Mustansiriyah University
College of Dentistry
Endodontics lectures
Fifth year

Tooth discoloration & bleaching II

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Complications and Adverse Effects to Bleaching

External Root Resorption. Clinical reports and histologic studies have shown that intracoronal bleaching may induce external root resorption. This is probably caused by the oxidizing agent, particulary 30 to 35% hydrogen peroxide. The mechanism of bleaching-induced damage to the periodontium or cementum has not been fully elucidated. Presumably, the irritating chemical diffuses via unprotected dentinal tubules and cementum defects and causes necrosis of the cementum, inflammation of the periodontal ligament, and, finally, root resorption. The process may be enhanced if heat is applied or in the presence of bacteria. Previous traumatic injury and age may act as predisposing factors.

Chemical Burns. Thirty percent hydrogen peroxide is caustic and causes chemical burns and sloughing of the gingiva. When using such solutions, the soft tissues should always be protected with ***Vaseline*** or ***Orabase***.

Damage to Restorations. Bleaching with hydrogen peroxide may affect bonding of composite resins to dental hard tissues. Scanning electron microscopy suggests a possible interaction between composite resin and residual peroxide, causing inhibition of polymerization and an increase in resin porosity. This presents a clinical problem when immediate esthetic restoration of the bleached tooth is required. It is therefore recommended that residual hydrogen peroxide be totally eliminated prior to composite placement.

Suggestions for Safer Bleaching of Endodontically Treated Teeth

• **Isolate the tooth effectively.** Intracoronal bleaching should always be carried out with rubber dam isolation. Interproximal wedges and ligatures may also be used for better protection.

• **Protect the oral mucosa.** Protective creams, such as ***Orabase*** or ***Vaseline***, must be applied to the surrounding oral mucosa to prevent chemical burns by caustic oxidizers. Animal studies suggest that catalase applied to oral tissues prior to hydrogen peroxide treatment totally prevents the associated tissue damage.

• **Verify adequate endodontic obturation.** The quality of root canal obturation should always be assessed clinically and radiographically prior to bleaching. Adequate obturation ensures a better overall prognosis of the treated tooth. It also provides an additional barrier against damage by oxidizers to the periodontal ligament and periapical tissues.

• **Use protective barriers.** This is essential to prevent leakage of bleaching agents that may infiltrate between the gutta-percha and root canal walls, reaching the periodontal ligament via dentinal tubules, lateral canals, or the root apex. In none of the clinical reports of post-bleaching root resorption was a protective barrier used.

Various materials can be used for this purpose. Barrier thickness and its relationship to the cementoenamel junction are most important. The ideal barrier should protect the dentinal tubules and conform to the external epithelial attachment.

• **Avoid acid etching.** It has been suggested that acid etching of dentin in the chamber to remove the smear layer and open the tubules would allow better penetration of the oxidizer. This procedure has not proven beneficial. The use of caustic chemicals in the pulp chamber is undesirable as periodontal ligament irritation may result.
• **Avoid strong oxidizers.** Procedures and techniques applying strong oxidizers should be avoided if they are not essential for bleaching. Solutions of 30 to 35% hydrogen peroxide, either alone or in combination with other agents, should not be used routinely for intracoronal bleaching.
Sodium perborate is mild and quite safe, and no additional protection of the soft tissues is usually required. Generally, however, oxidizing agents should not be exposed to more of the pulp space and dentin than absolutely necessary to obtain a satisfactory clinical result.
• **Avoid heat.** Excessive heat may damage the cementum and periodontal ligament as well as dentin and enamel, especially when combined with strong oxidizers. Although no direct correlation has been found between heat applications alone and external cervical root resorption, it should be limited during bleaching procedures.
• **Recall periodically.** Bleached teeth should be frequently examined both clinically and radiographically. Root resorption may occasionally be detected as early as 6 months after bleaching. Early detection improves the prognosis since corrective therapy may still be applied.

Post-Bleaching Tooth Restoration

Proper tooth restoration is essential for long-term successful bleaching results. Coronal microleakage of lingual access restorations is a problem, and a leaky restoration may lead to rediscoloration. There is no ideal method for filling the chamber after tooth bleaching. The pulp chamber and access cavity should be carefully restored with a light-cured acid-etched composite resin, light in shade. The composite material should be placed at a depth that seals the cavity and provides some incisal support. Light curing from the labial surface, rather than the lingual surface, is recommended since this results in shrinkage of the composite resin toward the axial walls, reducing the rate of microleakage.
Placing white cement beneath the composite access restoration is recommended. Filling the chamber completely with composite may cause loss of translucency and difficulty in distinguishing between composite and tooth structure during rebleaching.
As previously stated, residual peroxides from bleaching agents, mainly hydrogen peroxide and carbamide peroxide, may affect the bonding strength of composites. Therefore, waiting for a few days after bleaching prior to restoring the tooth with composite resin has been recommended. Catalase treatment at the final visit may enhance the removal of residual peroxides from the access cavity; however, this requires further clinical investigation.
Packing calcium hydroxide paste in the pulp chamber for a few weeks prior to placement of the final restoration, to counteract acidity caused by bleaching agents and to prevent root resorption, has also been suggested; this procedure, however, is unnecessary with walking bleach.

VITAL BLEACHING TECHNIQUES

Many techniques have been advocated for extracoronal bleaching of vital teeth. In these techniques, oxidizers are applied to the external enamel surface of the teeth. This

technique basically involves application of 30 to 35% hydrogen peroxide and heat or a combination of heat and light or ultraviolet rays to the enamel surface. Heat is applied either by electric heating devices or heat lamps. The technique involves the following steps:

1. Familiarize the patient with the probable causes of discoloration, procedure to be followed, expected outcome, and possibility of future rediscoloration.

2. Make radiographs to detect the presence of caries, defective restorations, and proximity to pulp horns. Well-sealed small restorations and minimal amounts of exposed incisal dentin are not usually a contraindication for bleaching.

3. Evaluate tooth color with a shade guide and take clinical photographs before and throughout the procedure.

4. Apply a protective cream to the surrounding gingival tissues and isolate the teeth with a rubber dam and waxed dental floss ligatures. If a heat lamp is used, avoid placing rubber dam metal clamps as they are subjected to heating and may be painful to the patient.

5. Do not inject a local anesthetic.

6. Position protective sunglasses over the patient's and the operator's eyes.

7. Clean the enamel surface with pumice and water. Avoid prophylaxis pastes containing glycerin or fluoride.

8. As an optional procedure, acid etch the darkest or most severely stained areas with buffered phosphoric acid for 10 seconds and rinse with water for 60 seconds. A gel form of acid provides optimum control. Enamel etching for extracoronal bleaching is controversial and should not be carried out routinely.

9. Place a small amount of 30 to 35% hydrogen peroxide solution into a dappen dish. Apply the hydrogen peroxide liquid on the labial surface of the teeth using a small cotton pellet or a piece of gauze. A bleaching gel containing hydrogen peroxide may be used instead of the aqueous solution.

10. Apply heat with a heating device or a light source. The temperature should be at a level the patient can comfortably tolerate, usually between 125°F and 140°F (52°C to 60°C). Rewet the enamel surface with hydrogen peroxide as necessary. If the teeth become too sensitive, discontinue the bleaching procedure immediately. Do not exceed 30 minutes of treatment even if the result is not satisfactory.

11. Remove the heat source and allow the teeth to cool down for at least 5 minutes. Then wash with warm water for 1 minute and remove the rubber dam. Do not rinse with cold water since the sudden change in temperature may damage the pulp or can be painful to the patient.

12. Dry the teeth and gently polish them with a composite resin polishing cup. Treat all of the etched and bleached surfaces with a neutral sodium fluoride gel for 3 to 5 minutes.

13. Inform the patient that cold sensitivity is common, especially during the first 24 hours after treatment. Also, instruct the patient to use a fluoride rinse daily for 2 weeks.

14. Re-evaluate the patient approximately 2 weeks later on the effectiveness of bleaching. Take clinical photographs with the same shade guide used in the preoperative photographs for comparison purposes. If necessary, repeat the bleaching procedure.

Complications and Adverse Effects.

Postoperative Pain. A number of short- and long-term symptoms may occur following extracoronal bleaching of vital teeth. A common immediate postoperative problem is pulpalgia characterized by intermittent shooting pain. It may occur during or after the bleaching session and usually persists for between 24 and 48 hours. The intensity of the pulpalgia is related to duration and the temperature of the bleaching procedure. Shorter bleaching periods are therefore recommended. If long term sensitivity to cold develops, topical fluoride treatments and desensitizing toothpastes should be used to alleviate these symptoms.

Pulpal Damage. Extracoronal bleaching with hydrogen peroxide and heat has been associated with some pulpal damage. Although investigators have not found significant irreversible effects on the pulp, these procedures must be approached and carried out with caution and not in the presence of caries, areas of exposed dentin, or in close proximity to pulp horns.

Table:-Indications and Contraindications for Thermo/Photo Extracoronal Bleaching

Indications	Contraindications
Light enamel discolorations	Severe dark discolorations
Mild tetracycline discolorations	Severe enamel loss
Endemic fluorosis discolorations	Proximity of pulp horns
Age-related discolorations	Hypersensitive teeth
	Presence of caries
	Large/poor coronal restorations

Defective restorations must be replaced prior to bleaching. Teeth with large coronal restorations should not be bleached.

Dental Hard Tissue Damage. Hydrogen peroxide has been shown to cause morphologic and structural changes in enamel, dentin, and cementum in vitro. A reduction in micro hardness has been observed. These changes may cause dental hard tissues to be more susceptible to degradation and to secondary caries formation.

Mucosal Damage. Caustic bleaching agents in contact with the oral mucosa may cause peroxide-induced tissue damage. Ulceration and sloughing of the mucosa are caused by oxygen gas bubbles in the tissue. Generally, the mucosa appears white but does not become necrotic or leave scar tissue. The associated burning sensation is extremely uncomfortable for the patient. Treatment is by extensive water rinses until the whiteness is reduced. In more severe cases, a topical anesthetic, limited movements, and good oral hygiene aid healing. Application of protective cream or catalase can prevent most of these complications.

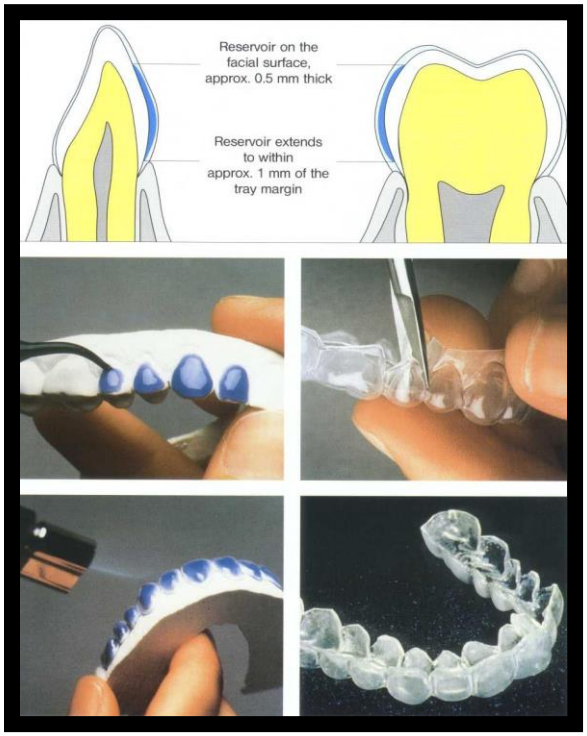
Laser-Activated Bleaching

Recently, a technique has been introduced using lasers for extracoronal bleaching. Two types of lasers can be employed: the argon laser that emits a visible blue light and a

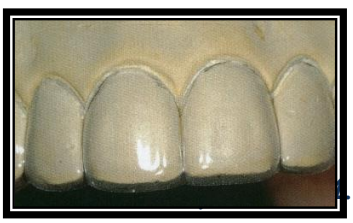
carbon-dioxide laser that emits invisible infrared light. These lasers can be targeted to stain molecules and, with the use of a catalyst, rapidly decompose hydrogen peroxide to oxygen and water. The catalyst/peroxide combination may be damaging; therefore, exposed soft tissues, eyes, and clothing should be protected.
Some techniques involve high-concentration hydrogen peroxide formulations as active ingredients (35 to 50%). It was reported that such laser bleaching techniques lightened teeth faster. However, short-term postoperative sensitivity can be profound. Laser bleaching is a relatively new technique, and there are currently no long-term studies regarding its benefits or adverse effects.

Mouth guard Bleaching

This technique has been widely advocated as a home bleaching technique, with a wide variety of materials, bleaching agents, frequency, and duration of treatment.
Numerous products are available, mostly containing either 1.5 to 10% hydrogen peroxide or 10 to 15% carbamide peroxide, which degrades slowly to release hydrogen peroxide. The carbamide peroxide products are more commonly used. Higher concentrations of the active ingredient are also available and may reach up to 50%.



Treatment techniques may vary according to manufacturers' instructions. The following step-by-step instructions should be used only as a general guideline.
The procedure is as follows:
1. Familiarize the patient with the probable causes of discoloration, procedure to be followed and expected outcome.
2. Carry out prophylaxis and assess tooth color with a shade guide. Take clinical photographs before and throughout the procedure.
3. Make an alginate impression of the arch to be treated. Cast the impression and outline the guard on the model. It should completely cover the teeth, although second molars need not be covered unless required for retention. Place two layers of die relief on the buccal aspects of the cast teeth to form a small reservoir for the bleaching agent.
Fabricate a vacuum-form soft plastic matrix, approximately 2 mm thick, trim with crown and bridge scissors to 1 mm past the gingival margins, and adjust with an acrylic trimming bur.
4. Insert the mouth guard to ensure a proper fit. Remove the guard and apply the bleaching agent in the space of each tooth to be bleached. Reinsert the mouth guard over the teeth and remove excess bleaching agent.



5. Familiarize the patient with the use of the bleaching agent and wearing of the guard. The procedure is usually performed 3 to 4 hours a day, and the bleaching agent is replenished every 30 to 60 minutes.
Some clinicians recommend wearing the guard during sleep for better long-term esthetic results.
6. Instruct patients to brush and rinse their teeth after meals. The guard should not be worn while eating. Inform the patient about thermal sensitivity and minor irritation of soft tissues and to discontinue use of the guard if uncomfortable.
7. Treatment should be for between 4 and 24 weeks. Recall the patient every 2 weeks to monitor stain lightening. Check for tissue irritation, oral lesions, enamel etching, and leaky restorations. If complications occur, stop treatment and re-evaluate the feasibility of continuation at a later date. Note that frequently the incisal edges are bleached more readily than the remainder of the crown.
The long-term esthetic results of this method are unknown. However, it appears that rediscoloration is not more frequent than with the other techniques. To date, no conclusive experimental or clinical studies on the safety of long-term use of these bleaching agents are available. Therefore, caution should be exercised in their prescription and application.

Table:-Indications and Contraindications for Mouth guard Vital Bleaching

Indications	**Contraindications**
Superficial enamel discolorations Mild yellow discolorations Brown fluorosis discolorations Age-related discolorations	Severe enamel loss Hypersensitive teeth Presence of caries Defective coronal restorations Allergy to bleaching gels Bruxism

Of major concern is the products marketed to the public over the counter, often without professional control. Their use should be discouraged.

Complications and Adverse Effects.

Systemic Effects. Controlled mouth guard bleaching procedures are considered relatively safe. However, some concern has been raised over bleaching gels inadvertently swallowed by the patient. Accidental ingestion of large amounts of these gels may be toxic and cause irritation to the gastric and respiratory mucosa. Bleaching gels containing carbopol, which retards the rate of oxygen release from peroxide, are usually more toxic. Therefore, it is advisable to pay specific attention to any adverse systemic effects and to discontinue treatment immediately if they occur.
Dental Hard Tissue Damage. *In vitro* studies indicate morphologic and chemical changes in enamel, dentin, and cementum associated with some agents used for **mouth guard** bleaching. Long-term in vivo studies are still required to determine the clinical significance of these changes.

Tooth Sensitivity. Transient tooth sensitivity to cold may occur during or after mouth guard bleaching. In most cases, it is mild and ceases on termination of treatment. Treatment for sensitivity consists of removal of the mouth guard for 2 to 3 days, reduction of wearing time, and re-adjustment of the guard.

Pulpal Damage. Long-term effects of mouth guard bleaching on the pulp are still unknown. To date, no correlation has been found between carbamide peroxide bleaching and permanent pulpal damage. The pulpalgia associated with tooth hypersensitivity is usually transient and uneventful.

Mucosal Damage. Minor irritations or ulcerations of the oral mucosa have been reported to occur during the initial course of treatment. This infrequent occurrence is usually mild and transient. Possible causes are mechanical interference by the mouth guard, chemical irritation by the bleaching active agent, and allergic reaction to gel components. In most cases, readjustment and smoothing the borders of the guard will suffice. However, if tissue irritation persists, treatment should be discontinued.

Damage to Restorations. Some *in vitro* studies suggest that damage of bleaching gels to composite resins might be caused by softening and cracking of the resin matrix. It has been suggested that patients are informed that previously placed composites may require replacement following bleaching. Others have reported no significant adverse effects on either surface texture or color of restorations. Generally, however, if composite restorations are present in esthetically critical areas, they may need replacement to improve color matching following successful bleaching.

It has also been reported that both 10% carbamide peroxide and 10% hydrogen peroxide may enhance the liberation of mercury and silver from amalgam restorations and may increase exposure of patients to toxic by-products. Although bleaching gels are mainly applied to the anterior dentition, excessive gel may inadvertently make contact with posterior teeth. Coverage of posterior amalgam restorations with a protective layer of dental varnish prior to gel application may prevent such hazards.

Occlusal Disturbances. Typically, occlusal problems related to the mouth guard may be mechanical or physiologic.

From a mechanical point of view, the patient may occlude only on the posterior teeth rather than on all teeth simultaneously. Removing posterior teeth from the guard until all of the teeth are in contact rectifies this problem. From a physiologic point of view, if the patient experiences temporomandibular joint pain, the posterior teeth can be removed from the guard until only the anterior guidance remains. In such cases, wearing time should be reduced.