary central incisor. J Endod 1990;16:158-161.
3) Adorno CG, Yoshioka T, Suda H: Incidence of accessory canals in Japanese anterior maxillary teeth following root canal filling ex vivo. Int Endod J 2010;43:370-376.
4) Matsunaga S, Shimoo Y, Kinoshita H, *et al*: Morphologic classification of root canals and incidence of accessory canals in maxillary first molar palatal roots: three dimensional observation and measurements using micro-CT. J Hard Tissue Biol 2014;23:329-334.
5) Ahmed HMA, Neelakantan P, Dummer PMH: A new system for classifying accessory canal morphology. Int Endod J: [Epub ahead of print]
6) Ahmed HMA, Versiani MA, De-Deus G, *et al*: A new system for classifying root and root canal morphology. Int Endod J 2017;50:761-770.
7) Sert S, Bayirli GS: Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. J Endod 2004;30:391-398.
8) Acar B, Kamburoğlu K, Tatar İ, *et al*: Comparison of micro-computerized tomography and cone-beam computerized tomography in the detection of accessory canals in primary molars. Imaging Sci Dent 2015;45:205-211.
9) Carvalho-Sousa B, Almeida-Gomes F, Carvalho PRB, *et al*: Filling lateral canals: Evaluation of different filling techniques. Eur J Dent 2010;4:251-256.
10) Barbosa FO, Gusman H, Pimenta de Araújo MC: A comparative study on the frequency, location, and direction of accessory canals filled with the hydraulic vertical condensation and continuous wave of condensation techniques. J Endod 2009;35:397-400.