

## Review

## Laser Assisted Vital Tooth Bleaching

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**Abstract:**

**Background:** Intrinsic discoloration of vital anterior teeth is a common esthetic concern that can adversely affect patients' confidence and quality of life. Conventional in-office bleaching using high-concentration hydrogen peroxide is effective; however, prolonged treatment time and postoperative sensitivity remain limitations. Er:YAG laser-assisted bleaching has emerged as an advanced technique that enhances the bleaching reaction by accelerating the decomposition of hydrogen peroxide into reactive oxygen species, thereby improving whitening efficiency while reducing chairside time. **Case Presentation:** A 26-year-old male presented with persistent intrinsic brown band-like discoloration involving the maxillary anterior teeth (13–23), present since childhood. Clinical examination confirmed vital, caries-free teeth with no structural defects or periapical pathology. A conservative esthetic treatment consisting of in-office vital bleaching using 35% hydrogen peroxide (Pola Office) activated with an Er:YAG laser (2940 nm) was performed over two sessions spaced one week apart. Laser activation was carried out in non-contact mode using standardized parameters, followed by an adequate reaction period for the bleaching gel. **Results:** The patient demonstrated a marked reduction in the intensity of intrinsic brown discoloration with improved color uniformity and overall esthetics. Minimal to no postoperative sensitivity was reported between treatment sessions, and no adverse effects or complications were observed. The patient expressed a high level of satisfaction with the esthetic outcome. **Conclusion:** Er:YAG laser-assisted vital bleaching represents a safe, minimally invasive, and effective treatment modality for managing intrinsic discoloration of vital anterior teeth. The technique offers enhanced bleaching efficacy, reduced chairside time, minimal postoperative sensitivity, and excellent esthetic outcomes, making it a valuable alternative to conventional in-office bleaching protocols.

**Keywords:** Intrinsic tooth discoloration; Er:YAG laser; Vital bleaching; Laser-assisted tooth whitening; Hydrogen peroxide; Maxillary anterior teeth; Esthetic dentistry; In-office bleaching; Conservative dental treatment; Case report.

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## INTRODUCTION

The demand for aesthetic dental procedures has surged globally, with tooth whitening remaining one of the most requested treatments. Discoloration of the maxillary anterior teeth can significantly impact a patient's self-esteem and social interactions. Common causes of such discolorations include fluorosis, tetracycline staining, systemic conditions during tooth development, and localized trauma.

Dental discoloration may be classified as extrinsic or intrinsic, with intrinsic discoloration often presenting as a greater clinical challenge due to its deeper location within enamel and dentin. Vital tooth bleaching has emerged as a conservative and minimally invasive approach for managing such cases.

Traditional in-office bleaching techniques utilizing high concentrations of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) are effective; however, they often require prolonged application times and may result in postoperative sensitivity. To overcome these limitations, laser-assisted bleaching techniques have been introduced. Among these, the erbium-doped yttrium aluminum garnet (Er:YAG) laser has gained considerable attention.

The Er:YAG laser operates at a wavelength of **2940 nm**, which is highly absorbed by water and hydroxyapatite. When used in bleaching procedures, it accelerates the breakdown of hydrogen peroxide into reactive oxygen species through combined photothermal and photochemical effects. This enhances the bleaching efficacy, reduces chairside time, and may improve the depth of pigment removal.

Recent literature suggests that laser-assisted bleaching can produce faster and more pronounced whitening compared to conventional methods, although the effect on postoperative sensitivity remains variable. The present case report describes the successful management of intrinsic discoloration in maxillary anterior teeth using Er:YAG laser-assisted vital bleaching.

## CASE REPORT

### Patient Presentation

A 26-year-old male patient presented with the chief complaint of a **persistent band of brown discoloration on maxillary anterior teeth (canine to canine)**. The discoloration had been present since childhood and had become a significant esthetic

concern, particularly affecting the patient's professional confidence.

### Clinical Examination

- **Visual Inspection:** Non-pitting, non-ditching bilateral brownish-yellow streaks and patches were observed on the labial surfaces of teeth 13, 12, 11, 21, 22, and 23, forming a horizontal band pattern.
- **Vitality Testing:** All teeth responded normally to electric pulp testing (EPT) and cold testing, confirming vitality.
- **Radiographic Examination:** Periapical radiographs revealed normal pulp chamber morphology with no evidence of periapical pathology.
- **General Findings:** Teeth were free from caries, restorations, and structural defects; periodontal status was within normal limits.

Based on these findings, a diagnosis of **intrinsic discoloration of vital maxillary anterior teeth** was established.

### Treatment Plan

A conservative esthetic treatment approach was planned:

- In-office vital bleaching
- Use of **Pola Office bleaching system (35% hydrogen peroxide)**
- Activation with **Er:YAG laser**
- Completion in **two sittings spaced one week apart**

Informed consent was obtained after explaining the risks, benefits, and possible outcomes.

### Clinical Procedure

#### Sitting 1

1. **Preparation:** Professional scaling and polishing were performed to remove plaque and extrinsic stains.
2. **Soft Tissue Protection:** A light-cured gingival barrier was applied to protect the gingiva, along with adequate isolation.
3. **Application of Bleaching Agent:** Pola Office bleaching gel (35% hydrogen peroxide) was applied in a uniform 1–2 mm layer over the labial surfaces.
4. **Laser Activation:**
  - Er:YAG laser (2940 nm) was used in **non-contact mode**

- Parameters: approximately **0.5 W, 10 Hz**
  - The laser was moved in a continuous sweeping motion over each tooth for **30 seconds per tooth**
5. **Reaction Phase:** The gel was left undisturbed for approximately **8 minutes** following activation.
  6. **Cycle Repetition:** The bleaching cycle was repeated **twice** during the first sitting.

**Sitting 2 (After 7 Days)**

- The patient reported **zero to mild sensitivity** during the interim period.
- The same bleaching and laser activation protocol was repeated.
- Final evaluation was done after **48 hours** to allow for rehydration and stabilization of tooth color.

**Final Outcome**

- Significant reduction in the intensity of the brown discoloration band was observed.
- Teeth exhibited a **more uniform and brighter appearance.**

- The esthetic outcome was satisfactory to the patient.
- No adverse effects or complications were noted.

**Post-operative Instructions and Precautions**

To maintain results and minimize sensitivity, the patient was advised:

1. **Dietary-Restrictions:**  
Follow a “white diet” for at least **48 hours**, avoiding tea, coffee, red wine, turmeric, and smoking.
2. **Sensitivity-Management:**  
Use desensitizing toothpaste containing potassium nitrate, sodium fluoride and other desensitizing agents if sensitivity occurs.
3. **Oral-Hygiene:**  
Maintain regular brushing and flossing; avoid highly acidic foods and beverages temporarily.
4. **Temperature-Precautions:**  
Avoid extremely hot or cold foods for a few days.
5. **Follow-up:**  
A recall visit at **6 months** was scheduled to evaluate color stability.



IN-OFFICE VITAL BLEACHING POWERED BY ER:YAG LASER





**DISCUSSION**

Vital tooth bleaching relies on the oxidation of chromogenic molecules within enamel and dentin using hydrogen peroxide. The decomposition of hydrogen peroxide releases reactive oxygen species that penetrate the tooth structure and break down pigmented compounds into smaller, less colored molecules.

Laser-assisted bleaching enhances this process by accelerating peroxide decomposition. The Er:YAG laser is particularly effective due to its high absorption in water, which is abundant in bleaching gels. This leads to a rapid increase in temperature within the gel layer rather than the tooth structure, facilitating efficient free radical release.

In the present case, the use of the Pola Office system in conjunction with Er:YAG laser activation resulted in:

- Faster bleaching action
- Reduced chairside time
- Improved depth of bleaching

It has also been suggested that laser activation may transiently alter the enamel organic matrix, allowing deeper penetration of hydrogen peroxide.

A major concern in bleaching procedures is **intrapulpal temperature rise**. Studies indicate that a temperature increase of more than **5.5°C** may compromise pulp vitality. However, due to the Er:YAG laser's strong absorption by the bleaching gel and its use at low energy settings, thermal heat is largely confined to the gel layer, minimizing pulpal risk.

Postoperative sensitivity is another concern. Although some studies report no significant reduction in sensitivity with laser activation, others suggest that controlled laser parameters may reduce discomfort by shortening exposure time.

The successful outcome in this case can be attributed to:

- Appropriate case selection (vital teeth with intrinsic discoloration)
- Controlled laser parameters
- Use of a high-concentration bleaching agent
- Proper isolation and technique
- Patient compliance

## CONCLUSION

Er:YAG laser-assisted vital bleaching is an effective and minimally invasive approach for the management of intrinsic discoloration of anterior teeth. It enhances the action of hydrogen peroxide, reduces treatment time, and provides satisfactory esthetic outcomes.

This case demonstrates that a band of brown intrinsic discoloration can be successfully treated with two sessions of laser-assisted in-office

bleaching, resulting in significant improvement without compromising tooth vitality.

## LIMITATIONS

Despite favorable results, certain limitations must be considered:

- **Cost:** High cost of laser equipment increases treatment expense
- **Technique Sensitivity:** Requires trained operator and precise parameter control
- **Dehydration Effect:** Immediate results may appear exaggerated due to dehydration; true shade stabilizes after 2–7 days
- **Longevity:** Results are not permanent; relapse may occur within 1–3 years depending on habits
- **Sensitivity:** Postoperative sensitivity remains unpredictable
- **Enamel Effects:** Excessive or improper laser use may cause microstructural changes in enamel

## REFERENCES

1. Dostalova T, et al. Erbium:YAG laser-assisted whitening of teeth. *J Clin Laser Med Surg*. 2004.
2. Lin CH, et al. Evaluation of laser-assisted bleaching on pulpal temperature and enamel morphology. *Dent Mater J*. 2009.
3. Mulligan S, et al. Effect of laser wavelengths on bleaching efficiency. *J Esthet Restor Dent*. 2017.
4. Sulieman M. An overview of bleaching techniques: History, chemistry, safety. *Dental Update*. 2005.
5. Kikly A, Jaâfoura S. Laser-activated tooth bleaching and sensitivity: A systematic review. *J Esthet Restor Dent*. 2019.
6. Awati AS, et al. Effectiveness of lasers in tooth bleaching. *J Conserv Dent Endod*. 2024.

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