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Case Report

Clinical case: second mandibular premolar with three root canals.

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Abstract:

The effectiveness and success of endodontic treatment depends on the doctor's professionalism and knowledge of the anatomy and morphology of root canals. The equipment that is at the disposal of the dentist is also of great importance. At the moment, it is difficult to imagine the diagnosis of complex endodontic pathology without the use of cone-beam computed tomography. Diagnostic radiographs in different projections are important for getting an idea of the number of existing root canals, but do not always give a complete picture of the anatomy and morphology of root canals. Magnifying devices (binoculars and dental microscope) are also very helpful for competent treatment in modern dentistry in general and endodontics in particular. Premolars of the mandible are among the most difficult teeth for endodontic treatment due to a sufficient number of variations in internal morphology, the presence of additional root canals, apical deltas and lateral canals.

Key words: second lower premolar; clinical case; endodontic treatment; root canal anatomy

The goal of endodontic treatment is always to clean the root canal of pathogenic microbes and infected pulp, prevent the formation of toxic products and protect the periapical tissue. The presence of root canal variability increases the complexity of endodontic treatment. The complex anatomy of the root canals, the presence of additional channels, unnoticed by the dentist, can cause the failure of endodontic treatment [1]. A wide variety of variations of anatomy in relation to the number and shape of roots and root canals are presented in literary sources [2, 3]. For several decades, this topic has been the subject of many experimental and clinical studies. Lack of knowledge about anatomical variants can lead to untreated canal space, which can potentially lead to failure of endodontic treatment [4]. Premolars of the mandible often have a complex anatomy that cannot be clearly detected on two-dimensional periapical radiographs [5]. With the advent of high-precision technologies, cone-beam (CBCT) and X-ray computed microtomography, as well as the use of various degrees of magnification (binoculars, operating microscope) in clinical practice have significantly expanded the understanding of the complexity of the structure of the root canal system. According to various studies, there is more and more information that the numerous channels inside the root together represent a very complex system consisting of the main, additional channels, lateral branches and the apical delta [6]. In addition, it is generally recognized and proven that the structure of roots and channels can vary greatly in different races, within the same population group, and even in a single person. Anatomical variations in the root canal system of the second premolar of the mandible are known. For example, Vertucci found that the second lower premolar has 1 root, 1 oval or round channel in 97.5% and a channel bifurcating at the apex in 2.5% [7]. Other authors, according to Grigoriev S.S., 2019, admit that other variations

may sometimes occur [8]. For example, two channels ending with one apical opening (4%), or two independent channels (4%), as well as a two-root tooth. Variations in anatomy were demonstrated by the research of B. Willershausen and co-authors in 2009. It has been shown that the probability of root canal curvature in the premolars of the human mandible has a sigmoid line, that there is a tendency to increase the curvature of the root canal length in the range from 9 to 12 mm and that in the premolars of the mandible one can expect a large deviation from the original channel path by 9 mm from the cement-enamel joint [9]. Xuan Yu and co-authors (2012) examined the upper and lower premolars in the Chinese population. All 178 mandibular second premolars had one root. Of these, 97.2% of the teeth had one channel and 2.2% had two. The prevalence of C-shaped channels was 0.6%. All 178 second premolars of the mandible were single–rooted and the canal configurations of these teeth according to the Vertucci classification were most often type I (173 teeth, 97.2%), type II was found in one tooth (0.55%) and type V - in three teeth (1.7%). Only one tooth had a C-shaped configuration (0.55%). In both the first and second premolars of the mandible, having morphology type V or type VIII, bifurcation of the canal was found in the mid-apical part of the root, where 87% and 75% of the variations of the canal system occur in the first and second premolars of the mandible, respectively [10].

The purpose of this study is to present a clinical case with a complex anatomy of the lower second premolar.

A clinical case. The patient, a man, 43 years old, without concomitant somatic diseases, sought dental help. Clinical examination revealed deep caries on the 45th tooth. According to the treatment plan, the patient was shown the replacement of the missing 46 tooth, the patient refused implantation, so they decided to replace the missing defect with a non-removable bridge prosthesis supported by 45 and 47. Since the amount of dentin to the pulp chamber after excision of carious tissues was less than 0.4 mm, and the cold test (RoekoEndo-Frost, Coltene) provoked the development of pain for 20 seconds. it was decided to carry out endodontic treatment of the 45th tooth. In addition, during the analysis of the radiograph, the presence of an area of X-ray translucency (carious cavity) was identified, the bottom of which bordered the pulp chamber (Figure 1).

Figure 1: *Sighting radiograph of the second premolar of the lower jaw before treatment.*

During the first visit after anesthesia and isolation, access to the root canals was formed, the mouth of the third canal could not be detected, after chemo-mechanical treatment, the treated root canals were filled with calcium hydroxide. For better visualization, it was decided to continue the treatment of the 45th tooth using the PRIMALABOMED surgical operating microscope (Labo America Inc., USA) with preliminary CBCT examination. Axial, coronal and sagittal sections of CBCT (CS 9300, Carestream Dental) (internal software version 3.5.15.0 at 5 cm x 5 cm, 85 kV, 8 mA, 20 s, 985 mGr • cm2) revealed the presence of three channels (Figure 2-3).

Figure 2: *Coronal CBCT section: visualization of two roots.*

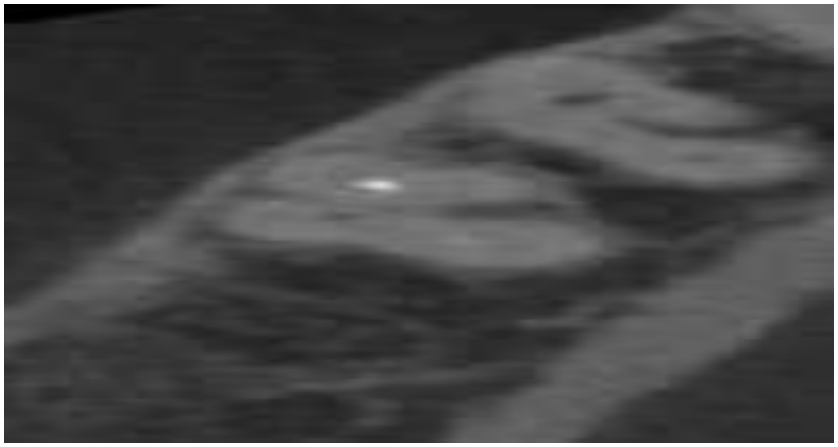

Figure 3: *Axial CBCT section: visualization of three root canals.*

The working length was determined using the Root PII apex locator (DENJOY DENTAL Co. LTD., China) and was supported by radiography. The channels were cleaned and formed using Profile (Dentsply Mallifer, Switzerland) to a final size of 30.04. Irrigation of the channels was carried out with 3% sodium hypochlorite and 17% EDTA solution (figure 4).

Figure 4: *Photo of the root canal mouths before obturation in a PRIMALABOMED microscope.*

After the final irrigation, root canal filling was carried out using AH plus (Dentsply, USA) and gutta-percha using a hybrid method of volumetric root canal filling (figure 5).

Figure 5: *Photo of the root canal mouths after obturation in a PRIMALABOMED microscope.*

The control of root canal filling is shown in figure 6.

Figure 6: *Control of root canal filling.*

After 2 months, a bridge-shaped prosthesis was made with support for 45 47 teeth, the patient is under dynamic observation, no pathology of periapical tissues was detected on a control radiovisiography after 12 months (figure 7).

Figure 7: *Dynamic observation, control radiovisiography after 12 months.*

Conclusion

The second premolar of the mandible is one of the most difficult teeth for endodontic treatment due to variations in internal morphology, additional root canals, apical deltas and lateral canals. Diagnostic radiographs in different projections are important for getting an idea of the number of existing root canals. As a rule, in premolars of the lower jaw with three channels, the upper half of the root is wider than usual, with little or no narrowing. Root canals may not be visible on radiographs and may look unusual. A sudden change in radiographic density and a sudden narrowing of the root canal space usually indicates the presence of an additional

canal. Therefore, when carefully interpreting the periodontal space, many assume the presence of an additional root or channel. The use of binoculars, fiber-optic illumination to observe anatomical landmarks in the pulp chamber, sodium hypochlorite bubbling in additional channels, and dyes, for example methylene blue, can be useful when detecting additional channels.

Conflict of Interest: The authors declare that there is no conflict of interest.

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