ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Review Article

External Cervical Resorption

Mohammed Hani Ahmed[1]*, Dua'a Matooq Alyahya[2], Dalal Abdulaziz Alnafisah[2], Fatimah Hassan Almubarak[2], Majid Mohammed Asiri[2], Rawan Mohammed Alrabie[3], Amjad Selmi Alrehaili[3], Abdarhman Mohamad Alshangiti[3], Ahmed Saeed Alharthi[4], Zahraa Ali Sultan Alali[5], Abdulrahamn Salem Alfarha[6], Abdullah Dhafer Alshahrani[7], Arafa Ali AlMahroos[8], Noor Jomah Allowaim[9] and Bushra Ali Alqahtani[10]

[1]Cairo University, Egypt

[2]Ministry of Health, Saudi Arabia

[3]Taibah University Dental College, Saudi Arabia

[4]Al Noor Specialist Hospital, Saudi Arabia

[5]Alfarabi College, Saudi Arabia

[6]King Abdulaziz University, Saudi Arabia

[7]Ministry of Interior, Saudi Arabia

[8]Jordan University of Science and Technology, Jordan

[9]Almashfai Hospital, Saudi Arabia

[10]Armed Forces Hospital, Saudi Arabia

***Corresponding Author**: Mohammed Hani Ahmed, Professor of Restorative Dentistry, Registered in Saudi Commission for Health Specialties as Consultant and Cairo University, Egypt. Number: 05JD0323. **E-mail:** abdelghanymohamedhany@gmail.com

Received: October 09, 2021; **Published:** October 28, 2021

Abstract

Introduction: Invasive cervical resorption of a tooth leads to loss of the mineralized tooth structure and replacement of the natural tooth structure by inflammatory and granulation tissue. The target area for tooth loss in the case of Cervical resorption is the precementum layers due to their unmineralized characteristic. The precementum layer is resorbed and replaced by odontoclastic cells.

Aim of the Study: This review aims at describing the various aspects of External Cervical resorption, understanding the etiology, and reviewing various restorative materials used for the management of such lesions.

Methodology: This review is a comprehensive research of PUBMED and Google Scholar from the years 1989 to 2020.

Conclusion: External Cervical Resorption is an aggressive disease in which the unmineralized dentin layer is replaced by granulation tissue, the etiology of this disease is multifactorial and is a result of various dental treatments like orthodontics, bleaching, periodontal therapies, etc. CBCT gives a better picture of the extent of resorption, which makes it easier to decide the treatment approach. Various Calcium silicate cement has been used for restoring resorptive lesions as they help in regenerating the lost cementum. Biodentine is widely popular as the restorative choice due to its increased biochemical properties. The need of the hour is to understand the etiology of the lesion better and test various calcium silicate-based cement for a better prognosis of teeth with External cervical lesion.

Keywords: *External Cervical Resorption; Odontoclastoma; Osteoclasts; Biodentine; Calcium Silicate-Based Cement*

Introduction

Odontoclastic action leading to a loss in dental hard tissue is referred to as root resorption. In contrast to the primary dentition, where the root resorption helps in exfoliation of old teeth and eruption of new permanent teeth, resorption in permanent teeth is not a desirable outcome as it is irreversible damage that may lead to complete loss of tooth structure. Resorption of teeth can be broadly divided into

two parts according to the site of occurrence, i.e. External Resorption and Internal Resorption. External Resorption is again divided into 4 parts based on the etiology of the resorption:

1. Surface resorption
2. External inflammatory resorption
3. External replacement resorption
4. External cervical resorption
5. Transient apical breakdown [1].

External cervical resorption is the most aggressive form of external resorption, and Heithersay described it as Invasive Cervical resorption because of its extremely incursive nature [2]. Invasive cervical resorption of a tooth leads to loss of the mineralized tooth structure and replacement of the natural tooth structure by inflammatory and granulation tissue. The area of occurrence is near the cervical region, from where it gradually proceeds within the tooth structure. It is a relatively rare disease with a less than 2% prevalence rate, but the asymptomatic nature of the disease leads to an aggressive loss in tooth structure. The target area for tooth loss in the case of Cervical resorption is the precementum layers due to their unmineralized characteristic. The precementum layer is resorbed and replaced by odontoclastic cells. This demineralization occurs in the peri canal area of the tooth and does not infiltrate the root canal area due to protective layering that is present around the canal [3]. In the initial stages, the patient generally does not experience any pain or discomfort, and seldom a small cervical lesion is seen, depicting class V caries. It is only after a radiographic evaluation that resorption can be identified. Various names have been used to identify External cervical resorption like odontoclastoma, peripheral inflammatory root resorption, Subepithelial inflammatory resorption. In this article, we aim to describe External Cervical resorption, understand the etiology and management of the same [4].

Disease mechanism for external cervical resorption

Due to its low rate of prevalence, there is not much literature on the definitive cause of external cervical resorption. Various schools of thought and assumptions have been made regarding the etiology of this disease. The two ostensive mechanisms that are generally believed to be the cause for resorption mainly revolve around whether microorganisms play an important role in the initiation of resorption. A few articles have stated that the initiation of Resorption is irrespective of the presence or absence of microorganisms, and the primary role of microorganisms is the sustenance of the disease. The Source of these microorganisms can be periodontal pockets or the existing elastic cells in the connective tissue area that attach to the root surface. Another school of thought says the periodontal microorganisms present are the main cause of resorptive initiation, and degradation of the lesion once started is further carried on by the odontoclastic cells from the lesion itself [5].

The resorption starts due to insufficient thickness or some irreversible damage to the cementum layer below the level of attachment of the epithelial layer; once the protective cementum layer is a deficit, odontoclasts start their resorptive process resulting in dentin resorption. The type of cementum attachment plays a major role in this process. Cementum attachment is sometimes seen with gaps and areas where there is a significant gap, and the unmineralized dentin is directly exposed to osteoclastic cells [6].

Etiological factors contributing to external cervical resorption

The study conducted by Hiethersay, where he studied 257 teeth, concluded that the most common cause for resorption was orthodontic treatment followed by trauma:

1. **Orthodontic treatment:** Orthodontic brackets, when applied on the tooth surface, cause excessive force on the cervical region of the tooth, which leads to the loss of unmineralized dentin surrounding the root. The mononuclear precursor cells present in the area then differentiate into odontoclasts which migrate towards the dentin and start the resorptive process [7]. The degree

of resorption is highest in Maxillary canines, followed by incisors and mandibular first molars. This can be a result of higher orthodontic forces applied to these teeth; in most of the orthodontic treatment plans, the lower molars are banded completely, which deteriorates the already vulnerable cementoenamel junction [7]. There is an increased risk of resorption in males compared to females, and the duration of the treatment plays an important role in determining the degree of resorption. Earlier studies had stated the intrusive movements are more detrimental towards the teeth compared to extrusion [8]. In a recent study conducted by Han., *et al*. it was seen that intrusion and extrusion both caused almost equal amounts of root resorption. The rate of root resorption increases when the tooth in question has already undergone trauma [9].

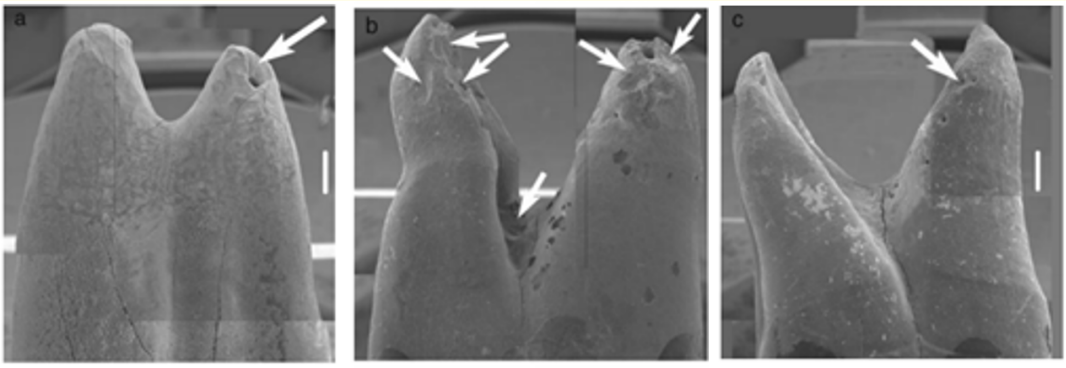

Figure 1: *Microscopic evaluation of [a] a normal tooth [b] resorption caused by intrusion [c] resorption caused by extrusion [9].*

2. **Trauma:** Dental trauma contributes highly as a cause for external cervical resorption. When the tooth undergoes any kind of trauma like Luxation, Avulsion, Intrusion, or Extrusion, the chances of resorption increase. This risk further increases in cases where the tooth is exposed to any kind of chemical treatment like bleaching, periodontal therapies, and orthodontic treatment. The most commonly affected teeth were the maxillary incisor owing to their location in the arch, which predispose the tooth to a higher risk for fracture [10]. Trauma to primary teeth might also predispose permanent teeth for resorption. In case of intrusion of the primary teeth, the cervical region of the permanent tooth gets infected, leading to resorption. In the case of spatial movement of the teeth, splints are used to reposition the tooth back in place; this repositioning is advised to be done with the help of orthodontic treatment instead of forceful repositioning; some studies have even revealed increased resorption due to splinting [11]. In a study conducted by Andreasen, he concluded that as compared to the repositioning of the tooth, orthodontic extrusion provided a better result as little or no force was applied on the cementoenamel junction [12].

3. **Chemical treatment on the tooth surface in the form of bleaching:** During intracoronal bleaching, hydrogen peroxide is released in the canals of root-filled teeth, which later travel through the dentinal tubules and reach the outer surface of the teeth. This hydrogen peroxide then enters the gap present in the cementoenamel junction and demineralizes the dentin causing resorption. The presence of hydrogen peroxide also decreases the pH causing an acidic environment, which escalates the osteoclastic activity [13]. Other reasons that might lead to resorption due to bleaching are the application of heat during the process, placement of a rubber dam around the cementoenamel junction. Teeth with bleaching had a higher rate of repair, and it was concluded that until there was an existing cervical lesion present, bleaching did not predispose the tooth to resorption. In order to prevent resorption caused by coronal bleaching, certain measures can be taken during the procedure like, putting precautionary calcium hydroxide dressing after the canal preparation and sealing off the access cavity with phosphate cement in order to prevent leakage of hydrogen peroxide. The best practice in order to prevent any resorption would be a thorough radiographic and clinical assessment of the tooth in question; before starting the procedure is to rule out any cervical lesion and to make a barrier against the access cavity to prevent leakage of bleaching materials. Using milder bleaching agents like sodium perborate and carbamide peroxide also helps in preventing bleaching-induced resorption [14,15].

4. **Systemic correlation:** The association of systemic diseases with cervical resorption cannot be ruled out. Although the evidence for this correlation has not been reviewed much in the past, it cannot be completely ruled out. In a study conducted by Moscow in 1989, he suggested that an excess of oxalate in the body which happens as an aftereffect of kidney failure, can predispose resorption, as in the case of hyperoxaluria and oxalosis [16]. Other significant systemic risk factors for resorption are diabetes, nephrolithiasis, and hypercalciuria [17,18].

Diagnosis

Due to its asymptomatic nature, diagnosing cervical resorption is always a challenge. In most cases, cervical resorption is seen as a small cervical lesion that can be easily confused with a class V lesion. It is only after a thorough radiographic evaluation that a clinician can distinguish cervical resorption. The lesion spreads in axial and horizontal directions, and in very aggressive cases, it might spread circumferentially [19]. Seldom the patient notices a pink discoloration around the cervical region of the tooth. The presence of highly vascular granulation tissue, which is visible through the thinned-out dentin, is the primary reason for this discoloration (Figure 2). Apart from this pink discoloration, the lesion does not present itself with any other symptom and goes unnoticed because of its painless nature [20].

Figure 2: *Pink discoloration seen near the cervical region of the tooth, which leads to the diagnosis of cervical resorption [20].*

One of the challenges faced by clinicians during the diagnosis of resorption is its similarity with subgingival caries or class V caries. Listed below are a few points that help to differentiate cervical lesion from external cervical resorption [20] (Table 1).

1.	Resorptive lesions have a characteristic pink color due to the presence of granulation tissues which is absent in subgingival caries.
2.	Subgingival caries have a non-sticky feel to them when probed
3.	After excavating the defected portion in case of the resorptive lesion, the base remaining is hard and mineralized
4.	Due to the presence of highly vascular connective tissues in case of resorption, there is profuse bleeding on probing present.
5.	A positive response to sensitivity tests is elicited by the tooth in case of resorption as it does involve the pulp tissues.

Table 1: *Differentiating characteristics of external cervical resorption [20].*

Radiographic evaluation plays a vital role in understanding the progression of the disease; an asymmetric radiolucent lesion is seen in the early stages, which later on appear as mottled because of the osseous infiltration in later stages. One of the classic features in resorption radiographs is the presence of an intact root canal anatomy. With the advent of the Cone Beam Computed Tomography (CBCT) technique, a better understanding of the lesion can be seen. CBCT has proven to be a superior means for diagnosis as compared to periapical radiographs in diagnosing resorptive lesions. CBCT not only gives a better picture of the location and size of the lesion but also tells in detail about the extension of the resorption that has already taken place [21].

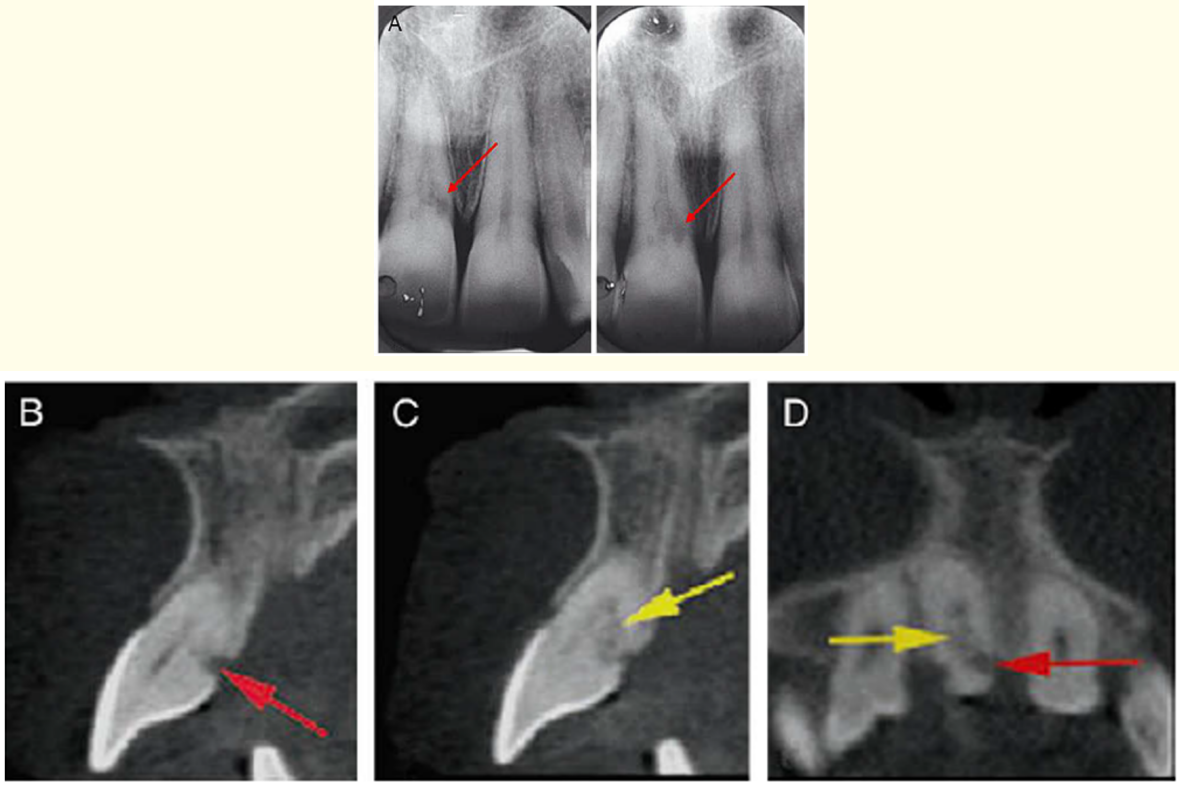

Figure 3: *[A] Periapical radiograph showing the presence of an external cervical lesion. The radiograph only shows the presence of the lesion, size and extent of the resorption cannot be assessed in the periapical radiograph. [B-D] CBCT images showing the extent of the lesion in sagittal and axial sections, CBCT gives us a better picture of the extent and degree of resorption that has occurred in the tooth [21].*

Management of external cervical lesion

Various treatment plans have been proposed over time for the management of external cervical lesions. The management depends on various factors like the location and extent of the lesion; the involvement of the root canal system also influences the treatment regime to be followed. The aim of treatment in ICR lesions is the complete removal of clastic cells followed by restoration of the tooth structure that has been lost. Treatment has two main approaches internal and external. The external treatment approach includes surgical and restorative treatment depending on the location of the lesion. The internal approach mainly involves treating the tooth endodontically and reaching the resorptive lesion through the root canal system [22].

External approach: External treatment of the lesion is generally approached in two ways depending on the location of the lesion. In cases where the lesion is below the gingival margin, surgical treatment involving raising a flap becomes necessary. In cases where the lesion is above the gingival margin, normal restorative treatment can be done. In the external approach, the root surface is first treated with Trichloroacetic acid, the lesion is removed by curettage, and restoration of the tooth is done. Cases that involve the root canal system are also treated endodontically. The restorative material used is generally calcium silicate-based cement or GIC [23,24]. In recent times where conservative treatment options are prioritized, the use of Tricholoroacetic acid has been questioned due to its caustic action on the root surface. In place of TCA, ultrasonic instruments can be used, which can easily access even the smallest resorptive area without removing a huge chunk of the healthy tooth structure [25]. Although GIC has always been preferred for restoring cervical lesion due to its biocompatibility and self-adhesive nature, the need of the hour is a regenerative material which can induce cementum formation. Calcium

silicate cement-like Endosequnce and Biodentine have been reportedly used in recent case studies for restoration of the cervical lesion [25]. The materials used should have a reduced setting time with increased compressive and bond strength and a better washout resistance. Biodentine has shown good potential as a restorative material because of its increased push-out bond strength as compared to MTA and its resistance to root canal irrigants and blood contamination [26]. Another advantage of using biodentine is its increased aesthetic properties which is a general concern when used for anterior teeth restoration [27].

Internal approach: Internally, the resorptive lesion is treated through the access cavities by removing the lesion with endodontic preparation and sodium hypochlorite root canal irrigant; the canals are further given calcium hydroxide dressings for 4 weeks which reduce and dissolve the resorptive tissue load. The canals are further filled with gutta-percha and sealer. In a case reported by Shemesh., *et al*. they treated a mandibular lower incisor with Heathersay class IV resorptive defect with the internal endodontic approach in which they used ultrasonic instruments for cleaning and activating the irrigant and further sealed the canal with Gutta-percha after 4 weeks of calcium hydroxide dressing [28]. In a recent study done, the internal approach without endodontic treatment was accomplished where they performed vital pulp therapy using calcium-enriched mixture cement near the resorptive lesion, which was believed to release calcium over time, thereby alkanising the lesion, the teeth were found to be asymptomatic after a follow up of three years, and there was no enlargement in the restorative lesion [29].

Conclusion

External Cervical Resorption is an aggressive disease in which the unmineralized dentin layer is replaced by granulation tissue, the etiology of this disease is multifactorial and is a result of various dental treatments like orthodontics bleaching, periodontal therapies, etc. With the advent of CBCT, it has become easier to diagnose these lesions at an early stage and arrest the development. CBCT gives a better picture of the extent of resorption in a 3D image which makes it easier to decide the treatment approach to be used. Various Calcium silicate cement has been used for restoring resorptive lesions as they help in regenerating the lost cementum. Biodentine is widely popular as the restorative choice due to its increased biochemical properties. The need of the hour is to understand the etiology of the lesion better and test various calcium silicate-based cement for a better prognosis of teeth with External cervical lesion.

Bibliography

1. Patel S and Ford TP. "Is the resorption external or internal?" *Dental Update* 34.4 (2007): 218-229.

2. Heithersay GS. "Clinical, radiologic, and histopathologic features of invasive cervical resorption". *Quintessence International* 30.1 (1999).

3. Heithersay G S. "Invasive cervical resorption". *Endodontic Topics* 7.1 (2004): 73-92.

4. Rotondi O., *et al*. "The Disease Process, Diagnosis and Treatment of Invasive Cervical Resorption: A Review". *Dentistry Journal* 8.3 (2020): 64.

5. Mavridou A M., *et al*. "Understanding external cervical resorption patterns in endodontically treated teeth". *International Endodontic Journal* 50.12 (2017): 1116-1133.

6. Neuvald L and Consolaro A. "Cementoenamel junction: microscopic analysis and external cervical resorption". *Journal of Endodontics* 26.9 (2000): 503-508.

7. Heithersay GS. "Invasive cervical resorption: an analysis of potential predisposing factors". *Quintessence International* 30.2 (1999).

8. Linkous E R., *et al*. "External apical root resorption and vectors of orthodontic tooth movement". *American Journal of Orthodontics and Dentofacial Orthopedics* 158.5 (2020): 700-709.

9. Han G., *et al*. "Root resorption after orthodontic intrusion and extrusion: an intraindividual study". *The Angle Orthodontist* 75.6 (2005): 912-918.

10. Malikaew P., *et al*. "Prevalence and factors associated with traumatic dental injuries (TDI) to anterior teeth of 11-13 year old Thai children". *Community Dental Health* 23.4 (2006): 222-227.

11. Trope M. "Root resorption due to dental trauma". *Endodontic topics* 1.1 (2002): 79-100.

12. Andreasen J O., *et al*. "Textbook and color atlas of traumatic injuries to the teeth". *John Wiley and Sons* (2018).

13. Newton R and Hayes J. "The association of external cervical resorption with modern internal bleaching protocols: what is the current evidence?" *British Dental Journal* 228.5 (2020): 333-337.

14. Lim KC. "Considerations in intracoronal bleaching". *Australian Endodontic Journal* 30.2 (2004): 69-73.

15. Chng H K. "Update on materials used in intracoronal bleaching". *Annals of the Royal Australasian College of Dental Surgeons* 16 (2002): 147-150.

16. Moskow BS. "Periodontal manifestations of hyperoxaluria and oxalosis". *Journal of Periodontology* 60.5 (1989): 271-278.

17. Irinakis E., *et al*. "External cervical resorption: a retrospective case-control study". *Journal of Endodontics* 46.10 (2020): 1420-1427.

18. Llena-Puy M C., *et al*. "Idiopathic external root resorption associated to hypercalciuria". *Medicina Oral: Organo Oficial de la Sociedad Espanola de Medicina Oral y de la Academia Iberoamericana de Patologia y Medicina Bucal* 7.3 (2002): 192-199.

19. Gunst V., *et al*. "External cervical resorption: an analysis using cone beam and microfocus computed tomography and scanning electron microscopy". *International Endodontic Journal* 46.9 (2013): 877-887.

20. Patel S., *et al*. "External cervical resorption: a review". *Journal of Endodontics* 35.5 (2009): 616-625.

21. Schröder Â G D., *et al*. "Accuracy of digital periapical radiography and cone-beam computed tomography for diagnosis of natural and simulated external root resorption". *Journal of Endodontics* 44.7 (2018): 1151-1158.

22. Patel S., *et al*. "The potential applications of cone beam computed tomography in the management of endodontic problems". *International Endodontic Journal* 40.10 (2007): 818-830.

23. Karunakar P., *et al*. "Endodontic management of invasive cervical resorption: Report of two cases". *Journal of Conservative Dentistry: JCD* 21.5 (2018): 578.

24. Heithersay GS. "Treatment of invasive cervical resorption: An analysis of results using topical application of trichioracetic acid, curettage, and restoration". *Quintessence International* 30.2 (1999).

25. Karypidou A., *et al*. "Management of bilateral invasive cervical resorption lesions in maxillary incisors using a novel calcium silicate-based cement: A case report". *Quintessence International* 47.8 (2016).

26. Aggarwal V., *et al*. "Comparative evaluation of push-out bond strength of ProRoot MTA, Biodentine, and MTA Plus in furcation perforation repair". *Journal of Conservative Dentistry: JCD* 16.5 (2013): 462.

27. Vallés M., *et al*. "Color stability of teeth restored with Biodentine: a 6-month in vitro study". *Journal of Endodontics* 41.7 (2015): 1157-1160.

28. Shemesh A., *et al*. "Minimally invasive treatment of class 4 invasive cervical resorption with internal approach: a case series". *Journal of Endodontics* 43.11 (2017): 1901-1908.

29. Asgary S., *et al*. "Vital pulp therapy as a conservative approach for management of invasive cervical root resorption: A case series". *Journal of Endodontics* 45.9 (2019): 1161-1167.

Volume 20 Issue 11 November 2021