CASE REPORT

Cone beam CT assisted re-treatment of class 3 invasive cervical resorption

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SUMMARY

Invasive cervical root resorption is an uncommon external root resorption which initiates at the cervical aspect of the tooth. This case report involves a case of cervical root resorption which was initially misdiagnosed and managed as cervical root caries. It was later diagnosed with cone beam CT and the lesion microsurgically removed and restored with resin modified glass ionomer cement. The importance of increasing awareness of this uncommon pathology and the role of cone beam CT in mapping the extent of the lesion is emphasised.

BACKGROUND

Invasive cervical root resorption (ICR) is a rare entity with an estimated frequency of less than 0.1% and could be misdiagnosed as cervical root caries.¹ This can result in inappropriate management of the lesion with continuing resorption and eventual loss of tooth. This case highlights the need to increase the awareness of this uncommon clinical entity and the role of cone beam CT in its diagnosis and treatment planning.

CASE PRESENTATION

A 32-year-old healthy man reported to us with primary symptoms of sensitivity to hot and cold fluids on his maxillary anterior teeth along with sensitive and bleeding gums. He had visited a general dental practitioner 3 months ago to report this discomfort. He was told he had subgingival caries on his maxillary right central incisor (11) and was managed by the placement of a tooth coloured restoration. The dentist informed the patient that it was difficult to control the bleeding and advised him to return if symptoms persisted.

Figure 1 Preoperative images showing discolouration of the cervical restoration on 11.

On presentation to our office, a greyish discoloured restoration was noticed on the labial cervical aspect of the maxillary right central incisor (**figure 1**). This tooth exhibited persistent discomfort following cold and electric pulp testing. There was no sensitivity to percussion or abnormal mobility. Though there was bleeding on probing, there was no periodontal pocketing associated with the concerned tooth. The oral hygiene was good with mild plaque-associated generalised gingivitis.

INVESTIGATIONS

A periapical radiograph revealed a cervical restoration on 11 with radiolucency apical to it, in the cervical third of the root (**figure 2**). The borders of the root canal could be traced through the cervical radiolucency. The continuity of the lamina dura appeared intact around 11. Considering the unusual location and appearance of the cervical radiolucency, a small field of view (FOV) cone beam CT (CBCT) of the maxillary anterior region was taken (Kodak 9000 C, 70 Kv, 8 mA, 10.8 s). The scan revealed a 2 mm radiolucency labial and apical to the existing restoration with a thin layer of dentin separating it from the pulp canal space (**figure 3**).

Figure 2 Preoperative periapical radiograph of 11 showing cervical radiolucency apical to the restoration and the outline of root canal space can be seen through the radiolucency.

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Figure 3 Axial section seen on the top left corner showing resorption (arrow) and sagittal section showing resorption (arrow) apical to the restoration in the lower right corner image. Note the thin predentin between the resorption and root canal space.

A characteristic micro-opening on the cemental surface at the level of the crestal bone in the distal aspect was noted, with the radiolucency fanning out coronally and apically ([figure 4](#)).

The continuity of the labial radiolucency with that of the distal one could be demonstrated by sequentially viewing sections of the scans ([figure 4](#)).

Figure 4 Axial section on the top left corner showing that labial and proximal resorption is continuous with each other (thin arrow). Coronal slice through the proximal aspect of the restoration seen in the lower right side image showing a micro-opening on the root surface and resorption (thick arrow) fanning out coronally and apically.

Figure 5 Status of pulp tissue with signs of partial necrosis.

DIFFERENTIAL DIAGNOSIS

Though root caries can be located at the cemento enamel junction, they are predominantly seen on the root surface of teeth that are exposed to oral cavity.² Further, root caries is more prevalent in those above 60 years and is usually associated with xerostomia, either from polypharmacy or other medical conditions.³ Root caries is also unlikely to affect a single tooth alone in an otherwise healthy young individual.

Another important differential diagnosis is internal resorption. Internal resorption originates from pulp tissue and distorts the outline of root canal anatomy. While at times it may be difficult to distinguish between the two by conventional intraoral radiography, it is generally accepted that if the root canal outline can be seen through the resorptive lesion, the defect is caused from external resorption. However, internal root resorption results in a widening of the canal space itself. A conventional radiograph may not be of help in distinguishing extensive lesions which communicate with the pulp space, although this association is readily visible with CBCT imaging.

External inflammatory root resorption (EIRR) which often occurs after trauma-induced pulp necrosis is another condition to be differentiated from ICR. In EIRR, a bowl like radiolucency is visible radiographically on bone and root surfaces but this becomes arrested following root canal treatment; however, ICR is not of pulpal origin.⁴ Nonetheless, root canal therapy may be required in extensive ICR lesions which involve the pulp space. Cervical burnout, which is often seen in a periapical radiograph, has to be considered in the differential diagnosis. Cervical burnout appears as a radiolucent band around the

Figure 6 Slight bleeding from a resorptive defect into the root canal space seen during the final stage of obturation.

necks of teeth with diffuse inner borders but with intact tooth edges.⁵ This is most likely due to the cervical root configuration and exposure parameters.⁵ A second radiograph taken at a slightly different angle is often required to rule out this radiographic illusion. It is an important consideration in the radiographic examination of maxillary incisor teeth.⁶ Based on the CBCT findings, clinical presentation, previous history and pulp sensitivity tests, the case was diagnosed as Heithersay class 3 invasive cervical resorption on the maxillary right central incisor (11) with symptomatic irreversible pulpitis.⁴

TREATMENT

Conventional non-surgical root canal treatment was performed on 11 to relieve the pulpal symptoms which revealed putrefaction of the coronal part of pulp tissue (figure 5). Though the root canals were completely dry during and before obturation, at the final coronal back fill stage bleeding points were noted on the labiocervical aspect denoting a communication with resorptive defect (figure 6). This potential complication should be envisaged and a concomitant internal or external approach to remove the resorption should be planned to avoid contamination of the root canal system. Considering the difficulty in accessing the complete lesion from an intracanal approach, a surgical approach was done in this case. A papilla-based incision was made in the midline and sulcular between the 11 and 12 teeth to facilitate access to the distal aspect of 11 under a surgical operating microscope. Care was taken to exclude the interdental papilla on distal of 12 from the releasing incision (figure 7). The previous restoration along with the granulation tissue was removed from the resorptive defect (figure 8). Obtaining haemostasis was not difficult and hence trichloroacetic acid was not used (figure 9). The defect was restored with resin-modified glass ionomer (Geristore, DenMat, USA) and the wound was closed with interrupted sutures using 5-0 Vicryl (Ethicon, USA; figure 10).

OUTCOME AND FOLLOW-UP

Healing was uneventful with complete resolution of symptoms and no significant soft tissue defects or discolouration (figure 11). An 18-month follow-up radiograph confirmed the arrest of resorption (figure 12).

DISCUSSION

The pathogenesis of invasive cervical resorption is not properly understood. Defects in the antiresorptive mechanism of the periodontal ligament, fibro-osseous disorder and inflammatory response to microbial factors are some of the suggested reasons for ICR.⁴ This latter hypothesis of inflammatory response to microbial factors recently received an impetus when bacteria along with toll-like receptors (TLR2,TLR4) and OPG (osteoprotegerin)—RANK (receptor activator of nuclear factor kappa-B) RANKL (receptor activator of nuclear factor kappa-B ligand) were demonstrated by immunostaining in ICR samples.⁷ This showed that the TLR response to the presence of bacterial results in stimulation of osteoclastogenesis through OPG-RANK-RANKL pathway.⁷ Although a variety of predisposing factors are identified for invasive cervical resorption, none of the factors were present in this case (table 1). On the basis of the extent of the resorptive defect in the coronal and radicular part of the tooth, Heithersay has categorised cervical resorption into class1–4, and accordingly this case was found to be a class 3 (box 1).⁴

Clinically invasive cervical resorption is suspected when there is pink cervical discolouration or persistent isolated bleeding

Figure 7 Carefully tailored incision to keep gingival recession to the minimum.

from marginal gingiva but can also be detected as an incidental finding in radiographs. Pulpal symptoms occur only in advanced stages, as the relatively less mineralised predentin layer offers protection against resorption due to the presence of antiresorptive factors in its organic non-collagenous component.⁸ A conventional periapical radiograph may aid in providing the mesiodistal extension of the lesion, but the buccopalatal extension is difficult to ascertain with this imaging technique.⁹ In our case, it was decided to take a small FOV CBCT for a number of reasons. Although the continuity of the root canal wall could be seen through cervical radiolucency in the periapical radiograph, communication with the pulp space and differentiation between internal or external resorption could not be accurately determined using two-dimensional imaging.^{10 11} In addition, the cervical entry point of the resorption could be accurately demonstrated only in CBCT (figure 4). This is important for haemostasis and to prevent recurrence of resorption. Finally, a small FOV CBCT imaging of the maxillary anterior region using Kodak 9000 3D results in an effective radiation dose of 5.3

microsieverts or one digital periapical radiograph.^{12 13} This is equivalent to nearly half a day of background radiation considering that the annual effective dose from background radiation in USA is 3000 microsieverts.¹⁴ Thus, precise preoperative CBCT-based mapping of the resorption aided us in accurate diagnosis, realistic assessment of the prognosis and better treatment planning with minimal radiation.

Based on the information gained from the CBCT, a papilla base incision was selectively used in this case to avoid black triangle formation, though a full thickness sulcular incision was needed at the specific site to access the resorption.¹⁵ However, some amount of recession should be expected in such cases, though creeping attachment and a more favourable response from periodontal fibroblasts are obtained with Geristore (resin-ionomer restoration).^{16 17} Apart from this, use of Geristore in subgingival restorations and resorptive defects has been associated with reduced inflammation, attachment of junctional epithelium and connective tissue to the material and decrease in probing depth.¹⁷ In addition, being a tooth coloured

Figure 8 Granulation tissue seen in the resorptive defect (arrow).

Figure 9 Dentin surface after complete debridement and haemostasis.

Figure 10 After restoration of the defect with Geristore.

restoration; aesthetic result is maintained with Geristore.¹⁷ However, mineral trioxide aggregate (MTA) would be an ideal choice for non-aesthetic areas considering the volume of evidence on its biocompatibility, sealability and ability to form cementum.¹⁸ It was avoided in our case due to the reported discolouration of coronal tooth structure, especially in the presence of blood even with white MTA.¹⁹ Biodentine is a new tricalcium silicate-based dentin replacement and repair material which has been shown to possess similar biocompatibility and sealability as MTA.²⁰ However, information on its use in resorptive defect is limited and long term colour stability of Biodentine remains unproven.^{20 21}

The long-term prognosis of class 3 and 4 resorption is questionable with a reported success rate of 12% in the class 4 stage.²² The decision to re-treat this case was to prolong the restorative cycle and delay implant placement. Root fracture, especially at the thinned cervical part, is the common reason for failure.⁴ These lesions require careful interdisciplinary treatment planning, especially when maxillary anterior teeth are involved with obvious aesthetic concerns. This is especially true for re-treatment of previously misdiagnosed lesions as soft tissue defects associated with previous mismanagement can often be difficult to treat. In cases with a high smile line, orthodontic extrusion would be an appropriate way to access the defect, though it might need to be followed by additional periodontal plastic surgery.²³ This case highlights the use of CBCT in accurate mapping of the cervical resorption, appropriate modification

Figure 11 Two-month review showing good colour matching and minimal soft tissue loss.

Figure 12 Eighteen-month radiograph showing arrest of resorption.

Table 1 Predisposing factors for invasive cervical resorption

Predisposing factors*	Percentage of association
Orthodontics	21
Trauma	14
Surgery involving CEJ	5.9
Trauma and bleaching	7.7
Intracoronary bleaching alone	4.5
No factors identified	14.9

*Adapted from Heithersay.⁴

Box 1 Heithersay's classification of invasive cervical resorption based on coronal and radicular extension of the lesion

Class 1—Denotes a small invasive resorptive lesion near the cervical area with shallow penetration into dentine
 Class 2—Denotes a well-defined invasive resorptive lesion that has penetrated close to the coronal pulp chamber but shows little or no extension into the radicular dentine
 Class 3—Denotes a deeper invasion of dentine by resorbing tissue, not only involving the coronal dentine but also extending into the coronal third of the root
 Class 4—Denotes a large invasive resorptive process that has extended beyond the coronal third of the root.
 Source: Adapted from Heithersay.⁴

of incision, careful choice of restorative material and successful microsurgical re-treatment of the defect.

Learning points

- ▶ Invasive cervical root resorption should be suspected if 'pink tooth appearance' is present on the cervical aspects along with localised spontaneous or profuse bleeding on probing.
- ▶ Root caries is found on the exposed root surface in elderly individuals often with concomitant xerostomia and should not be confused with cervical resorption.
- ▶ The small field of view cone beam CT helps in accurate mapping of the extent of the lesion and aids in diagnosis and treatment planning.
- ▶ Early diagnosis is important as the long-term prognosis is poor in class 3 and 4 cervical resorption.

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