IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 10 Ser. 2 (October. 2025), PP 11-15
www.iosrjournals.org

Multidisciplinary Surgical Approach To External Cervical Resorption With Biodentine™, PRF, And Photodynamic Therapy Under Operating Microscope-A Case Series

Dr. Kiran Kumar N, Dr Guruprasad CN, Dr. Manimozhi M, Dr. Biji Brigit, Dr. Swetha Geervani V, Dr. Abhishek M

(Department Of Conservative Dentistry And Endodontics, Government Dental College And Research Institute, Bengaluru, Karnataka, India.)

(Department Of Periodontology, Government Dental College And Research Institute, Bengaluru, Karnataka, India.)

Abstract:
External cervical resorption (ECR) is a progressive loss of dental hard tissues often linked to trauma, orthodontic treatment, or inflammation. Early diagnosis and prompt management are critical for tooth preservation. This report presents two cases of ECR treated with root canal therapy, surgical debridement under a dental operating microscope, and restoration with Biodentine™. Platelet-rich fibrin (PRF) was used to promote healing, and in one case, adjunctive photodynamic therapy enhanced disinfection. Both patients showed resolution of symptoms, functional retention, and favorable healing on follow-up. The combined use of Biodentine™, PRF, PDT and magnification provided predictable outcomes, underscoring the importance of regenerative materials and precise surgical visualization in managing ECR conservatively.

Keywords: *External cervical resorption, Biodentine™, Platelet-rich fibrin, Photodynamic therapy, Dental operating microscope*

Date of Submission: 25-09-2025 Date of Acceptance: 05-10-2025

I. Introduction

Root resorption is the loss of hard dental tissue (ie, cementum and dentin) as a result of odontoclastic action. Root resorption might be classified by its location in relation to the root surface, ie, internal or external resorption.[1] Internal or external root resorption may result from damage or irritation to the outer root surface, which includes the precementum and periodontal ligament, or the protective, non- collagenous outer layer of the root canal wall, which includes the odontoblast layer and predentine. This happens when pro-inflammatory cytokines are released, which attracts odontoclasts to the afflicted area and ultimately results in root resorption.[2]

Mavridou et al. (2016) reported that external cervical resorption (ECR) typically begins in the cervical area just below the epithelial attachment and may extend into root dentine in various directions, sometimes reaching the mid or apical thirds. It is often detected incidentally during clinical or radiographic examinations. Mild cases may be associated with symptoms of irreversible pulpitis, such as thermal sensitivity, while advanced cases may present with apical periodontitis. Although ECR lacks a typical presentation, the appearance of a cervical "pink spot" is a key clinical indicator.[3,4]

The treatment strategy for external cervical resorption (ECR) is largely dictated by the lesion's severity, anatomical location, and the overall prognosis for tooth restoration. A comprehensive assessment of the defect's extent and biological characteristics is therefore critical. In cases where pulpal proximity or perforation is evident, the use of bioactive endodontic cements, particularly Biodentine, has been advocated for indirect or direct pulp capping procedures. Biodentine demonstrates superior sealing capacity, favorable biocompatibility, and intrinsic antibacterial activity, rendering it advantageous in the management of resorptive defects. Additionally, its bioactive potential facilitates osteoblastic differentiation and stimulates the deposition of reparative dentin and cementum, thereby enhancing the long-term prognosis of the affected tooth.[5,6]

Cellular organization, chemical cues, and extracellular matrix for tissue restoration are all involved in the healing process. Platelet-rich fibrin (PRF) promotes both vascularization and bone regeneration, either as a standalone material or in combination with bone grafts. Its fibrin matrix supports osteoblast migration, adhesion, and proliferation, thereby facilitating new bone formation. In addition, PRF serves as a cytokine-rich scaffold that

enhances angiogenesis through the release of growth factors such as VEGF, FGFb, angiopoietin, and PDGF. These mediators stimulate endothelial activation and fibrin- driven angiogenesis. Furthermore, fibrin upregulates αvβ3 integrin expression in endothelial cells, promoting neovascularization, while entrapped stem cells acquire a secretory phenotype that contributes to vascular and tissue repair.[7,8]

Photodynamic therapy (PDT) is a medical treatment that employs light to activate a photosensitizing agent in the presence of oxygen. When exposed to light, the photosensitizer produces reactive oxygen species—such as free radicals and singlet oxygen—leading to localized photodamage and cell death. Clinically, this reaction exhibits both cytotoxic and vasculotoxic effects. Depending on the specific agent, photosensitizers may be applied topically, administered orally, or delivered intravenously.[9]

PDT, especially at low doses (LDPDT), can accelerate tissue repair by modulating inflammation and stimulating growth factors. Wound healing proceeds through overlapping phases—inflammation, tissue formation, and remodeling—guided by cytokines and growth factors (VEGF, FGF, PDGF, TGF-β). PDT's antimicrobial action further helps resolve chronic inflammation, though the precise mechanisms of its regenerative effects are still being elucidated.[10]

In this case series we have discussed the management of external root resorption using PRF and PDT along with biodentine.

II. Case Report-1

A 25-year-old female presented with pain in the maxillary anterior region. The patient reported a history of dental trauma 20 years earlier, during which the maxillary left central and lateral incisors (teeth #21 and #22) were avulsed and subsequently reimplanted. Clinical examination revealed root canal treated along with FPD involving teeth #21 and #22, with tenderness on percussion and a sinus tract associated with tooth #21. Tracing of the sinus tract with a gutta-percha point followed by radiographic evaluation was done . On correlating the history of trauma, clinical and radiographic findings it was diagnosed as external cervical resorption in relation to upper left Central Incisor (tooth# 21).

Management

The area of interest was disinfected and local anesthesia was administrated. The surgical procedure was carried out under dental operating microscope (Labomed Prima DNT Microscope). Mucoperiosteal flap was raised from the mesial aspect of upper left canine (tooth #23) to the distal aspect of upper right central incisor(tooth #11). The area of interest was visualized properly followed by surgical debridement. All the granulation tissues were removed completely using curette. Unsupported bony edges were trimmed. The surgical site was sufficiently irrigated with povidone iodine solution and saline throughout the procedure to efficiently remove the debris and to keep the site hydrated. Root surface was planned and the defect over the root surface was filled with biodentine (Septodont- Biodentine™). After debridement of the defect, PRF was placed. PRF preparation was done based on the procedure proposed by Choukroun *et al.*[11] Blood was drawn from the antecubital vein by venipuncture in 10 mL sterile glass tubes without anticoagulant and centrifuged at 3000 rpm for 10 min before surgical procedure. Centrifugation led to the formation of structured meshed fibrin in the center of the glass tube, between platelet-poor plasma (PPP) above meshed fibrin and red blood corpuscles (RBCs) settled at the base. Using sterile tweezers and scissors RBCs at the base were removed from PRF followed by PPP removal. Remaining fibrin mesh was placed onto sterile gauze piece and compressed, squeezing serum out of meshed PRF to form a stabilized fibrin membrane and was used to fill the defect area. The elevated mucoperiosteal flap was sutured back with interrupted sutures. Post operative instructions were given. Sutures were removed after 7 days. Follow up was done for 2 years where the patient was asymptomatic and showed good healing. (Fig 1: a-m)

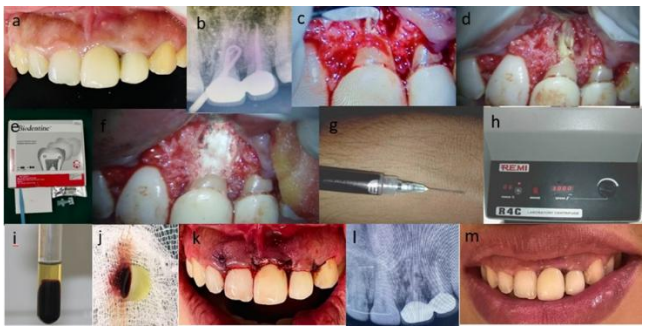

Fig 1: a. Preoperative clinical and b. radiographic images, c and d .Surgical exposure and debridement of the defect area , e. Mixing of Biodentine , f. Placing Biodentine over the defect area, g. collection of blood sample from the patient ,h. centrifugation of blood , i. PRF prepared from centrifugation , j. PRF separated from the test tube, k. Defect covered with PRF and sutures placed, l.2 year follow up radiographic and m. clinical image

III. Case Report – 2

A 27-year-old male patient was referred from the Department of Orthodontics and Dentofacial Orthopedics for evaluation of discoloration of the upper right central incisor(tooth #11). The patient reported a history of discontinued orthodontic treatment 5 years ago.

On clinical examination, a pink spot was observed on the cervical region of the upper right central incisor. On probing, the area was soft and exhibited bleeding on exploration. A closed bite was noted, along with an increased probing depth. Cone-beam computed tomography (CBCT) revealed a Heithersay Class III cervical resorption. Correlating the clinical and radiographic findings, a diagnosis of external cervical root resorption was established

Management

Root canal treatment was initiated with respect to the upper right central incisor. Access cavity preparation was carried out, followed by working length determination. Biomechanical preparation was completed, after which an intracanal medicament dressing was placed, and the tooth was restored with a temporary restoration.After one week, a surgical procedure was performed. Local anesthesia was administered, the access cavity was reopened, and a gutta-percha cone was placed inside the canal to maintain patency during the excavation and restoration of the resorptive defect. A mucoperiosteal flap was elevated, and curettage of the granulation tissue was carried out. Unsupported bone edges were trimmed, and the surgical site was thoroughly irrigated with povidone-iodine solution and saline throughout the procedure to remove debris and maintain tissue hydration. Hemostasis was achieved, followed by the application of methylene blue dye over the excavated area ($60\mu M$ — 3 min of pre irradiation time). The lesion was then irradiated with a 635 nm blue light-emitting diode laser (λ = P = 40 mW for 3 minutes, E = 7.2 J).

The defect was restored with a biocompatible material—Biodentine(Septodont- Biodentine^{TM}). The elevated mucoperiosteal flap was repositioned and secured with interrupted sutures. Photobiomodulation was performed over the surgical site, and a eugenol copack was placed.

After one week, the eugenol pack and sutures were removed, and root canal treatment was completed. After three weeks, to reinforce the tooth, a fiber post was placed and part of the Biodentine was replaced with glass ionomer cement (GIC), followed by definitive restoration. (Fig 2: a.-m)

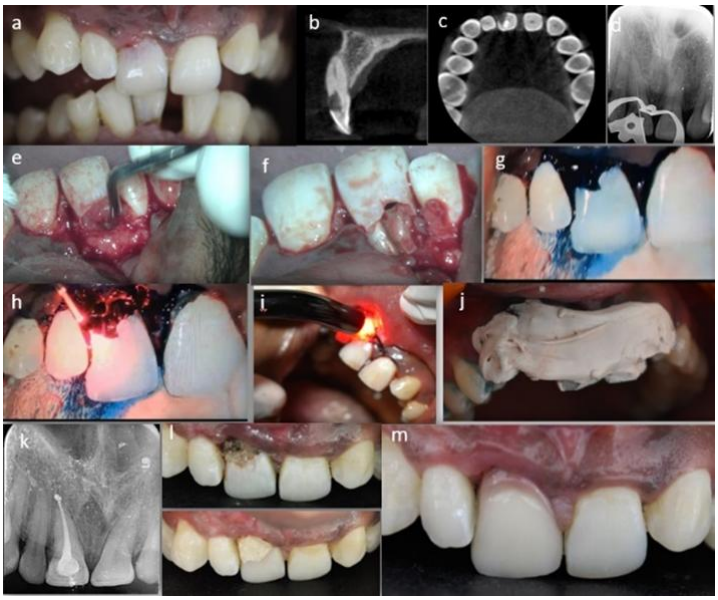

Fig 2: a. Preoperative clinical and b & c radiographic images, d. Canal patency establishment , e and f . Surgical exposure and debridement of the defect area , g. Application of methylene blue, h. Laser irradiation , i. Photobiomodulation therapy , j. Placement of eugenol pack , k .Completion of root canal treatment, l.One week and One month post op, m. Final definitive restoration.

IV. Discussion

The goals of the management strategy for external cervical resorption (ECR) are to avoid tooth extraction, maintain the affected tooth in a healthy and functional condition within the dental arch, and improve aesthetics when needed. To achieve this, it's essential to properly restore the tooth by removing the resorptive tissue, sealing the resulting defect, and blocking any pathways that could allow the resorptive process to continue.[12]

The above discussed cases present a cervical resorptive defect characterized by pulpal and periapical infection, requiring surgical debridement and subsequent filling of the defect. The etiology of the case was attributed to traumatic injury and orthodontic treatment.. 14% of ECR instances may be associated to trauma, and trauma-related ECR is distinct from resorption after PDL injury and ankylosis. [13]

Surgical intervention was performed under operating dental microscope, revealing significant contact between the root canal system and the resorption lacuna. Surgical exposure under operating microscope helps to view the field of resorption very effectively when compared to the internal management of the external cervical resorption.

The use of operating microscope makes the treatment process less intrusive because of the direct vision, which enables accurate inspection and treatment of both diseased tissues and root structures. It also provides comfortable seating, coaxial lighting, and high magnification.[14]

After granulation tissue removal the extent of the defect was finely viewed under the microscope which necessitates to be filled with a biocompatible graft material. Platelet concentrates are a concentrated suspension of growth factors derived from platelets, serving as bioactive surgical additives applied locally to promote wound healing. PRF is a new generation of platelet concentrate consisting of a matrix of autologous fibrin.[15] It contains leukocytes, cytokines, and glycoproteins like thrombospondin, which play key roles in growth factor release and immune response. It promotes tissue regeneration and wound healing by providing a concentrated suspension of platelets rich in growth factors. TGF-β accelerates dentin formation, while leukocytes and cytokines help prevent infection and inflammation. VEGF supports angiogenesis, crucial for revascularization. Fibrin enhances angiogenesis by slowly releasing cytokines like FGF, VEGF, and PDGF, and aids immune response by promoting adhesion and migration of cells. It also supports mesenchymal stem cell differentiation and acts as a scaffold for bone formation, aiding tissue restoration.[7]

To reinforce the tooth structure, Biodentine™ is an ideal dentine substitute due to its properties such as elastic modulus, compressive strength and micro hardness similar to that of dentin. It offers increased compressive strength, bond strength, density, and porosity, with better handling and a lower cost.
Additionally, it has high washout resistance, low fluid uptake, low resorption, and superior mechanical properties.[16]

Antimicrobial photodynamic therapy (aPDT) provides effective decontamination without fostering microbial resistance and is safe for surrounding healthy cells. It shows lower cytotoxicity than conventional chemical irrigants. PDT aids all healing stages by initiating neutrophil and monocyte recruitment with TNF-α release, then resolving inflammation via IL-10 and lipid-derived resolvins. It suppresses IL-1β, IL-6, IL-8, and TNF-α while boosting IL-10 and TGF-β1/β3, supporting balanced collagen deposition and better scar quality. PDT also elevates MMP-1, -2, -3, and -9 to promote extracellular matrix turnover and re-epithelialization, while reducing bacterial, fungal, viral, and protozoal loads to accelerate chronic wound healing.[17,18]

Executing the surgical procedure under operating microscope helps to efficiently view the area of defect, offered a good control over the granulation tissue removal. The use of PRF , PDT and Biodentine had highly influenced the outcome of this case which showed a very good healing and the patient was asymptomatic.

V. Conclusion

External cervical resorption can be successfully managed with a multidisciplinary approach involving root canal therapy, microsurgical debridement, PRF, photodynamic disinfection, and Biodentine™ restoration. Advanced biomaterials and minimally invasive techniques promoted healing, maintained function, and preserved natural dentition, highlighting the importance of early detection and regenerative strategies in improving prognosis.

References

[1]. Patel S, Kanagasingam S, Ford TP. External Cervical Resorption: A Review. Journal Of Endodontics. 2009 May 1;35(5):616-25.
[2]. Patel S, Krastl G, Weiger R, Lambrechts P, Tjäderhane L, Gambarini G, Teng PH. ESE Position Statement On Root Resorption. International Endodontic Journal. 2023 Jul;56(7):792-801.
[3]. Patel S, Saberi N, Pimental T, Teng PH. Present Status And Future Directions: Root Resorption. International Endodontic Journal. 2022 Oct; 55:892-921.
[4]. Patel S, Mavridou AM, Lambrechts P, Saberi N. External Cervical Resorption-Part 1: Histopathology, Distribution And Presentation. International Endodontic Journal. 2018 Nov;51(11):1205-23.
[5]. Patel S, Foschi F, Condon R, Pimentel T, Bhuva B. External Cervical Resorption: Part 2– Management. International Endodontic Journal. 2018 Nov; 51(11):1224-38.
[6]. Barczak K, Palczewska-Komsa M, Sikora M, Buczkowska-Radlińska J. Biodentine™–Use In Dentistry. Literature Review. Pomeranian Journal Of Life Sciences. 2020 Apr 1; 66(2):39-45.
[7]. Arshad S, Tehreem F, Rehab Khan M, Ahmed F, Marya A, Karobari MI. Platelet- Rich Fibrin Used In Regenerative Endodontics And Dentistry: Current Uses, Limitations, And Future Recommendations For Application. International Journal Of Dentistry. 2021;2021(1):4514598.
[8]. Paul MP, Amin S, Mayya A, Naik R. Platelet Rich Fibrin In Regenerative Endodontics: An Update. Int J Appl Dent Sci. 2020;6(2):25-9.
[9]. Konopka KR, Goslinski TO. Photodynamic Therapy In Dentistry. Journal Of Dental Research. 2007 Aug;86(8):694-707.
[10]. Reinhard A, Sandborn WJ, Melhem H, Bolotine L, Chamaillard M, Peyrin-Biroulet L. Photodynamic Therapy As A New Treatment

Modality For Inflammatory And Infectious Conditions. Expert Review Of Clinical Immunology. 2015 May 4;11(5):637-57.
[11]. Choukroun J, Adda F, Schoeffer C, Vervelle A. PRF: An Opportunity In Perio-Implantology (In French). Implantodontie 2000;42:55-62.
[12]. Talpos-Niculescu RM, Nica LM, Popa M, Talpos-Niculescu S, Rusu LC. External Cervical Resorption: Radiological Diagnosis And Literature. Experimental And Therapeutic Medicine. 2021 Oct;22(4):1065.
[13]. Patel J, Beddis HP. How To Assess And Manage External Cervical Resorption. British Dental Journal. 2019 Oct;227(8):695-701.
[14]. Setzer FC, Kratchman SI. Present Status And Future Directions: Surgical Endodontics. International Endodontic Journal. 2022 Oct;55:1020-58.
[15]. Borie E, Oliví DG, Orsi IA, Garlet K, Weber B, Beltrán V, Fuentes R. Platelet- Rich Fibrin Application In Dentistry: A Literature Review. International Journal Of Clinical And Experimental Medicine. 2015;8(5):7922.
[16]. Ravi H, Mahendran K, Velusamy V, Babu S. Biodentine-A Review On Its Properties And Clinical Applications.
[17]. Nesi-Reis V, Lera-Nonose DS, Oyama J, Silva-Lalucci MP, Demarchi IG, Aristides SM, Teixeira JJ, Silveira TG, Lonardoni MV. Contribution Of Photodynamic Therapy In Wound Healing: A Systematic Review. Photodiagnosis And Photodynamic Therapy. 2018 Mar 1;21:294-305.
[18]. Garcez AS, Arantes-Neto JG, Sellera DP, Fregnani ER. Effects Of Antimicrobial Photodynamic Therapy And Surgical Endodontic Treatment On The Bacterial Load Reduction And Periapical Lesion Healing. Three Years Follow Up. Photodiagnosis And Photodynamic Therapy. 2015 Dec 1;12(4):575-80.