Cervical root resorption and non vital bleaching

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ABSTRACT
Tooth-bleaching techniques today mostly employ hydrogen peroxide as the active agent. It is applied directly, or produced in a chemical reaction from sodium perborate or carbamide peroxide. More than 90% of success rate has been reported for intracoronal bleaching of non-vital teeth. Intracoronal bleaching is a conservative alternative to the more invasive esthetic treatment of non-vital discolored teeth. Careful examination is necessary, since the method requires healthy periodontal tissues and a root canal that is properly obturated to prevent the bleaching agent from reaching the periapical tissues, and an effective gingival barrier which prevents the bleaching agents from leaching into the periodontium. Cervical root resorption is a possible sequel of internal bleaching and is more frequently observed in teeth treated with the thermo-catalytic bleaching method. A high concentration of hydrogen peroxide in combination with heat or etching also seems to promote cervical root resorption. Cervical root resorption is an inflammatory-mediated external resorption of the root, which can be seen after trauma and following intracoronal bleaching.

Key words: Hydrogen peroxide, carbamide peroxide, sodium perborate, esthetics, resorption, barrier.

Introduction
Attractive teeth have always been a typical patient’s primary concern. What most people want, are teeth that make them look healthier, younger and more attractive. The sharp rise in the acceptance and demand for treatment of discolored teeth, to make them brighter, is become a big part of the practice. When the discoloration originates from within the pulp chamber, the treatment should also start from there itself. 1, 2, 5.

Tooth discoloration in non vital pulpless teeth is a challenge that many dentists face, and internal bleaching is a practical treatment option. Internal bleaching is used to lighten a discolored tooth that has had root canal therapy. It involves placing a chemical oxidizing agent within the coronal portion of a tooth to remove discoloration. 1. Discoloration can be caused by endodontic filling materials or medications that the patient is taking. 20. Discoloration associated with pulpal involvement can be caused by intrapulpal hemorrhage (in which case it is pink or brown), necrotic pulpal tissue, secondary dentin formation (in which case it is yellowish), and internal resorption (in which case it is a pink spot). 5, 6, 20, 25.

Indications for internal bleaching are discoloration of pulpal origin, dentin stains, and stains not amenable to extra-coronal bleaching. Contraindications to internal bleaching are superficial enamel stains, defective, enamel formation, severe dentin loss, presence of caries, and discolored composites. 20, 25, 29.

Most bleaching agents are oxidizers that act on organic structures of the hard tissues and degrade them into smaller molecules that are lighter in color, such as CO₂, O₂ and H₂O. 9, 20, 25, 30.

History of bleaching
Bleaching of discolored, pulpless teeth was first described in 1864 (Truman, 1864), and a variety of
medicaments such as chloride, sodium hypochlorite, sodium perborate, and hydrogen peroxide has been used, alone, in combination, and with and without heat activation (Howell, 1980). The “walking bleach” technique that was introduced in 1961 involved placement of a mixture of sodium perborate and water into the pulp chamber that was sealed off between the patient’s visits to the clinician (Spässer, 1961). The method was later modified and water replaced by 30–35% hydrogen peroxide, to improve the whitening effect (Nutting and Poe, 1963). The observation that carbamide peroxide caused lightening of the teeth was made in the late 1960s by an orthodontist who had prescribed an antiseptic containing 10% carbamide peroxide to be used in a tray for the treatment of gingivitis (Haywood, 1991). The observation was communicated to other colleagues and must be regarded as the beginning of the night guard bleaching era. More than 20 years later, the method describing the use of 10% carbamide peroxide in a mouth guard to be worn overnight for lightening tooth color was published (Haywood and Heymann, 1989).

Techniques and materials

There are two techniques for internal bleaching: the chairside technique and the “walking bleach” technique. The chairside technique uses Superoxyl in 30–35 percent concentration, H₂O₂, and heat. This technique is highly effective, but the oxidizing agent is strong and can burn. There is 6-8% chance of cervical resorption, increasing to 18 to 25% when the technique is used in conjunction with heat. The “walking bleach” technique uses a mixture of sodium perborate and water or 30% hydrogen peroxide (Superoxyl) and may be utilized if the chairside results are inadequate or if you prefer to avoid the possibility of a higher chance of cervical root resorption. The sodium perborate when fresh is 95% perborate giving off 9.9% of available oxygen. This material is more easily controlled and safer than Superoxyl; therefore, it is the material of choice.

Cervical root resorption and non vital bleaching

Cervical root resorption is an inflammatory-mediated external resorption of the root, which can be seen after trauma and following intracoronal bleaching (Friedman et al., 1988). In a four-year follow-up of 250 teeth with severe tetracycline discoloration, with sodium perborate in oxygen-water as the bleaching agent, no evidence of external resorption was found (Anitua et al., 1990). An analogous study comprised of 112 teeth bleached with a paste of sodium perborate in 30% hydrogen peroxide and observed for 3-15 years reported no external root resorption (Abou-Rass, 1998).

A high concentration of hydrogen peroxide in combination with heating seemed to promote cervical root resorption (Friedman et al., 1988; Baratieriet al., 1995) in line with observations made in animal experiments (Madison and Walton, 1990; Rotstein et al., 1991b; Heller et al., 1992). The underlying mechanism for this effect is unclear, but it has been suggested that the bleaching agent reaches the periodontal tissue through the dentinal tubules and initiates an inflammatory reaction (Cvek and Lindvall, 1985). It has also been speculated that the peroxide, by diffusing through the dentinal tubules, denatures the dentin, which then becomes an immunologically different tissue and is attacked as a foreign body (Lado et al., 1983). Frequently, the resorption was diagnosed...
several years after the bleaching (Lado et al., 1983; Friedmann et al., 1988) \textsuperscript{12, 21}. \textit{In vitro} studies using extracted teeth showed that hydrogen peroxide placed in the pulp chamber penetrated the dentin (Rotstein, 1991) and that heat increased the penetration (Rotstein et al., 1991d). The penetration has been found, \textit{in vitro}, to be higher in teeth with cervical defects of the cementum (Rotstein et al., 1991a) \textsuperscript{27, 28}. Hydrogen peroxide also increased dentin permeability (Heling et al., 1995) \textsuperscript{17}, and that may enhance the effects of hydrogen peroxide following repeated exposures. Based on the cited literature, the use of a thermo-catalytic bleaching procedure in teeth with cervical defects of the cementum constitutes a risk factor for the development of cervical resorption. In addition, efficacy studies have shown that 30% hydrogen peroxide was not essential to the attainment of an acceptable treatment outcome \textsuperscript{5, 9, 25}.

**Barrier to resorption**

It has been clinically proven that peroxide, if leaches out of the dentinal tubules into the periodontium can lead to cervical resorption. To prevent this one should place an effective barrier to prevent the passage of peroxide into the periodontal space. The points to consider are -

1. What is the perfect barrier?
2. Where should it be located?
3. What shape should it take?
4. What is the best material?

Previous studies and techniques have suggested using labial cementoenamel junction as a guide for barrier placement. However, the CEJ is not the level, but rather curves in an incisal direction on the proximal sides of the tooth. A flat barrier leaves the proximal dentinal tubules unprotected: this critical area is the site where the cervical resorption begins. The proximal tubules must be protected by the location and shape of the barrier \textsuperscript{25, 29}.

**Barrier Transfer** - To record the barrier position, three periodontal probings are made with a custom “transfer periodontal probe”. A periodontal probe is used for this purpose, carefully curved to match the labial contour of the tooth. First a labial recording is made, followed by distal and mesial recordings. These probings are made to determine the position of the epithelial attachment from the incisal edge of the tooth. The internal level of the barrier will be placed 1mm incisal to the corresponding external probing of the epithelial attachment. This strategy blocks patent dentinal tubules that may communicate with the periodontal ligament apical to the epithelial attachment \textsuperscript{20, 25, 29}.

![1a. Labial Recording](image1.png)
![1b. Transfer of Labial Recording](image2.png)
The idea is to block the dentinal tubules that lead from the pulp chamber apical to the epithelial attachment so that the internal bleaching agent stays within the access cavity 3, 10, 21, 22, 25, 26. By subtracting 1mm from each of the three probings, an internal template is created for the location of the barrier. Positioning the palatal portion of the barrier equal or coronal to the barrier’s proximal height protects the palatal CEJ without compromising the esthetic results. The resultant shape from a facial view is the “bobsled tunnel” (fig.2a) outline. The outline from the proximal view resembles a “ski-slope”. (Fig.2b). Radiographic verification post barrier placement confirms the proper positioning of the barrier. (Fig.2c.) 25, 26.

There is also an esthetic reason for avoiding the CEJ as a guide for barrier placement. In an instance of gingival recession the root would not be completely bleached using the CEJ guideline as a reference. Instead a more biologically critical and
esthetically essential landmark is to relate the barrier to the epithelial attachment.

After identification and transfer of the level of the epithelial attachment, the barrier may be placed. Studies have showed that materials like IRM, zinc-oxyphosphate, and dentin sealants have failed to provide adequate bleach barriers. However carefully placed cavit, or light cured glass ionomer cement may offer promise as better materials. The search for the perfect barrier material is still ongoing.

Conclusion

Dark discolored non vital teeth are commonly encountered in clinical practice. Typically the affected teeth are not only dark but tend to darken with time. Though cervical root resorption is seen in almost 10% cases, it’s a common finding in cases where the barrier is either not placed or placed improperly.

In order to have a safer intra coronal non vital bleaching one must follow these few guidelines:

- Practice proper isolation.
- Protect the oral mucosa.
- Verify the quality of the root canal filling.
- Judicious use of protective barriers.
- Properly place and verified gingival barrier.
- Avoid the use of heat, light or acid etching.
- Avoid higher concentrations of the oxidizing-bleaching agent.
- Regular recall evaluations.

References:


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