Case Report

A novel diode laser intervention in the management of external invasive cervical resorption

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Abstract

"Invasive cervical resorption (ICR)" is a rare category of "external root resorption." It is a progressive and destructive condition with an unclear cause. Managing external "ICR" presents a significant challenge, even to the most seasoned dental professionals. The removal of excessively vascularized granulation tissue is viewed as a pivotal step. This case report highlights the use of a diode laser to excise granulation tissue, by achieving optimal tissue ablation, promoting better healing, and subsequently restoring the severely damaged crown of the external ICR tooth with an intracanal fiber post.

Keywords: Diode laser; external invasive cervical resorption; glass fiber post

INTRODUCTION

For more than a century, medical professionals and researchers have been interested in debating the relatively unusual kind of external root resorption known as "invasive cervical resorption" or "cervical resorption." The other terminologies for the same include "odontoclastoma," "idiopathic external resorption," "fibrous dysplasia of teeth," "burrowing resorption," "peripheral cervical resorption," "late cervical resorption," "cervical external resorption," "extracanal invasive resorption," "supraosseous extracanal invasive resorption," "peripheral inflammatory root resorption," "invasive cervical resorption," "subepithelial inflammatory root resorption," "periodontal infection resorption," "or simply and most commonly, cervical resorption."[1]

Because of odontoclastic responses, "root resorption" happens in the hard tissues of teeth. Based on the originating tissue's location and how it interacts with the root surface, resorption can happen internally or externally.

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"Root resorption" can be classified as "external resorption" which originates from the periodontal tissue and "internal resorption" which originates from the pulp tissue.[2] There are further classifications for "external root resorption" which include "surface resorption," "external inflammatory resorption," "external cervical resorption" (ECR), "external replacement resorption," and "transient apical resorption."[3]

Even though the cause of external invasive cervical resorption (EICR) is unknown, "predisposing factors" include orthodontic treatment, reported histories of trauma, intracoronal bleaching, and surgical operations. Maxillary central incisors account for 30.4% of cases of EICR that have been documented.[4] EICR is typically asymptomatic and discovered on a routine radiographical evaluation. In more complex situations, patients may have pink discoloration in the "cervical region of the tooth" based on the tissue's size, thickness, and location of the EICR. Granulation tissue should be removed before therapy either by mechanical or chemical methods, to prevent the advancement of resorption.[5]

Clinical classification

Because of its severe and invasive course, Heithersay termed ECR as "invasive cervical resorption (ICR)" and classified as:[6]

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- "Class 1" – "Small invasive resorptive lesion near the cervical area with shallow penetration into dentin"
- "Class 2" – "Well-defined invasive resorptive lesion that has penetrated close to the coronal pulp chamber but shows little or no extension into the radicular dentin"
- "Class 3" – "Deeper invasion of dentine by resorbing tissue, not only involving the coronal dentin but also extending into the coronal third of the root"
- "Class 4" – "Large invasive resorptive process that has extended beyond the coronal third of the root."

CASE REPORT

A 30-year-old female came to the "Endodontic department" with the chief complaint of pain in her upper front tooth region for 5 days. The patient's medical history did not provide any relevant information. The patient presented with a previous episode of trauma 10 months ago, resulting in constant pain for the past 5 days. The pain is continuous and localized in nature, aggravating when chewing hard food and subsiding on taking medications.

The "clinical examination" revealed the gingival inflammation and granulation tissue that covered the cervical third with respect to 21 [Figure 1a]. Due to this extensive granulation tissue, the coronal part of the crown was seen to become pink in color, and there were no dental caries. The electrical pulp test could not be carried out since the tooth could not be isolated because of tissue loss in the cervical region. The tooth was sensitive to percussion.

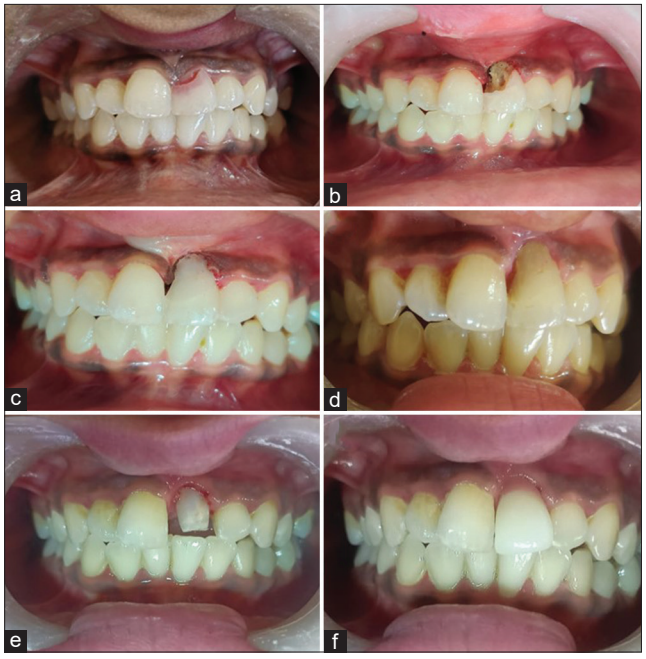

Figure 1: Clinical photographs (a) Preoperative clinical photograph (b) Excision of granulation tissue using 940-nm diode laser and exposure of resorptive lesion (c) Composite restoration covering the resorptive lesion (d) Radiograph following the composite restoration covering the resorptive lesion (e) Crown preparation done for zirconia crown with respect to 21 (f) Zirconia crown cementation done with respect to 21

The periapical radiograph revealed a large ill-defined radiolucency superimposed on the pulp chamber till the "coronal 3rd of the root" with respect to 21 [Figure 2a]. The case was diagnosed to be "Heithersay Class 3 ECR" with respect to 21.

The patient was made aware of the diagnosis, available treatments, and potential outcomes. Local infiltration anesthetic ("Lignox 2% A," "Lignocaine with 1:80,000 adrenaline") was administered followed by "rubber dam isolation."

"Access cavity preparation" was done using #4 round bur (Mani, inc), and "working length" was determined using an "electronic apex finder" ("Root ZX, Morita, Tokyo, Japan") with the help of 15 K file and confirmed with "radiograph" (IOPA) [Figure 2b]. The root canal was enlarged to ISO ProTaper size F4 (Dentsply Sirona, Ballaigues, Switzerland) file by crown-down technique till working length. The root canal was rinsed with "5.25% sodium hypochlorite" after recapitulating with each file. "Calcium hydroxide intracanal medicament" (Prime Dental Products Pvt Ltd., India) was placed in the dried canal, and the tooth was temporarily restored with "temporary filling material" (Cavit G, 3M ESPE, Germany).

The tooth was asymptomatic, and the intracanal medicament was removed by "sonically activated irrigation" after 14 days ("EndoActivator, Sirona Dentsply, Ballaigues, Switzerland"). "Master cone radiograph" was taken [Figure 2c]. The final rinse was done using "5.25% sodium hypochlorite," "17% EDTA," and "saline." Canals were dried using "absorbent paper points." Obturation was done using a single-cone technique with zinc oxide eugenol sealer [Figure 2d].

The patient was recalled on the next day, during which the gutta-percha was removed, leaving a 5-mm GP as an apical seal, and the postspace was prepared for a glass fiber post. Glass fiber post was luted using type I GIC (Shofu, Inc., Japan), and core buildup was done using composite (3M-ESPE, Filtek, Bulk Fill, Germany) [Figure 2e].

The patient was recalled after 1 week for the surgical intervention of the granulation tissue. Local infiltration anesthetic ("Lignox 2% A," "Lignocaine with 1:80,000 Adrenaline") was administered. Granulation tissue was excised using a diode laser (Biolase, EpicX, BIOLASE, Inc., USA), and resorptive lesion was exposed. Composite restoration was done covering the resorptive lesion [Figure 1b and c], and radiograph was taken [Figure 2f].

Figure 2: Radiographic images (a) Preoperative radiograph (b) Working length determination (c) Master cone selection (d) Obturation (e) Postspace preparation and glass fiber posttry-in (f) Glass fiber postcementation (g) Radiograph following the composite restoration covering the resorptive lesion (h) Radiograph following the zirconia crown cementation with respect to 21

The patient was advised to rinse with "0.2% chlorhexidine gluconate mouthwash" ("Hexidine, ICPA Health Products Ltd., India") twice daily for 14 days, along with the application of gum paint (Sensoform, Indoco remedies Ltd., India). The patient was recalled after 7 days for evaluation on the healing of the operative site for 2 weeks [Figure 1c and 2g].

After 2 weeks, crown preparation was done for the zirconia crown, and the putty impression was taken (DPI, Photosil Soft Putty elastomeric impression material) [Figure 1d]. In consecutive appointments, zirconia crown cementation was done using dual cure resin luting cement with respect to 21 [Figures 1e, f and 2h].

DISCUSSION

The trauma reported by the patient in this treated case most likely led to the occurrence of ICR. Heithersay's study revealed that "15.1% of the teeth" that underwent trauma developed "ICR." The "maxillary central incisors" are the teeth that are most commonly affected by trauma due to their position in the arch. As a result, they are more prone to developing ICR.[7]

On periapical radiographs, EICR can be detected as unobtrusive or marked radiolucency. The appearance of a lesion might vary from "well-circumscribed radiolucencies" to "irregularly-circumscribed radiolucencies."[8] Radiolucency is superposed on the pulp cavity; nevertheless, even in cases where resorption is extensive, the pulp would remain in a vital stage because of a layer of predentin protecting the pulp. Three-dimensional imaging methods such as cone-beam computed tomography can show the buccal and lingual extension and the spread of ICR lesions to the pulp cavity.[9]

In this case, the periapical radiograph showed that "invasive resorptive process" has "radicular extensions" but "not beyond the coronal third of the root" and hence diagnosed to be "Heithersay Class 3 ECR." Clinically, the affected tooth showed a "pink discoloration" and "cavitation of the overlying enamel."[10]

As the clinical signs of the various types of ICR become increasingly complex, different nonsurgical and surgical treatments will be required for its management. The goal is to inactivate "active resorbing tissue" and restore the resorptive defect through filling materials or biological systems such as membranes, preserving the tooth's health and appearance.[11]

Nonsurgical management includes the most commonly used trichloroacetic acid (90%) for 1 min due to its hemostatic effect achieved by causing coagulation necrosis of the granulation tissue. Disadvantages of this method include that the solution is highly caustic, and care should be taken to not damage the adjacent soft tissues.[12]

Recently, "diode laser-based therapeutic techniques" have been developed for debridement which can achieve excellent tissue ablation and improved healing.[13] A distinctive feature

of laser excision, as opposed to conventional surgical excision, is the development of a "coagulated tissue layer" along the walls of the laser incision.[14] Enhanced accuracy, a relatively bloodless surgical site, sterilization of the area, and minimal scarring are among the several benefits of utilizing a laser.

The diode laser used in this study, specifically the Biolase EpicX (BIOLASE, Inc., USA), is a versatile and advanced tool designed for soft-tissue management in dental procedures. It operates at a wavelength of approximately 940 nm, which is highly effective for soft-tissue cutting, coagulation, and ablation due to its affinity for hemoglobin and melanin. The EpicX diode laser offers precise tissue removal with minimal thermal damage to surrounding areas, promoting faster healing, and reducing postoperative discomfort. Its hemostatic properties ensure a bloodless surgical field, enhancing visibility and procedural accuracy.

The device is user-friendly, with adjustable power settings and various tip sizes, allowing for customized treatment based on clinical needs. In the context of treating ICR, the diode laser's ability to efficiently excise granulation tissue and disinfect the area while minimizing patient discomfort and promoting rapid healing makes it an invaluable asset.

In endodontically treated teeth with significant coronal damage, fiber posts are frequently utilized. The "fiber post" and "direct composite" for the permanent restoration preserve the remaining undamaged dental tissues and offer patient satisfaction and esthetics.[15]

Limitations

The use of diode lasers in treating EICR offers precise tissue ablation, a bloodless surgical site, and minimal scarring. However, limitations and potential complications include heat generation that can damage surrounding tissues, difficulty in controlling the depth of penetration, high equipment costs, and the need for specialized training. Potential complications involve thermal damage leading to delayed healing, increased risk of infection from incomplete tissue removal, gingival recession, tooth discoloration, and pulpal damage if the lesion extends deeply. Limited access to the lesion site can also hinder effective treatment. Therefore, while promising, diode laser use requires careful consideration of these factors to ensure optimal outcomes.

CONCLUSION

The complicated nature of EICR makes the diagnosis and treatment challenging. The prognosis of treatment significantly improves with early diagnosis and meticulous radiological evaluation. In the present case, a diode laser was used to "excise the granulation tissue," and the extensive loss of tooth material necessitated the use of glass fiber postrestoration.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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