AN ENDODONTIC RETREATMENT IN A MAXILLARY CENTRAL INCISOR WITH VERTUCCI'S TYPE V MORPHOLOGY

Retratamento endodôntico de incisivo central superior com morfologia tipo V de Vertucci

Alexandre Kowalczuck [1] - ORCID ID 0000-0002-1182-6700

Ulisses Xavier da Silva Neto[1] - ORCID ID 0000-0002-6886-3836

Everdan Carneiro[1] - ORCID ID 0000-0002-6886-3836

Sandra Joia Mizrahi Jakobson[1] - ORCID ID 0000-0002-6886-3836

Vânia Portela Ditzel Westphalen[1] - ORCID ID 0000-0002-6886-3836

[1] Pontifícia Universidade Católica do Paraná, Curitiba, Paraná, Brasil.

a_kowalczuck@pucpr.br

RESUMO

Introdução: Compreender a intricada anatomia dos incisivos centrais superiores, especialmente a morfologia do tipo V de Vertucci, é crucial para um planejamento preciso do tratamento endodôntico. A utilização de recursos de análise tridimensional é necessária para um planejamento eficaz do tratamento. Objetivo: Este estudo tem como objetivo apresentar um relato de caso clínico de retratamento endodôntico em um incisivo central superior com morfologia do canal radicular do tipo V de Vertucci. Relato do caso: Uma paciente do sexo feminino, com 9 anos de idade, que apresentava dor no dente 21, foi encaminhada para retratamento endodôntico. Devido às dificuldades em atingir a preparação completa do canal após a intervenção inicial, a tomografia computadorizada de feixe cônico (TCFC) foi solicitada, revelando uma condição morfológica rara do tipo V de Vertucci. O retratamento endodôntico foi realizado, com ênfase na irrigação ultrassônica passiva para limpeza da bifurcação apical. Resultados: O retratamento endodôntico foi conduzido com sucesso, pois ambas as vias do canal foram limpas e obturadas, resultando em sucesso clínico e radiográfico. Conclusão: Este caso destaca o papel crucial do reconhecimento de variações anatômicas complexas nos incisivos centrais superiores, especificamente a morfologia do tipo V de Vertucci. Ferramentas diagnósticas avançadas, especialmente o TCFC, são imperativas para um planejamento meticuloso do tratamento, especialmente em casos com morfologia de canal radicular não convencional.

Palavras-chave: Anatomia. Endodontia. Tomografia Computadorizada de Feixe Cônico. Tratamento do Canal Radicular.

ABSTRACT

Introduction: Understanding the intricate anatomy of maxillary central incisors, particularly Vertucci's type V morphology, is crucial for precise endodontic treatment planning. The utilization of three-dimensional analysis resources is necessary for effective treatment planning. Objective: This study aims to present a clinical case report of endodontic retreatment on a maxillary central incisor with Vertucci's type V root canal morphology. Case report: A 9-year-old female patient with pain in tooth 21 was referred for endodontic retreatment. Due to difficulties in achieving complete canal preparation after the initial intervention, cone-beam computed tomography (CBCT) was requested, revealing a rare Vertucci's type V morphological condition. Endodontic retreatment was performed, with a focus on passive ultrasonic irrigation for cleaning the apical bifurcation. Results: The endodontic retreatment was successfully conducted, as both canal pathways were cleaned and obturated, resulting in both clinical and radiographic success. Conclusion: This case emphasizes the crucial role of recognizing complex

anatomical variations in maxillary central incisors, specifically Vertucci's type V morphology. Advanced diagnostic tools, especially CBCT, are imperative for meticulous treatment planning, particularly in cases with unconventional root canal morphology.

Key words: Anatomy. Endodontics. Computed Tomography Scanner, X-Ray. Root Canal Therapy. Treatment Outcome.

INTRODUCTION

Comprehensive knowledge of root canal anatomy in three dimensions is paramount for the effective planning and execution of endodontic treatments. Traditionally perceived as straightforward, maxillary central incisors are believed to possess a single, straight root with a solitary canal, ensuring relatively uncomplicated endodontic procedures [1,2]. However, the perspective becomes notably intricate when considering the myriad anatomical variations documented in the literature ranging from the presence of two independent canals, three canals, four canals, to occurrences such as dens in dente [3-10].

This complexity can introduce significant challenges during endodontic treatments, particularly when confronting unconventional anatomical scenarios. The impact of such variations on treatment outcomes is underscored by the limited number of published case reports specifically addressing the presence of two canals within a single root. Failure to recognize and address these additional canals may result in persistent irritation, ultimately compromising the prognosis of root canal treatment [20].

Root canal morphology elucidation is primarily dependent on advanced imaging techniques, with cone-beam computed tomography (CBCT) emerging as a cornerstone for accurate diagnosis and treatment planning. This diagnostic reliance becomes especially critical when dealing with cases of incomplete root formation resulting from trauma, necessitating a profound understanding of root morphology [11]. Dentists are further challenged to combine manual skills with additional diagnostic resources, such as CT scans, to ensure proper endodontic treatment.

Within this intricate context, our presented clinical case report highlights a rare endodontic retreatment of a maxillary central incisor characterized by Vertucci's type V morphology.

CASE REPORT

D.G., a 9-year-old female, sought assessment at the Dentoalveolar Trauma Outpatient Clinic, Pontifícia Universidade Católica do Paraná, Brazil. Her mother reported a maxillary incisor trauma two years prior, resulting from a fall and subsequent impact on a table, leading to the intrusion of tooth 21. A dentist evaluated her, obtaining a periapical radiograph on the same day (Figure 1A), and advised spontaneous tooth re-eruption. In the first half of 2021, due to spontaneous pain, the patient underwent radical endodontic treatment of tooth 21.

Clinical examination revealed healthy soft tissues and normal crown morphology. However, radiographic evaluation indicated that the previous endodontic treatment did not achieve an acceptable apical working length. Consequently, endodontic retreatment was recommended. Additionally, a morphological alteration in the root canal, suggestive of apical bifurcation (type V morphology per Vertucci's classification) [1], likely undetected in the initial

treatment, was observed. The patient and her mother were informed, opting for endodontic retreatment.

Following infiltrative local anesthesia and atraumatic rubber dam isolation (Figures 1B and 1C), restoration removal exposed the filling material. Gates-Glidden drills accessed the cervical and middle thirds, and eucalyptol and hand files removed apical obturation. Negotiation involved small-diameter files (#10 and #15 K-files), with copious irrigation using 1% sodium hypochlorite. Residual filling material in the apical third was identified radiographically (Figures 1D and 1E), challenging removal due to lodging at the bifurcation site. Precurved #08 and #10 manual K-files, used with gentle back-and-forth movements, addressed this challenge. The session concluded with temporary sealing.

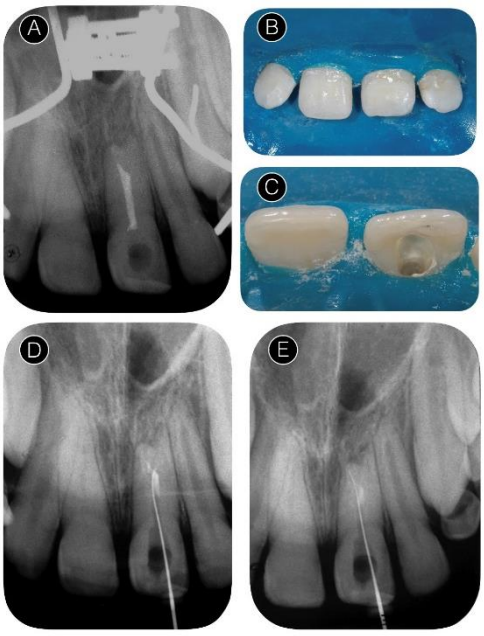

Figure 1 – (A) Initial auxiliary diagnostic periapical radiograph. (B, C) Modified rubber dam isolation. (D, E) Identification of residual obturation material in the bifurcation region.

Subsequently, cone beam computed tomography (CBCT) determined the undetected canal's position, guiding exploration strategies (Figures 2A, 2B, and 2C). After initial procedures, negotiation of the palatal region of the bifurcation utilized #10 and #15 manual K-files. Electronic apex locator determination and radiographic confirmation established the working length (Figure 2D). The buccal region of the bifurcation, where the ideal length wasn't reached, received copious irrigation. A rotary file (Proglider) and WaveOne Gold Primary file (#25/.07) were used for instrumentation, followed by apical enlargement with a #35 hand file. Radiographic examination confirmed master cone fit. Before obturation, 17% EDTA solution was applied for 3 minutes, followed by irrigation with 1% sodium hypochlorite. Three cycles of passive ultrasonic irrigation and a final irrigation with 30 mL of the solution were conducted. The canal was dried, and gutta-percha thermomechanical compaction with zinc oxide-eugenol cement was employed for obturation. A periapical radiograph confirmed obturation quality (Figure 3A).

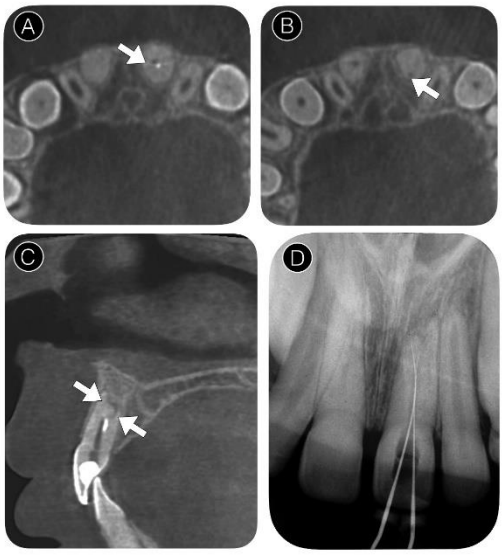

Figure 2 – (A) Axial CBCT section showing the canal in the buccal position. (B) Axial CBCT section showing the palatal canal. (C) Sagittal CBCT section showing the bifurcation region. (D) Radiograph for confirmation of the working length.

After pulp chamber cleaning, composite resin filled the palatal surfaces, which were finished and polished (Figure 3B). The patient was discharged with a recommendation for follow-up visits every six months (Figure 3C). The last follow-up on May 9, 2023, indicated clinical and radiographic success (Figures 4A). However, cracked enamel on tooth 11 resulting from a new sports-related trauma episode was detected (Figures 4B and 4C).

Figure 3 – (A) Radiograph for assess obturation quality. (B) Palatal aspect after direct composite restoration. (C) Immediate clinical appearance at the end of the obturation and restoration appointment.

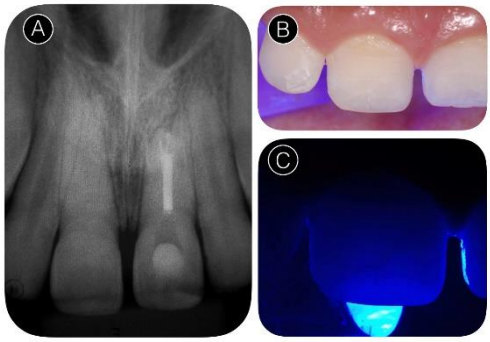

Figure 4 – (A) A six-month follow-up radiograph. (B) Clinical appearance of a coronal crack. (C) Transilumination with curing light revealing the coronal crack.

DISCUSSION

The meticulous exploration of internal tooth anatomy and its intricacies has spurred advancements in endodontic treatment techniques, methods, and instrumentation. Historical methods, grounded in histological section analyses and dye injection for canal visualization, laid the foundation for understanding tooth morphology. Pioneering studies such as those by Altman et al. (1970) and Vertucci (1984) initially focused on maxillary central incisors, positing a seemingly straightforward and regular root canal anatomy [1,12]. However, contemporary research challenges this notion, emphasizing the need for a nuanced approach to endodontic interventions.

Overconfidence in the perceived simplicity of maxillary central incisor anatomy poses a potential pitfall in treatment outcomes. A detailed clinical and radiographic assessment revealed no discernible changes in clinical crown volume, diverging from cases where extra canals were associated with anomalous crowns [13]. Unlike typical presentations, this case exhibited a subtle modification in the apical root contour, necessitating advanced imaging techniques [14]. Cone Beam Computed Tomography (CBCT), recognized as indispensable for assessing complex internal anatomy, played a pivotal role in elucidating the intricate root canal configuration [2,15-19]. Removal of root canal obturation prior to the CBCT scan sought to reduce the artifact produced by the filling material [20]. In addition to the hardships caused by the complex anatomy of the present case, the presence of filling material from a previous treatment remarkably interfered with the understanding of the original anatomy, shaping, and obturation of root canals.

The limitations of conventional instrumentation in cases with deep bifurcations were further highlighted in the present study, echoing contemporary challenges reported by Ghasemi et al. (2023) [18], who observed diverse bifurcation patterns. In the investigation undertaken by Calvert (2014), the initial intervention inadequately addressed the root canal, manifesting apical bifurcation [21]. Nevertheless, the case delineated in this report unveils a heightened intricacy in anatomical configuration, attributed to the bifurcation's more apical positioning.

The root canal morphology variations can be attributed, at least in part, to ethnic factors [2]. An assessment involved 2.343 permanent anterior teeth from the South African population, utilizing CBCT, and these teeth were systematically categorized using Vertucci's (1984) classification system. Within the subset of 387 scrutinized maxillary central incisors, all of them presented a singular root with a single root canal, falling under the classification of type I. Significantly, in the examination of the remaining anterior teeth within the total sample of 2.343, only 12 displayed a type V morphology (3 maxillary canines, 2 mandibular central incisors, 5 mandibular lateral incisors, and 2 mandibular canines) [2].

In light of the unattained efficacy of patency instruments within the buccal division of the canal, adjunctive irrigation enhancement strategies were employed. Ultrasonic sonic agitation of the irrigant solution facilitates the transport of sodium hypochlorite to remote regions of the root canal system, thereby enabling mechanical cleansing in areas impervious to the action of conventional instruments [22].

When facing the challenges posed by unconventional anatomy, the practitioner's adaptability to contemporary techniques, such as thermoplastic gutta-percha obturation, aligns with trends advocated by Buchanan (1994). Radiographic evidence, showcasing the complete filling of the apical third, aligns with present literature emphasizing the pivotal role of effective cleaning and sealing in ensuring favorable treatment outcomes [2].

In conclusion, the intricate anatomical considerations highlighted in this complex clinical case underscore the paramount importance of employing advanced diagnostic tools, including three-dimensional imaging modalities, for a comprehensive understanding of root canal morphology. The utilization of cutting-edge imaging techniques has proven indispensable in navigating the intricate intricacies of dental anatomy, enabling precise treatment planning and execution. The presented case not only serves as a testament to the evolving landscape of endodontics but also emphasizes the pivotal role of continuous advancements in technology for enhancing our ability to unravel the complexities inherent in root canal systems. As we reflect on this case, we recognize the imperative of integrating such insights into our daily practice, further advancing the precision and efficacy of endodontic interventions.

CONCLUSION

This case underscores the pivotal importance of recognizing intricate anatomical variations in maxillary central incisors, particularly Vertucci's type V morphology. Diagnostic tools, such as cone-beam computed tomography, are imperative for meticulous treatment

planning, especially when dealing with unusual morphology.

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