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A Decade of Survival after Intracanal Repair of External Cervical Resorption in Esthetic Zone: A Case Report

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Abstract

External cervical resorption (ECR) in anterior teeth poses significant treatment challenges due to esthetic and periodontal considerations. While external surgical repair demonstrates superior survival rates, internal approaches may be preferable for subcrestal lesions in the esthetic zone. This case presents a 25-year-old male with a Heithersay Class 3 and Patel 2Bp lesion. Microscope-assisted internal repair was performed using calcium hydroxide as an interim medicament, followed by mineral trioxide aggregate (MTA) restoration and root canal obturation 12 days later. Clinical and radiographic evaluations at 2, 4, and 9.5 years demonstrated complete healing, stable periodontal health, probing depths of 1-2 mm, and no signs of recurrence on cone-beam computed tomography, despite mild MTA-related crown discoloration that was acceptable to the patient. This nearly 10-year successful outcome highlights the possibility of a long-term successful internal repair with calcium hydroxide and MTA as a viable conservative option for select subcrestal ECR lesions in the esthetic zone.

Keywords: Calcium Hydroxide; Case Report; Endodontic; External Cervical Resorption; Mineral Trioxide Aggregate

Introduction

External cervical resorption (ECR) is a localized, progressive defect in which osteoclastic activity causes external loss of mineralized tooth structure [1]. It develops in the cervical region and may extend both coronally and apically, compromising tooth integrity [2]. The often asymptomatic progression of ECR, particularly in anterior teeth, coupled with its significant esthetic implications, necessitates timely diagnosis and intervention [3]. Cone-beam computed tomography (CBCT) plays a crucial role in determining lesion size, circumferential involvement, and relationship to the root canal system. It has become the standard imaging modality for treatment planning [4].

Treatment includes eliminating resorptive tissue and sealing the defect to prevent recurrence [2]. The external surgical approach is the conventional method; it involves flap reflection, osseous exposure, and osteotomy if the lesion extends subcrestally, which compromises soft tissue esthetics in the anterior region [5]. The internal approach is performed by lesion management through the intracanal space. It is a minimally invasive and periodontally conservative alternative [3]. Reported long-term success rates of internal repairs (approximately 40-45% at 8 years) are lower than those of external surgeries (around 70% at 5 years) [4, 6]. The treatment approach should be case-specific.

This case report was structured under the CARE guidelines, and it presents a ten-year follow-up of an anterior tooth ECR treatment that was managed internally, demonstrating clinical stability of a case-specific internal approach.

Case Presentation

A 25-year-old male patient presented to the clinic with a chief complaint of intermittent, sharp pain in the distal of the maxillary right canine (tooth #6), triggered by mechanical stimuli during high-impact activities such as jumping or jogging. The discomfort had been present for approximately 2–3 years and was of moderate intensity. The patient's medical history included a single episode of syncope during dental treatment, with no other systemic conditions reported, and a dental history of prior orthodontic treatment.

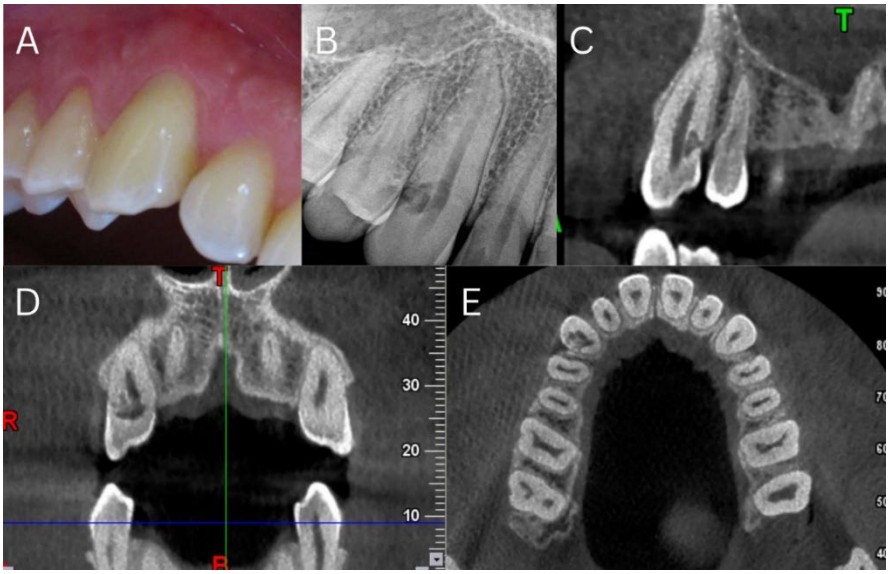

Figure 1. *A*) Intraoral photograph of tooth #6 showing no evidence of swelling or gingival recession; *B*) Initial periapical radiograph revealing a radiolucency in the cervical third of the distal root surface not involving the pulp chamber and slight widening of the PDL space; *C*) Sagittal CBCT slice demonstrating external cervical resorption with a small perforation communicating with the PDL; *D*) Coronal CBCT view of the lesion; *E*) Axial CBCT section illustrating the extent and location of the resorptive defect

Clinical and radiographic findings

Clinical examination

Extraoral examination revealed no swelling, facial asymmetry, or lymphadenopathy. Intraorally, tooth #6 presented with normal crown morphology, with no discoloration, cracks, or carious lesions (Fig. 1A). Periodontal evaluation demonstrated probing depths of 2 mm on the distal, buccal, and palatal aspects, with a slightly deeper pocket of 3 mm distally. There was no bleeding on probing, and radiographic assessment showed a healthy periodontal ligament (PDL) space. The tooth exhibited no mobility (Miller's Class 0). Pulp sensibility tests (cold and electric) were positive and within normal limits, and occlusal analysis revealed no premature contacts or interferences.

Radiographic assessment

A periapical radiograph revealed a well-defined, irregular radiolucency in the cervical third of the distal root surface, located subgingivally and not involving the pulp chamber (Fig. 1B).

CBCT confirmed a cervical resorptive defect with limited circumferential extension and minimal communication with the root canal system, associated with a small perforation into the periodontal space (Figs. 1C-E).

Diagnosis and etiology

The lesion was diagnosed as external cervical resorption, Heithersay Class 3 and Patel's 2Bp [7], as it extended into the coronal third of the root with a distinct radiolucent defect and pulpal communication. The most likely etiologic factor was considered to be orthodontic treatment–related trauma [8] since the patient's history was free of other common etiologies such as bleaching or blunt trauma.

Treatment planning

The lesion was classified as Heithersay class III and Patel class 2Bp. According to CBCT analysis, the defect extended 2 mm apical to the alveolar bone crest and was mainly distal. An external surgical route would therefore have required osteotomy through the thick, healthy buccal bone to access the lesion, resulting in unnecessary removal of the intact cortical plate. Despite a thick gingival phenotype, the surgical approach posed a risk to the aesthetic gingival contour. The internal approach was chosen to allow direct, controlled access to the defect *via* the root canal system, enabling its debridement and sealing while entirely preserving the external periodontal attachment and crestal bone.

Treatment protocol

The lesion was classified as Heithersay class III and Patel class 2Bp. An external approach would have required flap elevation, osteotomy, removal of granulation tissue, and restoration, with a possible risk of marginal tissue recession, disruption of the gingival zenith, and compromised symmetry in the anterior esthetic zone. In addition, the mesial curvature of the maxillary premolar root trunk and the proximity of adjacent structures increased the risk of iatrogenic injury and complicated surgical access. Internal repair through the pulp space was therefore considered the first-line approach, allowing selective debridement of the resorptive defect and sealing of the communication while preserving the surrounding periodontal attachment.

Figure 2. *A)* Periapical radiograph taken after the second treatment session showing MTA densely packed into the external cervical resorption defect; *B)* Final periapical radiograph following complete obturation of the root canal system, demonstrating well-condensed gutta-percha and sealer with an adequate apical seal

If this conservative approach had failed, an external surgical approach would have been considered. All procedures were performed under an operating microscope to maximize precision, minimize unnecessary structure removal, and control management of the defect in the maxillary anterior region.

First session

Following the administration of local anesthesia with lidocaine and rubber dam isolation, an internal access cavity was initiated. The canal preparation was achieved using a #A1 and #A2 Neoniti endodontic files (Neolix, Chatres-La-Forte, France). The pre-dentin wall adjacent to the lesion was thinned during the shaping. Under magnification, the margins of the defect were identified by a subtle color change. Since a complete pulpectomy was planned, a controlled, intentional perforation was created through this thinned wall to establish direct access to the resorptive cavity. This step was deemed essential to enable adequate mechanical debridement, chemical irrigation, and three-dimensional sealing of the ECR lesion. The defect cavity was then subjected to chemical disinfection, beginning with adequate irrigation using 5.25% sodium hypochlorite activated *via* an ultrasonic tip to enhance biofilm removal and tissue dissolution. Afterwards, a calcium hydroxide paste was placed into the defect and the root canal. This intermediate medicament was selected specifically to address the biological risks associated with the fresh perforation, providing antimicrobial action and inactivating residual clastic cells at the communication site before definitive sealing. The access cavity was sealed with a sterile cotton ball and a Zonalin temporary restoration (Kemdent, Swindon, UK).

Second session (day 6)

After routine anesthetic and isolation protocol, the temporary restoration was first removed, and the root canal was thoroughly irrigated with ultrasonically activated sodium hypochlorite (NaOCl). To prevent mineral trioxide aggregate (MTA) from occluding the canal lumen and to serve as an internal matrix, a size eighty gutta-percha cone (Meta Biomed, Cheongju-si, Republic of Korea)was inserted into the canal (Fig. 2A).

Mineral trioxide aggregate (MTA, L&S Co, Tehran, Iran), containing bismuth oxide as a radio-opacifier, was mixed to the dough consistency and carefully packed into the resorptive defect using an MTA carrier and hand instruments. No additional external matrix was required because the defect was confined and could be supported internally by the gutta-percha cone and the surrounding dentin. There was no active bleeding at the site; gentle saline irrigation and pressure with cotton pellets were sufficient to verify a clean and dry field before placement of MTA. Radiographic imaging confirmed the complete filling of the resorption space by MTA and a tight seal without extrusion into the PDL space. A moist cotton pellet was placed over the MTA to facilitate setting, and the access cavity was temporarily sealed.

Third session (day 12)

After temporary restoration removal, the temporary gutta-percha cone was removed from the canal, and the canal walls were thoroughly cleaned with 5.25% sodium hypochlorite. The root canal was then obturated with gutta-percha and sealer using the lateral condensation technique, and a post-obturation radiograph confirmed a dense and well-adapted filling (Fig. 2B). The access was provisionally restored, and the patient was referred for definitive coronal restoration.

Outcome and follow-up

At the short-term follow-up, two years post-treatment, the patient was asymptomatic, with probing depths of 3 mm on the distal aspect of the treated tooth. Radiographic evaluation demonstrated no evidence of progression in the resorptive lesion, and the PDL space remained intact and normal (Fig. 3A). A mild grayish discoloration of the crown was observed (Fig. 3B).

At the intermediate follow-up, four years post-treatment, the tooth remained asymptomatic. Although crown discoloration persisted, the patient reported no esthetic concerns (Fig. 3C). In cases where esthetic issues arise, internal bleaching or crown placement may be recommended. The follow-up periapical radiograph demonstrated a healthy PDL and bone status, with no signs of pathology (Fig. 3D).

Buccal and palatal clinical photographs at this interval further documented the MTA-related discoloration and the composite access restoration (Figs 3E & 3F). Periapical radiographs taken at this follow-up point included both distal and standard projections to fully evaluate the MTA-treated area (Figs 3G & 3H).

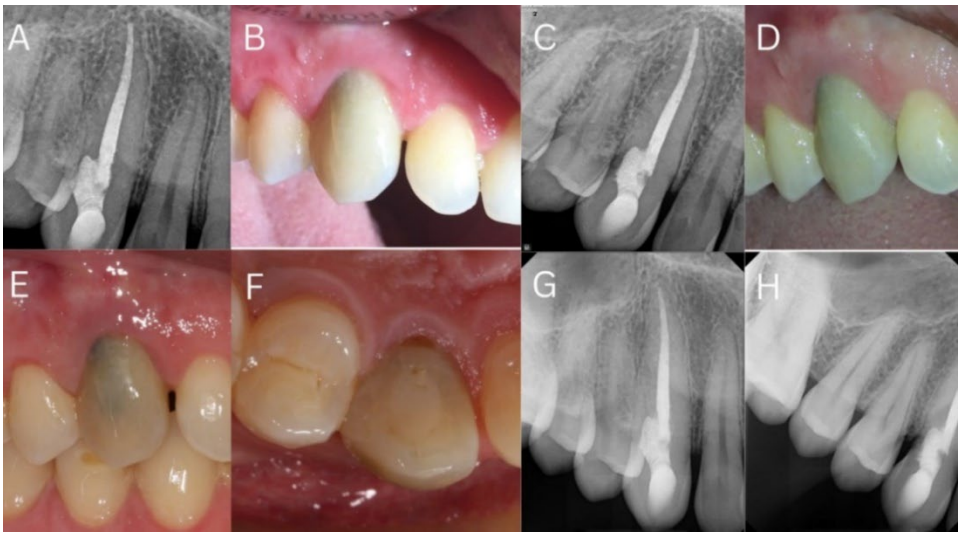

Figure 3. A) Periapical radiograph at 2-year follow-up showing stable periodontal ligament space and absence of lesion progression; *B)* Clinical photograph demonstrating mild grayish discoloration of the crown at 2-year follow-up; *C)* Periapical radiograph at 4-year follow-up illustrating a healthy periodontal ligament and surrounding bone; *D)* Clinical image at 4-year follow-up showing persistent but stable crown discoloration; *E)* 4-year follow-up clinical Buccal view showing grey discoloration of the canine due to MTA; *F)* 4-year follow-up clinical Palatal view displaying the composite restoration sealing the access cavity; *G & H)* 4-year follow-up radiographs. Two periapical radiographs; the distal PA does not include the apex but shows the MTA-treated area

At the long-term follow-up, 9.5 years post-treatment, clinical examination showed probing depths within physiological limits, ranging from 1 to 2 mm, with no signs of mobility or sensitivity. Radiographic imaging showed no evidence of recurrence. Periodontal bone levels and the lamina dura appeared intact and healthy, indicating successful long-term healing. The CBCT scan of the treated cervical resorption showed re-establishment of surrounding bone and a normal periodontal ligament space. The coronal and three-dimensional reconstructed views demonstrated maintenance of the external root contour and the supporting alveolar bone, without new defects or signs of active resorption (Fig. 4).

Discussion

ECR management is directed by lesion extent, proximity to the bone crest, pulpal status, and esthetic demands, with the overarching goals of arresting resorption, restoring the defect, and preserving periodontal health [2]. Preoperative CBCT is crucial for diagnosis and planning, providing three-dimensional information on lesion size, circumferential spread, and pulpal proximity [9]. In the present case, CBCT classified the lesion as Heithersay class 3 and Patel class 2Bp, a moderately extensive defect with pulpal communication located on the distal of a maxillary canine, extending approximately 2 mm below the alveolar crest and progressing mainly in the distal direction. This subcrestal position placed the tooth in a zone where treatment selection had to balance access, periodontal preservation, and esthetics.

External repair is favored for cervical lesions that can be reached without extensive bone removal or soft-tissue trauma [10, 11], while internal repair could be more appropriate for subcrestal lesions with limited external access and for esthetic-zone cases [12, 13]. Because the defect did not extend buccally, a hypothetical external approach would have required flap elevation and osteotomy through a thick, intact buccal cortical plate solely to gain access, since intraosseous extension usually requires osteotomy to expose the cavity for adequate instrumentation [14]. Removing healthy bone in this manner would have increased postoperative morbidity and the risk of marginal recession and altered gingival zenith. The internal route, by contrast, used the existing pulp chamber and canal system to reach the defect without harming the buccal periodontium; and with the patient's preference to avoid esthetic compromise, a microscope-assisted internal approach was the first-line option.

The current evidence does not claim a superior technique. A recent systematic review reported highly heterogeneous outcomes for internal and external repair, with two included studies favoring external repair and one favoring internal repair. The evidence was limited by small samples and inconsistent reporting [11]. Although external approaches may achieve higher survival in general cohorts, this advantage appears to decline over time [3]. Such findings reinforce case-specific decision-making: internal repair may be preferable when surgical access would demand removal of healthy bone, increase the risk of recession, or compromise the soft-tissue profile in the esthetic zone [12, 15].

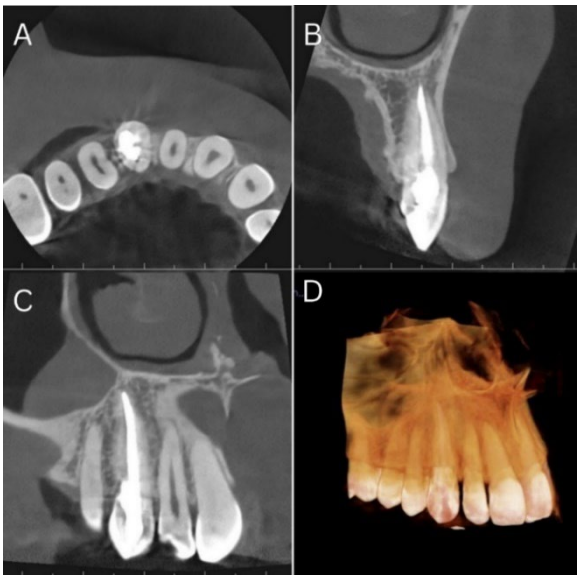

Figure 4. The 9.5-year follow-up: A) Axial view showing the well-obturated root canal and continuous peri-coronal bone; *B)* Sagittal view demonstrating the root canal filling extending to the apex with no periapical radiolucency and managed external cervical resorption; *C)* Coronal view illustrating preserved cortical bone, intact maxillary sinus floor, and normal periodontal ligament space; *D)* 3D volume-rendered view displaying maintained tooth contour and surrounding alveolar bone without resorptive defects

The Patel 2Bp designation indicated that the peri-canalar resorption-resistant sheet (PRRS), an uneven protective layer of dentin and occasionally bone-like tissue that may delay canal perforation by the resorptive process, had already been breached [10]. Where the PRRS remains intact and no pulpal communication exists, vital pulp therapy (VPT) with calcium silicate materials can preserve the pulp's defensive mechanisms and represents a viable alternative [10, 12]. The pre-existing PRRS breach had already compromised the separation between the resorptive defect and the pulp, so a deliberate, controlled perforation of the thinned pre-dentin wall was required to permit ultrasonic irrigation and precise placement of repair material [2]. This step would have inevitably introduced microorganisms into the pulp chamber and threatened pulp vitality; therefore, a complete pulpectomy with thorough chemomechanical disinfection was chosen to establish a sterile, predictable environment for repair [16]. The decision to perform root canal treatment thus reflected a biological-procedural necessity rather than a diagnosis of irreversible pulpitis.

The treatment sequence was designed to mitigate the risks of bacterial translocation into the periodontal ligament and possible material extrusion: ultrasonically activated 5.25% NaOCl disinfected the defect, followed by calcium hydroxide to inactivate residual clastic cells and denature bacterial endotoxins [17], and finally MTA to provide a stable long-term barrier at the perforation site. The absence of periapical pathology or recurrent resorption at the 9.5-year follow-up supports the safety of this intentional-perforation technique when combined with biological management.

Internal access under an operating microscope allowed conservative debridement of resorptive tissue, accurate identification of defect margins, and controlled placement of the repair material [18, 19]. Calcium hydroxide served as the interim medicament for its antimicrobial, anti-inflammatory, and anti-resorptive properties, such as its high pH, which promotes coagulation necrosis of residual soft tissue, inhibits osteoclastic activity, alters bacterial cell walls, and denatures lipopolysaccharide endotoxin, thereby reducing antigenicity and controlling inflammation [17, 20]. MTA was selected for definitive repair because it combines biocompatibility, sealing ability, and a strong capacity to support periodontal healing [21, 22]. An ideal repair material should offer radiopacity, a durable seal, high pH, low solubility, and periradicular tolerance while inducing odontoblastic differentiation [12]; newer bioactive bioceramics likewise favor tissue response, promote dentinogenesis, and facilitate hard-tissue bridge formation [5, 23]. Table 1 summarizes the biomaterials currently used in ECR management.

Esthetic considerations are always critical in anterior ECR management. The bismuth oxide radiopacifier mixed with MTA has a high-strength set but is associated with gray crown discoloration [24], something that should be discussed with the patient when the tooth is in the esthetic zone. Newer calcium silicate materials such as Biodentine may reduce discoloration and improve handling [25] but were not widely investigated at the time of treatment. Bioactive restorative materials, including Biodentine and EndoSequence Root Repair Material, may increasingly replace traditional choices for subgingival defect repair given their favorable biologic behavior and potential to support surrounding hard tissues [20].

The outcome was judged by the absence of recurrent resorption, stable periodontal measures, maintained function, and favorable CBCT findings over nearly ten years, indicating that internal repair provided strong retention in this specific anatomical and clinical context. This case should not be interpreted as evidence that internal repair is superior to external repair or predictably successful across all ECR lesions; rather, it illustrates that case-specific, microscope-assisted internal repair can be a conservative option when external surgery would pose periodontal or esthetic risk. With continued advances in bioceramic materials, including NeoPutty, Cold Ceramic, and BioSealer, further studies are needed to evaluate their handling and tissue compatibility in ECR management [34-37].

Table 1. Clinical role and rationale of materials used in the management of external cervical resorption

Material	Clinical role	Mechanism of action	Key rationale for ECR management	Main limitation
MTA	Definitive defect repair	Tricalcium silicate hydration forms calcium silicate hydrate and raises pH, promoting cementogenesis, osteogenesis, and hard-tissue formation [26].	Bioactive, biocompatible, moisture-tolerant, with excellent sealing and documented hard-tissue repair at the resorptive interface [12, 23, 24].	Prolonged setting time, potential discoloration, and difficult handling.
Calcium hydroxide	Temporary intracanal medicament	Releases Ca^{2+} and OH^-, producing high alkalinity that provides antimicrobial and anti-resorptive effects [27].	Suppresses bacterial activity and clastic cell activity before definitive ECR repair [17, 28].	Must be completely removed; no permanent seal; requires multiple visits.
Biodentine	Alternative definitive defect repair	Tricalcium silicate-based material that promotes mineralized tissue and dentinal bridge formation [29].	Bioactive, easier handling, shorter setting time, and lower discoloration risk than MTA; useful for ECR repair [22, 30].	Less long-term clinical evidence than MTA.
Glass ionomer cement	Defect/coronal sealing	Acid–base reaction provides chemical adhesion to dentine and fluoride release [31].	Biocompatible, self-adhesive, and useful for selected ECR cavity restorations [16].	Less bioactive/regenerative; inferior esthetics and mechanical strength.
Composite resin	Coronal restoration	Photopolymerized dimethacrylate polymer matrix bonded to tooth structure through a multi-step adhesive system [32].	Provides an esthetic coronal seal with good surface finish and bonding potential [33].	Technique-sensitive, moisture control required, and non-bioactive.

Conclusion

This case demonstrates long-term retention of a maxillary canine affected by external cervical resorption managed with microscope-assisted internal repair using calcium hydroxide and MTA. Within the limits of a single case, the findings support internal repair as a feasible option for selected lesions in which surgical access may pose periodontal or esthetic risk, rather than as a demonstration of superiority over external techniques.

Limitation

Several limitations must be acknowledged. As a single-case report, the findings are inherently descriptive and cannot establish comparative efficacy or be generalized across the spectrum of ECR presentations. Objective colorimetric or spectrophotometric data were not obtained, and the assessment of discoloration therefore relied on clinical observation and photographic records, which are subject to variability in lighting and reproduction. Documentation of the earliest treatment phases was retrospective in nature, introducing the potential for incomplete or imprecise record capture. Prospective, adequately powered studies with standardized classification, objective esthetic assessment, and extended follow-up are required to define the indications for, and expected outcomes of, internal repair in the management of external cervical resorption.

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Conflict of interest

None.

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Consent

Written informed consents were obtained from the patient to publish this case following the journal's patient consent policy.

Data Availability

The data supporting this report are available upon reasonable request from the Editorial journal.

Authors' contributions

Conceptualization: MA/ZGN; Methodology: ZGN/ES; Formal Analysis and Investigation: ZGN/ES; Writing-Original Draft Preparation: MA/ZGN; Writing-Review and Editing: ZGN/ES; Supervision: MA. All authors read and approved the final manuscript.

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