



# Removal of Human Gingival Melanin Pigmentation by Er:YAG vs Nd:YAG Laser: A Case Report

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**Abstract:** The present study was carried out to examine the removal of melanin pigmentation from human gingival surfaces using the Er:YAG laser. The results were compared to those obtained using the Nd:YAG laser. Two laser devices, an Er:YAG laser (SMART2940D) and an Nd:YAG laser (A10) (developed by DEKA, Florence, Italy) were used for laser treatment. The parameters of the Er:YAG laser were 5 Hz and 100 mJ, applied for 230  $\mu$ s using a contact tip under water mist and a noncontact tip without water mist. The Nd:YAG laser was applied at 10 Hz and 100 mJ for 300  $\mu$ s with Chinese black ink. In all cases, melanin pigmentation could be removed without local anesthesia. Melanin pigmentation removed by Er:YAG laser with or without water mist induced slight bleeding. Neither postoperative pain nor swelling were observed. Compared with the Nd:YAG laser, the Er:YAG laser showed no tendency for melanin pigmentation recurrence after 36 months. In addition, the color of the gingival surface lased by the Er:YAG laser was changed to pink. Comparison with the Nd:YAG laser revealed that the Er:YAG laser is useful in the removal of human gingival melanin pigmentation.

**Keywords:** Er:YAG laser, Nd:YAG laser therapy, human gingiva, melanin pigmentation.

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Melanin pigmentation of the oral mucosa and gingival surface is occasionally encountered in daily dental practice. The removal of melanin pigmentation by argon, Nd:YAG,<sup>1</sup> CO<sub>2</sub>,<sup>2-4,6</sup> Er:YAG,<sup>5</sup> and Er,Cr:YSGG<sup>7</sup> lasers has been reported. In particular, the Nd:YAG laser has been recommended due to the deep tissue penetrability and color dependency in absorption of this laser. On the other hand, the CO<sub>2</sub> laser is one of the most popular laser devices for use in surgical treatment and has been implemented for the removal of gingival melanin pigmentation. To date, however, there has been no report of Er:YAG laser application for the removal of gingival melanin pigmentation.

We examined and compared the effects of Er:YAG and Nd:YAG laser irradiation on the removal of human gingival melanin pigmentation in this case report.

## MATERIALS AND METHODS

Five patients who gave informed consent were examined. Patients and staff wore special eyeglasses for protection against laser beams. An Er:YAG laser (SMART2940D) and an Nd:YAG laser (A10) (developed by DEKA, Florence, Italy) were used. The Er:YAG laser was applied at 5 Hz and 100 mJ for 230  $\mu$ s using a contact tip under water mist and a noncontact tip

CASE REPORT



Fig 1 Preoperative appearance.



Fig 2 Immediately after irradiation.



Fig 3 Fourteen days after treatment.



Fig 4 Three years after treatment.

without water mist. The Nd:YAG laser was applied at 10 Hz and 100 mJ for 300  $\mu$ s using Chinese black ink. The laser treatment was performed without local anesthesia.

### CLINICAL RESULTS

In all cases, melanin pigmentation could be removed without local anesthesia. Melanin pigmentation removed by Er:YAG laser with or without water mist showed slight bleeding. Postoperative pain and swelling were not observed, and patients required no medication after treatment. Compared with the Nd:YAG laser, treatment performed by the Er:YAG laser showed no tendency for melanin pigmentation recurrence after 36 months. In addition, the color of gingival surface lased by the Er:YAG laser was changed to pink.

### Case 1

A 30-year-old female patient presented with gingival melanin discoloration (Fig 1). After clinical examination, laser therapy was performed with Er:YAG laser at 5 Hz and 100 mJ for 230  $\mu$ s using a contact tip under water mist. Immediately after laser irradiation, slight bleeding and ablation of the gingival surface were observed (Fig 2). Examination 14 days after laser treatment revealed no remarkable clinical findings (Fig 3). Even three years after treatment, no recurrence of gingival melanin pigmentation was observed (Fig 4).

### Case 2

A 53-year-old male patient presented with gingival melanin pigmentation (Fig 5). After clinical examina-



**Fig 5** Preoperative appearance.



**Fig 6** Immediately after therapy.



**Fig 7** One year after treatment.

tion, laser therapy was performed with Er:YAG laser at 5 Hz and 100 mJ for 230  $\mu$ s using a contact tip under water mist. After laser irradiation, slight whitening and vaporization of the surface gingival tissue were observed (Fig 6). Even three years after treatment, only very slight recurrence of melanin pigmentation on the gingival tissue was observed (Fig 7).

**Case 3**

A 44-year-old female patient presented with gingival melanin pigmentation (Fig 8). After clinical examination, laser therapy was performed with Er:YAG laser at 5 Hz and 100 mJ for 230  $\mu$ s using a contact tip under water mist. Observation 30 days after laser irradiation revealed complete removal of the surface gingival tissue pigmented with melanin (Fig 9). Upon observation

one year after treatment, no recurrence of melanin pigmentation in the gingival tissue was observed (Fig 10).

**Case 4**

A 30-year-old male patient presented with gingival melanin pigmentation (Fig 11). After clinical examination, laser therapy was performed with Nd:YAG laser at 10 Hz and 100 mJ for 300  $\mu$ s using a contact tip with Chinese black ink. Immediately after laser irradiation, slight bleeding and vaporization of the surface gingival tissue were observed (Fig 12). Upon observation 14 days after treatment, the gingival tissue appeared normal (Fig 13). Slight recurrence of melanin pigmentation on the gingival tissue was observed one year after treatment (Fig 14).



Fig 8 Preoperative appearance.



Fig 9 Thirty days after treatment.



Fig 10 One year after treatment.



Fig 11 Preoperative appearance.



Fig 12 Immediately after treatment.

### Case 5

A 30-year-old male patient presented with gingival melanin pigmentation (Fig 15). After clinical examina-

tion, laser therapy was performed with Nd:YAG laser at 10 Hz and 100 mJ for 300  $\mu$ s using a contact tip with Chinese black ink. Seven days after laser irradiation, no melanin pigmentation was observed on the gingival sur-



**Fig 13** Fourteen days after treatment.



**Fig 14** One year after treatment.



**Fig 15** Preoperative appearance.



**Fig 16** Seven days after treatment.



**Fig 17** Sixty days after treatment.



**Fig 18** Two years after treatment.

face (Fig 16). Slight recurrence of melanin pigmentation was observed 30 days after treatment (Fig 17). Moderate recurrence of melanin pigmentation on the gingival tissue was observed after two years (Fig 18).

## DISCUSSION

In the present study, the Er:YAG laser was applied at 5 Hz and 100 mJ for 230  $\mu$ s using a contact tip with and



without water mist. It is possible to change these parameters depending on, for example, the technique, patient discomfort, degree of melanin pigmentation, and use of local anesthesia. The Nd:YAG laser was applied at 10 Hz and 100 mJ for 300  $\mu$ s using the Chinese black ink. As in the cases of the Er:YAG laser, it is also possible to change these parameters. Widespread use of the Er:YAG laser used in this treatment in general dental clinics will require a cost reduction.

In all cases, melanin pigmentation could be removed without local anesthesia. However, all of the patients felt slight discomfort, the degree of which depended on the laser energy, pulse, speed of tip movement, the condition of the patient, and the technique of the operator. The reason for the reduced pain reported during the laser treatment is believed to be that the ends of the sensory nerves are sealed<sup>8</sup> and the central nervous conducting system is changed.<sup>9</sup> Topical or local anesthesia should be used with patients who are sensitive to laser treatment.

In the cases of melanin pigmentation removal with Er:YAG laser under water mist, slight bleeding was observed. However, in the cases carried out without water mist, there was little bleeding. The reason for this difference appears to be the degree of coagulation caused by the laser energy and wavelength. Coagulation of capillaries and soft tissue by the laser are thought to be the reason for the absence of postoperative bleeding.

Postoperative pain and swelling, which were not observed in this study, might be caused by heat generation at the nerve endings distributed in the treatment area and in the thin necrotic layer, which protects the lased tissue from outside irritation.<sup>1,4,10</sup>

In the present study, the recurrence of gingival melanin pigmentation was observed in two out of two cases of Nd:YAG laser treatment and one out of three cases of Er:YAG laser treatment. Unlike the cases of Nd:YAG laser treatment, those performed with the Er:YAG laser showed no tendency of recurrence of melanin pigmentation for 36 months. Matsumoto et al<sup>1</sup> reported the period of no recurrence to be only three months for the Nd:YAG laser. Nakamura et al<sup>4</sup> reported that recurrence using the CO<sub>2</sub> laser was observed in 4 out of 7 patients after 24 months. Tal et al<sup>5</sup> reported that 6-month follow-up examinations of 10 patients treated using the Er:YAG laser revealed an absence of recurrence of melanin pigmentation. Berk et al<sup>7</sup> reported that in two patients, no pigmentation recurrence had occurred after 6 months. Based on these reports, as well as the present findings, the removal of gingival melanin pigmentation with Er:YAG laser ap-

pears to be an effective treatment method. However, the recurrence of gingival melanin pigmentation depends on the laser wavelength, the removal depth, the degree of melanin pigmentation, the energy density, and the technique. In the present study, it is difficult to understand the removal effects based on the relationship between the penetration of the Nd:YAG and Er:YAG lasers into tissue and the color dependency of the Nd:YAG laser. In addition to this problem, the reason for the absence of recurrence of melanin pigmentation after 3 years when using the Er:YAG laser should be clarified in future studies.

## CONCLUSION

Comparison with the Nd:YAG laser revealed that the Er:YAG laser is useful in the removal of human gingival melanin pigmentation.

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