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CASE PRESENTATION

Healing of iatrogenic perforations during endodontic treatment: a case report

Curación de perforaciones iatrogénicas durante el tratamiento endodóntico: reporte de un caso

Luis Darío Pérez-Villalba[1], **Adriana María García-Novillo**[1], **Eugenio Rodrigo Navas-Llanos**[1]

[1]Universidad Regional Autónoma de los Andes, Ambato. Ecuador.

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ABSTRACT

Introduction: root perforations are communications between the root canal system and the external surface of the tooth, requiring accurate diagnosis and appropriate treatment to avoid complications and ensure the success of the endodontic procedure.
Objective: to evaluate the efficacy of Biodentin in sealing furcation perforations during endodontic treatment.
Case presentation: a 19-year-old patient suffered a furcation perforation during root canal treatment on tooth 46. Biodentin was used to seal the perforation, resulting in complete healing. Biodentin proved to be an effective option, with sealing properties and tissue compatibility superior to MTA. Accurate diagnosis, appropriate material selection, and careful attention during treatment are crucial for long-term success in the repair of furcation perforations and other similar defects. Continued research is essential to improve endodontic treatment options and ensure optimal clinical outcomes.
Conclusion: the success of endodontic treatment in furcation perforations depends on an accurate diagnosis and the appropriate choice of sealant. Biodentin, with its excellent sealing capacity and high tissue compatibility, promotes regeneration and is superior to silicate oxide cement in terms of ease of handling.

Keywords: Diagnosis; Furcation Defects; Cone-Beam Computed Tomography; Dental Implantation; Endosseous, Endodontic.

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RESUMEN

Introducción: las perforaciones radiculares son comunicaciones entre el sistema de conductos radiculares y la superficie externa del diente, siendo necesario su diagnóstico preciso y tratamiento adecuado, para evitar las complicaciones y garantizar el éxito del procedimiento endodóntico.
Objetivo: evaluar la eficacia de la Biodentina en el sellado de perforaciones de furca durante el tratamiento endodóntico.
Presentación de caso: paciente de 19 años sufrió una perforación de furca durante un tratamiento de conducto radicular en el diente 46. Se utilizó Biodentina para sellar la perforación, logrando una curación completa. La Biodentina demostró ser una opción efectiva, con propiedades de sellado y compatibilidad tisular superiores al MTA. El diagnóstico preciso, la elección adecuada de materiales y la atención cuidadosa durante el tratamiento son cruciales para el éxito a largo plazo en la reparación de perforaciones de furca y otros defectos similares. Es fundamental continuar investigando para mejorar las opciones de tratamiento endodóntico y garantizar resultados clínicos óptimos.
Conclusión: el éxito del tratamiento endodóntico en perforaciones de furca depende de un diagnóstico preciso y la elección adecuada del sellador. La Biodentina, con excelente capacidad de sellado y alta compatibilidad con los tejidos, favorece la regeneración y supera al cemento de óxido de silicato en facilidad de manipulación.

Palabras clave: Diagnóstico; Defectos de Furcación; Tomografía CBCT; Tratamiento Endodóntico.

INTRODUCTION

Root perforations may arise pathologically, i.e., by resorption processes or by caries, or they may occur iatrogenically as a complication during or after root canal treatment.[1] The Glossary of Endodontic Terms of the American Association of Endodontists (AAE) defines perforations as mechanical or pathological communications between the root canal system and the external surface of the tooth.[2] The subsequent injury to the periodontium results in the development of inflammation, destruction of periodontal fibers, bone resorption, formation of granulomatous tissue, proliferation of the epithelium and development of a periodontal defect.[3]

Root perforations can occur anywhere along the root and are classified according to their timing in relation to root canal treatment. They may be preoperative, usually pathological, such as those caused by resorption or caries; intraoperative, resulting from accidents during access cavity preparation or canal instrumentation; or postoperative, related to errors in preparing a postoperative space. Correctly identifying the origin of the perforation is crucial for determining the appropriate treatment approach and improving clinical prognosis. According to Kvinnsland,[4] 53 % of iatrogenic perforations occur during post insertion (prosthodontic treatment) and the remaining 47 % occur during routine root canal treatment.

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To avoid complications during root canal treatment, a thorough understanding of the location and dimensions of the pulp chamber, as well as the anatomical variations of the individual tooth and its canal system, is essential. Careful examination of radiographic views is important to assess the shape and depth of the pulp chamber and the width of the furcation floor.[3]

In multi-rooted teeth, furcation perforations may occur when dentin is removed from the chamber floor in the search for canal orifices. These coronal perforations are often due to factors such as root angulations, calcifications, anatomical variations, misidentification of canals, or excessive dentin removal. Furthermore, attempts to locate calcified orifices or excessive flaring of curved roots may result in lateral root perforations. Overinstrumentation perforations occur mainly in the coronal or mid-root region, are ovoid in shape, and are known as strip perforations.[5]

Diagnosing the presence and location of a perforation, as well as determining a treatment plan, can be challenging. Because the time between the creation of a perforation and its repair is critical to the prognosis of the tooth, early and accurate determination of the presence of a perforation is of vital importance.[3] The diagnosis should be confirmed by clinical observations, including etiologic aspects, and radiographic findings.

The first clinical appearance of a perforation is frequently associated with profuse bleeding from the defect within the chamber or canal. If anesthesia is inadequate, the patient may experience sudden pain when the perforation occurs. Indirect assessment of bleeding using paper points has been shown to be useful in identifying smaller perforations or strip perforations within the canal. The use of magnification (i.e., a surgical microscope) has gained popularity, as it provides better visualization and improved magnification and illumination, allowing for an easier and clearer diagnosis. Minimal perforations can easily be missed, compromising the treatment outcome. The use of a surgical microscope during treatment is considered an important factor in the repair of a perforation site, and the high success rates with the use of MTA can be attributed to this combination.[6,7]

Angled radiographic views are essential for an accurate diagnosis, although detection of root perforations can be difficult due to overlap with intact bone structure. Cone-beam computed tomography (CBCT) offers more conclusive three-dimensional information and is recommended with a small field of view (FOV) to minimize radiation exposure and improve image quality. However, the presence of high-density structures can generate artifacts that affect diagnostic accuracy. Adjusting the contrast in digital software can help reduce these drawbacks and improve image interpretation.[8,9]

Preventing perforations during endodontic treatment is crucial to the success of the procedure. To avoid perforations, it is essential for the dentist to be experienced and skilled, perform a thorough evaluation of the tooth, use careful techniques and appropriate tools, and be attentive to dental anatomy. Pressure and speed control, the use of magnification, and follow-up radiographs are also important to minimize the risk of inadvertent perforations. However, when a perforation occurs during endodontic treatment, it is crucial to take immediate action to address the situation and minimize any further damage. Therefore, the objective of this report is to demonstrate a technique for sealing a furcation perforation (type B) using a dental biomaterial.

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CLINICAL CASE REPORT

We present the case of a 19-year-old female patient who presented with pain and discomfort in her lower right molar for the past two weeks. The patient described mild intermittent pain in tooth 46, exacerbated by food accumulation. Vitality testing suggested irreversible pulpitis as a presumptive diagnosis. Therefore, pain relief was achieved by removing the chamber pulp, and due to the short timeframe for the procedure, the furca was perforated during localization of the mesial canals. Approximately four months later, the patient returned to complete treatment, and an intraoral periapical radiograph revealed a well-defined radiolucency in the furca region (Figure 1), indicative of perforation, along with a periapical radiolucency in the mesial canals, suggestive of apical periodontitis. The established treatment plan was a nonsurgical root canal approach.

Fig. 1 Drilling at the junction of the two roots of OD # 4.6.

After anesthesia with mepivacaine and adrenaline (1/1,000,000) (Septodont, France), the perforation was decontaminated by applying pure calcium hydroxide (Ca(OH)2) using an amalgam holder and left in place for 15 days. At the second appointment, the temporary restoration placed at the previous appointment was removed. The cavity was observed to be dry. Perforation of the furcation was confirmed by direct observation (Figure 2).

Fig. 2 Clinical assessment of perforation.

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The mesial canals were located and completely negotiated, within one millimeter of the perforation, using WaveOne Gold Primary files followed by WaveOne Gold Medium (Dentsply Sirona, Switzerland). Petroleum jelly (Weir, Ecuador) was placed on the Medium gutta-percha cones, which were positioned within the canals to working length (Figure 3).

Fig. 3 Gutta-percha cone 40.05 with petroleum jelly inside the canal.

Subsequently, with the cones inside the canals, the perforation was sealed with Biodentine (Septodont, France) following the manufacturer's mixing instructions. A 15-minute wait was followed. The gutta-percha cones were removed, the canals were filled with intracanal mediation (Ca(OH)2), and IRM (Dentsply Sirona, Switzerland) was placed as a temporary filling material for seven days. Analgesics were prescribed, and the patient reported that she was asymptomatic from the following day on. The patient was recalled seven days later for definitive filling of the root canals with Ah plus endodontic cement (Dentsply Sirona, Switzerland). A follow-up x-ray was taken one month later, showing complete sealing of the perforation (Figure 4), but with signs of an apical process that was in the process of healing.

Fig. 4 Sealing the perforation.

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DISCUSSION

An accurate treatment plan requires an accurate diagnosis; for this purpose, CBCT imaging is recommended due to its high resolution and effectiveness. In this case report, the furcation perforation was sealed with biodentin, which is composed primarily of tricalcium silicate cement. This facilitates better clearance during the manufacturing process and may explain the more homogeneous particle size.[10]

Sealing with silicate-based cement is associated with disinfection of the area to ensure the success of root canal treatment in perforated or immature teeth.[11,12]

A study by Al-Nazhan showed that premixed Biodentin used to repair furcation perforation in human teeth performed better clinically and radiographically than MTA due to its ease of handling and sealing properties and higher tissue compatibility. The higher tissue compatibility of Biodentin over MTA was attributed to the absence of heavy metals present in MTA which leach into tissues and body fluids.[13] They also mentioned that the small amount used to repair the perforation defect does not influence the healing rate.

Apart from the biological and physical characteristics of Biodentin, the size of the furcation perforation may influence the healing process. The size of perforations examined in animal studies ranged from 0.5 to 1 mm in rodents and from 1 to 1.4 mm in dogs. However, a recent study concluded that perforation size does not influence treatment outcome,[14] in contrast to the results of Askerbeyli Örs et al.[15] The conflicting results should be considered carefully due to variations in study designs, evaluation methodology, materials used, perforation size, tooth type, location, and follow-up period.

In a study by Al-Nazhan,[16] where Biodentine was used in five cases, complete healing occurred in all but one. Pruthi et al.,[17] successfully used platelet-rich fibrin as an external matrix in the treatment of furcal perforation. It was placed in the perforated area and then Biodentine was compacted over it. Complete healing of the defect was observed. They attributed this to the osteoconductive and osteoinductive properties of platelet-rich resorbable fibrin tissue in enhancing bone regeneration, thereby accelerating wound healing.

Finally, a systematic review revealed that Biodentin and MTA performed similarly and produced excellent treatment outcomes, regardless of differences in the experimental model. This similarity was also observed in this clinical case.[16]

CONCLUSION

The success of endodontic treatment in furcation perforations depends on an accurate diagnosis and the appropriate choice of filling material. CBCT scans offer high resolution to enhance case evaluation. In this report, Biodentin, a tricalcium silicate cement composite, was shown to be effective due to its ease of handling, excellent sealing, and greater tissue compatibility compared to MTA, promoting healing and regeneration. The choice of material should be based on specific clinical factors and availability, while ongoing research is key to optimizing treatment options and ensuring successful long-term outcomes.

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BIBLIOGRAPHIC REFERENCES

1. Roda RS. Root perforation repair: surgical and nonsurgical management. Pract Proced Aesthetic Dent PPAD [Internet]. agosto de 2001 [Citado 15/05/2025];13(6): 467-72; quiz 474. Disponible en: https://pubmed.ncbi.nlm.nih.gov/11544819/

2. AAE. Glossary of Endodontic Terms. [Internet]. Chicago, IL; 2020 [Citado 15/05/2025]. Disponible en: file:///C:/Users/User/Downloads/Glossary%20Of%20Endodontic%20Terms%20-%20UPDATED%20MARCH%202020%20050720.pdf

3. Tsesis I, Fuss Z. Diagnosis and treatment of accidental root perforations. Endod Top [Internet]. marzo de 2006 [Citado 15/05/2025]; 13(1): 95-107. Disponible en: https://onlinelibrary.wiley.com/doi/full/10.1111/j.1601-1546.2006.00213.x

4. Kvinnsland I, Oswald RJ, Halse A, Grønningsæter AG. A clinical and roentgenological study of 55 cases of root perforation. Int Endod J [Internet]. marzo de 1989 [Citado 15/05/2025]; 22(2): 75-84. Disponible en: https://pubmed.ncbi.nlm.nih.gov/2599663/

5. Siew K, Lee AHC, Cheung GSP. Treatment Outcome of Repaired Root Perforation: A Systematic Review and Meta-analysis. J Endod [Internet]. noviembre de 2015 [Citado 15/05/2025]; 41(11):1795-804. Disponible en: https://pubmed.ncbi.nlm.nih.gov/26364002/

6. Bryan EB, Woollard G, Mitchell WC. Nonsurgical repair of furcal perforations: a literature review. Gen Dent [Internet]. 1999 [Citado 15/05/2025]; 47(3): 274-8; quiz 279-80. Disponible en: https://pubmed.ncbi.nlm.nih.gov/10687439/

7. Torabinejad M, Parirokh M, Dummer PMH. Mineral trioxide aggregate and other bioactive endodontic cements: an updated overview – part II: other clinical applications and complications. Int Endod J [Internet]. marzo de 2018 [Citado 15/05/2025]; 51(3):284-317. Disponible en: https://pubmed.ncbi.nlm.nih.gov/28846134/

8. Venskutonis T, Plotino G, Juodzbalys G, Mickevičienė L. The Importance of Cone-beam Computed Tomography in the Management of Endodontic Problems: A Review of the Literature. J Endod [Internet]. diciembre de 2014 [Citado mayo de 215/05/2025025]; 40(12): 1895-901. Disponible en: https://pubmed.ncbi.nlm.nih.gov/25287321/

9. Patel S, Brown J, Pimentel T, Kelly RD, Abella F, Durack C. Cone beam computed tomography in Endodontics – a review of the literature. Int Endod J [Internet]. 2019 Aug [Citado 15/05/2025]; 52(8): 1138-1152. Disponible en: https://pubmed.ncbi.nlm.nih.gov/30868610/

10. Abu Hasna A, Pinto ABA, Minhoto GB, Corazza BJM, Carvalho CAT, Ferrari CH. Pictograph system for diagnosis making and data management in endodontics. Braz Dent Sci [Internet]. Sep 2020 [Citado 15/05/2025]; 23(4): 6. Disponible en: https://bds.ict.unesp.br/index.php/cob/article/view/2056

11. Estrela C, Decurcio DDA, Rossi-Fedele G, Silva JA, Guedes OA, Borges ÁH. Root perforations: a review of diagnosis, prognosis and materials. Braz Oral Res [Internet]. 18 de octubre de 2018 [citado 28/03/2024]; 32(suppl1). Disponible en: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1806-83242018000500608&lng=en&tlng=en

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ISSN: 1561-3194 **RNPS:** 1877
Rev Ciencias Médicas. 2025; 29(S1): e6810

12. Abu Hasna A, Pereira Santos D, Gavlik De Oliveira TR, Pinto ABA, Pucci CR, Lage-Marques JL. Apicoectomy of Perforated Root Canal Using Bioceramic Cement and Photodynamic Therapy. Testarelli L, editor. Int J Dent [Internet]. 9 de diciembre de 2020 [citado 28/03/2024]; 2020: 6677588. Disponible en: https://pubmed.ncbi.nlm.nih.gov/33376491/

13. Schembri M, Peplow G, Camilleri J. Analyses of Heavy Metals in Mineral Trioxide Aggregate and Portland Cement. J Endod [Internet]. julio de 2010 [citado 28/03/2024]; 36(7): 1210-5. Disponible en: https://pubmed.ncbi.nlm.nih.gov/20630301/

14. Gorni FG, Andreano A, Ambrogi F, Brambilla E, Gagliani M. Patient and Clinical Characteristics Associated with Primary Healing of Iatrogenic Perforations after Root Canal Treatment: Results of a Long-term Italian Study. J Endod [Internet]. febrero de 2016 [citado 28/03/2024]; 42(2): 211-5. Disponible en: https://pubmed.ncbi.nlm.nih.gov/26743731/

15. Askerbeyli Örs S, Aksel H, Küçükkaya Eren S, Serper A. Effect of perforation size and furcal lesion on stress distribution in mandibular molars: a finite element analysis. Int Endod J [Internet]. marzo de 2019 [citado 28/03/2024]; 52(3): 377-84. Disponible en: https://pubmed.ncbi.nlm.nih.gov/30193002/

16. Al-Nazhan S, El Mansy I, Al-Nazhan N, Al-Rowais N, Al-Awad G. Outcomes of furcal perforation management using Mineral Trioxide Aggregate and Biodentine: a systematic review. J Appl Oral Sci [Internet]. 2022 [citado 28/03/2024]; 30: e20220330. Disponible en: https://pubmed.ncbi.nlm.nih.gov/36477558/

17. Pruthi PJ, Goel S, Yadav P, Nawal RR, Talwar S. Novel application of a calcium silicate–based cement and platelet-rich fibrin in complex endodontic cases: a case series. Gen Dent [Internet]. 2020 [citado 28/03/2024]; 68(3): 46-9. Disponible en: https://pubmed.ncbi.nlm.nih.gov/32348243/

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