

## Apexification of a traumatic central incisor with bioceramic putty: A case report

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### Abstract

**Introduction:** Apexification is a well-established endodontic treatment aimed at inducing apical closure in immature permanent teeth with necrotic pulp and open apices, often resulting from trauma. The introduction of bioceramic materials has enhanced the predictability and efficiency of this procedure.

**Description of Case:** An 18-year-old female presented with a discolored, non-vital maxillary right central incisor (tooth 11) with a history of trauma at age 10. Clinical and radiographic examination revealed an open apex, wide root canal, and periapical radiolucency, consistent with a diagnosis of pulpal necrosis and symptomatic apical periodontitis. Apexification was performed using a bioceramic root repair material as a 4 mm apical plug, followed by thermoplastic obturation. Subsequent visits included intracoronal bleaching and esthetic restoration using direct composite resin. The patient remained asymptomatic, and follow-up showed successful periapical healing and esthetic restoration.

**Discussion:** Bioceramic materials offer numerous advantages over traditional calcium hydroxide, including superior biocompatibility, shorter setting time, and reliable sealing in moist conditions. This case supports existing literature indicating high success rates with bioceramic apexification, particularly in trauma-related necrotic teeth where regenerative endodontic therapy may be less predictable.

**Conclusion:** Apexification using bioceramic putty is a predictable and efficient treatment for managing non-vital immature teeth. In this case, the treatment resulted in successful apical closure, symptom resolution, and restoration of function and esthetics, reinforcing the role of bioceramic materials in contemporary endodontic practice.

**Keywords:** Apexification; Apical End Closure; Bioceramic Putty; Dental Trauma

### 1. Introduction

Apexification is an endodontic procedure used to manage permanent teeth with necrotic pulp and open apices, often resulting from trauma. These cases present unique clinical challenges due to the wide root canal and the absence of an apical constriction, which complicates the control of obturation materials and compromises the long-term prognosis if left untreated [1,6].

With the advent of bioceramic materials such as mineral trioxide aggregate (MTA) and other hydraulic calcium silicate cements (HCSCs), single-visit apical plug techniques have shown comparable success rates, often exceeding 90%, with improved efficiency and reduced risk of reinfection [4].

Traumatic dental injuries, especially in the anterior region such as the maxillary incisors, are the most common cause of pulpal necrosis in young patients. Apexification is a preferred option in cases where the apical tissues are insufficient to support regenerative outcomes or where the existing root structure is deemed adequate for function [7].

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This case report describes the apexification treatment of an 18-year-old female patient presenting with a discolored, non-vital maxillary right central incisor (tooth 11) as a result of dental trauma during childhood using bioceramic apical plug material and thermoplastic obturation. This case underscores the clinical relevance and effectiveness of apexification as a predictable and efficient treatment option for immature non-vital teeth.

## 2. Description of Case

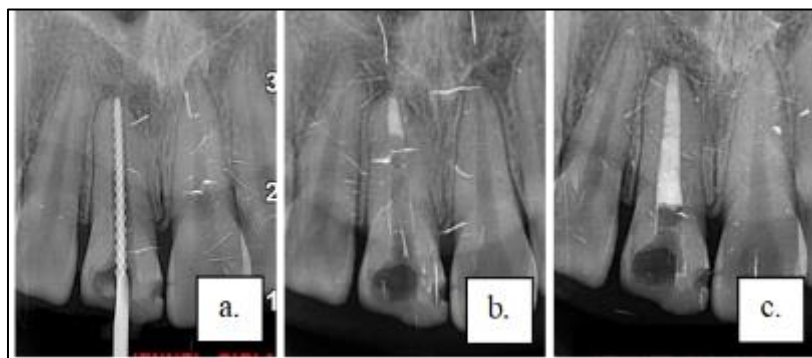


**Figure 1** Initial photograph (a) showing a discolored incisor. (b) periapical radiograph showing an open apex

An 18-year-old female presented with a chief complaint of discoloration in her upper right front tooth (tooth 11), which had become noticeably darker. She reported no current pain but expressed a desire to have the tooth aesthetically restored. Her dental history revealed trauma to the tooth at the age of 10 due to an impact. The tooth had previously undergone several treatment sessions at a public health center before being referred to the Dental Hospital of Universitas Airlangga (RSGM Unair). The patient had no systemic illnesses or known drug allergies.

Clinical examination revealed a fracture on the incisal one-third of tooth 11 and visible discoloration. The tooth was tender to percussion but negative to bite test. Surrounding gingival tissue appeared normal. Vitality testing confirmed the tooth was non-vital. Radiographic examination showed radiolucency in the crown suggestive of caries, a wide pulp chamber and root canal, open apex, and the presence of a periapical lesion. Based on these findings, the diagnosis was pulpal necrosis with symptomatic apical periodontitis on tooth 11.

The treatment plan involved apexification using an apical plug technique with bioceramic root repair material, followed by thermoplastic obturation and final restoration through intracoronary bleaching and direct composite resin restoration. The prognosis was considered good. Treatment was carried out over seven visits. During the first visit, patient education, consent, rubber dam isolation, access opening, working length determination (20 mm) using an apex locator, and canal debridement using the circumferential filing technique were performed. Irrigation was done using NaOCl 1,5%, distilled water, EDTA 17%, and activated with passive ultrasonic irrigation. The canal was then medicated with a bioceramic dressing and sealed temporarily.



**Figure 2** (a) periapical radiograph with No. 90 K-File establishing approximate working length. (b) 4 mm apical plug of bioceramic putty was confirmed radiographically. (c) final obturation result

In the second visit, two weeks later, the patient reported no complaints. The bioceramic dressing was removed, and irrigation was repeated. A collagen sponge was placed apically to serve as a matrix, followed by the placement of a 4 mm bioceramic apical plug, which was confirmed radiographically. At the third visit, one week later, obturation of the

root canal was completed using a resin-based sealer and thermoplastic gutta-percha backfill technique, followed by vertical condensation and radiographic verification.

The fourth visit included intracoronal bleaching using 35% hydrogen peroxide was applied as the bleaching agent. The fifth visit, final restoration with composite resin was completed.

During follow-up visit, the patient remained asymptomatic, with healthy surrounding gingiva and stable color. The composite restoration showed excellent esthetics and function. Overall, the apexification procedure was successfully completed with a favorable outcome.



**Figure 3** (a) clinical photograph after intracoronal bleaching and (b) radiograph after apexification

### 3. Discussion

The management of non-vital immature permanent teeth with open apices due to trauma remains a significant clinical challenge. Apexification has long been recognized as an effective treatment option to induce apical closure and allow for obturation in such teeth. In the presented case, the use of a bioceramic material for the creation of an apical plug in tooth 11, combined with thermoplastic obturation and aesthetic restoration, yielded a favorable outcome—clinically and radiographically [1,6].

Historically, calcium hydroxide was the material of choice for apexification. While effective in promoting hard tissue formation, its prolonged treatment time, multiple visits, and potential for weakening dentinal walls due to long-term application have led to a shift toward materials like mineral trioxide aggregate (MTA) and newer bioceramics. MTA-based apexification, as shown in the 20-year follow-up study by Bogen and Ricucci, demonstrated not only high success rates in apical barrier formation but also the potential for continued root development in some cases [2].

In this case, bioceramic root repair material was used for a one-step apexification approach, which is consistent with current best practices. These materials exhibit excellent biocompatibility, antibacterial properties, and the ability to form a tight seal in moist environments—crucial for successful outcomes. Additionally, newer formulations such as BC RRM Putty have overcome some of the limitations of MTA, such as extended setting time and handling difficulties [2,5].

The clinical decision to opt for apexification over regenerative endodontic treatment (RET) was appropriate in this case. RET is indicated with very thin dentinal walls or when further root development is desired in younger patients. However, RET outcomes in trauma cases are often less predictable due to the potential damage to the apical papilla and the regenerative cell populations, which are critical for continued root development. In patients with sufficient root length, the creation of an apical barrier via apexification offers a predictable and effective treatment alternative [5,6]. Moreover, the case was managed meticulously with multiple irrigants (NaOCl, EDTA, and distilled water), ultrasonic activation, and circumferential filing to ensure proper disinfection. Canal debridement and effective irrigation as essential steps prior to apical plug placement [6].

Radiographically, the treated tooth showed resolution of the periapical lesion and a well-placed bioceramic apical plug. The follow-up confirmed the absence of symptoms and the stability of the restoration. This matches the criteria for successful apexification outcomes: resolution of clinical signs and symptoms, periapical healing, and maintenance of tooth function [6,7].

In summary, apexification using modern bioceramic materials provides a reliable, efficient, and biologically favorable approach for treating non-vital immature teeth, especially in trauma cases where regenerative techniques may be less predictable. This case reinforces the continued relevance of apexification in contemporary endodontic practice and highlights the importance of material selection, precise technique, and individualized patient assessment in ensuring long-term treatment success [8].

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#### 4. Conclusion

Apexification using bioceramic putty presents a reliable and effective treatment for immature permanent teeth with necrotic pulp and open apices, particularly in cases resulting from dental trauma. In this case, the application of a bioceramic apical plug in a non-vital maxillary central incisor provided a predictable apical barrier, allowed for successful obturation, and preserved the tooth both functionally and esthetically. The case outcome—marked by clinical resolution of symptoms, radiographic healing, and esthetic restoration—reinforces current evidence supporting bioceramic apexification as a contemporary standard in managing such complex endodontic conditions.

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#### Compliance with ethical standards

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##### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest regarding the publication of this document.

##### *Statement of informed consent*

Informed consent was obtained from patient included in the study.

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