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Microsurgical Management of a Three-Rooted Maxillary Premolar: A Case Report

Abdulwahab Saleh Alwadei[1], Nawaf Masad Alkhammash[2*], Mahmud Uz Zaman[3], Mohammed Hijji Alhajji[4] and Omar Abdullah Aldayel[5]

[1,2,5]Prince Abdulrahman Advanced Dental Institute, 14318 Riyadh, Saudi Arabia
[3]Department of Oral and Maxillofacial Surgery and Diagnostic Sciences, College of Dentistry, Prince Sattam Bin Abdullaziz University, 11942 Al-kharj, Saudi Arabia
[4]Private Sector, Al Mursilat, 12462 Riyadh, Saudi Arabia

Author Designation: [1]Endodontics Consultant, [2]Endodontics Resident, [4]General Practitioner, [5]Restorative Consultant

*Corresponding author: Nawaf Masad Alkhammash (e-mail: nawafmalkhammash@gmail.com).

Abstract This case report details the management of a three-rooted maxillary first premolar presenting with symptomatic apical periodontitis after root canal has been done. An 18-year-old male patient experienced persistent pain localized around the treated tooth, despite a previous intervention six months ago. Clinical and radiographic evaluations revealed a complex three-canal system with a extruded material. Given the persistent symptoms and anatomical complexities, a combined approach of apicoectomy, surgical debridement and guided tissue regeneration were employed. No postoperative complications were observed and the 10-month follow-up confirmed satisfactory periapical healing and restoration of function. The treatment included the use of biocompatible materials and microsurgery techniques to enhance healing and structural integrity. This report highlights the importance of recognizing anatomical variations and discusses the effective integration of advanced surgical approaches and materials in managing complex endodontic cases. This case underscores the significance of recognizing rare anatomical variations and highlights the effective use of guided tissue regeneration and microsurgical techniques for successful endodontic outcomes. The follow-up demonstrated significant symptomatic relief and radiographic signs of healing, highlighting the effectiveness of the chosen management strategy.

Key Words Root Canal Treatment, Maxillary Premolar, Three-rooted Premolar, Surgical Endodontics, Guided Tissue Regeneration, Canal Complexity

INTRODUCTION

Root canal treatment aims to treat and prevent apical periodontitis within the complex canal anatomy by disinfecting and sealing the canal system and removing causative factors [1,2]. Successful treatment is indicated by the absence of both apical periodontitis and symptoms over the observation period [3]. The outcome of endodontic therapy can be affected by multiple factors, including the status of the root canal, the extent of periradicular infection, the presence of iatrogenic mishaps, the quality of obturation and the complexity of the root canal system [3-6]. Surgical intervention can be an appropriate approach in managing a variety of cases involving canal complexity and mishaps [7]. A significant extrusion of root canal filling is one of the complications after root canal treatment resulting in an inflammatory response and symptoms [8]. In a clinical situation when it was impossible to solve the problem by orthograde treatment, then the surgical option is better [9,10]. Variation is a common finding in endodontics and three-rooted maxillary premolars have a low prevalence of approximately 1.4-0.3% [11,12]. Three-rooted maxillary premolars represent a rare anatomical variant with a documented prevalence of 1.0-1.7% in the Saudi population [13], posing significant diagnostic and therapeutic challenges. Given the presence of a fiber post in the palatal root and well-obturated canals, orthograde retreatment was deemed impractical. This case report describes an endodontic surgical approach to manage an extruded root-filling material of a premolar with anatomical variation.

CASE REPORT

An 18-year-old male patient, unaware of any medical problems, was referred from the prosthodontic department regarding an upper left first premolar, with a chief complaint of pain upon palpation after root canal treatment done six months ago. Clinical examination revealed a crowned tooth with mild, dull, localized pain that required a stimulus (Figure 1). Radiographic examination showed a three-canal system with an extruded material, a full coverage crown with a fiber post in the palatal root (Figure 2, 3).

Apicoectomy and surgical debridement were selected, with preoperative preparation including ibuprofen 600 mg

Figure 1: Preoperative clinical photo

Figure 2: Pre-operative periapical radiograph showing extruded gutta-percha in the buccal and palatal canals

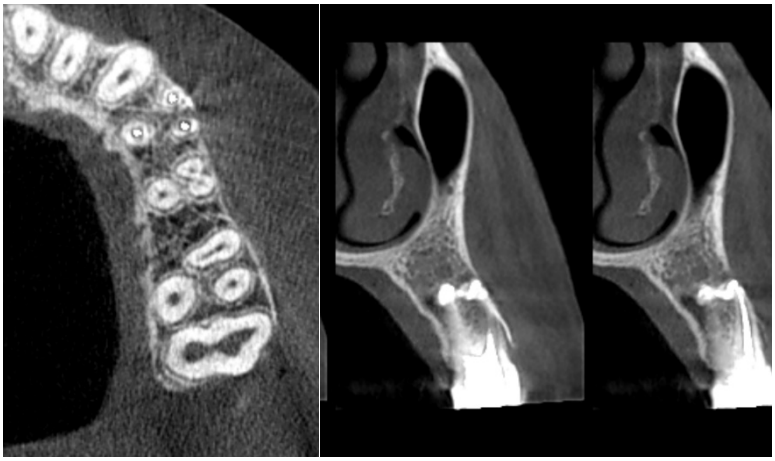

Figure 3: Axial and coronal CBCT images confirming three distinct roots and extrusion of material into periapical tissues

Figure 4: Clinical view after flap reflection showing the extruded material

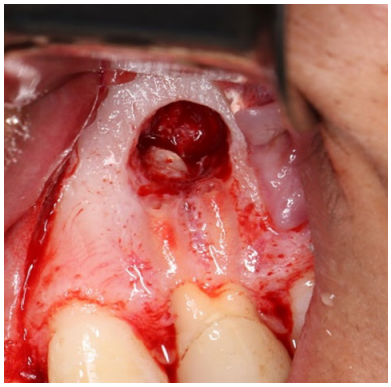

Figure 5: Root-end preparation of 3 mm in depth using surgical ultrasonic tips

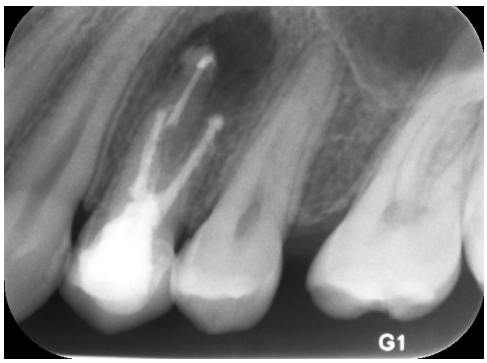

Figure 6: Preapical radiograph confirmed the proper root-end filling with no voids

and a 0.2% chlorhexidine gluconate mouth rinse for one minute. A lidocaine L.A. with 18 ml 1:100,000 epinephrine was administered with buccal and palatal infiltration.

A triangular intrasulcular incision was made from mesial to the canine with a vertical incision to mid-buccal of the first molar and a full-thickness mucoperiosteal flap was raised. Care was taken to preserve the interdental papilla and minimize trauma to ensure optimal soft tissue healing. The extruded material was easily detected after the flap reflection (Figure 4). Osteotomy was performed using a round carbide bur, a 3 mm root end resection for three roots one palatal and two buccal using a multipurpose bur by high speed handpiece. Curettage removed all granulation tissue and extruded filling material. Root end cavity preparation for the roots was done using ultrasonic tips (AS3D, Satelec Acteon Group, Merignac, France) under water cooling to a 3 mm depth (Figure 5). Retro-filling was performed using bioceramic putty filling material TotaFill (FKG Dentaire SA, Switzerland) (Figure 6, 7). TotaFill bioceramic putty was selected for its high sealing ability, biocompatibility and osteoconductive properties, making it a suitable choice for retrograde filling.

Figure 7: Placement of bioceramic putty as root-end filling material

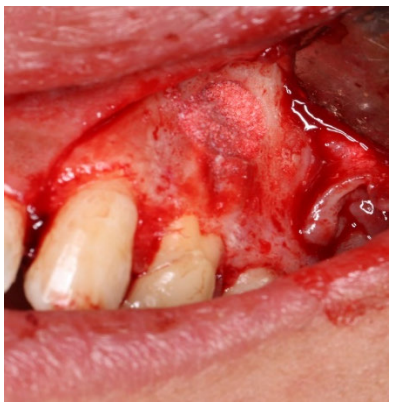

Figure 8: Bone graft material mixed with saline and placed into the bony defect

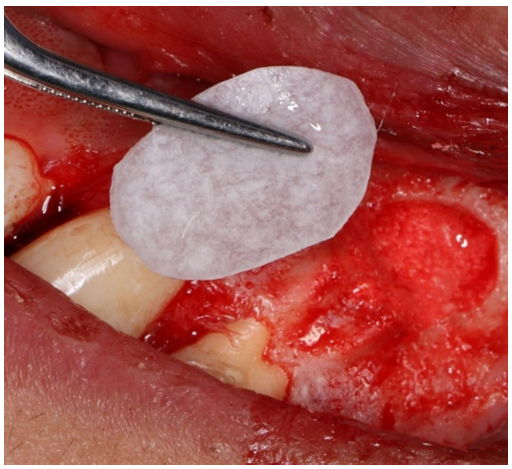

Figure 9: A collagen membrane was placed on top of the bone graft

A xenogeneic bone graft (InterOss Anorganic Canoncellous granules, Austria) mixed with saline was gently packed into the apical area (Figure 8) and then covered with a wet, absorbable collagen membrane (Cytoplast, RTM Collagen, Germany) (Figure 9). The wound edges were carefully re-approximated to allow for primary intention

Figure 10: Suturing using 5-0 Vicryl

Figure 11: Three-month follow-up radiograph showing periapical healing

healing. The repositioned flap was compressed with saline-moistened gauze to reduce the coagulum between the flap and the cortical bone. Single interrupted sutures were placed using 5-0 vicryl (Figure 10). Postoperative instructions were given, which included a one-week course of amoxicillin 500 mg three times a day, ibuprofen 600 mg every 8 hours for three days and CHX mouthwash. After one week, the sutures were removed. The patient was educated on oral hygiene measures, advised to avoid trauma to the surgical site and scheduled for periodic follow-ups. BCT imaging at 10 months revealed substantial bone fill and disappearance of the periapical radiolucency, indicating complete resolution of the lesion.

At follow-up visit performed at 3 and 10 months, the patient was found to be asymptomatic, soft tissue healing and resulotion of periapical radiolucency (Figure 11-13).

DISCUSSION

A three-rooted maxillary premolar is a normal variation where radiographic interpretation plays an essential role in evaluating root canal morphology [14]. Cone beam computed tomography can provide a more detailed evaluation of canal morphology and detect lesion extension and proximity to vital structures, which can play a crucial role in the success of endodontic treatment [15-17]. In our case, CBCT showed a rare finding of a present three-root system in all premolars, with the first left premolar showing gross extrusion of a material. In cases where symptoms persist despite orthograde treatment and extruded materials are involved, surgical intervention becomes essential for definitive management [7,8].

Many studies demonstrate that endodontically treated teeth with an extruded material beyond the apex that remain symptomatic may require apical surgery [18,19]. The presence of a foreign body, such as extruded root filling materials, in the periapical region may make it more difficult for the periapical tissue to repair after treatment, according to clinical and histologic evidence [19]. A foreign body reaction can be a causative factor of non-microbial reaction of apical periodontitis. Despite new advancements in sealers and biocompatibility, extruded thermoplastized gutta-percha and sealer can have adverse effects depending on the previous

Figure 12: Clinical view showing soft tissue healing

Figure 12: Ten-month follow-up radiograph showing periapical healing

status of radicular tissue [20,21]. These extruded materials probably became a significant factor in treatment failure only if the microorganisms are present [18].

In well-obturated teeth, an orthograde retreatment is unlikely to resolve the problem, as it does not remove the extruded materials beyond the root canals [19]; surgical management is preferable when persistent pain cannot improve by other means [22-23]. Orthograde retreatment, though effective in many cases, is often inadequate in removing extruded material, particularly when access is obstructed by posts or restorations [18,19] As new technologies such as microscopes and biocompatible materials have been introduced, the concept of microsurgery in endodontics has increased, with an increasing success rate. Modern endodontic microsurgery, aided by magnification and ultrasonic root-end preparation, has demonstrated superior outcomes, with success rates reaching up to 94% compared to 59% with traditional methods [24]. Apical surgery performed with the aim of guided tissue regeneration has the potential to increase bone regeneration and can increase the success rate of periapical surgery [25-27]. Guided tissue regeneration helps reestablish the periodontal architecture by preventing soft tissue invasion and promoting osseous regeneration at the surgical site [25,26] In addition to offering the chance to eliminate the extruded materials that cause apical radiolucency, a surgical procedure enables a retrograde method to clear the apical part of the root canal system from any possible infection [19].

CONCLUSION

The main purpose of this case report is to highlight the successful surgical management of a three-rooted maxillary premolar with an extruded material when orthograde retreatment is not feasible. With advanced imaging (CBCT) combined with precise microsurgical techniques and bioactive materials the treatment provides predictable outcomes for teeth with complex anatomy which cannot be treated orthograde. The correct identification of anatomical divergences becomes essential for creating effective endodontic treatment strategies.

Conflicts of Interest

The authors report no conflicts of interest related to this case report.

REFERENCES

[1] Winkler, Alexander et al. "Endodontic outcome of root canal treatment using different obturation techniques: a clinical study." *Dentistry Journal*, vol. 11, no. 8, August 2023. https://www.mdpi.com/2304-6767/11/8/200.

[2] Bueno, Mike Reis *et al.* "Mesenchymal chondrosarcoma mimicking apical periodontitis." *Journal of Endodontics,* vol. 34, no. 11, November 2008, pp. 1415-1419. https://pubmed.ncbi.nlm.nih.gov/18928860/.

[3] Friedman, Shimon *et al.* "Treatment outcome in endodontics: the Toronto Study. Phase 1: initial treatment." *Journal of Endodontics,* vol. 29, no. 12, December 2003, pp. 787-793. https://www.sciencedirect.com/science/article/pii/S0099239905603755.

[4] Bergenholtz, G. "Assessment of treatment failure in endodontic therapy." *Journal of Oral Rehabilitation,* vol. 43, no. 10, August 2016, pp. 753-758. https://onlinelibrary.wiley.com/doi/abs/10.1111/joor.12423.

[5] Matsumoto, Toru *et al.* "Factors affecting successful prognosis of root canal treatment." *Journal of Endodontics,* vol. 13, no. 5, May 1987, pp. 239-242. https://www.sciencedirect.com/science/article/pii/S0099239987800985.

[6] Park, Da-Min *et al.* "Factors Influencing Non-Surgical Root Canal Treatment Outcomes in Mandibular Second Molars: A Retrospective Cone-Beam Computed Tomography Analysis." *Journal of Clinical Medicine,* vol. 13, no. 10, May 2024. https://www.mdpi.com/2077-0383/13/10/2931.

[7] Gulabivala, Kishor and Yuan Ling Ng. "Factors that affect the outcomes of root canal treatment and retreatment—A reframing of the principles." *International Endodontic Journal,* vol. 56, January 2023, pp. 82-115. https://onlinelibrary.wiley.com/doi/full/10.1111/iej.13897.

[8] Rosen, Eyal *et al.* "The prognosis of altered sensation after extrusion of root canal filling materials: A systematic review of the literature." *Journal of Endodontics,* vol. 42, no. 6, June 2016, pp. 873-879. https://www.sciencedirect.com/science/article/pii/S0099239916301078.

[9] Wang, Wen-Hsi *et al.* "Compositional characteristics and hydration behavior of mineral trioxide aggregates." *Journal of Dental Sciences,* vol. 5, no. 2, June 2010, pp. 53-59. https://www.sciencedirect.com/science/article/pii/S1991790210600098.

[10] Setzer, Frank C. and Samuel I. Kratchman. "Present status and future directions: Surgical endodontics." *International Endodontic Journal,* vol. 55, June 2022, pp. 1020-1058. https://onlinelibrary.wiley.com/doi/full/10.1111/iej.13783.

[11] Xu, Mengchen *et al.* "Systematic review and meta-analysis of root morphology and canal configuration of permanent premolars using cone-beam computed tomography." *BMC Oral Health,* vol. 24, no. 1, June 2024. https://link.springer.com/article/10.1186/s12903-024-04419-y.

[12] Aljawhar, Abdullah Mohammed *et al.* "Characterization of the root and canal anatomy of maxillary premolar teeth in an Iraqi subpopulation: A cone beam computed tomography study." *Odontology,* vol. 112, no. 2, November 2023, pp. 570-587. https://link.springer.com/article/10.1007/s10266-023-00870-5.

[13] Al-Zubaidi, Saad M. *et al.* "Assessment of root morphology and canal configuration of maxillary premolars in a Saudi subpopulation: A cone-beam computed tomographic study." *BMC Oral Health,* vol. 21, August 2021. https://link.springer.com/article/10.1186/s12903-021-01739-1.

[14] Ok, Evren *et al.* "A cone-beam computed tomography study of root canal morphology of maxillary and mandibular premolars in a Turkish population." *Acta Odontologica Scandinavica,* vol. 72, no. 8, May 2014, pp. 701-706. https://www.tandfonline.com/doi/abs/10.3109/00016357.2014.898091.

[15] Khanna, Ateksha Bhardwaj. "Applications of cone beam computed tomography in endodontics." *Evidence-Based Endodontics,* vol. 5, September 2020. https://link.springer.com/article/10.1186/s41121-020-00020-4.

[16] Goyal, Bhawna *et al.* "Comparative evaluation of platelet-rich plasma and guided tissue regeneration membrane in the healing of apicomarginal defects: A clinical study." *Journal of Endodontics,* vol. 37, no. 6, June 2011, pp. 773-780. https://pubmed.ncbi.nlm.nih.gov/21787487/.

[17] Nixdorf, D.R. *et al.* "Frequency of persistent tooth pain after root canal therapy: A systematic review and meta-analysis." *Journal of Endodontics*, vol. *36, no.* 2, 2010, pp. 224-230.

[18] Kim, Syngcuk. *Endodontic Microsurgery.* In: Pathways of the Pulp, 2002, https://cir.nii.ac.jp/crid/1571417125420771200.

[19] Goon, W.W. "The" radiculous" maxillary premolar: recognition, diagnosis, and case report of surgical intervention." *Northwest Dentistry,* vol. 72, no. 2, April 1993, pp. 31-33. https://pubmed.ncbi.nlm.nih.gov/8332442/.

[20] Ramachandran Nair, P.N. "Non microbial etiology: foreign body reaction maintaining post treatment apical periodontitis." *Endodontic Topics,* vol. 6, no. 1, June 2004, pp. 114-134. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1601-1546.2003.00052.x.

[21] Ricucci, Domenico *et al.* "Apically extruded sealers: Fate and influence on treatment outcome." *Journal of Endodontics,* vol. 42, no. 2, February 2016, pp. 243-249. https://www.sciencedirect.com/science/article/abs/pii/S0099239915010833.

[22] Krastev, Bogdan and Ivan Filipov. "Periapical Surgery. Epidemiology, indications and contraindications. Review." *Journal of IMAB–Annual Proceeding Scientific Papers,* vol. 26, no. 2, June 2020, pp. 3114-3121. https://www.journal-imab-bg.org/issues-2020/issue2/JofIMAB-2020-26-2p3114-3121.pdf.

[23] Floratos, Spyros and Syngcuk Kim. "Modern endodontic microsurgery concepts: A clinical update." *Dental Clinics,* vol. 61, no. 1, 2017, pp. 81-91. https://bedentalexpert.com/wp-content/uploads/2021/09/Modern-Endodontic-Microsurgery-Concepts-A-Clinical-Update.pdf.

[24] Setzer, Frank C. *et al.* "Outcome of endodontic surgery: a meta-analysis of the literature—part 1: Comparison of traditional root-end surgery and endodontic microsurgery." *Journal of Endodontics,* vol. 36, no. 11, November 2011, pp. 1757-1765.

[25] Alotaibi, A. *et al.* "Treatment outcomes of different endodontic regeneration techniques for mature teeth with necrotic pulp and apical periodontitis: A systematic review and meta-analysis." *Journal of Clinical Medicine,* vol. 11, no. 4, 2022, pp. 1062-1062.

[26] Corbella, Stefano *et al.* "Guided tissue regeneration using a barrier membrane in endodontic surgery." *Swiss Dental Journal,* vol. 126, no. 1, 2016, pp. 13-25. https://air.unimi.it/handle/2434/418037.

[27] Zubizarreta-Macho, Álvaro *et al.* "Influence of guided tissue regeneration techniques on the success rate of healing of surgical Endodontic treatment: A systematic review and network meta-analysis." *Journal of Clinical Medicine,* vol. 11, no. 4, February 2022. https://www.mdpi.com/2077-0383/11/4/1062.