Successful Gingival Depigmentation With Laser-Patterned Microcoagulation: A Case Report

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Introduction: Current methods for gingival depigmentation, including mechanical surgery, cryosurgery, laser treatments, and radiosurgery, create significant patient discomfort and risk of complications, thereby reducing attractiveness of the depigmentation procedure for many patients. To our knowledge, this case report presents a first-time application of a new technology, laser-patterned microcoagulation (LPM) based on the concept of fractional laser photothermolysis that was successfully applied in dermatology and ophthalmology.

Case Presentation: One patient was treated for local hyperpigmentation of the labial attached gingiva in the maxillary anterior area. A diode laser with wavelength 980 nm and power 20 W was used to create microcoagulation columns with a 30% area filling factor. Two treatments were performed, 2 weeks apart, without anesthesia. The patient was followed for 5 months. The discomfort during the procedure was tolerable without anesthesia. Healing was uneventful and visually completed with significant reduction of pigmentation at 2 weeks after treatment. Complete visual depigmentation was observed at both 2 weeks and 2 months after the second treatment.

Conclusions: To our knowledge, this is the first clinical case of hyperpigmentation treatment using LPM, demonstrating feasibility of a new, minimally invasive and effective method of localized gingival hyperpigmentation removal. The patient discomfort is significantly less than that reported for other methods for depigmentation. Clin Adv Periodontics 2011;1:210-214.

Key Words: Hyperpigmentation; laser therapy; lasers, semiconductor; surgical procedures, minimally invasive.

Background
Brown or dark gingival pigmentation often presents an esthetic problem because it may be apparent during smile or speech. The most frequent reason of hyperpigmentation is melanin deposits mainly located in basal and parabasal layers of the epithelium.¹ The traditional approach for treatment of gingival hyperpigmentation is surgical and includes mucoperiosteal flap, free gingival graft, or deepithelization as a less invasive approach. Still, all these surgical procedures are painful and expensive and have all the typical risks associated with surgery, including infection, scarring, gingival recession, damage to underlying periodontium and bone, and delayed wound healing.² Multiple less invasive deepithelization alternatives have been explored,
including erbium lasers, CO₂ lasers, cryogenic destruction, near-infrared lasers and radiosurgery. However, the majority of existing techniques are still associated with significant patient discomfort and protracted healing time, making gingival depigmentation an unattractive procedure for the majority of patients.

In the past several years, esthetic dermatology was significantly enhanced by a new technology known as fractional photothermolysis. It was successfully used with several million patients for skin rejuvenation, wrinkle removal, scar conversion to normal tissue, and melasma treatment. The concept of fractional photothermolysis may be explained as “Formation of isolated non-contiguous microthermal wounds creating necrotic zones surrounded by zones of viable tissue in a geometrical pattern that is not dependent on chromophore distribution.” It was found that, if the size and concentration (area filling ratio) of the microscopic wounds are within certain limits, the tissue can regenerate without scarring and result in younger, healthier tissue after healing is complete. In addition to dermatology, the same concept was successfully applied in ophthalmology, but it has not been applied for oral tissues. Because oral mucosa is known to have better regeneration properties than skin, we hypothesized that fractional treatment of oral mucosa and gingiva will result in a similar or better response, facilitating regeneration and creating new tissue without scarring. Near-infrared radiation easily penetrates into soft tissues, because absorption in water and hemoglobin is not very significant, but strongly absorbed in melanin, providing natural selectivity in laser–tissue interaction. The tissue regeneration cannot restore melanin deposits concentrated in the basal layer and therefore the pigmentation should be eliminated, at least in the areas in which melanin was destroyed by direct laser radiation. Because the treatment procedure is substantially creating a pattern of microcoagulated columns in the tissue, it may be called laser-patterned microcoagulation (LPM).

**Clinical Presentation**

A 36-year-old male was seen at a routine dental hygiene appointment. Several irregular brown pigmented spots were noted on the attached gingiva labial to the maxillary incisor teeth (Fig. 1). The pigmented regions were flat and asymptomatic. The patient had considered them as an esthetic problem, but had not sought treatment to remove the pigmentation. The pigmentation was diffuse, bilateral, and existed for ≈ 30 years; therefore, it was considered as physiologic pigmentation. The patient was offered the option to treat the most pronounced spots with LPM, a new technology similar to fractional photothermolysis widely used for skin rejuvenation and hyperpigmentation treatment.

**Case Management**

The case treatment was performed under the local ethical committee permission (Protocol #1 of Nizhny Novgorod Medical Academy Clinical and Animal Study Ethical Committee, 2010), and the patient signed an informed consent. The laser microcoagulation treatment is a quasi-periodic pattern of columns covering a pigmented spot, in which each column is created by application of a single laser pulse from a diode laser system. A diode laser operating at 980 nm wavelength and generating up to 20 W of power was used in this case. The delivery system had replaceable tips with 0.6 mm diameter.

In this case, each column was created by an 80 ms pulse. No anesthesia was used. The gingival surface facial to the left maxillary incisors was dried with compressed air and isolated by cotton rolls (special attention was paid to prevent cotton fibers from getting to the treatment field). The
pigmented spot was covered with laser columns with a filling ratio (coagulated area divided by total treatment area) of ≈ 30%. Digital photos (Figs. 1 through 5) were taken before the procedure, immediately after, and during each follow up visit. Red articulating paper and untreated pigmented spots were used for brightness and color reference in the photos. A second treatment was performed 2 weeks after the first treatment, also with a 30% filling ratio and without anesthesia (Fig. 3a).

**Clinical Outcomes**

The patient reported a tolerable slight burning sensation during and immediately after the laser pulse and minor tingling in the treated area at 1 day after treatment. No other discomfort or side effects were observed. At 1 week after the first treatment, a noticeable bleaching of pigmentation was noted compared to another area of hyperpigmentation near the right maxillary incisor teeth. The healing columns were noticeable on the surface as small indentations. Complete visual healing after the first treatment was observed at 2 weeks after treatment. The surface texture was restored, and the pigmentation was inhomogeneous, more at the mesial part of the spot (Fig. 2b). At this time, a second treatment was performed (Fig. 3a).

Two weeks after the second treatment (Figs. 3b and 5c), the surface was smooth and shiny, the pigmentation was absent, and there were no visible traces of columns. Two months after the first treatment (Fig. 5d), the surface was smooth and shiny with no repigmentation, and the patient expressed a high level of satisfaction and willingness to treat remaining areas of hyperpigmentation. No repigmentation was observed at 5 months after the second treatment (Fig. 5e).

To our knowledge, this is the first clinical case of hyperpigmentation treatment using LPM, demonstrating feasibility of a new, minimally invasive and effective method for localized gingival hyperpigmentation removal. The patient discomfort was significantly less than that reported for other methods for hyperpigmentation treatment, including surgical (mechanical) techniques, erbium laser, CO₂ lasers, cryogenic destruction, near-infrared lasers, or radiosurgery.
Summary

<table>
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<tr>
<th>Why is this case new information?</th>
<th>To our knowledge, this is the first case report of the application of new technology—LPM—for a successful removal of local gingival pigmentation.</th>
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<tr>
<td>What are the keys to successful management of this case?</td>
<td>Optimization of LPM parameters determined in previous in vitro and animal experiments led to a minimally invasive yet efficacious method with less discomfort.</td>
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<td>What are the primary limitations to success in this case?</td>
<td>Additional cases and longer postoperative evaluations are necessary to determine the long-term benefit of this technique.</td>
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Acknowledgments

This case report was supported by Russian Federation State Contract 02.740.11.5149 and Grant 10-02-01175 of the Russian Foundation for Basic Research. Dr. Feldchtein is a co-inventor of a patent related to the LPM technology and is an employee of Dental Photonics (Walpole, MA), a company commercializing LPM treatment. Dr. Altshuler is a shareholder and consultant for Dental Photonics and has a patent application in LPM treatment. Drs. Gladkova, Fomina, Karabut, and Kiseleva have received financial support for research and consulting fees from Dental Photonics. Dr. Allen reports no conflicts of interest related to this case report.

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References


