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"Internal Bleaching of Endodontically Treated Teeth: Clinical Success in Two Cases"

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ABSTRACT

Discoloured anterior teeth present a common esthetic concern for thepatients. It can have a significant impact on their self-esteem, confidence and interaction with others. Toothdiscolouration may be intrinsic or extrinsic, depending on its cause, location, appearance, and extent. Bleaching is a more conservative approach which is non-invasive as compared with other options like laminates, veneers and crowns. Different bleaching agents such as carbamide peroxide, hydrogen peroxide (H_2O_2), sodium perborate, laser, etc have been used successfully to achieve desirable esthetics. In case of non-vital discoloured teeth, walking bleach using sodium perborate with hydrogen peroxide/ saline by packing the bleaching agents In the pulp chamber after proper coronal and apical seal, can achieve very good esthetic results. "Walking bleach technique" though very economicaland effective and provides superior cosmetic results, but cervical resorption has been reported in many cases. It can be prevented byproper cervical barrier, conforming to the cervical line, preventing leaching of hydroxyl ions in cervical dentin. The present article discusses two case reportsof non-vital tooth bleaching utilizing the walking bleach techniquewith sodium perborate and 3% hydrogen peroxide mixture after establishing proper cervical barrier.

KEYWORDS:walking bleaching, non-vital bleaching, sodium perborate, hydrogen peroxide, discoloured teeth.

I. INTRODUCTION

Tooth discoloration, particularly in anterior teeth, presents a significant esthetic concern for patients. Various causes of discoloration in non-vital teeth includes trauma, incomplete removal of pulp tissue, pulpal necrosis, use of MTA , medicaments like triple antibiotic paste and coronal leakage.It presents a challenging condition that necessitates a targeted and minimally invasive esthetictreatment. [(1,2)]These discolorations are primarily intrinsic, as breakdown products from necrotic pulp or haemorrhage infiltrate dentinal tubules, making surface bleaching techniques ineffective. [(3)]

Historically, discoloured non-vital teeth were often managed with full-coverage crowns, which, although aesthetically acceptable, required significant removal of tooth structure. With the advent of adhesive dentistry and more conservative cosmetic approaches, internal bleaching has been the preferred first-line treatment due to its non-invasive, tooth structure-preserving, and cost-effective treatment modality.[(4,5)]

The walking bleach technique, introduced by Nutting and Poe (1963), remains one of the most widely used internal bleaching protocols. It involves the placement of a chemical oxidizing agent into the pulp chamber of an endodontically treated tooth, followed by temporary sealing of the access cavity. Among various agents tested, sodium perborate, when mixed with hydrogen peroxide ($H_2 O_2$), saline or distilled water, is a commonly used bleaching compound that provides controlled and sustained release of nascent oxygen, which breaks down chromogens within the tooth structure resulting in lightening of tooth colour.[(6)]

Sodium perborate mixed with 3% hydrogen peroxide enhances the oxidative capacity of the bleaching paste and accelerates the whitening process. However, concerns regarding external cervical resorption, especially when higher concentrations of hydrogen peroxide with or without heat are used, have prompted clinicians to use this technique cautiously. The placement of an effective cervical barrier (typically glass ionomer

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or composite resin) conforming to the cervical line of the tooth is now considered standard to minimize the risk of chemical leakage into periodontal tissues.[1,2]

This article presents the use of non-vital bleaching with a sodium perborate and 3% hydrogen peroxide mixture, applied through the walking bleach method in two clinical scenarios. It discusses the outcomes, effectiveness, and safety of the technique and highlights critical clinical considerations such as case selection, risk mitigation strategies, and follow-up.

II. CASE REPORTS

CASE -1

A 35-year-old female patientreported to the Department of Conservative Dentistry and Endodontics in Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh with **Chief Complaint**of discoloration of the upper right front tooth following trauma 5years ago.

Dental History: Root canal treatment on #11 was completed 5years ago at a different clinic; no crown was placed. Post obturation history was uneventful but for the gradual discolouration of tooth.

Medical History: Non-contributory.

Clinical Examination:-

- Tooth #11 had a yellowish-brown discoloration. The shade of the discoloured tooth was A4 whereas rest of the teeth were having shade A2.**(figure 1 a)**
- No swelling, sinus tract, or tenderness to percussion.
- Tooth structure intact, no caries or no frank fracture but crack lines were observed.

Radiographic Findings:

- Root canal obturation appeared adequate, no signs of periapical radiolucency.**(figure 1b).**

A diagnosis ofpostobturation discolouration due to leaching through the crack lines and possible inadequate cleaning of the pulpal horns. A non- vital bleaching protocol utilizing sodium perborate and 3% hydrogen peroxide was planned for the case.

STEPS FOR WALKING BLEACH TECHNIQUE

After confirming adequate root canal obturation. The patient was explained about the treatment of bleaching and informed consent was obtained. Using the Vita Classic shade guide in natural light, preoperative photos were taken to ascertain the tooth's shade (A4) and to compare the progress of bleaching. The tooth was isolated using rubber dam, old coronal restoration fromthe pulp chamber was removed till the canal orifice. Then,further 2 mm of gutta-percha apical to the orifice was removed and verified radiographically. A cervical mechanical barrier conforming to the cervical line was created with 2 mm of glass ionomer cement (GIC), preventing external root resorption by avoiding leakage of hydroxyl ions in the cervical cementum.Sodium perborate and 3% hydrogen peroxide [sodium perborate and 3% H_2O_2 in a 2:1 (g/mL) ratio] were mixed to make a slurry on the glass slab.After placement in the cleaned pulp chamber, the access cavity was sealed with Kalzinol and the patient was recalled after one week or earlier in case the coronal sealing was lost. In the second visit after 1 week, there was improvement in shade(A3) but still more lightening of shade was required. So again the fresh mix of bleaching agent was sealed, and the patient was recalled after 1 week. In the second recall the desired shade(A2) was achieved. After cleaning the chamber,an antioxidant (sodium ascorbate 35%) was placed in pulp chamber for 2 mins, followed by rinsing and drying of the pulp chamber. This was done to neutralize the effect of bleaching agents to prevent cervical root resorption as well as improve the bonding of the composite to the bleached dentin. Composite resin is then used to permanently restore the tooth, and a layer of bonding agent was applied on the facial surface of the tooth to seal the cracksand patient was recalled after 1 month, 6 months and 1 year. Radiographs were taken, tooth remained asymptomatic with no signs of cervical root resorption and no reappearance of discolouration was noted.

CASE 1 - Bleaching performed over 2 sessions (14 days) with excellent shade improvement.

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Fig. 1.a:Pre- 0perative photographs (11)

Fig.1.b: Guttapercha removed till CEJ, followed by GIC Placement (2mm Layer)

Fig. 1.c:Shade after 1st sitting

Fig. 1.d: Shade after2nd sitting

Fig. 1.e: Post-operative photograph

Figure 1(a-e)–Photographs of non - vital bleaching procedure in case 1

The teeth showed significant changes in shade from A4 to A2 respectively.

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Pre-operative photograph | Post-operative photograph

Figure 2- Pre & Post-operative photograph of Case 1

CASE -2

Patient: A 21- year-old male patient reported to the Department of Conservative Dentistry and Endodontics in Himachal Institute of Dental Sciences, Paonta Sahib, Himachal Pradesh with**Chief Complaint** of brownish discoloration of the upper right front tooth (#12) following trauma 5 years back.

Dental History:History of root canal treatment and apicoectomy done 1 year back of teeth (#11 and #12) and discolouration of tooth #12 was present sincethe patient reported for his treatment last year.

Medical History: No relevant medical history.

Clinical Examination:

- Tooth #12had brownish discolouration. The shade of the discoloured tooth
- was C4 whereas rest of the teeth were having shade C1.**(figure 3a)**
- No signs of inflammation, tenderness, or any other periapical pathology.

Radiographic Findings:

- Presence of a radio-opaque retrograde filling material (MTA, Super-EBA or IRM) with acceptable root canal obturation.
- Intact lamina dura around the apical area of the root.
- No periapical radiolucency, suggesting osseous healing.
- Normal trabecular bone pattern in the periapical region.
- No signs of external or internal root resorption.

A diagnosis of discolouration due to trauma was made. A non- vital bleaching protocol utilizing sodium perborate and 3% hydrogen peroxide was planned for the case since patient was coming from a long distance and could not afford the multiple visits. After conforming the adequate obturation, the patient was explained about the treatment of bleaching and informed consent was obtained. Using the Vita Classic shade guide in natural light, preoperative photos were taken to ascertain the tooth's shade (C4) and to compare the progress of bleaching. Same procedure of walking bleach was performed as mentioned in previous case. 3 bleaching sessions were required for desired shade achievement (C1). As in previous case after cleaning the chamber, an antioxidant (sodium ascorbate 35%) was placed in pulp chamber for 2 mins, followed by rinsing and drying of the pulp chamber. Permanent restoration with C1 shade composite was done and the patient was recalled after 1 month, 6 months and 1 year for follow-up,radiographs were taken.Tooth remained asymptomatic with no signs of cervical rootresorption and no reappearance of discolouration was noted.

CASE 2- Bleaching performed over 3 sessions (21 days) with excellent shade improvement.

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Fig. 3.a:Pre-operative photograph (12)

Fig. 3.b:Guttapercha removed till CEJ, followed by GIC Placement(2mm Layer)

*Fig. 3.c:*Photograph after *1st sitting*

Fig. 3.d -Photograph after :2nd sitting

Fig. 3.e:Final photograph after 3rd sitting

Figure 3 (a-e) – Photographs of non - vital bleaching procedure in case 2

The teeth showed significant changes in shade from C4 to C1 respectively.

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Pre-operative photograph | Post -operative photograph

Figure 4 - Pre & Post-operative photograph of Case 2

III. DISCUSSION

The cases presented here demonstrate the successfuland affordable management of discolouration using walking bleach technique with sodium perborate and hydrogen peroxide for esthetic rehabilitation of discoloured non-vital teeth. All patients exhibited noticeable improvement in tooth shade with minimal or no adverse effects, reinforcing the efficacy of this conservative treatment modality.

▸ Mechanism of Action and Material Choice

Sodium perborate undergoes hydrolysis to release hydrogen peroxide and nascent oxygen, which oxidizes pigmented organic molecules trapped within dentinal tubules. When combined with hydrogen peroxide, the reaction is enhanced, leading to more effective and faster bleaching. The 3% hydrogen peroxide concentration used in both cases provided a safe and efficient oxidation process without resorting to the higher concentrations (30–35%) used in older thermocatalytic techniques, which are now avoided due to increased risks of cervical resorption and soft tissue damage.[8]

While sodium perborate with distilled water has been proposed as a safer alternative, it is generally slower and less effective than when mixed with hydrogen peroxide.[9] The decision to use hydrogen peroxide in our cases was based on the need for a balance between treatment efficacy and safety, as well as time constraint due to the distant location of the patients causing minimum visits. To counteract the side-effects of hydrogen peroxide, a very low percentage was used. A properly contoured cervical barrier was placed to mitigate associated risks and an antioxidant was applied after the bleaching in the chamber.[7, 6]

▸ Clinical Success and Safety Considerations

In both the cases, all teeth achieved satisfactory shade improvement within 2–3sessions, with the bleaching paste replaced every 7–10 days. No tooth required more than three sessions, and no signs of post-treatment external cervical resorption, pain, or swelling were observed during the follow-up periods.

The key to safe application lies in:

- Thorough cleaning of the pulp chamber to remove necrotic debris and residual gutta-percha/sealer.
- Placement of a 2 mm cervical barrier at the cementoenamel junction to prevent peroxide diffusion into periodontal tissues.
- Using moderate concentrations of hydrogen peroxide (3%) instead of high-concentration or heat-activated agents.[1,2,10]
- Use of antioxidant (Sodium ascorbate) to neutralize residual oxygen radicals and restore the redox potential of the bleached tooth surface, additionally, it also improves bond strength and fracture resistance, enabling immediate resin restoration.[7]

Long-term stability of bleaching results and resorption risk requires ongoing radiographic and clinical monitoring. While no complications were seen during the follow-up in both cases,

literature suggests that root resorption may occur months to years after bleaching if proper precautions are not taken.[10]

▸ **Comparison with Other Bleaching Techniques**

TECHNIQUE	EFFICACY	RISK OF RESORPTION	TIME REQUIRED	REMARKS	STUDIES
Sodium perborate+H_2O_2	High	Moderate	1-3 weeks	Best balance of speed & safety	Friedman S et al.Incidence of external root resorption in 58 bleached pulpless teeth (Endod Dent Traumatol, 1988). [11]
Sodium perborate+H_2O	Moderate	Low	2-4 weeks	Safest for mild-moderate discolouration.	Rotstein I, Zalkind M, Mor C, Tarabeah A, Friedman S. In vitro efficacy of sodium perborate preparations used for intracoronal bleaching of discolored non-vital teeth. Endod Dent Traumatol. 1991 Aug;7(4):177-80.[12]
30-35% H2O2 (thermocatalytic)	Very high	High	Immediate results	Higher risk; not routinely recommended	Friedman S. Internal bleaching: long-term outcomes and complications. J Am Dent Assoc. 1997 Apr;128 Suppl:51S-55S.[13]
Carbamide peroxide	Low-moderate	Low	Variable	Off- label for internal resorption	Frank AC, Kanzow P,Rödig T, Wiegand A. Comparison of the Bleaching Efficacy of Different Agents Used for Internal

					Bleaching: A Systematic Review and Meta-Analysis. J Endod. 2022 Feb;48(2):171-178.(14)

Several alternative internal bleaching techniques exist but the walking bleach technique using sodium perborate and 3% hydrogen peroxide remains the gold standard in terms of efficacy, safety, and ease of clinical execution, especially when used with a proper sealing protocol. (16)

▸ Factors Affecting Bleaching Outcomes

The outcome of internal bleaching can be influenced by several factors:

- Etiology of discoloration: Trauma-induced discoloration often responds more slowly due to deeper chromogen penetration.
- Duration of discoloration: Long-standing discoloration may require more sessions.
- Tooth anatomy and dentin permeability: Younger teeth with larger tubules tend to respond faster to bleaching.
- Endodontic quality: Teeth with well-obturated canals and clean pulp chambers bleach more predictably.
- Through cleaning of the pulp chamber for bleaching agents to penetrate the dentinal tubules.(17)

In this series, both cases responded within two to three appointments with satisfactory esthetic outcomes.

IV.CONCLUSION

This article demonstrates that non-vital bleaching using sodium perborate and hydrogen peroxide is a safe, cost-effective, and conservative approach to managing discoloured non-vital teeth when appropriate clinical protocols are followed. Proper case selection, use of a cervical barrier, coronal seal, and use of neutralizing agent(anti-oxidant) after completion of bleaching and close monitoring are essential to optimize outcomes and minimize risks. With increasing demand for esthetic treatments, internal bleaching remains a valuable tool.

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