CASE REPORT

Management of Multiple Idiopathic Root Resorption in a Rheumatoid Arthritis Patient: A Case Report with 4-year Follow-up

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Abstract

Cervical root resorption is a rare destructive disease that originates from the external cervical root surface. It has a multifactorial etiology. Cervical root resorption may affect several teeth and its treatment can be complicated due to the size, location, and extension of the resorptive defect. Rheumatoid arthritis is a chronic inflammatory autoimmune disease that has systemic effects. The objective of this article was to report a rare case of multiple idiopathic cervical resorptions in a patient with rheumatoid arthritis. A 52-year-old male patient with a 20-year history of rheumatoid arthritis was diagnosed with multiple idiopathic cervical resorptions through cone-beam computed tomography (CBCT) and clinical examination. All known causes for cervical resorption were ruled out after a detailed anamnesis. This report details inflammation due to rheumatoid arthritis as a possible cause of idiopathic cervical resorption. The systemic alterations wrought by rheumatoid arthritis could be related to the etiopathogenesis of cervical root resorption. Non-surgical endodontic treatment was done for the maxillary left canine. The defect was surgically repaired using bioceramic putty. The 12-month recall revealed the good healing of the periodontal and periradicular conditions with no obvious clinical symptoms. At the 36-month recall visit, clinical and radiographic evidence of deterioration in the repair material was observed. At the 54-month follow-up, deterioration of repair material was observed with an increase in the extension of resorption in tooth 14 was detected. Reasons for this deterioration remain unclear. Ruling out all other factors for cervical root resorption, how rheumatoid arthritis contributes to cervical root resorption is still lacking/unclear. Dental care providers must be vigilant for signs of cervical root resorption in vulnerable patients with rheumatoid arthritis for early diagnosis and prompt treatment.

Keywords: External root resorption, Inflammatory markers, Multiple root resorption, Rheumatoid arthritis, Resorption repair.

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Introduction

Root resorption in permanent dentition is a pathological process.[1] It has histological features similar to physiological root resorption in primary and mixed dentition.[2] Root resorption can occur due to the derangement of the equilibrium between bone resorption and deposition.[3] It results in a progressive loss of dentin and cementum through a sustained action of osteoclastic activity. Invasive cervical root resorption is an insidious subtype of external inflammatory root resorption characterized by destructive invasion around the cervical region of the tooth.[4] Ultimately, it is a localized resorption process originating from the external cervical root surface.[5] It is a rare disease with a prevalence of 0.02–0.08%.[6] The potential predisposing factors include trauma, intracoronal bleaching, bruxism, intracoronal restorations, and orthodontic treatment.[7] Irrespective of the initial cause, the underlying process has an invariable inflammatory origin predominantly affecting the maxillary anterior teeth.[8,9] The etiology of invasive cervical resorption remains nebulous and warrants further investigation.

Management of root resorption depends on the pattern of the resorption, location, and its extension, which may vary from non-surgical root canal treatment to a combination of non-surgical root canal treatment and surgical repair.[10]

Rheumatoid arthritis is a chronic inflammatory autoimmune destructive disease that affects around 460 people per 100,000 population across the globe.[11] It is characterized by painful joint inflammation which may cause destructive bone erosion.[12] Dysregulation of the immune system provokes the action of inflammatory cells leading to a prolonged persistent inflammatory state that can worsen coronary artery disease, pulmonary fibrosis, osteoporosis, and vasculitis.[13] Furthermore, T cells, B cells, and macrophages get activated and release cytokines and inflammatory mediators which ultimately leads to joint and bone destruction over time. The disease itself is incurable and has a significant impact on a patient's quality of life and function.[14] Control of inflammation and associated symptoms can improve quality of life and delay disease progression.[15]

The systemic alterations may have significant repercussions on internal organs, bone, and other tissues of the body such as skin, heart, eyes, lungs, and blood vessels.[16] Warm, swollen, and painful joints are the classic manifestations of rheumatoid arthritis. The lining of the patients' joints is affected leading to bone resorption and joint deformity causing painful swellings.

Several studies have remarked on the link between rheumatoid arthritis and periodontal disease.[17] Both diseases share numerous

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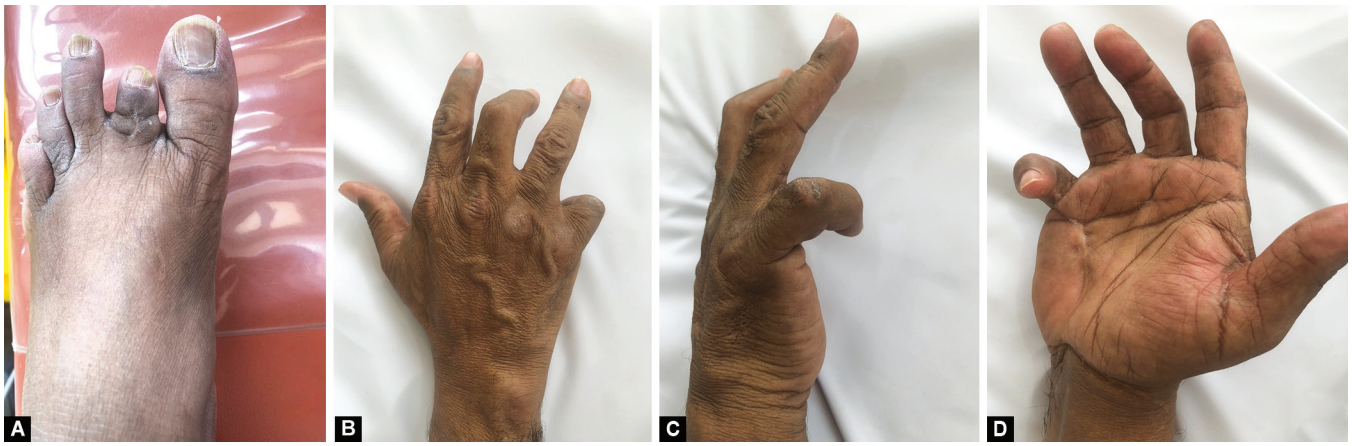


Figs 1A to D: Pictures show a history of multiple surgeries to correct joints deformities due to rheumatoid arthritis

characteristics including pathogenetic processes.[18] Tumor necrosis factor α, interleukin-1, and interleukin-6 are the cytokines that were found to be expressed in rheumatoid arthritis patients.[19] They also represent inflammatory biomarkers that stimulate a number of events in periodontal disease.[20] The available evidence suggests that periodontal disease is higher and more severe in rheumatoid arthritis patients.[21]

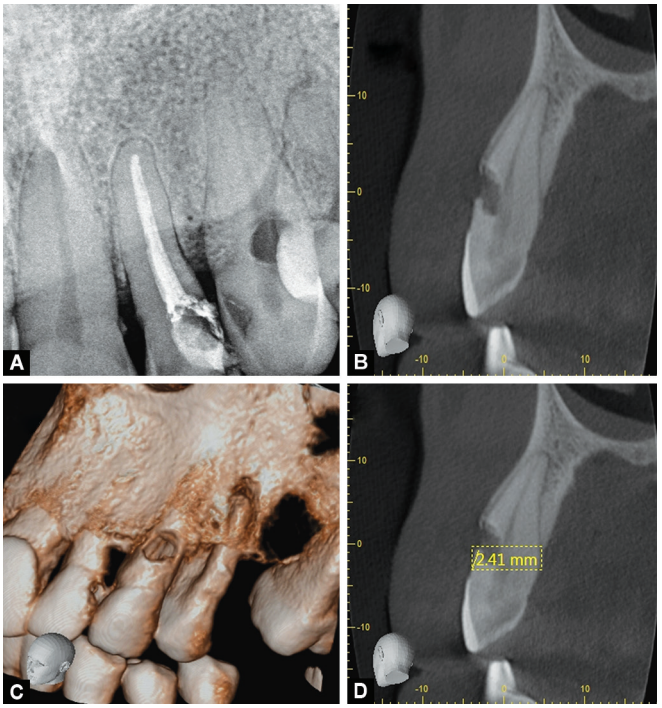
There is a little published information on the influence of deranged inflammatory mechanisms on the progression of invasive cervical resorption. An understanding of how rheumatoid arthritis contributes to cervical root resorption is lacking. The purpose of this case report is to shed light on the possible association between rheumatoid arthritis and cervical root resorption. This article describes a case of multiple idiopathic cervical root resorption (MICRR) in a patient with rheumatoid arthritis treated with a bioceramic repair material

Case Description

This case report followed the Case Report (CARE) statement and reporting guidelines.[22] Our investigation complies with the Declaration of Helsinki ethical principles and written informed consent was obtained from the patient.

A 52-year-old male patient presented to the clinic at the College of Dentistry, Jazan University, Jazan, Saudi Arabia, in October 2017 to get a comprehensive dental treatment. The elicited medical history revealed that the patient suffers from rheumatoid arthritis for the past 20 years. The patient is on medication and his condition was stable. At the time of examination, he was taking the following medications: Hydroxychloroquine 200 mg, Prednisolone 5 mg, Relaxon (chlorzoxazone 250 mg, Paracetamol 300 mg), Coxicam 15 mg, Vitamin D 15 mL, and Carboset CA-600 mg. The past surgical history revealed multiple surgeries to correct joint deformities due to rheumatoid arthritis. The patient had no history of trauma, orthodontic treatment, or tooth bleaching. A general examination revealed a loss of mobility in certain fingers and digits (Fig. 1).

On the extraoral examination, the patient had limited mouth opening as a result of temporomandibular disorder (TMD). The oral clinical examination showed average oral hygiene, multiple missing teeth, and generalized periodontitis. The radiographic examination, using intraoral periapical X-rays, showed the presence of a circular radiolucent area over the maxillary left canine (Fig. 2A).

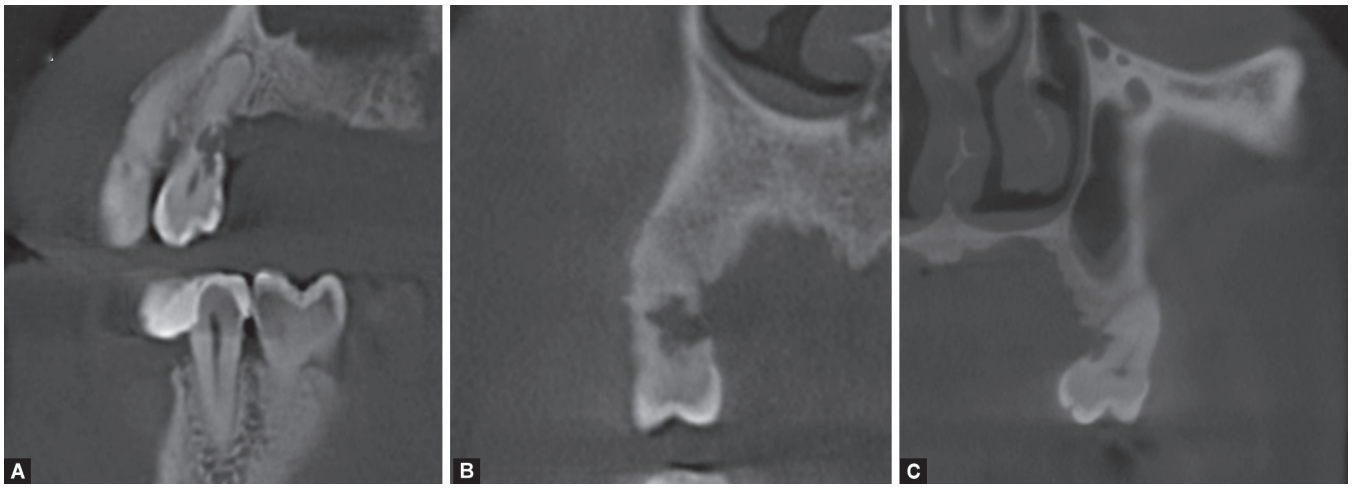


Figs 2A to D: (A) Preoperative periapical X-ray revealing resorption in the left maxillary canine; (B to D) Cone-beam computed tomography images showing the extent of root resorption in the left upper canine

The patient reported slight discomfort when he touches the labial gingiva over the maxillary left canine and below the gingival sulcus. The marginal gingiva around the area of the maxillary left canine was erythematous. On probing, the soft tissue felt fibrous, and bleeding from the gingival sulcus was observed. The maxillary left canine showed a vital response with sensitivity tests and periodontal tests were within normal range.

CBCT Assessment

The CBCT assessment was used to examine the extent and progression of the lesion. The CBCT device used was 3D Accuitomo 170 (MORITA, Japan) set at 5–8 mA, 90 kV, with 17.5-s exposure time and 0.25-mm voxel size. Morita's i-Dixel 3D software was used for processing the CBCT radiographs. The CBCT images revealed evidence of external root resorption in the maxillary left



Figs 3A to C: Cone-beam computed tomography images for the resorptive defect on the right maxillary second premolar and the left maxillary first molar (A) Sagittal view revealing the destruction of the cervical area due to resorption of the root of the right maxillary second premolar; (B) Coronal view for right maxillary second premolar revealing the extent of the lesion; and (C) Coronal view for the left maxillary first molar

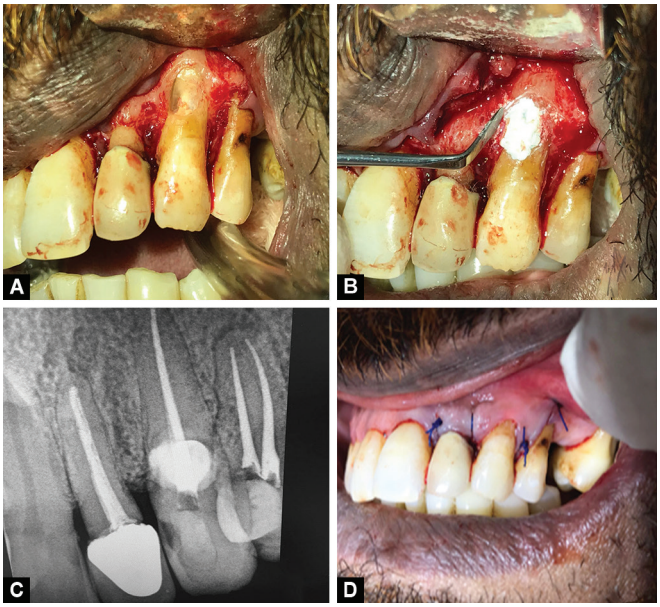
canine. The circumscribed radiolucent lesions were evident on the cervical region of the tooth. The resorption was present on the labial surface of the root, located approximately 2.4 mm below the cementoenamel junction (CEJ) and involving the pulp. The dimensions of the lesion were 2.5 mm in height, 3 mm in width, and 2.5 mm in depth (Figs 2B to D). In addition to the left maxillary canine, the CBCT images revealed that the maxillary right first premolar and maxillary left first molar tooth also had root resorption on the palatal surface (Figs 3A to C). The resorption in all three teeth was located 2–3 mm below the CEJ.

Treatment Plan

The resorptive lesion appeared to originate at the level of the CEJ and involved multiple teeth. We diagnosed the patient as having MICRR (= invasive cervical root resorption) as no other systemic or local factors could be identified. Treatment protocols were presented and discussed with the patient including extraction, endodontic treatment, and surgical repair. The pattern of resorption in the maxillary right first premolar leads to difficult access, severely limiting our options non-surgically or surgically. The patient was informed of the unfavorable prognosis with the maxillary right first premolar. He reported having lost multiple teeth for similar reasons over the years. The patient was referred to his physician for an opinion on medical fitness before starting any dental procedure. The physician gave approval, stating that the patient was medically fit for routine dental procedures without any adjustments in medications. A treatment plan was formulated after discussion with the patient involving non-surgical root canal treatment for the left maxillary canine followed by surgical repair for the resorptive defect. The secondary treatment plan involved extraction of the tooth and implant rehabilitation. The patient agreed to the surgical repair and wanted to save the tooth.

Treatment Procedure

The endodontic treatment was completed over multiple visits as the patient had a temporomandibular joint disorder, which is a classic oral manifestation of rheumatoid arthritis, and was unable to open his mouth for an extended time. In the first visit, regular root canal treatment was done for the maxillary left canine and the canal was obturated with EndoSequence bioceramic sealer (Brasseler, USA) and gutta-percha. Some gutta-percha extruded from the resorptive



Figs 4A to D: Surgical repair of the resorption (A) Defect after preparation; (B) Bioceramic putty used to restore the defect; (C) Postoperative periapical radiograph; and (D) Flap returned to position and sutured

defect. A temporary filling was placed to seal the access cavity. The postoperative instructions were given and an appointment for the surgical repair was scheduled.

At the time of the surgical repair, the maxillary left canine was asymptomatic. Two cartridges of lidocaine 2% with 100,000 epinephrine were given to anesthetize the area of the surgery. A single vertical incision was placed distal to maxillary left first premolar. This was followed by an intrasulcular incision extended mesial to the maxillary left central incisor. Under a dental operating microscope, the flap was reflected and the defect was visualized. The contents of the defect were cleared out. The extruded material was removed. The periphery of the resorptive defect was smoothened using a round bur (Fig. 4A).

Bioceramic putty (Brasseler, USA) was used to restore the defect (Fig. 4B). Postoperative X-ray for repair material was taken

and showed proper adaptation of the repair material (Fig. 4C), then the flap was sutured to its original place using four zero vicryl (Fig. 4D). Postoperative instructions were given to the patient.

At the 1-week recall, the healing of the soft tissues was normal; the sutures were removed. No marked percussion or palpation tenderness was found. The patient was instructed to maintain proper oral hygiene and was scheduled for frequent recall visits for further evaluation. The patient was advised to return after 3–6 months for follow-up.

Follow-up (0–54 Months)

The patient returned for a recall visit after 12 months. The clinical and radiographic examinations showed no signs or symptoms and everything looks within normal limits. The normal pocket depth was observed. The repair material appeared intact in the periapical radiograph and CBCT images (Figs 5A to D).

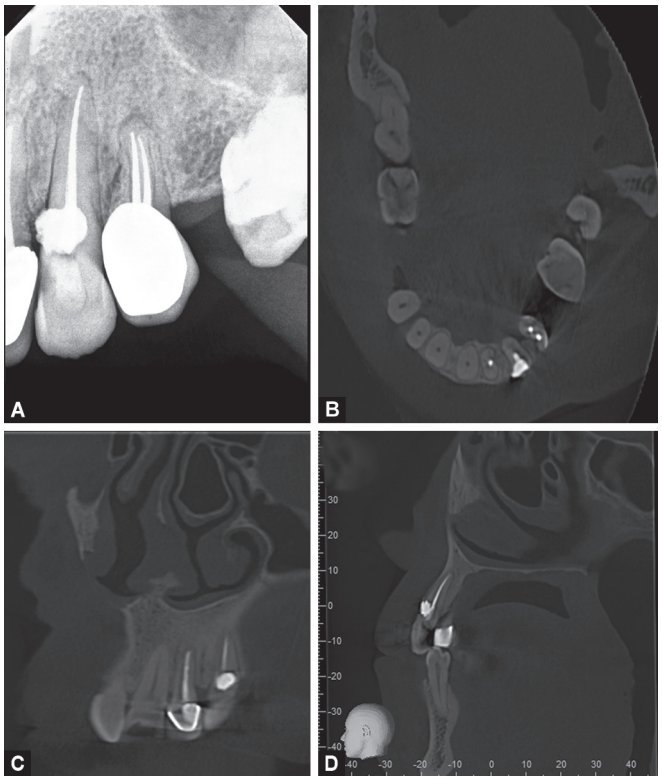
The patient was asked to return regularly for follow-up appointments. The next recall visit occurred after 36 months when the patient noticed a purulent discharge from the gingival sulcus.

At the 36-month recall visit, the periodontal pocket depth in relation to the maxillary left canine was approximately 5 mm (Fig. 6A). Normal appearance –texture- of the soft tissues at this recall was seen (Fig. 6B). Periapical radiograph and CBCT did not reveal any evidence of a periapical lesion around the apex of the maxillary left canine. There appeared to be deterioration of the repair material (Figs 6C and D).

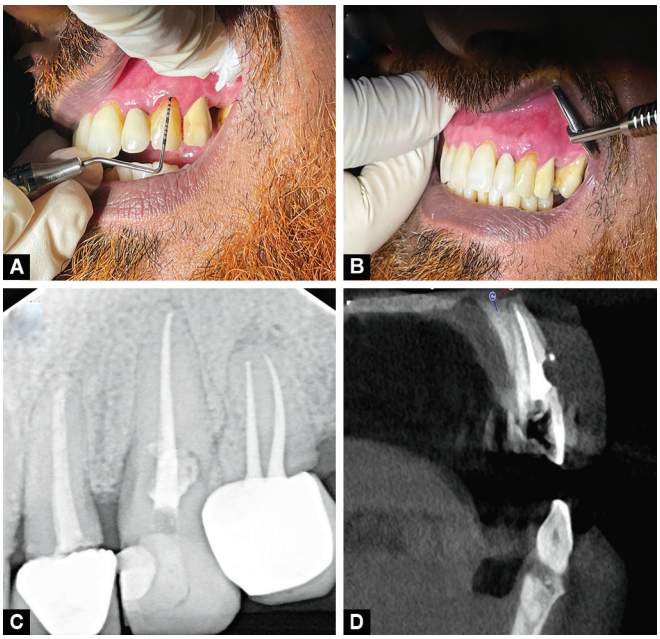
The patient reported no symptoms. The clinical examination showed that the patient had the maxillary right first premolar extracted since the previous recall visit. The need for surgical repair for the maxillary left canine to fill the defect again or extract the tooth was communicated to the patient. Notwithstanding concerns or possible future complications, the patient declined further treatment as he did not have any symptoms.

The patient returned at 54 months for the third recall visit in May 2022. The medical history was reviewed. The patient had developed hypertension and was on medication (Amlodipine 10 mg). Clinical examinations revealed a normal appearance of the soft tissue. The maxillary left canine had a pocket depth of 6 mm. On probing, a discharge of blood and pus was evident from the labial surface of the marginal gingiva of the maxillary left canine. Gingival recession was observed in the same area (Figs 7A and B).

The radiographic examinations revealed further deterioration of the repair material in the maxillary left canine. The cervical root resorption in the maxillary left molar tooth was more apparent (Figs 8A to C). The findings of this case report with their complications were communicated to the patient. The available treatment options were presented. The patient remained unwilling

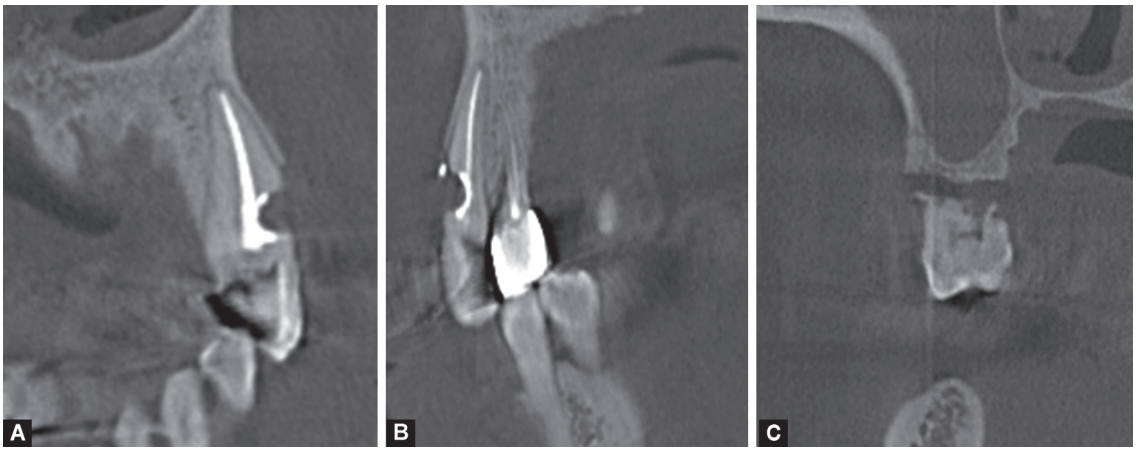


Figs 5A to D: Periapical radiograph and CBCT images of the area at one-year follow-up (A) 1-year follow-up periapical X-ray; (B) 1-year follow-up CBCT axial view; (C) 1-year follow-up CBCT coronal view; (D) 1-year follow-up CBCT sagittal view



Figs 6A to D: Photograph and radiographs of the patient at recall visits (A) A 5-mm probing depth in the left maxillary canine at 36-month follow-up; (B) Normal appearance of the soft tissues at 36-month recall; and (C and D) Radiographs showing deterioration of the repair material at 3-year follow-up

Figs 7A and B: (A) Gingival recession in labial area of the left maxillary canine; and (B) 6 mm pocket depth with bleeding and suppuration



Figs 8A to C: Cone-beam computed tomography images for the maxillary left canine (A) Sagittal view of left maxillary canine (mesial); (B) Sagittal view of left maxillary canine (distal) showing deterioration of the repair material at 4.5-year follow-up; and (C) Coronal view of left maxillary first molar showing the progression of the resorptive defect

for the treatment at this time but was willing to return for the regular follow-up visits. The total follow-up until May 2022 was 54 months (4.5 years).

Discussion

This report presents findings of a rare case of severe invasive cervical root resorption in an older male patient. We classified this defect as a class IV cervical resorption—a well-defined resorptive lesion penetrating near the coronal pulp chamber, and into dentin, based on the clinical classification by Heithersay.[23] The pathologic process involves damage to the cervical attachment apparatus. A persistent inflammation leads to progressive resorption of cementum, enamel, and dentin by fibrovascular tissues.

In this case report, the periapical X-rays and CBCT images showed external root resorption located about 2.4 mm below the level of the CEJ on the maxillary left canine, affecting coronal one-third of the root and involving the root canal space. Studies have shown that CBCT provides the following two benefits: More accuracy in determining the nature and extension of the defect and helps to develop an appropriate treatment plan.[24,25]

We chose to obturate the resorptive defect using bioceramic repair material due to the extensive resorptive damage. Bioceramic cements have been suggested as a repair material if the defect is small and below the CEJ as they tolerate moisture and have better long-term adaptation with dentin.[26] It shares similar properties of hardness, compressive, and flexural strength as dentin.[27] They show excellent biocompatibility and stability.[28] They do not shrink on setting. Its alkaline pH contributes to an antibacterial effect.[29] Bioactive restorative materials such as biodentin are suitable for the restoration of subgingival external cervical resorption even if there is a communication with the oral cavity.[10]

Our treatment plan aimed to inactivate the resorptive process and reconstitute the resorptive defect through surgical repair. Our treatment plan was consistent with a previous report by Ali Nasseh who successfully treated extensive root resorption using EndoSequence Bioceramic formulations.[30] A defect in the maxillary left central incisor due to external cervical resorption located less than 2 mm below the CEJ was repaired surgically using a nanoparticulate bioceramic root repair material. Two years of follow-up showed clinical and radiographic success.[30] In our study, the maxillary left canine was asymptomatic and the patient reported no issues at the first follow-up visit 12 months post-treatment. During the 36-month recall visit, the radiographs showed evidence of material deterioration (Figs 6C and D).

The reason for the failure and deterioration of the repair material remains unclear. A possible explanation is the increased inflammatory state with a rise in osteoclastic activity due to rheumatoid arthritis. Bioceramic material has not been tested for suitability in patients diagnosed with rheumatoid arthritis. This raises the question of whether bioceramic material is affected by inflammatory disease activity leading to its deterioration. Restorative options tend to be limited as lesions present on the cementum or dentin bond poorly to materials. The choice of material differs based on the location of the lesion and the approach used (surgical versus non-surgical).

Regarding the other teeth with cervical root resorption, the maxillary right second premolar underwent extraction due to poor prognosis. The patient declined the treatment for the maxillary left first molar as it had been asymptomatic. It is difficult to forecast the progression of cervical root resorption and which teeth it may affect. The literature regarding cervical root resorption is rife with reports of cases with 3–31 teeth involved.[31–34] Accumulating case studies have provided insights into defining the etiology and pathophysiology of cervical root resorption.

The incidence of MICRR is an uncommon condition and rarely reported. Invasive cervical root resorption may be due to the local factors such as trauma, orthodontic therapy, tumor, or cyst or due to systemic factors such as hyper- and hypoparathyroidism, hyper- and hypophosphatemia, Paget's disease, Goltz syndrome, and Papillon–Lefevre syndrome.[35,36] We ruled out these factors through a detailed medical and dental history.

The presence of this pattern of resorption in multiple teeth in a patient with a history of rheumatoid arthritis raises the possibility of an association between root resorption and rheumatoid arthritis.

The oral manifestations of rheumatoid arthritis remain understudied. Research has shown that oral dryness, TMD, aphthous ulcers, and angular cheilitis are found in rheumatoid arthritis patients with increased disease activity.[37,38] Rheumatoid arthritis may contribute to the initiation and progression of periodontal disease due to its inflammatory nature.[39] Both periodontal disease and rheumatoid arthritis share inflammatory mechanisms that can lead to bone loss.[40]

Bone erosion is a central feature of rheumatoid arthritis. Both trabecular bone and cortical bone are targeted for erosion in rheumatoid arthritis.[12] They do not emerge at random locations but show a predilection for certain anatomic sites such as the radial aspects of finger joints.[41] Bone erosions in rheumatoid arthritis tend to emerge at the site where the synovium contacts bone, suggesting that anatomic factors play a role in the erosion distribution pattern.[42]

Osteoclasts are giant multinucleated cells with a monocytic lineage capable of resorbing bone.[43] Hormones, cytokines, and growth factors play a crucial role in the differentiation of osteoclasts, regulating their activities. A large body of research shows that dysregulation of this check-and-balance system regulating osteoclast action can vastly influence bone remodeling and root resorption.[44–46]

Radiographs may not initially detect the small radiolucency associated with the lesion. Clinically, cervical root resorption remains asymptomatic unless the pulpal tissue of the affected tooth is exposed to microorganisms.[47] The patient may verbalize any obvious symptoms or signs, or indeed even perceive any symptoms.[10] This can lead the patient to delay treatment or even decline necessary care; thus, exacerbating the condition, as reported in this case.

This report provides several useful pieces of information that aid future researchers and provide practical insights for the clinician. Cervical root resorption may be an underdiagnosed oral manifestation of long-term rheumatoid arthritis. The early diagnosis of cervical root resorption is vital as the level of destruction of dental tissues determines the treatment and prognosis. Our report accurately reflects decision-making in the real-world management of a chronic painful condition. Optimal treatment of root resorption patients remains a critical field of enquiry. Further trials on the efficacy of resorptive lesion repair materials are warranted. Prolonged longitudinal studies on individuals with rheumatoid arthritis may be a useful approach in identifying its contribution to the development of cervical root resorption.

Conclusion

Multiple idiopathic cervical root resorption is a challenging disease due to its aggressive nature and limited preventive strategies. It is often detected in radiographs during routine dental checkups. The dental care providers must remain vigilant for signs that cervical root resorption could be present in a patient suffering from rheumatoid arthritis. Invasive cervical root resorption and rheumatoid arthritis share a similar proinflammatory profile. Prolonged longitudinal studies with representative samples are necessary to establish the possible association of invasive cervical root resorption with rheumatoid arthritis. Our report highlights the need for transdisciplinary research combining medicine and dentistry for the integrated management of invasive cervical root resorption.

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