

Bleaching Options for Pulp-Calcified Teeth: Case History Reports

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Clinical Relevance

This technique is a conservative approach to recover the esthetics of calcified teeth.

SUMMARY

The aim of this article is to review some essential aspects of anterior tooth calcification and its esthetic treatment. Furthermore, three cases including different and successful bleaching strategies are reported.

INTRODUCTION

The psychosocial well-being of a person can be influenced by smile attractiveness. Tooth color has particular cosmetic importance and is readily perceived by people. In many cases, just one discolored tooth can compromise the entire smile harmony.¹

The real cause of discoloration should be properly diagnosed in order to conduct a correct treatment.²

Trauma to dentition can result in a calcific pulpal response, and in 67% to 79% of affected teeth, the clinical crown exhibits yellow discoloration.^{3,4} Pulp canal obliteration, or calcific metamorphosis, is a sequela of tooth trauma characterized by the pronounced deposition of hard tissue (tertiary dentin) within the pulp chamber and root canal space.⁵ This decreases the translucency of dentin. Dentin confers the basic hue of the tooth, while enamel just modulates the chroma and the value according to its thickness. The result is a yellowish appearance of the crown in about 3 months or 1 year after the injury.⁶⁻⁸ The color appearance can be modified in case of any change to the structural composition or thickness of these structures.⁹

It is generally accepted that the frequency of pulp canal obliteration is dependent on the extent of the traumatic injury and the stage of root formation.¹⁰ Partial or total obliteration of the root canal space is reported to develop more often in anterior teeth of young adults with a history of concussion and subluxation injuries.⁵ Approximately 4% to 24% of traumatized teeth develop varying degrees of pulp canal obliteration.^{11,12}

The exact mechanism of canal obliteration is unknown, but several hypotheses have emerged to

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Figure 1. Discolored anterior tooth No. 8.

explain the event. Avery¹³ suggested that the pronounced deposition of hard tissue could result from a reduced vascular flow in the pulp leading to tissue respiratory depression and subsequent pathological mineralization. Torneck⁸ hypothesized that



Figure 2. X-ray shows pulp chamber obliteration.

Table 1: Materials Used	
Bleaching product	Manufacturer
Powerbleaching 10%	BM4 Materiais Odontológicos, Palhoça, SC, Brazil
Powerbleaching Office 37%	BM4 Materiais Odontológicos, Palhoça, SC, Brazil

the phenomenon could be either a result of stimulation of the preexisting odontoblasts or loss of their regulatory mechanism. Other authors believe that the calcification occurs in response to a severe injury to the neurovascular supply of the pulp, which, after healing, leads to accelerated dentin deposition.¹⁴⁻¹⁶

Clinically, there is a progressive decrease in the response to thermal and electrical pulp testing as the deposition of hard tissue becomes more pronounced.^{4,17} Nevertheless, it is generally accepted that a negative response to sensitivity tests does not automatically imply pulp necrosis.^{4,18}

Although there are different points of view regarding the management of canal-obiterated teeth, studies indicate that the incidence of pulp necrosis varies from 1% to 27% of cases, suggesting that a change in tooth color is not a reliable indication of pulp or periapical pathosis.^{4,11,19} Even a complete radiographic obliteration does not necessarily mean the absence of the pulp or canal space; in most of these cases, there is a pulp canal space with pulpal tissue.^{8,11,17} Histopathologic studies designed to assess the pulpal status of teeth with pulp canal obliteration have also failed to show any inflammatory component indicative of a pathologic process.^{8,20}

The following three case reports describe the management of anterior calcified and discolored teeth, in which different bleaching strategies were used to solve the patients' esthetic discomfort.

CLINICAL CASE REPORTS

Case 1

A 24-year-old woman presented to the Federal University of Santa Catarina complaining of the yellowish appearance of her anterior tooth (No. 8) as a result of a trauma that had occurred 10 years before (Figure 1). Radiographic evaluation revealed pulp chamber obliteration and no apical lesion (Figure 2). The patient manifested no response to thermal pulp testing. She used a home 10% carbamide peroxide gel (Table 1) placed in a customized tray with windows cut out of the tray adjacent to the



Figure 3. Final aspect after 21 days of at-home tooth bleaching.

discolored tooth, on either side. The patient was instructed to use the tray during the daytime (1 hour per day). After 3 weeks, tooth No. 8 presented satisfactorily with the same color as adjacent teeth, and an excellent outcome was obtained (Figure 3).

Case 2

A 35-year-old man presented to the dental office unsatisfied with his tooth No. 9, which had gradually become dark yellow (Figure 4) after labial trauma 20 years before. Radiographic evaluation demonstrated pulp chamber and root canal obliteration without apical lesion (Figure 5) and no response to thermal stimulus. It was proposed to proceed with in-office whitening sessions to assess the color change. The patient was submitted to a 1-hour session with an in-office bleaching gel composed of 37% carbamide peroxide (Table 1) three times per week. Because of



Figure 4. Intraoral view of darkened tooth No. 9.



Figure 5. X-ray reveals complete obliteration of pulp chamber and root canal.

its lower concentration of hydrogen peroxide, the gel did not require application of a gingival barrier (Figure 6). After 3 weeks, a pleasant esthetic result was achieved (Figure 7).

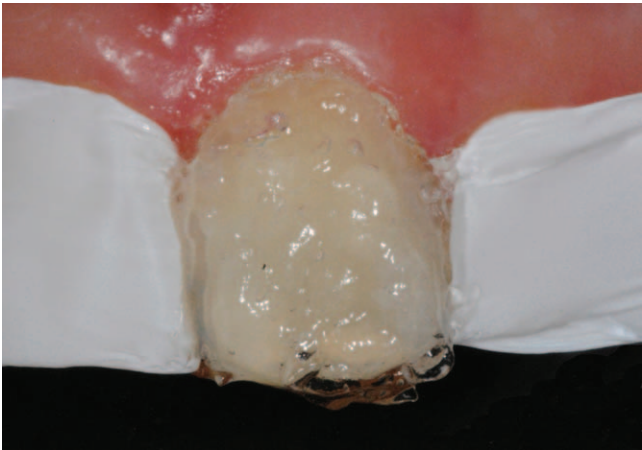


Figure 6. Thirty-seven percent peroxide carbamide in-office gel applied over the tooth and without gingival barrier.



Figure 7. Aspect after nine in-office whitening sessions.

Case 3

A 25-year-old woman suffered a fall 11 years before, and since then, her tooth No. 8 had become discolored (Figure 8). Despite radiographic evaluation showing a periapical lesion, the patient related that she never felt pain or any other discomfort since the trauma (Figure 9). Thermal pulp testing was negative. The use of a 37% carbamide peroxide in-office gel was indicated. The patient received a customized at-home bleaching tray and was instructed to use it 1 hour per day (Figure 10). After 9 days, tooth No. 8 reached the same color as the adjacent teeth (Figure 11).

Potential Problems

Because of esthetic concerns, West²¹ considered that there are potentially four treatment options for restoring discolored pulpally obliterated teeth to an acceptable color:

- External or vital bleaching that should be considered first as it is the most conservative option
- An intentional root canal treatment followed by intracoronar bleaching
- Internal and external bleaching without root canal treatment
- Extracoronar full or partial coverage restorations

The diagnostic status and treatment-planning decisions regarding teeth with obliterated root canal remain controversial. Based on two clinical parameters, Rock and Grundy⁷ suggested that root canal treatment should be performed as soon as narrowing of the pulp chamber shadow is seen radiographically: 1) once the guidance afforded by the pulp canal is lost, it is more difficult to prepare a post hole without penetrating the periodontal ligament, and 2) should necrosis occur in the remaining apical tissue, the only possible access may be surgical intervention. According to Fischer,²² a pulp undergoing obliteration has a reduction of cellular components, which makes it more susceptible to infection and limits the tissue's ability to heal.



Figure 8. Initial smile aspect with discolored tooth No. 8.

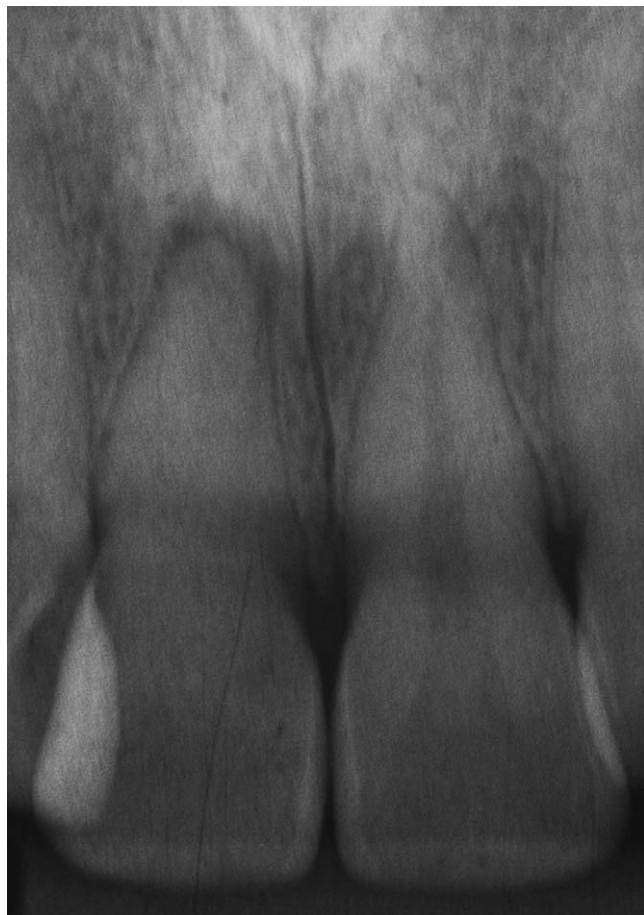


Figure 9. X-ray demonstrating complete obliteration of pulp chamber and root canal.

Scientific data produced in the past years demonstrate that peroxide-based tooth-whitening products are safe and effective. When properly indicated, there is no evidence of significant health risks.



Figure 10. Patient using a customized bleaching tray filled with 37% carbamide peroxide gel.



Figure 11. Final smile aspect after nine days of bleaching.

Sensitivity and gingival irritation are usually mild and transient.²³

Most current materials use carbamide peroxide ($\text{CH}_6\text{N}_2\text{O}_3$) and hydrogen peroxide (H_2O_2) as active ingredients for tooth bleaching regardless of in-office or at-home strategies.²⁴⁻²⁶ Chemically, carbamide peroxide is composed of approximately 3.5 parts of H_2O_2 and 6.5 parts of urea, so that a bleaching gel of 10% carbamide peroxide provides about 3.5% of H_2O_2 .²⁷ Typically, H_2O_2 concentrations used for in-office bleaching range from 25% to 40%. There is a greater prevalence reported of gingival irritation associated with bleaching products containing higher H_2O_2 concentration.^{28,29}

In cases 2 and 3, a 37% peroxide-carbamide gel was used. It contains 12.95% of hydrogen peroxide after its dissociation. In both strategies (in-office and at-home), no gingival irritation was related after its application without any gingival barrier. Furthermore, patients did not report sensitivity of vital adjacent teeth. The use of this whitening product demonstrated a faster result than the traditional 10% carbamide peroxide gel used in case 1.

Advantages

- Conservative treatment not involving tooth anatomy and texture modifications
- No effect on future restorative procedures
- Lower cost than other restorative strategies
- Little or no sensitivity during the whitening treatment

Limitations

- Bleaching progress can be slow because of the lower permeability of tertiary dentin.
- In some cases, the whitening level cannot totally match adjacent teeth.

CONCLUSIONS

- Considering the high incidence of dental trauma, the dentists' working knowledge regarding treatment possibilities of discolored teeth is essential.
- Bleaching of calcified teeth should be performed whenever possible because it is a simple, conservative, and affordable procedure.
- Whitening of calcified teeth using 37% peroxide-carbamide gel provided excellent results.

Conflict of Interest

The authors of this manuscript certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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