

World Journal of *Clinical Cases*

World J Clin Cases 2022 August 16; 10(23): 8057-8431



Contents

Thrice Monthly Volume 10 Number 23 August 16, 2022

OPINION REVIEW

- 8057** Invasive intervention timing for infected necrotizing pancreatitis: Late invasive intervention is not late for collection

Xiao NJ, Cui TT, Liu F, Li W

- 8063** Clinical utility of left atrial strain in predicting atrial fibrillation recurrence after catheter ablation: An up-to-date review

Yu ZX, Yang W, Yin WS, Peng KX, Pan YL, Chen WW, Du BB, He YQ, Yang P

MINIREVIEWS

- 8076** Gut microbiota and COVID-19: An intriguing pediatric perspective

Valentino MS, Esposito C, Colosimo S, Caprio AM, Puzone S, Guarino S, Marzuillo P, Miraglia del Giudice E, Di Sessa A

- 8088** Beta receptor blocker therapy for the elderly in the COVID-19 era

Santillo E, Migale M

ORIGINAL ARTICLE

Retrospective Cohort Study

- 8097** Nonselective beta-blocker use is associated with increased hepatic encephalopathy-related readmissions in cirrhosis

Fallahzadeh MA, Asrani SK, Tapper EB, Saracino G, Rahimi RS

Retrospective Study

- 8107** Different squatting positions after total knee arthroplasty: A retrospective study

Li TJ, Sun JY, Du YQ, Shen JM, Zhang BH, Zhou YG

- 8115** Outcomes of seromuscular bladder augmentation compared with standard bladder augmentation in the treatment of children with neurogenic bladder

Sun XG, Li YX, Ji LF, Xu JL, Chen WX, Wang RY

- 8124** Distinctive clinical features of spontaneous pneumoperitoneum in neonates: A retrospective analysis

Kim SH, Cho YH, Kim HY

- 8133** Cognitive training for elderly patients with early Alzheimer's disease in the Qinghai-Tibet Plateau: A pilot study

Wang XH, Luo MQ

- 8141** Diagnostic value of elevated serum carbohydrate antigen 125 level in sarcoidosis

Zhang Q, Jing XY, Yang XY, Xu ZJ

- 8152** Evaluation of progressive early rehabilitation training mode in intensive care unit patients with mechanical ventilation

Qie XJ, Liu ZH, Guo LM

- 8161** Comparison of demographic features and laboratory parameters between COVID-19 deceased patients and surviving severe and critically ill cases

Wang L, Gao Y, Zhang ZJ, Pan CK, Wang Y, Zhu YC, Qi YP, Xie FJ, Du X, Li NN, Chen PF, Yue CS, Wu JH, Wang XT, Tang YJ, Lai QQ, Kang K

Clinical Trials Study

- 8170** Role of H₂receptor blocker famotidine over the clinical recovery of COVID-19 patients: A randomized controlled trial

Mohiuddin Chowdhury ATM, Kamal A, Abbas MKU, Karim MR, Ali MA, Talukder S, Hamidullah Mehedi H, Hassan H, Shahin AH, Li Y, He S

Observational Study

- 8186** Short-term prognostic factors for hepatitis B virus-related acute-on-chronic liver failure

Ye QX, Huang JF, Xu ZJ, Yan YY, Yan Y, Liu LG

- 8196** Three-dimensional psychological guidance combined with evidence-based health intervention in patients with liver abscess treated with ultrasound

Shan YN, Yu Y, Zhao YH, Tang LL, Chen XM

- 8205** Role of serum β 2-microglobulin, glycosylated hemoglobin, and vascular endothelial growth factor levels in diabetic nephropathy

Yang B, Zhao XH, Ma GB

SYSTEMATIC REVIEWS

- 8212** Gallbladder neuroendocrine carcinoma diagnosis, treatment and prognosis based on the SEER database: A literature review

Cai XC, Wu SD

CASE REPORT

- 8224** Sepsis complicated with secondary hemophagocytic syndrome induced by giant gouty tophi rupture: A case report

Lai B, Pang ZH

- 8232** Spontaneous remission of autoimmune pancreatitis: Four case reports

Zhang BB, Huo JW, Yang ZH, Wang ZC, Jin EH

- 8242** Epstein-Barr-virus-associated hepatitis with aplastic anemia: A case report

Zhang WJ, Wu LQ, Wang J, Lin SY, Wang B

- 8249** Aspiration as the first-choice procedure for airway management in an infant with large epiglottic cysts: A case report

Zheng JQ, Du L, Zhang WY

- 8255** Sequential multidisciplinary minimally invasive therapeutic strategy for heart failure caused by four diseases: A case report
Zhao CZ, Yan Y, Cui Y, Zhu N, Ding XY
- 8262** Primary ascending colon cancer accompanying skip metastases in left shoulder skin and left neck lymph node: A case report
Zhou JC, Wang JJ, Liu T, Tong Q, Fang YJ, Wu ZQ, Hong Q
- 8271** Clinical and genetic study of ataxia with vitamin E deficiency: A case report
Zhang LW, Liu B, Peng DT
- 8277** Complete resection of large-cell neuroendocrine and hepatocellular carcinoma of the liver: A case report
Noh BG, Seo HI, Park YM, Kim S, Hong SB, Lee SJ
- 8284** Immunotherapy combined with antiangiogenic agents in patients with advanced malignant pleural mesothelioma: A case report
Xuan TT, Li GY, Meng SB, Wang ZM, Qu LL
- 8291** Bladder malacoplakia: A case report
Wang HK, Hang G, Wang YY, Wen Q, Chen B
- 8298** Delayed inflammatory response evoked in nasal alloplastic implants after COVID-19 vaccination: A case report
Seo MG, Choi EK, Chung KJ
- 8304** Phosphoglyceride crystal deposition disease requiring differential diagnosis from malignant tumors and confirmed by Raman spectroscopy: A case report
Ohkura Y, Uruga H, Shiiba M, Ito S, Shimoyama H, Ishihara M, Ueno M, Udagawa H
- 8312** Vulvovaginal myeloid sarcoma with massive pelvic floor infiltration: A case report and review of literature
Wang JX, Zhang H, Ning G, Bao L
- 8323** Femoral neck stress fracture and medial tibial stress syndrome following high intensity interval training: A case report and review of literature
Tan DS, Cheung FM, Ng D, Cheung TLA
- 8330** Periosteal chondroma of the rib: A case report
Gao Y, Wang JG, Liu H, Gao CP
- 8336** Papillary thyroid carcinoma occurring with undifferentiated pleomorphic sarcoma: A case report
Lee YL, Cheng YQ, Zhu CF, Huo HZ
- 8344** Laparoscopic treatment of bilateral duplex kidney and ectopic ureter: A case report
Wang SB, Wan L, Wang Y, Yi ZJ, Xiao C, Cao JZ, Liu XY, Tang RP, Luo Y
- 8352** Incontinentia pigmenti with intracranial arachnoid cyst: A case report
Li WC, Li ML, Ding JW, Wang L, Wang SR, Wang YY, Xiao LF, Sun T

- 8360** Relapsing polychondritis causing breathlessness: Two case reports
Zhai SY, Zhang YH, Guo RY, Hao JW, Wen SX
- 8367** Endodontic management of a fused left maxillary second molar and two paramolars using cone beam computed tomography: A case report
Mei XH, Liu J, Wang W, Zhang QX, Hong T, Bai SZ, Cheng XG, Tian Y, Jiang WK
- 8375** Infant biliary cirrhosis secondary to a biliary inflammatory myofibroblastic tumor: A case report and review of literature
Huang Y, Shu SN, Zhou H, Liu LL, Fang F
- 8384** Metastatic low-grade endometrial stromal sarcoma with variable morphologies in the ovaries and mesentery: A case report
Yu HY, Jin YL
- 8392** Bronchogenic cysts with infection in the chest wall skin of a 64-year-old asymptomatic patient: A case report
Ma B, Fu KW, Xie XD, Cheng Y, Wang SQ
- 8400** Incidental accumulation of Technetium-99m pertechnetate in subacute cerebral infarction: A case report
Han YH, Jeong HJ, Kang HG, Lim ST
- 8406** Metal stent combined with ileus drainage tube for the treatment of delayed rectal perforation: A case report
Cheng SL, Xie L, Wu HW, Zhang XF, Lou LL, Shen HZ
- 8417** Using ketamine in a patient with a near-occlusion tracheal tumor undergoing tracheal resection and reconstruction: A case report
Xu XH, Gao H, Chen XM, Ma HB, Huang YG

LETTER TO THE EDITOR

- 8422** Reflections on the prevalence of human leukocyte antigen-B27 and human leukocyte antigen-B51 co-occurrence in patients with spondylarthritis
Gonçalves Júnior J, Sampaio-Barros PD, Shinjo SK
- 8425** Comment on "Disease exacerbation is common in inflammatory bowel disease patients treated with immune checkpoint inhibitors for malignancy"
Argyriou K, Kotsakis A
- 8428** Intranasal sufentanil combined with intranasal dexmedetomidine: A promising method for non-anesthesiologist sedation during endoscopic ultrasonography
Wang Y, Ge ZJ, Han C

ABOUT COVER

Editorial Board Member of *World Journal of Clinical Cases*, Peng Liang, MD, Associate Professor, Day Surgery Center, Department of Anesthesiology, West China Hospital of Sichuan University, Chengdu 610041, Sichuan Province, China. 39485572@qq.com

AIMS AND SCOPE

The primary aim of *World Journal of Clinical Cases* (WJCC, *World J Clin Cases*) is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

INDEXING/ABSTRACTING

The WJCC is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2022 Edition of Journal Citation Reports® cites the 2021 impact factor (IF) for WJCC as 1.534; IF without journal self cites: 1.491; 5-year IF: 1.599; Journal Citation Indicator: 0.28; Ranking: 135 among 172 journals in medicine, general and internal; and Quartile category: Q4. The WJCC's CiteScore for 2021 is 1.2 and Scopus CiteScore rank 2021: General Medicine is 443/826.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Hua-Ge Yin; Production Department Director: Xiang Li; Editorial Office Director: Jin-Lei Wang.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

August 16, 2022

COPYRIGHT

© 2022 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Endodontic management of a fused left maxillary second molar and two paramolars using cone beam computed tomography: A case report

Xiao-Han Mei, Jin Liu, Wei Wang, Qian-Xia Zhang, Tao Hong, Shi-Zhu Bai, Xiao-Gang Cheng, Yu Tian, Wen-Kai Jiang

Specialty type: Dentistry, oral surgery and medicine

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): C, C

Grade D (Fair): 0

Grade E (Poor): 0

P-Reviewer: Elshazly NEAB, Egypt; Rakhshan V, Iran; Suzuki EY, Thailand

Received: March 17, 2022

Peer-review started: March 17, 2022

First decision: May 12, 2022

Revised: May 20, 2022

Accepted: July 11, 2022

Article in press: July 11, 2022

Published online: August 16, 2022



Xiao-Han Mei, Wei Wang, Qian-Xia Zhang, Xiao-Gang Cheng, Yu Tian, Wen-Kai Jiang, Department of Operative Dentistry and Endodontics, School of Stomatology, The Fourth Military Medical University, Xi'an 710032, Shaanxi Province, China

Jin Liu, Department of Stomatology, Huangshan City People's Hospital, Huangshan 245000, Anhui Province, China

Tao Hong, Shi-Zhu Bai, Digital Dentistry Center, School of Stomatology, The Fourth Military Medical University, Xi'an 710032, Shaanxi Province, China

Corresponding author: Wen-Kai Jiang, PhD, Associate Chief Physician, Associate Professor, Department of Operative Dentistry and Endodontics, School of Stomatology, The Fourth Military Medical University, No. 145 Western Changle Road, Xi'an 710032, Shaanxi Province, China. Jiangw6@cardiff.ac.uk

Abstract

BACKGROUND

Fused teeth usually involve several complications, such as the development of caries in the groove between fused crowns, tooth impaction, diastemas, aesthetic and periodontal problems, and pulpal pathosis, due to the complex anatomical structure of fused teeth. A thorough diagnosis is paramount to forming an accurate treatment plan and obtaining a favourable prognosis. With the advent of cone-beam computed tomography (CBCT), accurate 3-dimensional images of teeth and their surrounding dentoalveolar structures can now be readily obtained, and the technology can accurately provide a minimally invasive approach to acquire detailed diagnostic information. Therefore, we utilize CBCT data herein to generate a digital model for the infected region in a patient, and this model enables us to better plan the management of his case.

CASE SUMMARY

This report details the diagnosis and endodontic treatment of a rare case involving a fused maxillary second molar and two paramolars with apical periodontitis. The patient experienced pain upon biting and cold sensitivity in the area of the maxillary left molar. No caries or other defects were identified in these teeth, and a normal response to a pulp electric viability test was observed. With

the aid of CBCT and digital model technology, we initially suspected that the infection originated from the isthmus between the maxillary second molar and two paramolars. Therefore, we only treated the isthmus by an endodontic approach and did not destroy the original tooth structure; furthermore, the vital pulp was retained, and good treatment outcomes were observed at the 24-month follow-up.

CONCLUSION

This finding may provide new insights and perspectives on the diagnosis and treatment of fused teeth.

Key Words: Cone-beam computed tomography scans; Endodontic therapy; Fusion of teeth; Maxillary molar; Digital model technology; Case report

©The Author(s) 2022. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: Fused teeth usually involve several complications due to their complex anatomical structure. A thorough diagnosis is of vital importance. With the aid of cone-beam computed tomography (CBCT) and digital model technology, accurate 3-dimensional images of teeth can be obtained; thus, CBCT provides a minimally invasive approach to acquiring detailed diagnostic information. In this report, we utilized CBCT data to generate a digital model of a fused tooth and only treated the infected isthmus by an endodontic approach. Good treatment outcomes were observed at the 24-month follow-up. This finding provides new perspectives on the diagnosis and treatment of fused teeth.

Citation: Mei XH, Liu J, Wang W, Zhang QX, Hong T, Bai SZ, Cheng XG, Tian Y, Jiang WK. Endodontic management of a fused left maxillary second molar and two paramolars using cone beam computed tomography: A case report. *World J Clin Cases* 2022; 10(23): 8367-8374

URL: <https://www.wjgnet.com/2307-8960/full/v10/i23/8367.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v10.i23.8367>

INTRODUCTION

During endodontic treatments, obtaining a thorough diagnosis is paramount for preparing an accurate treatment plan that results in a favourable prognosis. However, complex anatomical structures often introduce challenges to forming diagnoses and performing treatments. The incidence of fusion is approximately 0.1% in permanent dentition and 0.5% in primary dentition[1]. During tooth development, abnormal fusion of the pulp, cementum, dentine, or enamel can occur between two or more contiguous tooth germs that develop separately[2,3]. When such fusion occurs, roots and pulp chambers may either remain separate or join together depending on the particular developmental stage in which union occurs[4]. Such fusion processes involve multiple germ layers, often resulting in morphological tooth outcomes that are abnormal[5]. Fusion between supernumerary and permanent teeth occurs less frequently than fusion between other types of teeth[6]. Supernumerary teeth in the molar region can be defined as para- or distomolars depending upon their location.

Clinically, fused teeth may cause several complications, such as the development of caries in the groove between the fused crowns, tooth impaction, diastemas, aesthetic and periodontal problems, and pulpal pathosis. Many of these complications necessitate a multidisciplinary approach, and the treatment depends on the type and position of the supernumerary tooth as well as its relation to the adjacent teeth[7]. In endodontics, periapical X-ray (PAX) is mandatory for diagnosis, treatment, and follow-up. However, such images provide a limited 2-dimensional view of the true 3-dimensional (3D) anatomy. With the advent of cone-beam computed tomography (CBCT), accurate 3D images of teeth and their surrounding dentoalveolar structures can be readily obtained[8], and the technology can accurately provide a minimally invasive approach to acquire detailed diagnostic information[9].

In this study, a rare case of fusion between a maxillary second molar and two paramolars is described. 3D images were obtained to visualize the relationship of the supernumerary to its counterpart. The low-density transmission image was extended along the isthmus pathway to the apical area, and it was clearly observed that the roots of the two supernumerary teeth were fused with the mesial buccal roots of the second molar and that the root canal systems of the two supernumerary teeth intersected in the middle 1/3 of the root and the apical area; moreover, no communication was observed between the canal systems of the teeth. To determine if normal pulp was present, electric pulp testing was adopted; this test was also utilized to gain confidence in performing more accurate and conservative treatment methods. With the goal of preserving the vitality of the unaffected counterpart, this

patient underwent endodontic treatment of the isthmus pathway, thereby eliminating periapical tissue inflammation.

CASE PRESENTATION

Chief complaints

A 24-year-old male presented to the Department of Operative Dentistry and Endodontics of the Fourth Military Medical University with complaints of pain upon biting and cold sensitivity on his maxillary left molar; notably, these symptoms had occurred for approximately 1 month.

History of present illness

For approximately one month, the patient felt pain in his maxillary left molar while chewing, and the tooth was sensitive to cold. Before this time, the tooth did not exhibit spontaneous pain.

History of past illness

The patient did not have a relevant medical history. He did not report any history of drug allergies or systemic diseases and exhibited no apparent dental treatment contraindications.

Personal and family history

The patient did not report any personal and family history.

Physical examination

Clinical analyses revealed the presence of two extra teeth on the buccal aspect of the maxillary left second molar (#15); however, these teeth were separated by distinct developmental grooves ([Figure 1A](#) and [B](#)). Long-term impaction of food caused gingival recession in this region, but no caries or other obvious defects were detected. Decay in the intersecting groove was evident. Pain was evident in response to percussion, but responses were normal for the adjacent and contralateral teeth. The visual analogue scale (VAS) score of the #15 tooth was 3.5. The readings of the pulp viability test of the #15 and #2 teeth were 21 and 20, respectively. A pulp electric viability test yielded normal responses, which were identical to those of the control teeth. The periodontal probing depth of the #15 tooth was < 3.0 mm. No mobility or swelling was evident. The Oral Hygiene Index-Simplified (OHI-S) and Decayed Missing Filled-Index (DMF-Index) scores are shown in [Tables 1](#) and [2](#).

Laboratory examinations

This case did not have any laboratory examinations.

Imaging examinations

Digital periapical radiography was performed preoperatively, and the results did not provide sufficient information ([Figure 1C](#)). Tooth fusion was suspected; therefore, CBCT was considered to be appropriate. After obtaining informed consent from the patient, CBCT imaging was performed to assess the root canal systems of the fused left maxillary second molar and supernumerary teeth *via* 3D technology (New Tom VG10048S; Quantitative Radiologys.r.l, Verona, Italy). The axial, sagittal, and coronal sections confirmed that the maxillary left second molar and two paramolars were fused, and no such abnormalities were evident on the other side ([Figure 1D](#)). Three slightly curved and patent root canals were present in the maxillary second molar, and each of the fused paramolars contained a single similar canal. The apex area of the irregular bending isthmus was observed in the periapical transmission image ([Figure 1E-H](#)).

FINAL DIAGNOSIS

Based on the subjective, objective, and radiographic findings, this tooth was diagnosed as a fused tooth with periodontal apical periodontitis.

TREATMENT

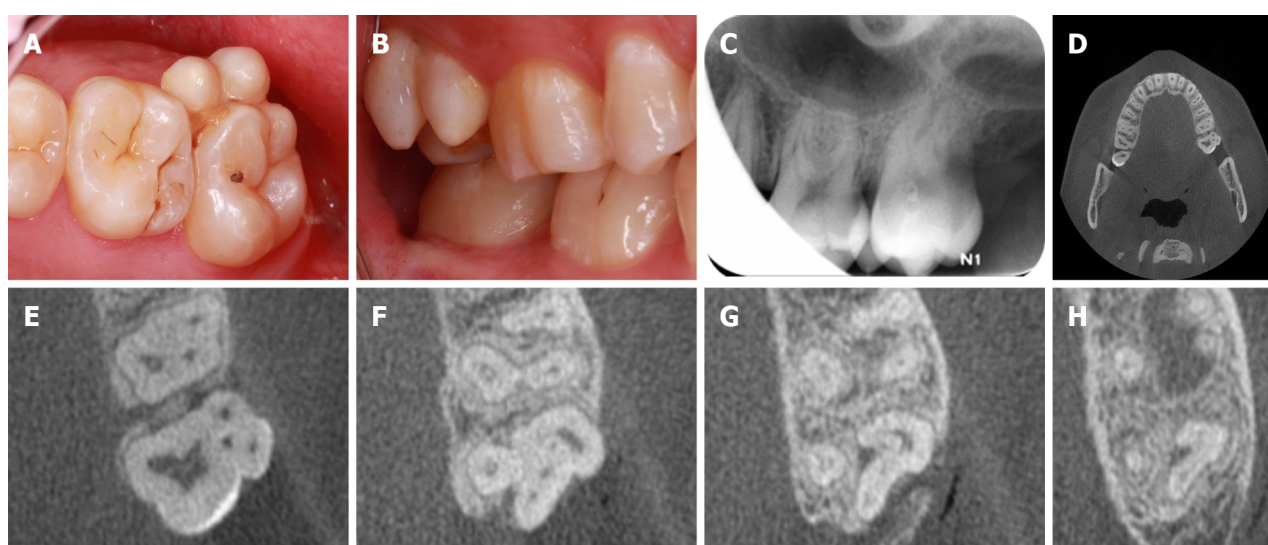
The patient provided informed consent to undergo a planned endodontic treatment of the isthmus that was formed at the fusion joint. A rubber dam was properly positioned ([Figure 2A](#)), and a ball drill (ET BD) and ET 20 ultrasonic equipment (P5 Newtron; ACTEON Satelec, Merignac, France) were used to remove the decay under a microscope ([Figure 2B](#)). The working lengths were determined with an electronic apex locator (EAL) and a #6K file ([Figure 2C](#)), and filing was performed until reaching a #20

Table 1 Oral hygiene index-simplified dental chart

Oral hygiene index-simplified	Labial (Buccal) surface				Lingual surface		Total score
	#3	#8	#14	#24	#19	#30	
Debris index-simplified	1	0	1	0	1	0	5
Calculus index-simplified	0	0	1	0	1	0	

Table 2 Decayed missing filled-index dental chart

Decayed missing filled-index		
D (Decayed)	1	#18 occlusal caries
M (Missing)	4	#1, #16, #17, #32 missing
Filled (Filled)	0	0



DOI: 10.12998/wjcc.v10.i23.8367 Copyright ©The Author(s) 2022.

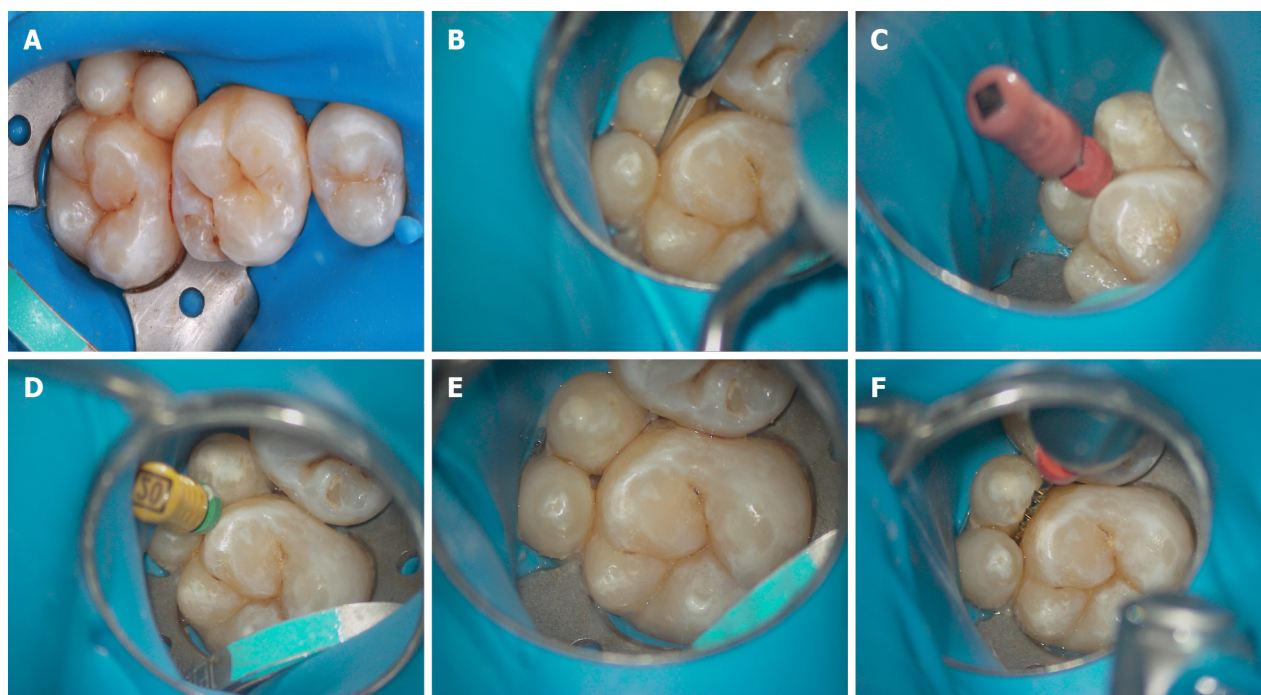
Figure 1 Representative preoperative intraoral photographs and radiographs of the fusion tooth. A: Occlusal intraoral view revealing the presence of two supernumerary paramolars on the buccal aspect of the maxillary left second molar, with evidence of distinct developmental grooves separating these teeth and additional evidence of food impaction; B: Buccal view; C: A preoperative radiograph of the left maxillary second molar; D: Cone-beam computed tomography (CBCT) axial cross-sections of the maxillary fused second molar and paramolars; E-H: CBCT images revealed three slightly curved, patent root canals, which were associated with the maxillary second molar, and there was single similar canal for each of the fused paramolars. The apex of the irregular bending isthmus area that was formed by the intersection of three teeth was connected in a periapical transmission image.

size (Figure 2D and E). Next, the isthmus was cleaned and shaped *via* a crown-down approach using Waveone Gold Ni-Ti rotary instruments (Dentsply Sirona, Switzerland) with considerable 3% NaOCl and 17% EDTA irrigation (Figure 2F). Strong electrolytic water and ultrasonication (P5 Newtron) were used for a final irrigation, and the canals were dried with paper points. Then a calcium hydroxide [Ca(OH)₂] paste was applied to the canals, and the access cavity was sealed using CavitTMav.

At 10 d post-operation, the patient experienced no pain upon percussion or cold stimulation. The VAS score of the #15 tooth was 0. Complete canal obturation was achieved through the single cone technique (Figure 3A-C) with IROOT SP (Innovative BioCreamix Inc, Vancouver, BC, Canada), and the access cavity was then sealed with flow and nanoresin (3M Dental Products, MN, United States) (Figure 3D). A final digital PAX was taken at this time, in which well-obtured canals were observed (Figure 3G).

OUTCOME AND FOLLOW-UP

The patient reported no symptoms throughout the 6 month, 12 month, 18 month, and 24 month follow-up periods. The VAS score of the #15 tooth was 0. Additionally, the treatment success was confirmed *via*



DOI: 10.12998/wjcc.v10.i23.8367 Copyright ©The Author(s) 2022.

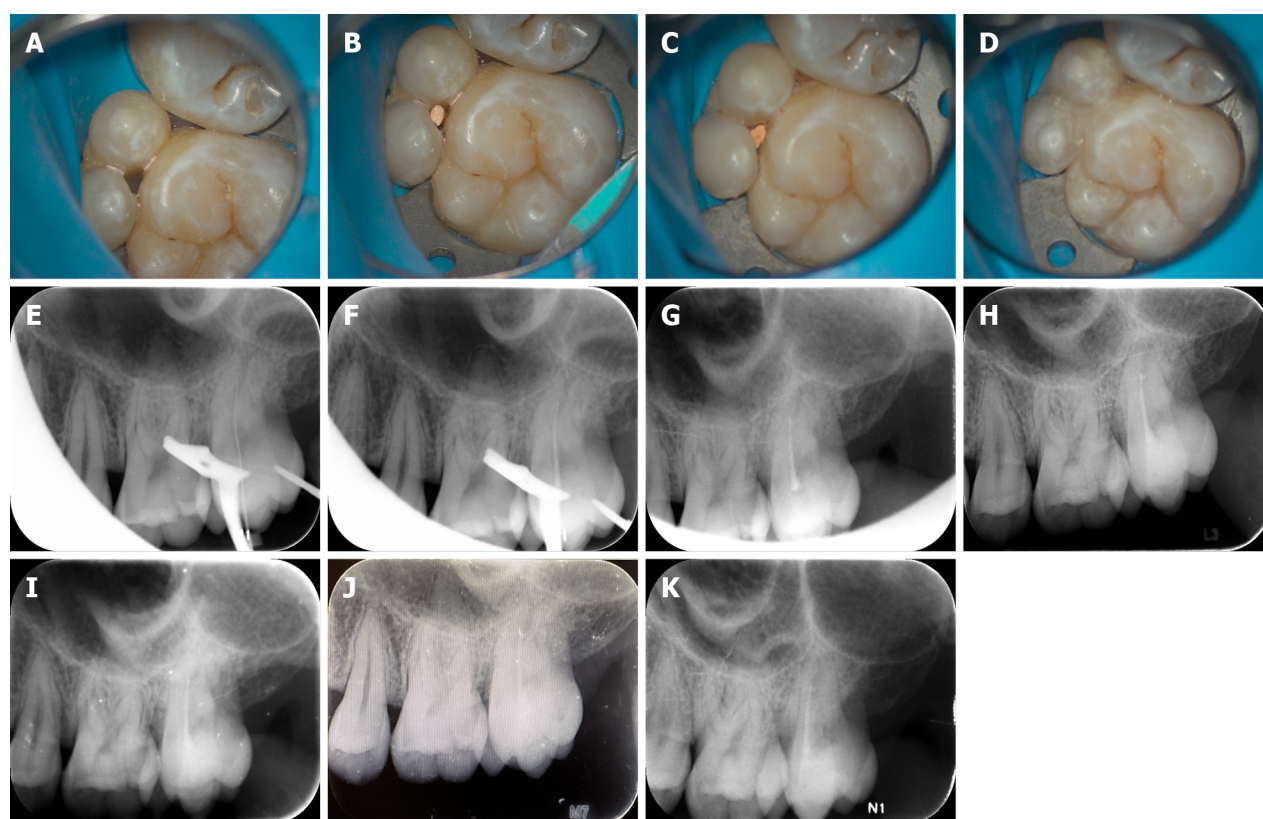
Figure 2 Representative intraoral photos of the fused tooth during root canal therapy. A: A rubber dam was positioned; B: A ball drill (ET BD) and ET 20 of the ultrasonic equipment (P5 Newtron) were used to remove the damaged tissue under a microscope; C: An electronic apex locator was utilized to determine the working lengths with 6#K-file; D-E: Filing was performed until size 20# was reached; F: Waveone Gold Ni-Ti rotary instruments were used to clean and shape the canals.

X-ray examinations (Figure 3H-K).

DISCUSSION

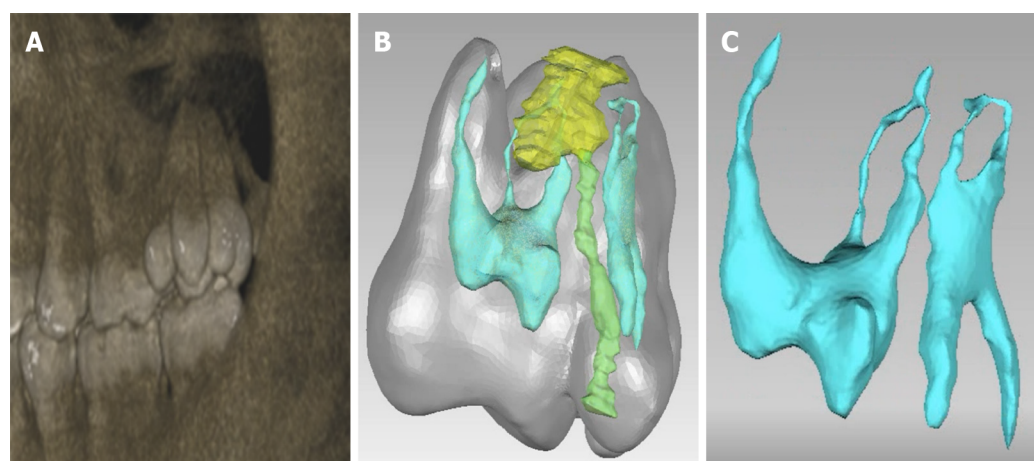
Tooth fusion is thought to affect 0.5%-2.5% of the primary dentition and affects permanent teeth with an even lower frequency[4]. Fusion can result in significant changes in dental and periodontal anatomy, and these changes contribute to plaque retention, a higher risk of caries formation, and associated periodontal problems. Intraorally, fused teeth may present a range of phenotypes and can occur in any region, although they most commonly involve the anterior teeth and are unilateral in nature[10]. Additionally, fusion can occur between two teeth, between normal and supernumerary teeth, or between a tooth and an unerupted crown[11]. In a rare process known as concrescence, two fully formed adjacent teeth fuse only in the cementum. This process is most often observed with maxillary molars. More specifically, concrescence most often involves the maxillary third molar and a supernumerary tooth. Supernumerary molars are denoted as either paramolars or distomolars based on their location; paramolar are supernumerary teeth on the mesiobuccal side of molars and distomolars are supernumerary teeth on the distal side of the third molar[12]. The aetiological basis for such fusion is not well understood, and the fusion is thought to be associated with dental arch crowding, caries-related chronic irritation, trauma, and/or rapid orthodontic movement, which result in the resorption of interdental alveolar bone between fully formed teeth. Subsequently, fusion can occur due to cementum deposition[5,13]. In the present case report, two paramolars were fused on the mesiobuccal side of the upper left second molar, and fusion of the enamel at the crown was observed; in addition, cementum was fused at the roots of these teeth, and dentin was likely involved.

Successful treatment is dependent upon accurately evaluating the sources of any pain and accurately establishing the pulp status. In the present case, the patient exhibited percussion pain and temperature sensitivity. The pulp vitality tests yielded normal results, and no caries were observed. Conventionally, intraoral periapical radiographic imaging cannot reveal any obvious abnormality and only yields two-dimensional superimposed images that have the potential to magnify 3D structures or provide inaccurate angulation information[14]. Therefore, it can be challenging to obtain an accurate diagnosis. Here, we used CBCT images to construct a digital model of the local anatomy (Figure 4), and this model provided more intuitive information than that of previous models. Specifically, the low-density transmission image was extended along the isthmus pathway to the apical area, but the apex was not involved, and the roots of the two supernumerary teeth were fused with the mesial buccal roots of the



DOI: 10.12998/wjcc.v10.i23.8367 Copyright ©The Author(s) 2022.

Figure 3 Representative intraoral photos of the fused tooth during root canal therapy and radiographs at different follow-up periods. A: The canals were dried following a final irrigation; B: Occlusal view of the canal tip; C: Complete canal obturation was achieved via vertical gutta-percha condensation; D: Image of the nanoresin-mediated seal of the access cavity; E: Working length radiograph; F: Cone fit radiograph; G: A final digital PAX revealed that the canals were well-obtured; H-K: A radiograph taken during the 6-, 12-, 18-, 24-mo follow-ups revealed good treatment outcomes.



DOI: 10.12998/wjcc.v10.i23.8367 Copyright ©The Author(s) 2022.

Figure 4 The construction of digital model of the fused tooth's local anatomy. A-C: A digital model of the local anatomy was constructed, revealing that the roots of the two supernumerary teeth were fused with the mesial buccal roots of the second molar, and the root canal systems of the two supernumerary teeth intersected the middle 1/3 of the root and apical area while remaining separated from the second molar root canal system.

second molar. The images also showed that the root canal systems of the two supernumerary teeth intersected in the middle 1/3 of the root and the apical area while an independent root canal system was retained in the second molar. Considering these findings, we suspected that the infection arose from the central isthmus of the fused tooth. Thus, we were able to speculate that the patient's primary complaint was associated with partial bone loss in the apical area, and this bone loss was caused by periapical periodontitis and gingival recession as a result of long-term food impaction. Exposure of the dentin in the dental cervix led to temperature sensitivity. Therefore, we provided the patient with two treatment

options, either complete resection of the paramolars or retention of the paramolars, while only endodontic treatment was provided for the isthmus pathway. Although the paramolars and the second molar have independent root canal systems, performing a complete resection of the paramolars from the second molar necessitates a traumatic periodontal flap. Additionally, after the paramolars undergo a hemisection, the procedure may cause buccal dentin and cementum to become exposed, which may aggravate temperature sensitivity and even cause pulpitis. Because the fused tooth was in the area of the posterior teeth, the patient did not need to consider aesthetics. In addition, the patient has a good awareness of oral hygiene. Therefore, after negotiating the treatment plan with the patient, the patient preferred the conservative treatment to resolve the existing symptoms.

In such cases, the large buccal-lingual dimensions and the complexities of this isthmus pathway can further complicate the treatment process. First, it can be challenging to place the rubber dam clamp during endodontic procedures and achieve effective isolation. Therefore, we utilized a bow method to position the rubber dam so that the clip could be placed under a direct view. Additionally, cleaning and shaping the isthmus pathway was difficult. Compared to the inner wall of conventional root canals, the walls of the path around the enamel and cementum were harder because the isthmus exhibited an irregularly curved path. We used ultrasonic instruments to remove carious tissues and part of the coronal tooth structure to enhance straight-line access. In general, the canal curvature can better be followed with smaller files owing to their flexibility; therefore, smaller files should be utilized to gently negotiate the canal prior to utilizing larger files. Next, we used reciprocating Ni-Ti files to clean and shape the canals. These procedures seemed to enhance path negotiation, allowing for faster and more efficient instrumentation. However, owing to the irregular shape of this pathway, we were unable to determine whether the pathway walls were composed of dentin or cementum following treatment. Even so, effectively isolating the tooth and performing cleaning, irrigation, disinfection, and sealing during endodontic treatment can effectively eliminate inflammation and reinfection, thereby alleviating patient discomfort and achieving a successful outcome[4,15,16].

The 6 month, 12 month, 18 month, and 24 month follow-ups showed that the treatment was effective. The limitation of this treatment was that it did not restore the normal shape of the maxillary second molar. However, the fused tooth was in the posterior teeth area, and the patient had low aesthetic requirements. Therefore, the patient preferred a conservative treatment to preserve vital pulpal tissue. Additionally, the tooth was located at the distal end of the dental arch close to the buccal aspect, which is not conducive to daily cleaning. Consequently, we emphasized the importance of correct oral hygiene maintenance and long-term follow-up to the patient; thus, we anticipate a good prognosis.

CONCLUSION

In summary, we described a rare case that involved the fusion of the maxillary second molar and two paramolars. It is often challenging to clinically detect fused teeth. The underlying abnormal tooth structures may limit the ability of obtaining an appropriate diagnosis with traditional radiographic imaging, which yield insufficient information for diagnoses and treatments. We herein utilized CBCT data to generate a digital model of the affected region in this patient, and this model enabled us to better plan the management of his case. In addition, with the resultant models, we could better view the underlying complex morphology. The models provided 3D morphological insights and supported the accurate detection of pulp electrical vitality to ensure that the endodontic diagnosis was successful.

FOOTNOTES

Author contributions: Mei XH and Jiang WK performed the dental treatment; Liu J, Wang W and Qianxia Zhang QX reviewed the literature, and contributed to the drafting of the manuscript; Hong T and Bai SZ contributed to the design of the treatment plan; Cheng XG, Tian Y and Jiang WK were responsible for the revision of the manuscript for important intellectual content; and All authors issued final approval for the version to be submitted.

Supported by the Innovative Talents Promotion Program-Youth Science and Technology Star Project, No. 2019KJXX-086; Shaanxi Provincial Natural Science Basic Research Foundation of China, No. 2019JM-376; and National Nature Science Foundation of China, No. 81970929.

Informed consent statement: The patient provided informed written consent prior to study enrollment.

Conflict-of-interest statement: The authors declare that there are no conflicts of interest regarding the publication of this paper.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by

external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Xiao-Han Mei 0000-0002-8096-6766; Jin Liu 0000-0002-6408-7673; Wei Wang 0000-0001-8527-987X; Qian-Xia Zhang 0000-0002-6229-6711; Tao Hong 0000-0001-5183-947X; Shi-Zhu Bai 0000-0002-2439-3211; Xiao-Gang Cheng 0000-0003-0107-3335; Yu Tian 0000-0001-6461-662x; Wen-Kai Jiang 0000-0002-2213-9850.

S-Editor: Ma YJ

L-Editor: A

P-Editor: Ma YJ

REFERENCES

- 1 **Tortora C**, Meazzini MC, Garattini G, Brusati R. Prevalence of abnormalities in dental structure, position, and eruption pattern in a population of unilateral and bilateral cleft lip and palate patients. *Cleft Palate Craniofac J* 2008; **45**: 154-162 [PMID: 18333651 DOI: 10.1597/06-218.1]
- 2 **Chen F**, Wang S, Bai N, Li X, Wang L, Xia X, Liu J, Tan F. Management of Fused Anterior Teeth: Review and Clinical Report. *J Prosthodont* 2022; **31**: 282-288 [PMID: 35000263 DOI: 10.1111/jopr.13478]
- 3 **Garattini G**, Crozzoli P, Brenna F. Bilateral dental fusion of the upper central incisors: a multidisciplinary approach. *J Esthet Dent* 1999; **11**: 149-154 [PMID: 10825872 DOI: 10.1111/j.1708-8240.1999.tb00392.x]
- 4 **Açikel H**, İbiş S, Şen Tunç E. Primary Fused Teeth and Findings in Permanent Dentition. *Med Princ Pract* 2018; **27**: 129-132 [PMID: 29402820 DOI: 10.1159/000487322]
- 5 **Sato M**, Garcia-Sanchez A, Sanchez S, Chen IP. Use of 3-dimensional-Printed Guide in Hemisection and Autotransplantation of a Fusion Tooth: A Case Report. *J Endod* 2021; **47**: 526-531 [PMID: 33352149 DOI: 10.1016/j.joen.2020.12.006]
- 6 **Rani A K**, Metgud S, Yakub SS, Pai U, Toshniwal NG, Bawaskar N. Endodontic and esthetic management of maxillary lateral incisor fused to a supernumerary tooth associated with a talon cusp by using spiral computed tomography as a diagnostic aid: a case report. *J Endod* 2010; **36**: 345-349 [PMID: 20113806 DOI: 10.1016/j.joen.2009.07.014]
- 7 **Aydın H**. Relationship between crown and root canal anatomy of four-rooted maxillary molar teeth. *Aust Endod J* 2021; **47**: 298-306 [PMID: 33314382 DOI: 10.1111/aej.12478]
- 8 **Katheria BC**, Kau CH, Tate R, Chen JW, English J, Bouquet J. Effectiveness of impacted and supernumerary tooth diagnosis from traditional radiography versus cone beam computed tomography. *Pediatr Dent* 2010; **32**: 304-309 [PMID: 20836949]
- 9 **Shim YS**, Kim AH, Choi JE, An SY. Use of three-dimensional computed tomography images in dental care of children and adolescents in Korea. *Technol Health Care* 2014; **22**: 333-337 [PMID: 24704642 DOI: 10.3233/THC-140788]
- 10 **Nunes E**, de Moraes IG, de Novaes PM, de Sousa SM. Bilateral fusion of mandibular second molars with supernumerary teeth: case report. *Braz Dent J* 2002; **13**: 137-141 [PMID: 12238806 DOI: 10.1590/s0103-64402002000200012]
- 11 **Sugiyama M**, Ogawa I, Suei Y, Tohmori H, Higashikawa K, Kamata N. Concrescence of teeth: cemental union between the crown of an impacted tooth and the roots of an erupted tooth. *J Oral Pathol Med* 2007; **36**: 60-62 [PMID: 17181745 DOI: 10.1111/j.1600-0714.2006.00464.x]
- 12 **Nangia D**, Dinkar S, Nawal RR, Talwar S. Endodontic management of mandibular second molar fused to odontome with 12-month follow-up using cone beam computed tomography: A case report. *Aust Endod J* 2021; **47**: 350-357 [PMID: 33030279 DOI: 10.1111/aej.12452]
- 13 **El Backly RM**, Kotry GS, Moussa H. Multidisciplinary management of a fused maxillary incisor: Case report with 5-year follow-up. *Clin Case Rep* 2021; **9**: 775-786 [PMID: 33598244 DOI: 10.1002/ccr3.3629]
- 14 **Silva MA**, Wolf U, Heinicke F, Bumann A, Visser H, Hirsch E. Cone-beam computed tomography for routine orthodontic treatment planning: a radiation dose evaluation. *Am J Orthod Dentofacial Orthop* 2008; **133**: 640.e1-640.e5 [PMID: 18456133 DOI: 10.1016/j.ajodo.2007.11.019]
- 15 **Ray S**. Esthetic management of fused incisors with ceramic veneers. *J Prosthet Dent* 2019; **121**: 217-219 [PMID: 30017160 DOI: 10.1016/j.prosdent.2018.04.019]
- 16 **Ben Salem M**, Chouchene F, Masmoudi F, Baaziz A, Maatouk F, Ghedira H. Fusion or Geminatio? *Case Rep Dent* 2021; **2021**: 6661776 [PMID: 34123435 DOI: 10.1155/2021/6661776]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

