Case Report

DOI: 10.7860/JCDR/2018/37435.12408

Surgical Management of Root Canal Perforation Aided by CBCT Scan

Dentistry Section

ALVARO HENRIQUE BORGES[1], DURVALINO OLIVEIRA[2], IUSSIF MAMEDE-NETO[3], CYNTIA ARAUJO RODRIGUES ESTRELA[4], CARLOS ESTRELA[5]

ABSTRACT

This study describes the surgical management of two Root Canal Perforations (RCP) in maxillary incisors aided by CBCT scans. In the first case, a patient was referred for retreatment due to a history of overfilling. The chief complaint was frequent discomfort and slight oedema in upper front tooth (#9). Periapical radiography showed gutta-percha extruded out of the root canal. CBCT revealed a RCP and more than 1 cm of a gutta-percha cone extruded out of the apex. At follow-up one year after surgical procedure for the removal of the extruded filling material and apicoectomy, bone tissue formation was observed, without clinical symptoms. In the second case, a series of RCP was verified in multiple maxillary incisors of the same patient, who was referred due to a history of unresolved pain. On clinical examination, no abnormalities of the soft tissue were observed. Imaging exams revealed RCP in all maxillary incisors. The patient underwent conventional treatment and follow-up surgical procedures to seal the RCP. One year after surgery, imaging exams demonstrated tissue formation without clinical symptoms. RCP is considered a serious error in operative procedure. Once properly diagnosed, localised and sealed with biomaterial, a favourable prognosis is often achieved. MTA offered a good seal of perforations, with promising results. The use of CBCT in diagnosis allowed better security, correct positioning and improved surgical planning of RCP.

Keywords: Cone-beam computed tomography, Endodontics, Mineral trioxide aggregate, Parendodontic surgery

CASE REPORT

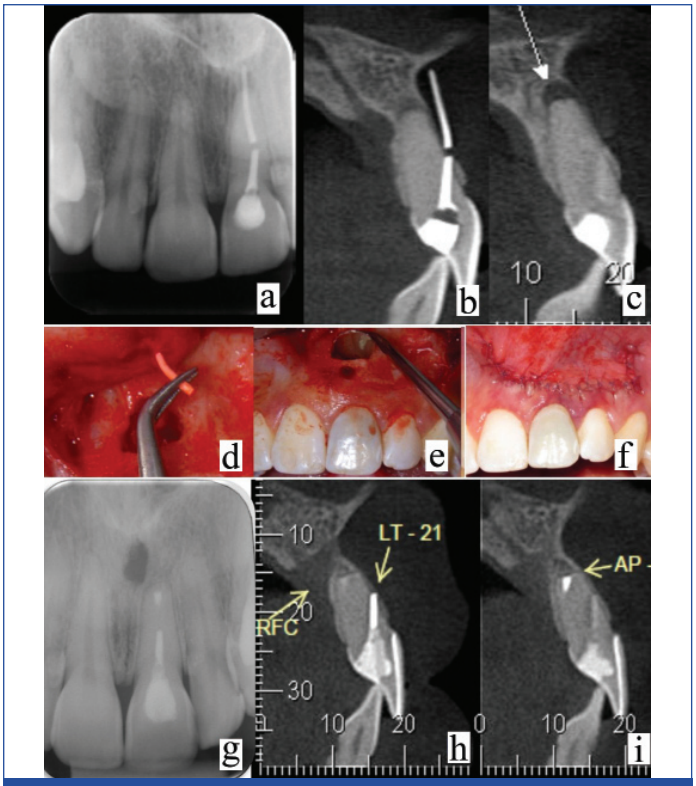
Case 1

A 28-year-old female patient in good general health sought treatment at the Dental Clinic with a chief complaint of frequent discomfort and, in last three days, spontaneous pain related to an increase of volume in the periapical area of upper front tooth (#9). A root canal treatment about three years ago was reported which resulted in a change in the tooth colour. Pulp tests were performed in all upper anterior teeth using Endo-Frost (Roeko-Wilcos do Brasil, Rio de Janeiro, Brazil) and suggested presence of non-vital pulp tissue in tooth #9. Upon clinical examination, a grayish colour was observed, and in the initial radiographic exam, excess gutta-percha was found to be extruding out of the root canal, and there were signs of a periapical radiolucent area. The images showed an interruption and small displacement of the filling material at the level of the middle third of the root canal and gutta-percha extruding out of the root canal [Table/Fig-1a]. Thus, a Cone Beam Computed Tomography scan (I-CAT Cone Beam 3D imaging system, Imaging Sciences International, Hatfield, PA, USA) was obtained to improve the localisation of and access to the RCP. In the sagittal plane, an RCP was observed in the middle third of the buccal surface with more than 1 cm of gutta-percha cone extruding out of the root canal and reaching the anterior nasal spine [Table/Fig-1b]. At the periapical level, a radiolucent area was verified [Table/Fig-1c]. The clinical recommendation included surgical procedures to remove the filling material that had extruded into the buccal soft tissue through the RCP [Table/Fig-1d] and additionally, an apicoectomy in the apical third of the tooth. Once the treatment plan was established, the patient signed an informed consent form agreeing to the study procedures.

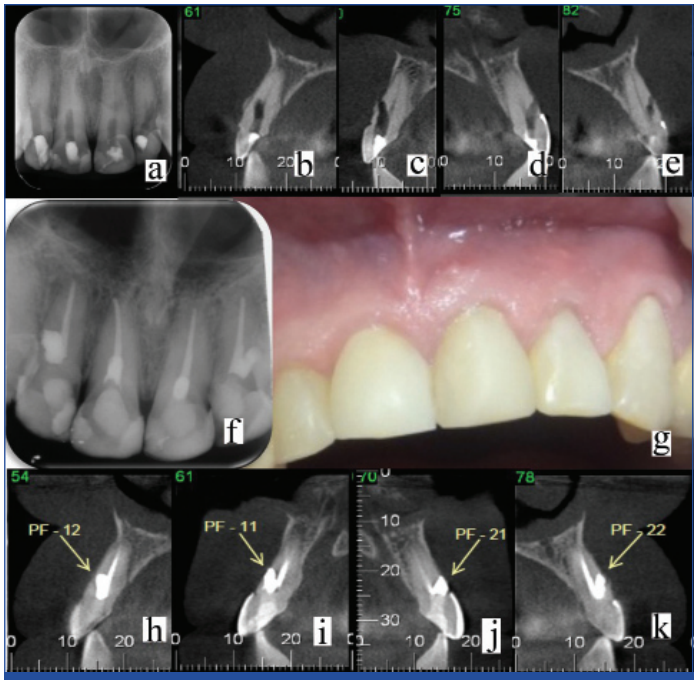
A 3% mepivacaine containing 1:100000 adrenaline (DFL, Rio de Janeiro, RJ, Brazil) was administered to obtain local anaesthesia of the left and right infraorbital nerve and then the surgical phase was initiated by Neumann's incision with mucoperiosteal flap. The total divulsion of the flap was done at the meeting point of the vertical and horizontal incision, enabling the visualisation of the apical area of tooth #9. The burs #2 and 3, in high rotation, were used for osteotomy. After this, the apical curettage was followed with the removal of smooth tissue. The apicoectomy was performed with Zekrya bur, 3 mm from the radicular vertex with 0° angle (no bevel). The retrocavity was made with ultrasound points and followed the filling of the cavity with white MTA (Angelus, Soluções Odontológicas Ltda, Londrina-PR, Brazil) [Table/Fig-1e]. Residual surgical bed was filled with blood clot and suturing was performed with non-absorbable monofilament nylon [Table/Fig-1f]. After seven days, the patient returned for suture removal, and 15 days following the surgery, complete healing of the mucosal wound was observed. In a subsequent recall appointment one year after the surgery, periapical radiographic analyses demonstrated bone tissue formation around the apex. A small radiolucent area persisted near the osseous neoformation area, suggesting the presence of periapical scar tissue [Table/Fig-1g]. No clinical symptoms of pain or signs of lesion recurrence was recorded. A new CBCT was obtained [Table/Fig-1h,i]. The patient was informed of the need to continue recall appointments for several years.

Case 2

A 60-year-old male patient sought treatment at the Dental Clinic for root canal treatment with a chief complaint of spontaneous pain, during last two days, in the maxillary buccal anterior area. According to the patient, the crowns of upper front teeth (#7-10) had been opened in a previous procedure. On clinical examination, no soft tissue abnormality was observed. Pulp tests were performed in all upper anterior teeth using Endo-Frost (Roeko-Wilcos do Brasil, Rio de Janeiro, Brazil) and suggested presence of non-vital pulp tissue in tooth #7-10. Palpation caused discomfort in the periapical regions and revealed the absence of sinus tracts, oedema, or periodontal pockets and a normal tissue colour. The initial radiographic examination revealed RCP in all maxillary incisors [Table/Fig-2a]. A 3D imaging exam (cone beam computed tomography scans, I-CAT Cone Beam 3D imaging system, Imaging Sciences International, Hatfield, PA, USA) was required for treatment planning and to determine the



[Table/Fig-1]: a) An interruption and small displacement of the filling material at the level of the middle third of tooth #9 and gutta-percha extruding out of the root canal; b) In the sagittal plane, an RCP was observed in the middle third of the buccal surface with more than 1 cm of gutta-percha cone extruding out of the root canal and reaching the anterior nasal spine; c) At the periapical level, a radiolucent area was verified (white arrow); d) Remotion of the filling material that had extruded into the buccal soft tissue; e) The apicoectomy retrocavity filled with white MTA (Angelus, Soluções Odontológicas Ltda, Londrina-PR, Brazil); f) Residual surgical bed was filled with blood clot and suturing was performed with non-absorbable monofilament nylon; g) A small radiolucent area persisted near the osseous neoformation area, suggesting the presence of periapical scar tissue; h&i) CBCT scans on one-year follow-up.



[Table/Fig-2]: a) The initial radiographic examination revealed RCP in all maxillary incisors; b-e) A 3D imaging exam (cone beam computed tomography scans, I-CAT Cone Beam 3D imaging system, Imaging Sciences International, Hatfield, PA, USA) was required for treatment planning and to determine the precise location of and access to the RCP; f) In the same visit, the RCP sites were surgically exposed and filled with MTA (Angelus, Soluções Odontológicas Ltda, Londrina-PR, Brazil); g) After seven days, the patient returned for suture removal, and the buccal area showed complete healing of the mucosal wound; h-k) In subsequent recall appointments approximately one year after surgery, imaging exams demonstrated tissue formation.

precise location of and access to the RCP [Table/Fig-2b-e]. After the treatment plan was established, the patient underwent conventional root canal treatment followed by surgical procedures to seal the RCP with MTA (Angelus, Soluções Odontológicas Ltda, Londrina-PR, Brazil). The patient signed an informed consent form agreeing to the procedures. The coronal opening was also prepared, and the teeth were individually instrumented up to 1 mm above the root apex with a #45 K-file (Dentsply/Maillefer, Ballaigues, Switzerland) and irrigated carefully with 0.5% sodium hypochlorite (NaOCl) (NatuPharmas, Goiânia, GO, Brazil). The root canals were dried with sterile paper points and completely filled with calcium hydroxide in saline. After 30 days, the intracanal dressing was removed from the teeth using saline and mechanical instrumentation with K-files. Subsequently, the root canals were dried and filled with gutta-percha cones and Sealapex (SybronEndo, Romulus, MI, USA). In the same visit, the RCP sites were surgically exposed and filled with MTA [Table/Fig-2f]. After seven days, the patient returned for suture removal, and the buccal area showed complete healing of the mucosal wound [Table/Fig-2g]. In subsequent recall appointments approximately one year after surgery, imaging exams demonstrated tissue formation without clinical symptoms of pain or signs of lesion recurrence [Table/Fig-2h-k]. The patient was informed of the need to continue recall appointments for several years.

DISCUSSION

Root canal perforation is defined as a communication between the crown or root canals and the periodontal space and it is often associated with errors in operative procedure [1-3]. The prognosis of RCP must be considered carefully, and depending on certain characteristics, the level of success may be in question [3,4]. The location of and access to the RCP are aspects that deserve to be carefully analysed [4,5]. The visualisation of three-dimensional structures of the bucco-maxillofacial complex through the use of CBCT imaging has provided new perspectives in endodontic practice [2,6]. The value of image interpretation in several planes contributes considerably to the diagnostic and prognostic process [2]. Methods that allow the dynamic visualisation of dental structures in three dimensions presents potential benefits for diagnosis and prognosis in clinical dental procedures [2,6-8].

RCP that occur during coronal opening may be associated with a lack of proper observation of the dental anatomy or poor operator ability [4]. The dental crown can present with reduced or obstructed volume due to the deposition of reparative dentin as a consequence of constant aggression and/or tissue aging [6]. Thus, it is important to consider the degree of axial inclination of the tooth relative to the adjacent dental elements and the alveolar bone [7,8]. One should be cautious during the coronal opening of poorly positioned teeth [5]. Failures in the analysis of the initial radiography may also lead to accidents [2,6,9-13].

In both case reports presented here, it appears that RCP occurred due to procedural errors during access cavity preparation. In the first case report, the absence of a proper relationship between the choice of the size of bur and the pulp chamber volume and the direction of access might have caused the RCP. In addition to discomfort, a small swelling corresponding to the extruded material was observed. The solution first involved the more accurate visualisation of the decoupled structures to better determine the position of the material and the location of the perforation. The cone shift technique was used; however, a better visualisation of the RCP in other planes could provide greater benefits in the planning and surgical management of the case. Imaging exams (CBCT scans) provided more details in various planes to aid in the correct positioning of the RCP. The surgical management and planning were better structured after the three-dimensional visualisation of images. This observation was consistent with the literature that evidences the consequences of overinstrumentation and the ensuing inadequate apical stopping, resulting in extensive gutta-percha extrusion into the maxillary sinus [14]. The use of CBCT enhances endodontic diagnosis and serves as an aid for the visualisation of foreign materials, improving clinical outcomes [3,8,10-12].

In the first case report described, a good outcome was observed after one year. Periapical scar tissue was detected near the neoformed area around the apex. No clinical symptoms of pain or signs of lesion recurrence were observed, however continued recall in subsequent years was recommended for follow-up. The unresolved periapical radiolucency may often occur due to healing with fibrous scar tissue, which may be mistaken as a sign of failed endodontic treatment [7,8,14]. At the microscopic level, this area is composed of dense collagenous soft connective tissue. In the second case report, considerable dental injury was verified, with a series of perforations in the maxillary incisors. The failure to diagnose and treat RCP may have disastrous consequences, leading to tooth loss and subsequent replacement by a dental implant. Improper care may be responsible for severe consequences and recurrence, which impairs the prognosis [2,11,15].

CONCLUSION

RCP is considered a serious error in operative procedure. Once properly diagnosed, localised, and sealed with biomaterial, a favourable prognosis is often achieved. MTA offered a good seal of perforations, with promising results. The use of CBCT in diagnosis allowed better security, correct positioning and improved surgical planning of RCP.

REFERENCES

[1] Kakani AK, Veeramachaneni C, Majeti C, Tummala M, Khiyani L. A Review on perforation repair materials. J Clin Diagn Res. 2015;9(9):ZE09-13.

[2] Dudeja PG, Dudeja KK, Garg A, Srivastava D, Grover S. Management of a previously treated, calcified, and dilacerated maxillary lateral incisor: a combined nonsurgical/surgical approach assisted by cone-beam computed tomography. J Endod. 2016;42(6):984-88.

[3] Strbac GD, Schnappauf A, Giannis K, Moritz A, Ulm C. Guided modern endodontic surgery: a novel approach for guided osteotomy and root resection. J Endod. 2017;43(3):496-501.

[4] Camilo do Carmo Monteiro J, Rodrigues Tonetto M, Coêlho Bandeca M, Henrique Borges A, Cláudio Martins Segalla J, Cristina Fagundes Jordão-Basso K, et al. Repair of iatrogenic furcal perforation with mineral trioxide aggregate: a seven-year follow-up. Iran Endod J. 2017;12(4):516-20.

[5] Lagisetti AK, Hegde P, Hegde MN. Evaluation of bioceramics and zirconia-reinforced glass ionomer cement in repair of furcation perforations: An in vitro study. J Conserv Dent. 2018;21(2):184-89.

[6] Ee J, Fayad MI, Johnson BR. Comparison of endodontic diagnosis and treatment planning decisions using cone-beam volumetric tomography versus periapical radiography. J Endod. 2014;40(7):910-16.

[7] Venskutonis T, Plotino G, Juodzbalys G, MickevičienėL. The importance of cone-beam computed tomography in the management of endodontic problems: a review of the literature. J Endod. 2014;40(12):1895-901.

[8] Uraba S, Ebihara A, Komatsu K, Ohbayashi N, Okiji T. Ability of cone-beam computed tomography to detect periapical lesions that were not detected by periapical radiography: a retrospective assessment according to tooth group. J Endod. 2016;42(8):1186-90.

[9] Setzer FC, Hinckley N, Kohli MR, Karabucak B. A Survey of cone-beam computed tomographic use among endodontic practitioners in the United States. J Endod. 2017;43(5):699-704.

[10] Lima TF, Gamba TO, Zaia AA, Soares AJ. Evaluation of cone beam computed tomography and periapical radiography in the diagnosis of root resorption. Aust Dent J. 2016;61(4):425-31.

[11] Haghanifar S, Moudi E, Mesgarani A, Bijani A, Abbaszadeh N. A comparative study of cone-beam computed tomography and digital periapical radiography in detecting mandibular molars root perforations. Imaging Sci Dent. 2014;44(2):115-19.

[12] Van Der Meer WJ, Vissink A, Ng YL, Gulabivala K. 3D Computer aided treatment planning in endodontics. J Dent. 2016;45:67-72.

[13] Brooks JK, Kleinmam JW. Retrieval of extensive gutta-percha extruded into the maxillary sinus: use of 3-dimensional cone-beam computed tomography. J Endod. 2013;39(9):1189-93.

[14] Smigiel KS, Parks WC. Macrophages, wound healing, and fibrosis: recent insights. Curr Rheumatol Rep. 2018;20(4):17.

[15] Yamaguchi M, Noiri Y, Itoh Y, Komichi S, Yagi K, Uemura R, et al. Factors that cause endodontic failures in general practices in Japan. BMC Oral Health. 2018;18(1):70.

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Oral Sciences, University of Cuiaba, Cuiaba, Mato Grosso, Brazil.
2. Professor, Department of Oral Sciences, University of Cuiaba, Cuiabá, MT, Brazil.
3. Professor, Department of Oral Sciences, Federal University of Goias, Goiania, Goias, Brazil.
4. Professor, Department of Oral Sciences, University of Cuiaba, Cuiabá, MT, Brazil.
5. Professor, Department of Oral Sciences, Federal University of Goias, Goiania, Goias, Brazil.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Alvaro Henrique Borges,
Avenida ISAAC Povoas 1177 ED Conjuntonacional 102 SALA 102, Cuiaba, Mato Grosso, Brazil.
E-mail: alvarohborges@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Jun 05, 2018**
Date of Peer Review: **Jul 27, 2018**
Date of Acceptance: **Oct 11, 2018**
Date of Publishing: **Dec 01, 2018**