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CASE REPORT/CASO CLINICO

Endodontic retreatment of a lower canine associated with a periapical lesion: case report of an unusual anatomy

Ritrattamento canalare di un canino inferiore affetto da lesione periapicale: caso clinico relativo ad una anatomia inusuale

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KEYWORDS
Root canal anatomy;
Two roots;
Lower canine;
Retreatment;
Periapical lesion;
Operating microscope.

Abstract
Objectives: To describe the endodontic orthograde retreatment of a lower canine with a rare anatomy, affected by a symptomatic periapical lesion.
Materials and methods: A 30-year-old Caucasian woman came to our office reporting severe pain and swelling located at the right mandible. A two-roots/two-canals configuration was discovered for the lower canine which sustained the periapical infection; a missed lingual canal was not recognized and treated at the previous primary endodontic therapy.

A full pre-operative examination and diagnosis, the application of modern endodontic strategies along with the use of magnification technologies (like the Surgical Operating Microscope - SOM) and proper disinfection protocols were employed for endodontic re-treatment.
Result and conclusions: Healing of the periapical infection was clinically and radiographically confirmed at a 9-month follow-up. Endodontists should know the anatomical variations of human teeth and be vigilant about them when approaching treatments. More than a single radiographic projection is recommended in the diagnostic phase.

Careful procedures related to instrumentation, cleaning and filling of the entire root canal system enhance the potential for healing of apical lesions.

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PAROLE CHIAVE
Anatomia canalare radicolare;
Canino inferiore;
Due radici;
Ritrattamento;
Lesione periapicale;
Microscopio operatorio.

Riassunto
Obiettivi: Descrivere il ritrattamento endodontico ortogrado di un canino mandibolare caratterizzato da una anatomia inusuale, affetto da lesione periapicale sintomatica.
Materiali e metodi: Una donna caucasica di 30 anni si è presentata all'osservazione a causa di un dolore severo, associato a gonfiore, localizzato all'emimandibola destra. Il canino inferiore (n.43) è stato individuato quale dente responsabile dell'infezione apicale; per lo stesso elemento è stata riscontrata una anatomia rara caratterizzata da due radici e due canali. Le procedure diagnostiche hanno evidenziato la presenza del canale linguale non trattato nella precedente terapia endodontica primaria. Il ritrattamento per via ortograda è stato intrapreso attenendosi ai protocolli dell'endodonzia contemporanea, per mezzo di strumenti ingranditori (microscopio operatorio) ed accurate procedure di disinfezione del sistema canalare.
Risultati e Conclusioni: E' stata ottenuta la completa risoluzione della lesione apicale, confermata dalle indagini cliniche e radiografiche del follow-up a 9 mesi. Gli endodonzisti dovrebbero conoscere le possibili variazioni anatomiche del sistema canalare dei denti umani, e vigilare sulla loro eventuale presenza al momento del trattamento. Molteplici proiezioni radiografiche sono raccomandate e possono agevolare la fase diagnostica.
Procedure endodontiche attente relative alla strumentazione, disinfezione ed otturazione del sistema canalare possono favorire la guarigione delle lesione periapicali.

Introduction

The aim of the root canal treatment is to achieve a correct shaping, cleaning and three-dimensional filling of the root canal system.[1,2] The ultimate goal is to eliminate the infected tissue, bacteria and to fill the complex anatomy of the root canal system, in order to allow the healing of a periapical lesion or to prevent the infection of periradicular tissues.[3,4]

Rare or complex anatomical variations may lead to inappropriate endodontic treatment, often associated with an incomplete elimination of the infected tissue, resulting in a treatment failure.[5,6] Moreover, some unusual root canal systems may be undetected at all by the clinician. In order to minimize the above-mentioned challenges, a careful clinical and radiological examination of the tooth to be treated is recommended. It is not advisable to approach a root canal treatment giving as granted that a specific tooth has a predetermined number of roots or canals. The lower canine anatomy usually presents just one wide canal associated with a single root[7]; a variation in such a morphological pattern might complicate the treatment. In a sample of 830 extracted human mandibular canines studied using a clearing technique, 98.3% of these teeth exhibited a single root, with 92.2% presenting one canal and one foramen.[7] According to Vertucci, in single-rooted mandibular canines, type II and type III configurations may be found in 14% and 3% of the cases, respectively.[8] The type II Vertucci configuration identifies two canals which start with independent orifices and then merge together (usually at or near the apical third of the root) into a single canal with its unique foramen; in the type III configuration a single main canal is split by a dentinal island, along its way to the apex, into two canals; finally, these two canals merge together at or near the apex forming just one foramen. Other researchers have performed in-vitro studies using sectioning[9] or radiographic[10] techniques: they also reported that about 15% of single-rooted lower canines show two canals with one or two foramina.

The presence of two-roots and two-canals in mandibular canines is a more unusual condition. In a study conducted by Ouellet,[11] the presence of the second root appeared in proportion of 5% of all teeth included; other authors have reported a considerably lower percentage, with a rate of 1.7% of mandibular canines with two roots featuring two canals.[7] A recent study assessed the anatomy of two-rooted mandibular canines by using high-resolution micro-computed tomography[12]: the findings revealed that root bifurcation occurred in the apical and middle thirds; moreover, lateral and furcation canals were observed in 29% and 65% of the samples, respectively.

From a clinical point of view, periapical radiographs performed at different angulations may be of great help to discover anatomical variations of teeth.

The objective of this article is to describe a case report about the endodontic retreatment of a lower canine with a rare two-roots/two-canals configuration. The previous primary therapy didn't detect the entire canal system: a symptomatic periapical lesion developed and led patient to our dental office.

Case report

A 30-year-old woman came to our hospital reporting severe pain and swelling located at the right mandible. After taking proper medical and dental history, the intra-oral examination was performed and a mucosal edema corresponding to the apex of teeth 4.2 and 4.3 was discovered. However, clinical tests highlighted the absence of endodontic disease on the lower lateral incisor: vitality tests were normal, no pain at percussion was discovered and physiological periodontal probing was present. On the other hand, tooth 4.3 showed a post-endodontic restoration carried out with a metallic screw-type post associated with a secondary decay and marginal leakage. The canine was painful at vertical and bucco-lingual percussion tests. The first orthogonal X-ray examination of the right lower canine showed an apparently correct endodontic treatment: despite the filling of the canal seemed adequate in relation to the root length, a wide periapical bone rarefaction was present (Fig. 1a).

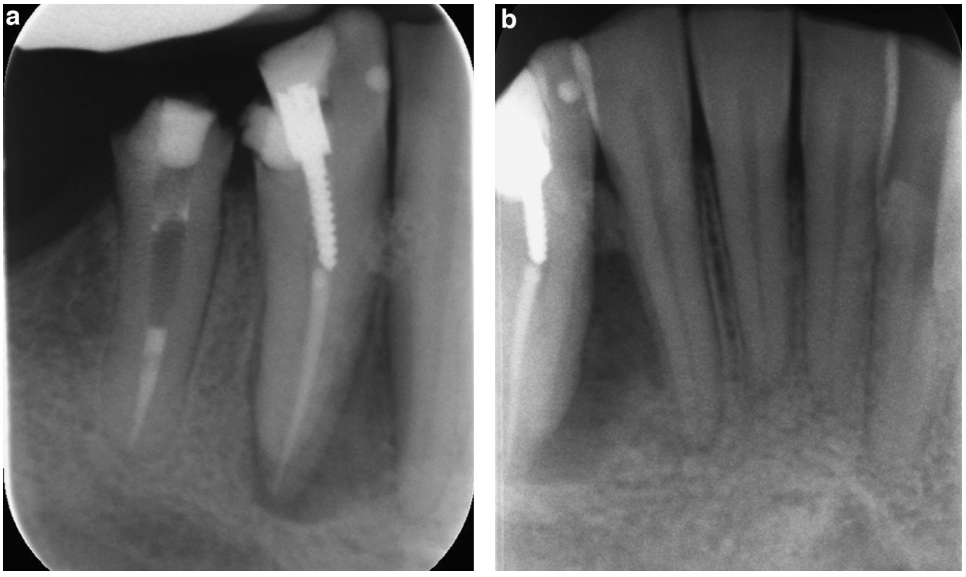

Figure 1 (a) Orthogonal pre-operative X-ray of the previous root canal therapy of tooth 4.3: secondary decay, marginal leakage of the post-and-core restoration and a large periapical lesion are clearly visible. (b) Mesio-distal pre-operative X-ray of the previous root canal therapy: the full extent of the periapical lesion is shown. The profile of a second root is discovered; the lower incisors are not involved.

A second X-ray, obtained according to Clark's rule from a mesio-distal projection, clearly showed a second lingual root remained unshaped and filled during the previous therapy: probably, this was the main problem sustaining the apical lesion (Fig. 1b). A further periodontal evaluation led to the exclusion of a vertical root fracture and/or other issues at the attachment apparatus. Finally a diagnosis of acute, symptomatic periapical periodontits on tooth 4.3 was formulated. After informed consent was obtained from the patient, the endodontic retreatment was scheduled. Following local anesthesia and rubber dam placement, the post-retained restoration and all decayed dentinal tissue were removed (Fig. 2). The access cavity was enlarged, extending the opening of the pulp chamber a bit more in the lingual direction: with the help of an operating microscope (Surgical Operating Microscope – SOM 32, KAPS International) the second, lingual orifice was found. The usage of magnification and powerful illumination is considered of key importance for many endodontic procedures: in this particular case it helped the exploration of the pulp chamber, orifice location and prevention of further tissue weakening in a previously root canal treated tooth. Residual necrotic pulp tissue and debris were present in the lingual canal; however a 08 manual k-file (Dentsply, Maillefer) easily reached the apex and patency was confirmed. Working length (WL) was determined with apex locator (Root ZX®, J. Morita Europe). After the initial instrumentation with hand files, shaping of the lingual canal was performed using Ni–Ti rotary files (Protaper Universal, Dentsply, Maillefer); disinfection was accomplished irrigating with 5,25% sodium hypochlorite (Niclor® 5, Ogna, Milan, Italy) alternated with 10% EDTA (Tubuliclean®, Ogna, Milan, Italy). The vestibular canal was retreated: after the removal of the previous canal filling (hand instrumentation with the aid of gutta-percha solvent, followed by dedicated Ni–Ti rotary files for retreatment (Protaper Retreatment, Dentsply, Maillefer)), the same shaping and cleaning protocols used for the lingual canal were applied. (Dentsply Maillefer). An intra-operative view of the pulp chamber, during disinfection procedures and showing instrumented canals, is provided in Fig. 3.

Subsequently, an X-ray was taken with guttapercha points in order to confirm the presence of a proper tug-back of the

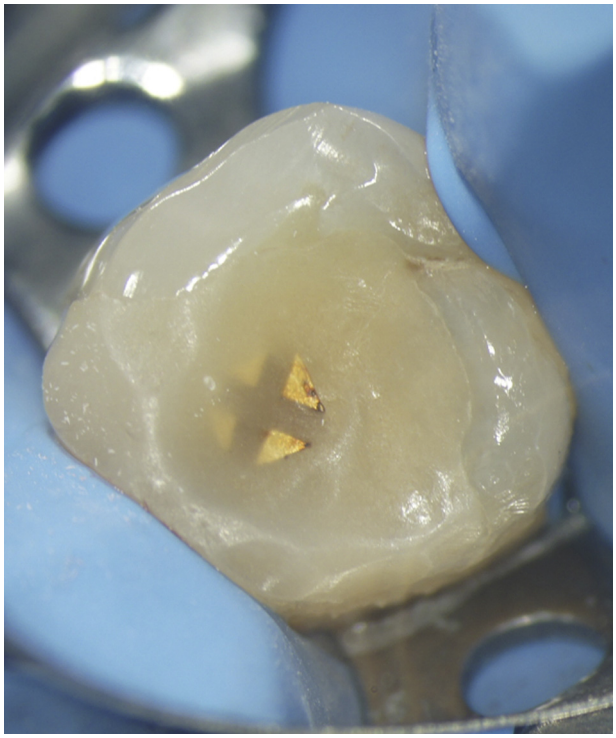

Figure 2 Rubber dam isolation: intra-oral operative view.

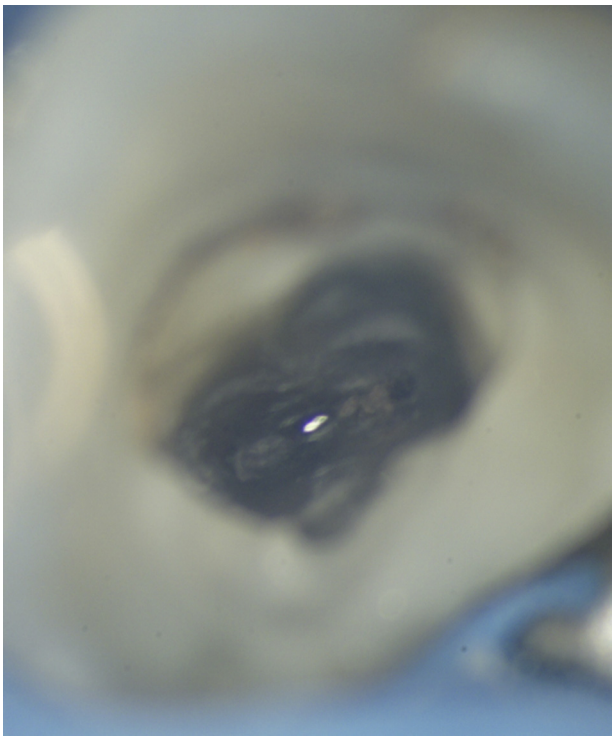

Figure 3 View of the pulp chamber during instrumentation steps showing vestibular and lingual canal orifices.

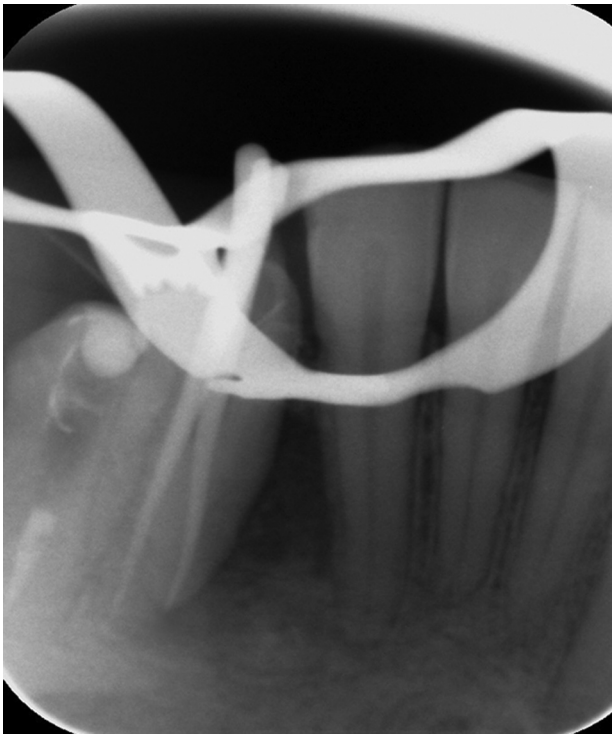

Figure 4 Intra-operative periapical radiograph showing the guttapercha master cones selected for filling: the two-canals-two roots configuration can be appreciated; working length and appropriate tug-back were confirmed.

Figure 5 Post-operative periapical radiograph showing completed endodontic filling of the lower canine.

cones at the appropriate WL (Fig. 4). Canals were dried with paper points and obturated with a warm vertical condensation technique: SystemB® (SybronEndo Corporation) was used as the heat source, in association with proper manual

Figure 6 Nine-months radiographic follow-up.

pluggers (Dr. Machtou Pluggers n. 1-2 and 3-4, Dentsply, Maillefer). The immediate post-operative radiograph, taken at rubber dam removal, is reported in Fig. 5.

The orifices of the canals were also protected by placing flowable composite in association with an etch-and-rinse adhesive technique, in order to avoid leakage/bacteria contamination of the root canal system, while waiting for the final restoration. A temporary filling sealed the access cavity.

The patient was finally discharged with a pharmacological prescription including NSAIDs and a broad spectrum, penicillin-based antibiotic to control both potential post operative pain and flare-up. A second appointment was scheduled for the subsequent week; the clinical examination confirmed that symptoms and swelling had disappeared; the tooth was restored with a fiberglass post and resin composite. The radiographic follow up after 9 months showed the complete healing of the periradicular lesion (Fig. 6); from a clinical perspective, the patient reported absence of pain, and the tooth was correctly responding to percussion (absence of pathological inflammation involving the periodontal ligament).

Discussion

The present case report described a successful non surgical retreatment of a lower canine with a two-roots/two-canals configuration; the follow-up X-ray showed healing of the periapical tissues (associated with lamina dura formation) at 9 months after therapy. Beside the identification of the missed lingual canal, vestibular canal of the lower canine was retreated due to potential leakage from the previous coronal restoration.

We may speculate that the primary endodontic intervention on the lower canine failed due to unsystematic radiographic examination[13]; inadequate access cavities or improper observation of the pulp chamber may also lead to untreated portions of the canal system.

Endodontic treatment failure has been associated to persistent infection of canals: unsatisfactory shaping or cleaning procedures, incomplete root canal filling, iatrogenic errors or leakage of temporary/post-endodontic restorations[14] are common factors that may impair an acceptable micro-organisms eradication.[5,15] Moreover, in case of one or more undetected/untreated root canals, large areas of necrotic pulp tissue are available for bacteria proliferation and their by-products accumulation.[16] Apical periodontitis, both acute or chronic in nature, has been associated to really limited, unreached endodontic infected spaces (i.e: apical ramifications, lateral canals, etc.).[14,17] For this reason, it is not surprising to discover a periapical infection in case of a completely uninstrumented main root canal (as the lingual one, in the present report).

Upper and lower canines are considered strategically important teeth in the arch; they usually have long, stable roots that make them favorite abutments for prosthetic purposes in case of partial edentulisms[18]; moreover, canines have a functional impact on occlusion (guidance on eccentric movements and posterior disclusion).[19] For the above-mentioned reasons, many efforts should be addressed toward the preservation of canines (i.e: avoiding extractions) even if anatomic variations or other morphological challenges may be encountered.

Few previous published data focusing on primary endodontic treatment of canines with two roots-two canals configuration has also suggested that this particular anatomy might be found across several populations of patients or ethnic groups.[20,21]

Traditional eccentric periapical radiographs are clinically useful during diagnostic examination of the tooth to be treated (in particular when accessory roots are present)[13]: this way, the clinician can imagine a three-dimensional picture of the root canal system prior to instrumentation. Overall, new modern imaging technologies (like CBCT or micro-computed tomography) might also be used to clarify the morphology of complex root canal systems.[22]

Conclusions

Mandibular canines might present two distinct roots with their respective canals; a deep knowledge of anatomical variations should help clinicians to enhance the success of endodontic therapy.

Conflict of interest

The authors have no conflict of interests to declare.

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