CASE REPORT

Treatment of a mandibular canine abutment with two canals

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Abstract

Human mandibular canines do not present an internal anatomy as simple as could be expected; there are such canines with a single root and two canals, two roots or fused roots. The existence of mandibular canines with more than one root canal is a fact that clinicians ought to keep in mind, in order to avoid failure during endodontic treatment. In spite of the low incidence of lower canines with one root and two canals, this possibility cannot be forgotten, inasmuch as the presence of a second canal in these teeth leads to difficulties in endodontic treatment. The precise knowledge of the dental endocanalicular system's anatomy is essential in the success of the root canal therapy, because the failure to detect the accessories canals and the incomplete radicular obturation leads to the infection of the periapical space, which will ultimately result in the loss of the tooth. The long-term success of the prosthodontic treatment depends directly on the quality of the endodontic treatment realized on the abutment teeth. The mandibular canine is very important as abutment for any type of prosthetic restoration. This article presents a clinical case of a canine tooth which displays a radicular morphology with two canals, which leads us to conclude that such anatomical variations on human teeth can also occur in our country as much as described in the international literature and cannot be overlooked when treating the teeth.

***Keywords*:** endocanalicular system's anatomy, endodontic treatment, prosthetic restoration.

Introduction

The vast majority of the problems that occur during the canal treatment are due to the insufficient knowledge of the anatomy of the endodontic space [1]. The main culprit in the failure of the endodontic treatment is the omission to obturate one of radicular canal because of ignoring the morphological variations of the dental anatomy. In order to perform a high quality endodontic treatment, which will ensure the tooth's long lasting durability, it is imperative that the dentist take into account the morphology of the radicular canals and the variations of the entire canalicular system before beginning the endodontic treatment [2, 3].

The foreign literature in this specialty has described modifications in the dental anatomy in different racial categories [4]. In Romania, there are no large-scale studies now. This article presents a case of a patient with an atypical mandibular canine, which displays a root and two canals, one buccal and the other one lingual, which comes to prove that such studies would be very useful in our country as well.

From a morphological standpoint, the mandibular canine is usually a monoradicular tooth, which has only one radicular canal. Despite this, statistics have shown anatomical variations, thus in 15% of the cases a second radicular canal was present with one or two apexes [2, 5, 6]. There was a mention of a case of a mandibular canine that had two roots and three radicular canals [7]. There is also evidence of even three canals with only two apexes, [8] but also of two roots with two separate canals [9].

The internal anatomy of the radicular canals does not always indicate the outer shape of the tooth. The mandibular canines do not always display the basic anatomy that we expect with one root and one canal. The proof is given by the numerous studies in which research was done on both the morphology of the monoradicular canines and the presence of those, which can display two radicular canals. It is important that this fact be taken into account in order to prevent the failure of the endodontic treatment and the subsequent loss of the tooth.

Patient and Methods

Patient M.F., 54-year-old, female, showed up at the dentist's office requesting a complete oral rehabilitation (Figures 1 and 2). The main complaints were aesthetic appearance and masticatory problems. In the personal chart, the patient declared no general pathology and refused implant therapy for financial reasons. The necessary Rx investigations were panoramic (Kodak) and retroalveolar (Irix). Following the clinical and radiological evaluation and diagnosis a treatment plan was established that would include two removable

partial dentures with snap and magnet attachments. The pre- and pro-prosthetic treatment included the inferior canine's root canal therapy, as the canine was a principal abutment tooth in the prosthetic restoration of the mandible. At the same time, the level and direction of the occlusion plan were finalized.

Figure 1 – ***Initial clinical status of the patient.***

Figure 2 – ***Initial panoramic radiography.***

The rotated and inclined position of the canine 43 increased the level of difficulty in achieving the parallelism required for the abutments. The abutment teeth of the inferior arcade were devitalized with a prosthetic purpose (Figure 3). At first glance, the devitalization of the 43 canine should have not presented any problems, this particular tooth being in most cases a monoradicular tooth displaying only one large radicular canal, easily accessible, located in the root's shaft.

Figure 3 – ***Endodontic treatment of the abutment teeth (second panoramic radiography).***

The access cavity was created through the center area of the lingual surface using a long-shank, round bur on a high-speed handpiece. The bur was held at a 30^0 angle to the long axis of the tooth until it has penetrated the pulp chamber. We removed the roof of the pulp chamber; the coronary pulp was removed with a hand instrument. When we tried to enter the shaft of the tooth to remove the root pulp, we noticed that the access was blocked along with the view down the radicular canal. It was observed that the entrance is positioned eccentrically, so we decide to do a retroalveolar X-ray from an eccentric position. The canal was highlighted using a gutta-percha cone; the curvature of the cone and the presence of two radicular canals were observed on the new radiological image (Figure 4). The access cavity was then enlarged in an incisal direction to facilitate the location of a lingual second root canal, which splits off from the main canal in the root area. Enlarging the access, we succeeded in penetrating the lingual canal and in observing the direction of the two canals.

Figure 4 – ***The 43 radiography showing a curved gutta-percha cone and the presence of two root canals.***

In the next stage, the mechanical treatment was performed; the length of the buccal canal was of 22 mm and the lingual was of 20 mm. The canals were prepared using a step back instrumentation technique up to 40 instruments. We rinsed the endodontic space with plenty of antiseptic substances, using a 2.5% of sodium hypochlorite as irigant, at every change of instruments. The canals were dried with sterile paper points. The final restoration was made with a material containing calcium hydroxide and with a gutta-percha cone (Figure 5). After the restoration of the tooth with oxide-phosphate cement and photopolymerizable composite, the 43 canine was filed down in order to achieve the parallelism necessary for the insertion of the metal–ceramic bridge (Figure 6).

Figure 5 – ***The endodontic treatment correctly performed on the canine's two canals. Final retroalveolar radiography.***

Figure 6 – ***Metal–ceramic inferior bridge: the fixed part of the composite prosthetic restoration.***

Results

In this case, the inferior right canine of the patient presented two canals, one lingual and the other buccal located. The difference in the length of these two canals

was 2 mm. The tooth was rotated and inclined and the position of the pulp chamber was following it. The entrance in the buccal canal was eccentric and suggested the possibility of the existence of another canal, which was confirmed using eccentric retroalveolar radiography. The endodontic treatment was performed successfully on both canals.

The complex prosthetic restoration of the inferior maxilla is a functional assembly in which the loss of the inferior canine as a principal post would lead to the failure of the entire treatment (Figure 7). That is why, for the long-term success of a prosthetic rehabilitation at such scale, it is very important to know the different morphological variances of the radicular canals. This will ensure a proper course of action in the endodontic treatment (Figure 8).

Figure 7 – ***Final prosthetic restoration of the inferior arch.***

Figure 8 – ***Final aspect of the complete prosthetic restoration in the oral cavity.***

Discussion

The mandibular canine is the second longest tooth in dentition. It is only 1–2 mm shorter than the upper canine. There are often two canals, which usually, but not always, join before the apex. We can also find two roots in the lower canine, one buccal and one lingual. The root canal is more flattened than in the upper canine, but is quite large and usually does not cause technical problems during instrumentation. Lower canines with two roots are often more difficult to instrument. The long axis of the canal meets the crown surface at the incisal edge or on the labial surface. If not taken into consideration, this may lead to a deviated preparation, the emphasis again being on the labial side of the canal. The lingual canal must be looked for using a small file with a curved tip. The lower canine is often quite straight, but sometimes the root tip and the canal curve distally and/or labially.

Numerous studies have shown a relatively high percentage of cases where the mandibulary canines were displaying two radicular canals. These studies were done on different populations and races. Genetic model is varied among populations and also affects tooth structure [10–13].Various studies have been carried out in different parts of the world on different races and used different methods [2–4, 12–15]. Lambrianidis T *et al.* [12] also stated that varied results could be due to the differences in genetic model and race in the studied population, sample size, techniques, classification systems and the researchers' judgment and diagnosis.

The presence of such cases in dentistry would lead us to think that such examples could be encountered in the Romanian population as well, as evidenced by the case presented. It is very important to detect such anatomical aberrations on the permanent teeth, so that the endodontic treatment can be performed appropriately. The dental anatomical knowledge is an essential condition in the practice of the specialty medicine.

Pécora JD *et al.* [16] conducts a study on the internal anatomy, the direction and the number of roots of the mandibular canines. The study was done on 830 mandibular canines, and the analysis showed that 98.3% had only one root and of these 97.2% had one canal and one opening orifice, 4.9% two canals and one orifice, 1.2% two canals and two orifices. Two canals and two roots were present in 1.7% of the cases. Hess (1921), Barrett (1925), Pucci and Rei (1944), Madeira *et al.* (1973), De Deuss (1982), all have described the case of one root and two canals. In 2006, Bakianian Vaziri P *et al.* [17] analyzes 100 canines, making transversal slices on them. Using the stereomicroscope, he detected the presence of two radicular canals in 12% of the cases, results that are in line with those obtained by Kaffe I *et al.* [18], in 1985, in a radiological study on 400 mandibular canines, *in vivo*, which showed a percentage of 13.75%. Without a significant departure from these percentages, Green D [19] reported 13% in 1973 following the analysis of 100 teeth; Hession RW reported 11% in 1977 [14]. In 1972, Pineda F and Kuttler Y [5] find 18.5% of the mandibular canines having two canals through a study on 187 radiological images. A very similar result was obtained by Calişkan MK *et al.* [3], in 1995, in a study of 100 mandibular canines, the actual number being 19.5%. Much greater percentages were reported by Sert S *et al.* [4], in 2004, and by Vertucci FJ [2], in 1974, with 24% and 22% respectively. At the opposite end, we find the study of Bellizzi R and Hartwell G [20], their examination of 195 mandibular canine X-rays showed a low percentage of 4.1%. Holtzman L reported mandibular canine with three root canals [21].

The anatomy of root canal systems dictates the condition under which root canal therapy is carried out and can directly affect this prognosis. Extra root or root canals if not detected are a major reason for failure of the treatment [22]. Incomplete removal of all the irritants from the pulp space may increase the possibility of treatment failure [23, 24].

Conclusions

A clear understanding of pulp anatomy and the variations that occur in it are essential if effective cleaning, shaping and obturation of the pulp space are to be achieved. Many problems that occur during root canal treatment result from poor knowledge of this anatomy: missed canals, perforation of the pulp floor or canal transportation. If the clinician can imagine a three-dimensional picture of the root canal system prior to instrumentation then iatrogenic errors are less likely to occur. As a rule, the second canal does not influence the size and shape of the main root canal near the apex where.

The practitioner should be aware of how many canals to expect, their location, length and relationship to each other. The large number of atypical cases from a morphological standpoint that occur throughout the world along with the very important role that the canine plays as an abutment tooth in the future prosthetic restoration, fully justifies the undertaking of a research study in the radicular anatomical variations on the entire Romanian population.

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Received: March 30th, 2010

Accepted: August 15th, 2010