Successful Nd:YAG Laser Therapy for Hair Removal in the Oral Cavity after Plastic Reconstruction Using Hairy Donor Sites

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Abstract
Background: Concepts of reconstruction of intraoral structures may often include the transfer of flaps composed of external skin with hairs. Given that intraoral hair growth following myocutaneous flaps can cause discomfort, there is a need for effective treatments to relieve cancer patients of these symptoms. Objective: To describe the successful epilation of hairy intraoral flaps using Nd:YAG laser emitting a wavelength of 1,064 nm. Methods: We performed an interdisciplinary prospective clinical study with 9 patients suffering from intraoral hair growth after plastic reconstruction of a hairy donor site due to cancer. Eight male and one female patients were treated with 1–4 sessions of Nd:YAG laser at 5–15-week intervals. Results: Laser treatment resulted in effective hair reduction in 8/9 patients regardless of flap type. In 5/9 patients a hair clearance of >90% could be achieved, whereas laser treatment was ineffective in one male with white hair. Patients were very satisfied with the outcome and no side effects could be observed. Conclusion: Nd:YAG laser therapy appears to be a successful therapeutic option for patients suffering from growth of dark hair in the oral cavity after plastic reconstruction using a hairy donor site.

Introduction
Radical resection is required for most patients suffering from oropharyngeal cancers. Primary reconstruction concepts of oral functions include the utilization of fasciocutaneous free flaps (e.g. radial forearm flap), myocutaneous flaps (e.g. anterolateral thigh flap) as well as free vascularized osteofasciocutaneous flaps (e.g. fibula flaps) [1]. The pedicled submental island flap is another reconstruction option with respect to speech and swallowing function [2]. However, persistent hair growth in the acceptor site caused by the hair of the donor site can be an important side effect of these techniques [3–5]. Hair growth in the oral cavity can cause considerable difficulties in chewing and swallowing or changes in speech. Additionally, the impaired aesthetic appeal might cause psychological problems such as lowered self-esteem and difficulties in social interactions. Given that all cancer patients experience some dis-
tress, these circumstances can contribute to manifest depression [6]. Most of the patients included in this study declared that they had visited a dentist for trimming the intraoral hair with scissors at 4–8-week intervals. Because trimming of the hair growing on the skin flaps can only succeed for short periods of time, there is a need for effective therapies in order to maintain an acceptable quality of life. Postoperative radiotherapy can reach a complete hair loss in hairy flaps, but severe side effects such as mucositis and fibrosis do not justify this method [3]. In a few recent case reports, successful therapy of intraoral hair growth using long-pulsed alexandrite laser has been demonstrated, and two male patients benefited from Nd:YAG laser treatment [5, 7–9]. In order to evaluate the efficacy of laser treatment in a larger cohort, we initiated an interdisciplinary prospective clinical study using the Nd:YAG laser in 9 patients suffering from hair growth in the oral cavity after plastic reconstruction using a hairy donor site.

**Methods**

Nine patients (8 male, 1 female; mean age 58.7 years, range 46–73) suffering from hair growth in the oral cavity after reconstruction using hairy donor sites were included in this prospective study (table 1). All patients underwent surgical excision of a tumor (8 squamous cell carcinoma and 1 non-Hodgkin lymphoma) using different techniques for primary reconstruction. Six of our treated patients (Nos. 1–6) had previously received submental island flaps as a reconstruction of intraoral defects after resection of squamous cell carcinomas of the oropharynx and the oral cavity. One patient (No. 7) underwent reconstruction using an osteocutaneous free flap and patient No. 8 received a radial forearm free flap after undergoing excision of a squamous cell carcinoma of the right oropharynx. One patient (No. 9) underwent local radiotherapy for non-Hodgkin lymphoma of her neck and developed atrophy of her mandibular mucosa. She received a myocutaneous flap from a donor region of her left thigh (anterolateral thigh free flap). None of the patients received postoperative radiotherapy. All patients reported extensive problems with pooling of saliva and passing of food as a consequence of the intraoral hair-bearing skin. The patients visited our department between June 2009 and March 2011, and were clinically examined and photo-documented before receiving the first laser treatment. All patients signed an informed consent.

Hair was trimmed using a scissor and/or a scalpel immediately prior to laser therapy (fig. 1). The therapy sessions took place under general anesthesia using low oxygen flow preventing inflammation caused by the laser light. At the beginning of the study, patients were intubated orally, but this way of intubation showed disadvantages because of the limited space for the laser handpiece in the oral cavity. Therefore, endonasal intubation was employed, leaving more space for the laser handpiece. A long-pulsed Nd:YAG laser with a wavelength of 1,064 nm (Gentle YAG™, Candela Corporation, Boston, Mass., USA) was used. A spot size of 18 mm, a fluence of 22–30 J and a pulse duration of 3–20 ms determined the laser effects (fig. 1). In order to control and remove smoke from the patient’s mouth during treatment, a smoke extractor was used. The patients were examined 2 weeks after each treatment and received 1–4 courses of treatment in 4–15-week intervals. Clinical follow-up data were obtained in 6 patients.
Results

After treatment, most patients experienced dramatic improvement of their symptoms. The amount of hair reduction achieved by each treatment session was approximately 20–30%, depending on the amount, texture and pigmentation of the intraoral hair. By the end of therapy, a hair reduction of >90% could be achieved in 5/9 patients (fig. 2). A reduction between 60 and 90% could be observed in 3/9 patients. All of theses patients showed good response on their dark hair, leaving behind solely depigmented hair (Nos. 3, 4 and 6) (table 1). One patient (No. 2) showed no benefit, having exclusively white hair (fig. 1). Two patients either recurred locoregionally (No. 6) or had

Table 1. Patient characteristics, laser parameters and clinical outcomes

| Patient No. | Sex | Age at consultation | Tumor | Flap | Pulse, ms | Density energy, J/cm² | Number of sessions | Intervals, weeks | Clearance | Follow-up, months | Clearance at follow-up |
|-------------|-----|---------------------|-------|------|-----------|------------------------|--------------------|-----------------|-----------|-------------------|------------------------|
| 1           | M   | 59                  | SCC   | SIF  | 3         | 28–30                  | 4                  | 5–6             | 90–100%   | 31                | 90–100%               |
| 2           | M   | 73                  | SCC   | SIF  | 3         | 28                    | 2                  | 5               | 0%        | 34                | 0%                    |
| 3           | M   | 59                  | SCC   | SIF  | 3         | 28–30                  | 4                  | 4–11            | 60–90%   | X                 | X                     |
| 4           | M   | 54                  | SCC   | SIF  | 3         | 28–30                  | 3                  | 5               | 60–90%   | 33                | 0%                    |
| 5           | M   | 46                  | SCC   | SIF  | 3         | 28–30                  | 4                  | 6–13            | 90–100%   | 26                | 30%                   |
| 6           | M   | 62                  | SCC   | SIF  | 3–20      | 22–30                  | 3                  | 5               | 60–90%   | DD                | DD                    |
| 7           | M   | 48                  | SCC   | FOFF | 3         | 28                    | 1                  | 0               | 90–100%   | X                 | X                     |
| 8           | M   | 69                  | SCC   | RFFF | 3–20      | 22–28                  | 2                  | 6               | 90–100%   | 41                | 90–100%               |
| 9           | F   | 58                  | NHL   | ALT  | 3         | 22–28                  | 4                  | 5–15            | 90–100%   | 34                | 60–90%                |

ALT = Anterolateral thigh free flap; DD = dead from disease; FOFF = fibula osteocutaneous free flap; NHL = non-Hodgkin lymphoma; RFFF = radial forearm free flap; SCC = squamous cell carcinoma; SIF = submental island flap; X = patient not available.

Fig. 2. Treatment of intraoral hair growth in patient No. 1. a Plastic reconstruction was performed using a submental island flap. b The hair-bearing intraoral flap at baseline. c After 2 sessions with the Nd:YAG laser a remarkable hair removal could be achieved. d Permanent hair reduction at follow-up after 31 months.
Additionally, Hall et al. fluence 9.5–36.4 J) resulted in significant hair reduction. Intraoral hair growth. Four treatments with long-pulsed flap after surgery for squamous cell cancer and developed published a male patient who received a radial forearm flap, and Shim et al. presented a patient suffering from intraoral hair-bearing dark hair after plastic reconstruction using hairy line treatment in patients suffering from intraoral flaps. In all these patients, laser therapy using a long-pulsed laser was performed, reaching a significant improvement in 4/6 cases and a partial response in 1 patient. In one Asian male patient, laser therapy was hampered by limited access to the mouth. Lumley [7] published a male patient who received a radial forearm flap after surgery for squamous cell cancer and developed intraoral hair growth. Four treatments with long-pulsed Nd:YAG-laser (1,064 nm; spot size 10 respectively 4 mm, fluence 9.5–36.4 J) resulted in significant hair reduction. Additionally, Hall et al. [5] presented one man who benefited from two laser hair removal sessions (Nd:YAG; 40 J/cm², pulse duration 55 ms).

In order to evaluate the efficacy of long-pulsed Nd:YAG-laser (1,064 nm) in managing patients suffering from intraoral hair growth after reconstructive surgery, we initiated this interdisciplinary prospective study. Eight of 9 patients benefit from our treatment, with a hair reduction >90% in 5 patients. Strikingly, the non-responding patient exhibited white hair, which contains less melanin, on his flap. This is in line with the fact that the long-pulsed Nd:YAG-laser targets the melanin in the hair shaft, thus damaging the hair follicles and providing permanent hair loss [10, 11]. This mechanism is called photoepilation or selective photothermolysis. Beside the absorption in melanin, destruction of stem cells in the bulge area of the hair follicle is also a mechanism underlying permanent hair removal [12]. In line with previous case reports, repetitive laser treatments (up to 4 sessions) were necessary in our patients in order to achieve a sufficient hair reduction [11]. Active growing and pigmented hair follicles in the early anagen phase are most vulnerable for thermic destruction via laser therapy [12]. Recently, a randomized trial comparing alexandrite and Nd:YAG laser for leg hair reduction showed similar results in hair reduction, but the alexandrite laser produced statistically significant more pain than the Nd:YAG laser [13]. Although other laser techniques such as alexandrite laser, diode laser or intense pulse light laser represent other therapeutic options, the long-pulsed Nd:YAG laser seems to be the safest device for hair removal [10]. The flap type did not influence the therapeutic success in our collective, because 4/5 patients with submental island flap as well as all patients with other flaps types (fibula osteocutaneous free flap, radial forearm free flap, anterolateral thigh free flap) benefited from Nd:YAG laser therapy. Follow-up data showed a permanent hair reduction in 50% of our patients, indicating a long-term success of the Nd:YAG laser epilation. The method is easy to apply, although general anesthesia is mandatory. The size of the hand-piece of our laser is a certain limit for treatment of very deeply positioned pharyngeal hairs. Side effects resulting from our therapeutic regimen were negligible.

In conclusion, Nd:YAG laser treatment is very effective for intraoral hair removal. We propose it as the first-line treatment in patients suffering from intraoral flaps bearing dark hair after plastic reconstruction using hairy donor sites. In the future laser treatment of the flap prior to grafting to the recipient site seems to be desirable, although tumor surgery cannot be delayed until hair removal is completed.

**Disclosure Statement**

The authors have no conflicts of interest to declare. Dr. Markus Zutt received payments for presentations on behalf of Candela company.
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