Invasive Cervical Resorption: Clinical Management in the Anterior Zone

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Abstract

According to the high number of articles published on invasive cervical resorption (ICR), this pathology, as commonly believed, is a more frequent form of cervical resorption. ICR is often misdiagnosed as internal resorption or caries, which leads to inappropriate treatment and even unnecessary tooth loss. Despite a correct diagnosis, the treatment of this type of hyperplastic invasive external resorption poses a challenge for the clinician. The Heithersay classification and the use of cone-beam computed tomographic imaging have increased our knowledge of the pathology and helped improve its prognosis. Nevertheless, there is no standard protocol for the treatment of this type of lesion. This article proposes a treatment protocol for ICR based on the pattern and location of resorption. Three treatment approaches (internal access, external access, and intentional replantation) are presented through 3 clinical cases. *(J Endod 2018;44:1749–1754)*

Key Words

Clinical approach, internal cervical resorption

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Significance

Management of ICR is a clinical challenge. A good knowledge of ICR can help clinicians properly plan the management of the lesion. Three different treatment approaches are presented through clinical cases: internal access, external access, and tooth replantation.

Invasive cervical resorption (ICR) is often described as a relatively uncommon form of cervical resorption (1–3). This finding somewhat contradicts the daily clinical experience because ICR is currently a common occurrence. Indeed, a literature search on PubMed yielded 49 articles published between 2013 and 2017 citing "invasive cervical resorption" or "external cervical resorption." However, ICR is still frequently misdiagnosed as internal resorption or caries, which leads to inappropriate treatment and even unnecessary tooth loss (4, 5).

In 1994, Heithersay (6) introduced the term ICR to define this type of external resorption. According to his findings (7), external resorptions can be classified as follows:

1. Trauma induced
2. Infection induced
3. Hyperplastic invasive, with the last one being the most challenging to treat

As for induced resorptions, the elimination of the cause (ie, infection) arrests the progress of the lesion. On the other hand, hyperplastic invasive lesions (eg, ICR) require complete removal of the resorptive tissue in order to avoid recurrence or concurrence of the lesion (7).

ICR usually occurs directly below the epithelial attachment of the tooth in the cervical region (5, 8, 9). It is widely accepted that damage to the cementum in that area exposes the dentin to osteoclasts, which, in turn, start to resorb it (10, 11), creating a space filled with granulomatous tissue. The hyperplastic lesion extends through the dentin but without affecting the root canal (12). The cause of ICR remains unknown although potential predisposing factors have been identified, such as trauma, orthodontic treatment, and intracoronal bleaching, which can occur either alone or in combination (13). Moreover, surgery, periodontal therapy, bruxism, and intracoronal restorations might also have an impact, but there are many affected patients who do not present any of these situations (8).

The clinical features of ICR vary notably from one case to another (eg, from a small defect in the gingival margin to a pink coronal discoloration of the tooth crown). This pink discoloration results in an ultimate cavitation of the overlying enamel. In most cases, ICR is painless unless there is a superimposed secondary infection when pulpal or periodontal symptoms may arise. Radiographically, features of ICR vary from well delineated to irregularly bordered mottled radiolucency, and these can be confused with dental caries (1, 7).

According to Heithersay (14), ICR can be clinically classified into 4 types:

1. A small invasive resorptive lesion in the cervical area with little penetration into the dentin

2. A well-defined invasive lesion penetrating deeply into the dentin, close to the pulp, but without reaching the radicular dentin
3. A deep resorptive lesion invading the dentin and affecting both the coronal dentin and the coronal third of the root
4. A large invasive resorption extending beyond the coronal third of the root

One of the main drawbacks of 2-dimensional radiographs is that it is extremely difficult to determine the real extent of the ICR (15), and, therefore, cone-beam computed tomographic (CBCT) imaging is extremely useful to diagnose ICR and to plan adequate treatment of these lesions (15–18). In fact, CBCT imaging reveals the real extension of the lesion and helps to determine the best way to access the cavity. Moreover, it is possible to segment the CBCT images in order to make a 3-dimensional (3D) digital reconstruction of the tooth and digitally plan the most conservative approach to restore the tooth (8).

Case Reports

Although Heithersay's classification is extremely useful for understanding ICR, from a clinical point of view, we have proposed an alternative evaluation based on the approach used to treat the lesion. This would enable the clinician to better manage this type of lesion depending on its extension and restoration potential. ICR lesions could be either restorable or nonrestorable, and the possible treatment options for the former include 3 main types of approach: external access (E), internal access (I), and no access (N). However, some lesions may require a combined approach (eg, internal and external accesses).

Type E: External Access. This type of lesion usually requires raising a flap to access the cavity. After complete rubber dam isolation, the lesion is cleaned with 90% trichloroacetic acid. Once all soft tissue has been removed, the cavity is filled with dentin adhesive material and composite. Root canal treatment (RCT) is not usually needed, being performed only in the event that signs or symptoms of necrosis or irreversible pulpitis are observed before treatment. RCT should be performed when access to all resorptive lesions requires crossing through the pulp chamber or root canal (sometimes in Heithersay class 2 and most often in Heithersay class 3 and 4).

Type I: Internal Access. This approach is typically indicated in lesions with a very small opening but with large internal extension. In these cases, any attempt to clean the internal extension through the natural opening would lead to unnecessary tooth destruction. In most cases, accessing the internal lesion involves an intentional endodontic treatment with the aim of eliminating the invasive tissue by using 90% trichloroacetic acid. After completing this step, the lesion's entry can be sealed with calcium silicate–based material from inside the endodontic access followed by the filling of the rest of the cavity with composite or other restorative material. It should be taken into account that some calcium silicate–based materials should be avoided because they can potentially stain the tooth, causing an esthetic problem (19–21).

Type N: No Access. In this case, the clinician may consider extraction because, to our knowledge, there is no conventional way to access the ICR lesion and seal the entrance. However, if the lesion is treatable but not accessible, an intentional replantation is the treatment of choice to save the tooth. This treatment is based on extracting the tooth, cleaning the resorption lesion with burs and 90% trichloroacetic acid, sealing the cavity, and replanting the tooth into the socket. It is crucial to prevent the trichloroacetic acid from entering into contact with the sound root surface, maintain the root moistened, and ensure that the extraoral time is as short as possible. Although RCT can be performed either before or after tooth replantation, doing so before allows for the correction of possible mishaps during the extraoral management of the tooth. After the cleaning and sealing of the lesion, the tooth is replanted, and a semirigid splint is used for 2 weeks.

To better illustrate the 3 types of treatment approach, we present 3 cases of each one.

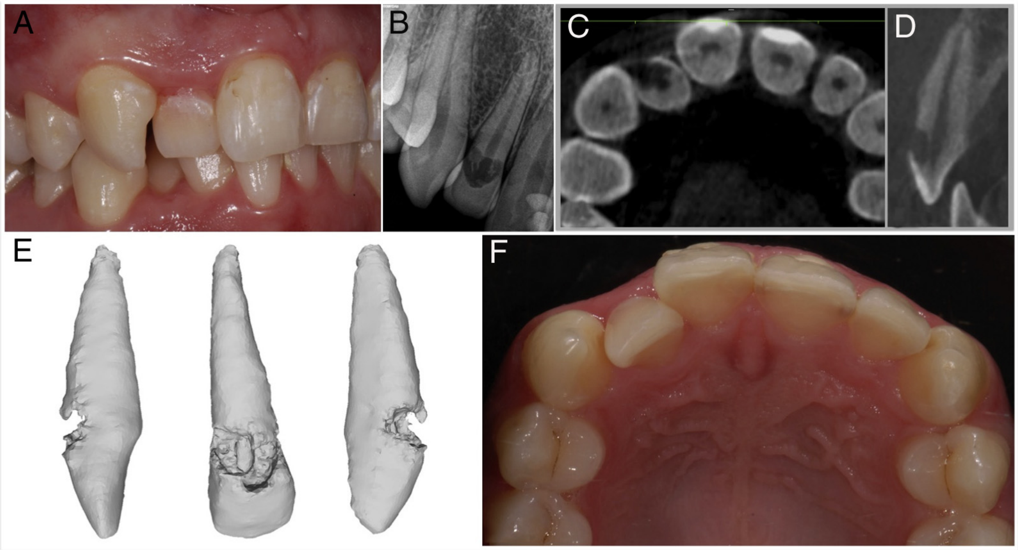

Figure 1. (*A*) At inspection, a reddish lesion was seen at the cervical area of tooth #7, compatible with ICR. (*B*) The initial periapical radiograph. A large radiolucent area with well-delimited borders at the cervical region of tooth #7 was observed. The root canal walls appeared preserved. (*C*) Transversal and (*D*) sagittal views of the resorptive lesion in CBCT imaging. The lesion was very close to the pulp canal, but it was not surrounding it yet. No or little extension toward the root dentin was observed. (*E*) A 3D digitalized image of the resorbed tooth was generated from CBCT imaging. The real extent of the lesion was visible. The predentin layer protecting the pulp was not visible because of its minimal thickness, and the pulp seemed exposed although it indeed was not. (*F*) Tooth #7 was palatally positioned regarding teeth #8 and #6. The palatal position interferes with the access to the cervical lesion. Orthodontic treatment was needed to correct malocclusion and, at the same time, to improve access to the resorptive lesion.

Type E Case

A 17-year-old male patient came to the dental clinic for a routine checkup. Examination showed a reddish zone in the buccal cervical area of tooth #7 (Fig. 1*A*). The patient reported no symptoms and responded normally to cold testing. A periapical radiograph of the tooth showed a well-delineated radiolucency in the cervical area centered on the cementoenamel junction (Fig. 1*B*). Because an ICR was suspected, it was decided to perform a small-volume CBCT scan (Planmeca 3Ds; Planmeca OY, Helsinki, Finland) to determine the real extent of the lesion (Fig. 1*C* and *D*). Based on the images obtained, the lesion was diagnosed as Heithersay class 2 ICR. To find the most adequate approach to treat the lesion, we have digitally reconstructed the tooth 3 dimensionally and performed segmentation of Digital Imaging and Communications in Medicine files in order to create a stereolithographic model using OsiriX Lite (Pixmeo, Bernex, Switzerland) and MeshLab software (Visual Computing Lab ISTI-CNR, Pisa, Italy) (Fig. 1*E*). Although the lesion was restorable, it could not be accessed because of the palatal position of tooth #7 in comparison with the adjacent teeth (Fig. 1*F*). Therefore, because the patient needed orthodontic treatment, we referred him to an orthodontist to perform a buccal movement of tooth #7 and thus facilitate access to the resorptive lesion. This movement took priority over other orthodontic movements in order to avoid any delay in the treatment, which would worsen the prognosis (Fig. 2*A*). A flap was raised at 3 months, revealing a lesion of the same shape and extension as in the 3D reconstruction (Fig. 2*B*). Subsequently, a rubber dam was placed, and the lesion was thoroughly cleaned by using cotton pellets dipped in 90% trichloroacetic acid without the help of burs (Fig. 2*C*). Once the lesion was clean, the cavity was filled with a nanohybrid composite resin (Sonicfill Kerhawe; Kerr, Bioggio, Switzerland) (Fig. 2*D*). A selective etching of the enamel was performed using a 2-bottle self-etching adhesive (Optibond XTR Kerhawe, Kerr). The restoration was polished with an Optidisc polishing disc (Kerhawe, Kerr), and the flap was sutured. The orthodontic treatment was completed within 2 years (Fig. 2*E* and *F*), with tooth #1.2 being quickly extruded (with adjustment of the incisal edge) to reduce the invasion of the biological width produced by the composite resin. At the 7-year follow-up, tooth #7 remained asymptomatic with a normal response to cold testing (Fig. 2*G*). A periapical radiograph showed minor apical resorption (Fig. 2*H*).

Type I Case

A 33-year-old woman was referred to us because of a radiolucent lesion in tooth #24 detected before orthodontic treatment. No other signs or symptoms were observed. A periapical radiograph showed a radiolucent lesion in tooth #24 compatible with Heithersay class 4 ICR (Fig. 3*A*), which was confirmed by CBCT imaging with a small field of view (FOV) (Fig. 3*B*). CBCT analysis further revealed a tiny opening in the cervical area, through which we planned to have an internal access

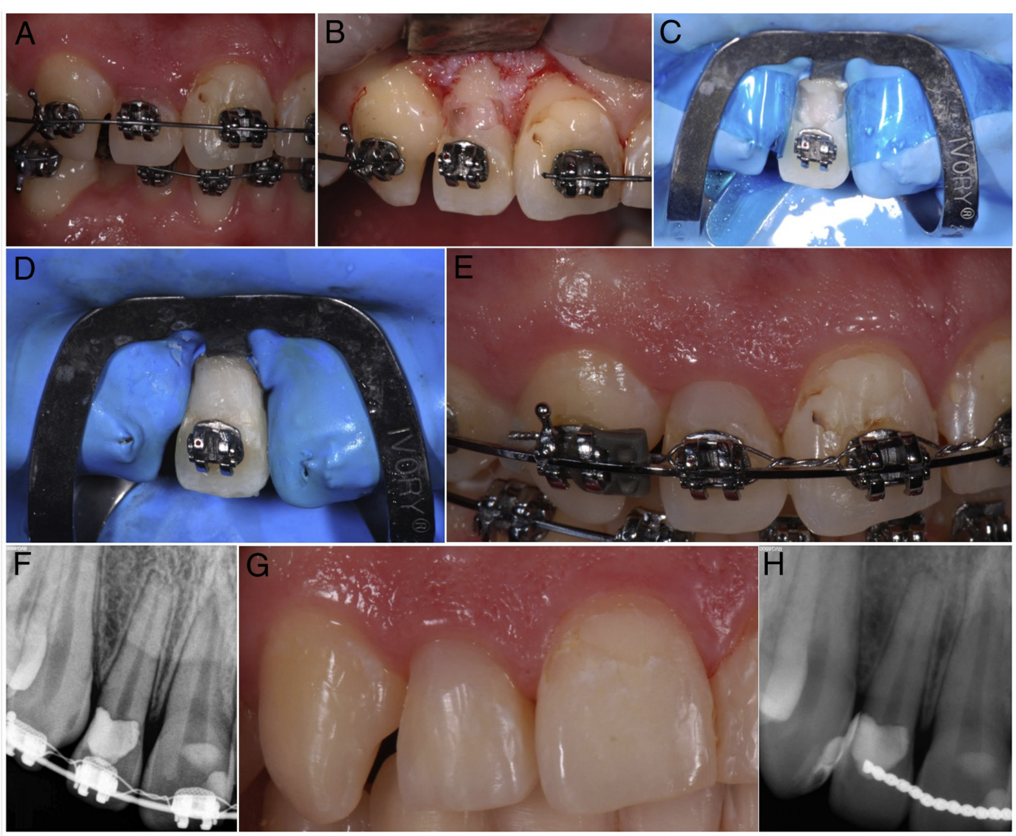

Figure 2. (*A*) After 3 months, tooth #7 was moved buccally to allow a better access to the resorptive lesion. (*B*) A flap was raised, and the resorption lesion became visible. Its shape and extent were very similar to that shown in the 3D virtual reconstruction. (*C*) Tooth #7 was isolated with a rubber dam, and 90% trichloroacetic acid was applied with a cotton pellet in order to remove all resorptive tissue. Finally, a plastic matrix was placed interproximally to allow a better composite restoration of the resorptive lesion. (*D*) The cavity was filled with Sonicfill nanohybrid composite resin. After removing the rubber dam, finishing and polishing were performed. (*E*) An image of tooth #7 showing restoration of the cervical lesion at the middle of orthodontic treatment. (*F*) Two years after treatment of ICR, just before removing the orthodontic braces. An apical resorption was observed, with normal pulp response to cold testing. (*G*) The 7-year follow-up. The tooth remained asymptomatic, with a normal response to cold testing. (*H*) At the 7-year follow-up, no signs of apical pathosis were observed on the periapical radiograph.

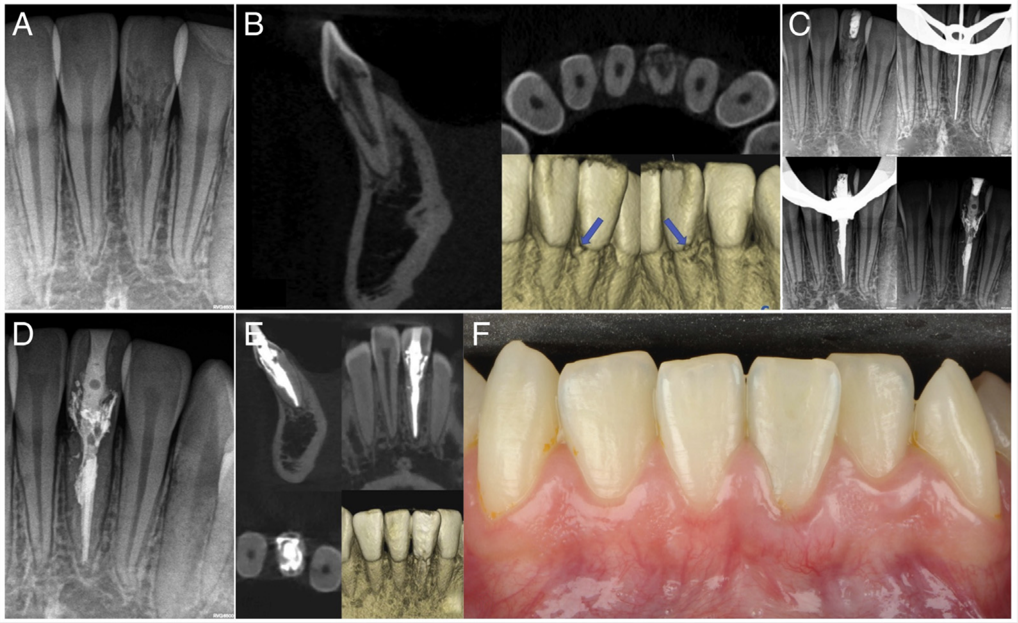

Figure 3. (*A*) A radiolucent lesion compatible with Heithersay class 4 ICR could be seen on the periapical radiograph. (*B*) A small FOV CBCT image of tooth #24 showed an image compatible with Heithersay class 4 ICR. In the sagittal view, the radiolucent lesion seemed to enter through the buccal aspect of the tooth, extending into the middle third of the root. The coronal view showed the lesion surrounding the pulp canal, apparently not affecting the external walls of the tooth. In the 3D reconstruction, 2 small openings were identified in the mesiobuccal and distal-buccal angles in the cervical area (*blue arrows*). (*C*) The radiographic treatment sequence. After cleaning the root canal, a calcium hydroxide dressing was left for 2 weeks. The calcium dressing was removed, and the root canal was filled with gutta-percha (apical and middle third of the root canal) and bulk flow composite (coronal third). The endodontic access was filled with nanohybrid composite resin. (*D*) At the 1-year follow-up, there were no signs of apical pathosis on the periapical radiograph. The tooth remained asymptomatic. (*E*) At the 3-year follow-up, CBCT imaging showed no signs of apical pathosis, whereas resorptive channels looked completely filled in the sagittal, frontal, and coronal views. There were no signs of bone loss. (*F*) The clinical view of tooth #24 at the 3-year follow-up.

to the lesion for intentional endodontic treatment. After accessing the pulp chamber through the palatal aspect of the crown, we cleaned and shaped the root canal and then filled it with calcium hydroxide. After 1 week, the root canal was rinsed with saline, and the apical two thirds were filled with gutta-percha and sealer. The coronal third and pulp chamber, in contrast, were treated with self-etching adhesive and filled with bulk fill flowable composite (SRD; Dentsply Sirona, York, PA), which involved the resorption lesion in the cervical area of the tooth. To achieve a good seal, an operating microscope was used. Thereafter, the endodontic access was also sealed with nanohybrid composite resin (Fig. 3*C*). At the 1-year follow-up, no signs or symptoms of apical pathosis or gingival inflammation were observed

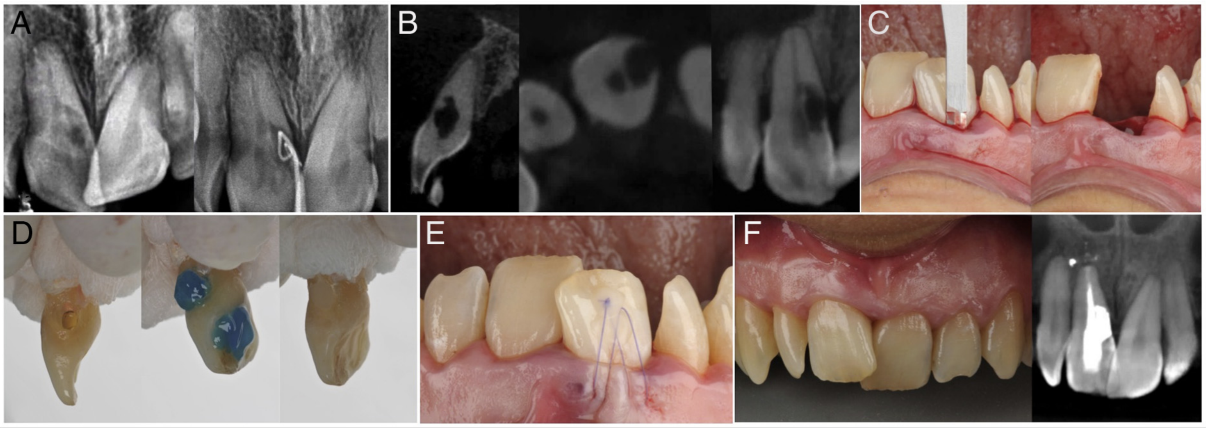

Figure 4. (*A*) Periapical radiographs of tooth #8. The initial radiograph brought by the patient and sinus tract tracing showing the mesial cervical lesion. (*B*) Sagittal, occlusal, and frontal slices of the ICR lesion in tooth #8. (*C*) The tooth was carefully extracted in an attempt to minimize trauma to the tooth and surrounding tissues. (*D*) After extraction, the tooth was held with gauze wetted with saline. Once the lesion was completely cleaned with 90% trichloroacetic acid, the cavity was prepared for adhesion and filled with microhybrid composite resin, which was then thoroughly polished. (*E*) The replanted tooth was stabilized by means of a suture adhered to the buccal enamel for 2 weeks. (*F*) At the 2-year follow-up, no signs of inflammation were observed in the gums or on the periapical radiograph.

(Fig. 3D). At the 3-year follow-up, the tooth remained asymptomatic, and as observed in the small FOV CBCT image, no signs of apical pathosis were detected, and a complete filling of the resorptive channels was observed with no bone loss (Fig. 3E and F).

Type N Case

A 32-year-old woman was referred to an endodontic specialist for a possible sinus tract associated with tooth #8. At exploration, the patient reported no pain, and the tooth responded normally to cold testing (vital). A periapical radiograph taken by the referring dentist showed a radiolucent area in the mesial wall of the tooth at the cervical margin. The radiolucent mesial lesion appeared to be clearly associated with the sinus tract, as seen in the sinus tract tracing taken with a gutta-percha point (Fig. 4A). It was decided to perform small FOV CBCT imaging, which allowed us to identify an image compatible with an ICR lesion (Fig. 4B). The CBCT image showed us that the lesion access and its isolation would be too challenging to perform, so we proposed an intentional replantation. The patient was informed that the tooth would be extracted with minimal trauma to the periodontal ligament and surrounding tissues and then replanted after cleaning and sealing the lesion. The patient was warned that in the event of an unsuccessful outcome, an alternative treatment (eg, dental implant placement) would be necessary. After the patient agreed with the treatment plan, we performed RCT of tooth #8 and then proceeded with the intentional replantation technique, which consisted of an atraumatic extraction (Fig. 4C). The extraoral procedure involved cleaning the ICR lesion with 90% trichloroacetic acid and filling the lesion and access cavity with a nanohybrid composite resin following a regular adhesive protocol (Fig. 4D).

Next, the tooth was replanted and stabilized by suturing the buccal aspect of the crown (Fig. 4E). The semirigid splinting was left in place for 2 weeks. At the 2-year follow-up, the tooth remained asymptomatic, with no signs of inflammation (Fig. 4F).

Discussion

This article discusses how to clinically manage different ICR lesions, above all those of the anterior zone. Rather than substituting Heithersay's classification, which remains extremely useful from a diagnostic perspective, our aim was to help the clinician to plan treatment management of this type of pathology. Thus, the use of new diagnostic tools, especially CBCT imaging, can significantly contribute to choosing the most appropriate approach (15, 22–24). Nevertheless, the clinician needs to understand that it is often difficult to classify the lesion, and, frequently, additional treatments such as orthodontic extrusion or gingival grafting are necessary (25). It is also important to understand that these lesions always pose a challenge because the patient needs to be informed in advance of the complications, including the possibility of tooth loss. The clinician should perform an analysis of each case and weigh the advantages and drawbacks of saving a tooth or replacing it with an implant in the esthetic zone. This is especially pertinent in young patients whose craniofacial growth continues into adulthood (26, 27).

The material used for sealing the cavity opening remains controversial. No material is known to fulfill the ideal requirements for a cavity, usually within the biological width, where chronic periodontal problems may occur. In terms of biocompatibility with gingival tissues, the use of materials such as Biodentine (Septodont, Saint-Maur-des-fossés, France) or glass ionomer is better than composite resin (28, 29), which may also form a long epithelial attachment (30). Moreover, the surface roughness of Biodentine or glass ionomer promotes plaque retention. Other products (eg, mineral trioxide aggregate) should be avoided in the esthetic zone given their propensity for staining teeth (21). Nanohybrid composite resins might not be compatible for periodontal tissues, but when well polished, these composite resins reduce plaque formation (compared with Biodentine or glass ionomer) and might produce a successful clinical outcome (24, 31).

Trichloroacetic acid is applied to the resorptive cavity to promote coagulation necrosis of the invasive tissue by penetrating smaller, more inaccessible recesses and resorptive channels (14, 24). Care should be taken when using trichloroacetic acid because of the potential irritation it may inadvertently cause to the surrounding soft tissues (14, 32). Single-tooth isolation or split dam techniques are needed to prevent inadvertent contact of trichloroacetic acid with the adjacent tissues. In the case of difficult isolation, 3%–5% sodium hypochlorite may be used similarly to trichloroacetic acid (14). Because the decalcification caused by trichloroacetic acid on dentin could affect adhesion, some authors recommend refreshing the adhesive surface with a bur (24). Although there is a dearth of evidence-based research on the topic, this issue should be taken into consideration.

Acknowledgments

The authors deny any conflicts of interest related to this study.

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