Aesthetic laser therapy correction of gingival hyperpigmentation

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A beautiful smile is dependent on many factors. One of those factors is the gingival scalloped Symmetry. A proper amount of pink, achieved through dental bleaching and gingival hyperpigmentation therapy, yields a healthy, aesthetic smile.

Hyperpigmentation was noted involving the attached gingiva of the mandible and maxilla, with the latter greater in severity (Fig. 2). The Oral Pigmentation Index in terms of pigmentation intensity (heavy clinical pigmentation) and scored 2 on the Takashi melanin pigmentation index in terms of its extension (formation of continuous ribbons extending from the neighbouring solitary units). In both the mandible and the maxilla the hyperpigmentation appeared more singular, posteriorly extending, macular lesions with well defined demarcated borders limited central to the mucogingival junctions. A diagnosis of physiological gingival hyperpigmentation was made and intervention for aesthetic correction was indicated (the patient initially sought treatment of the mandible only). Digital smile design (DSD) and smile analysis of the patient indicated need for correction to the altered passive eruption. Dental bleaching with a 4% carbamide peroxide gel (OptraGate, Ivoclar Vivadent), and local anesthesia achieved by slow infiltration of a 4% articaine with adrenaline (1:200,000) local aesthetic solution (Ulistim™ forte, mS ESPE). The area, mucosa and teeth surfaces, were cleaned with sterile gauze soaked in chlorhexidine gluconate aqueous solution (never used an alcohol solution with medical lasers). An Er,Cr:YSGG laser (Waterlase Plus 2.0, Biolase) was used for all the periodontal soft tissue surgeries. The crown lengthening by gingivectomy was first carried out as per the DSD guide, with a fine tip (MGG6, applied more parallel to the tooth, with the unit’s power settings at 75 Hz, with water and air settings 50 and 40 respectively thereafter. A broader, chisel tip (MGG7) was interchanged for the depigmentation/gross de-epithelialization, with power settings increased to 125 Hz. The tip size and power allowed for faster removal of tissue with water and air settings on for cooling. Broad, gradual strokes de-epithelialized the pigmented areas up to 1–2 mm beyond the lesions’ borders. To conclude the procedure, the unit was set to ‘laser handpiece’ mode, with lowered power settings at 1–1.5W and water and air off for hemostasis, leaving a layer of coagulum that would aid with the tissue healing. After the entire affected area was de-epithelialized (Fig. 3), post-operative instructions were given (no tooth brushing near the treated area for 1 week, rinse with chlorhexidine mouthwash 3 times a day (Ankor C, CivaNova Pharmaceuticals), soft diet avoiding spicy/irritating foods). The patient was recalled at 10 days, reporting having had no pain or discomfort, and demonstrating a near complete healing of the entire treated area (Fig. 4). There were no areas of hyperpigmentation noted (Fig. 5) The patient was rescored as zero on both pigmentation indices. Following dental bleaching the patient presented at the 2-year recall with no notable signs of repigmentation. The patient remained a score of zero on both indices. The gingival contour and colour remained stable with aesthetic results pleasing to the patient (Fig. 6).

Discussion

Pigmentation of the gingiva may pose an aesthetic concern to the patient seeking cosmetic correction thereof. Laser depigmentation is an evidence-supported, beneficial treatment modality. “Laser” is an acronym for light amplification by stimulated emission of radiation. Possibly the first report of laser radiation on oral soft tissues was as early as 1965. The first commercial laser for use in dentistry, the diode 304 Nd:YAG laser, was introduced in 1990. At present, a range of laser wavelengths are used in dentistry for a plethora of applications (Table 1). The fundamental mode of action of lasers is that waves consisting of photons (basic unit of radiant energy light) travel at the speed of light and these waves can be defined by their wavelength and amplitude. Amplitude is the vertical height of the wave, and in lasers, this corresponds to “brightness” its potential energy to do work. Wave-length is the distance between two corresponding points on the wave – the unit typically in laser dentistry is

Table 1: Lasers currently used in dentistry

<table>
<thead>
<tr>
<th>Laser type</th>
<th>Active medium</th>
<th>Wavelength (nm)</th>
<th>Treatments, applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excimer lasers</td>
<td>Argon fluoride (ArF)</td>
<td>193</td>
<td>Photodisintegration, phoshed out of dentistry.</td>
</tr>
<tr>
<td></td>
<td>Neodymium:Yttrium: Aluminum Garnet (Nd:YAG)</td>
<td>308</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td>Gas lasers</td>
<td>Carbon dioxide (CO2)</td>
<td>9300; 10,600</td>
<td>Sulcal debridement, per-implantitis, gingiva</td>
</tr>
<tr>
<td></td>
<td>Argon laser (Ar)</td>
<td>514</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td></td>
<td>Neodymium:Yttrium: Aluminium Garnet (Nd:YAG)</td>
<td>1064</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td>Diode lasers</td>
<td>Indium-gallium-arsenic-phosphorus (InGaAsP)</td>
<td>650 – 905</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td></td>
<td>Indium-gallium-garnet (InGaGarnet)</td>
<td>1064</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td>Medical use</td>
<td>Neodymium-lithium:  Fluoride (Nd:Fl)</td>
<td>1064</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td></td>
<td>Neodymium:Yttrium: Aluminium Garnet (Nd:YAG)</td>
<td>1064</td>
<td>Dental caries and calculus detection</td>
</tr>
<tr>
<td></td>
<td>Erbium-gallium-aluminum-garnet (Er:YAG)</td>
<td>2940</td>
<td>Caries removal, cavity preparation, self-tissue</td>
</tr>
<tr>
<td></td>
<td>Yttrium:Yttrium: Aluminium Garnet (YAG)</td>
<td>2790</td>
<td>Caries removal, cavity preparation, self-tissue</td>
</tr>
<tr>
<td>Other</td>
<td>Diode lasers</td>
<td>800 – 900</td>
<td>Non-surgical, photodynamic, caries detection</td>
</tr>
</tbody>
</table>

Figure 1: Preoperative view of the patient’s smile
Figure 2: Retracted, preoperative, intraoral view demonstrating the degree of pigmentation and extension of the affected areas
Figure 3: Immediately postoperative, crown lengthening and de-epithelialization of pigmented tissue completed
Figure 4: 10-days postoperative, rapid healing with dramatic results in gingival colour
Figure 5: The patient’s smile 10 days after the laser de-epithelialization and crown lengthening
Figure 6: Patient’s smile at the 2-year recall; dental bleaching, increased clinical crown, pink gingiva, all contribute to a healthy, aesthetic smile
The ablative action of the laser over a wider area allowed for removal of the superficial gingival layers rather than laser vaporization. Oral mucosa is high in water content and the laser effect primarily involves the thermal change in the tissue. When water temperature is raised to 100°C—a temperature of the water within the mucosa occurs, called ablation. Incision and excision of oral soft tissues here is at this temperature. Between 60° and 100°C proteins will denature without vaporization of underlying tissue, ideal for the removal of diseased degenerative tissue, for hemostasis and coagulation. Charring of the tissues may however occur at temperatures around 200°C. When removing hyperpigmented tissues, lower temperatures are needed, and much less energy is needed since chromophores attract the laser. Conversely, higher energy would be needed to excise fibrres with less chromophores.

Lasers used for the aesthetic correction of physiological hyperpigmentation have been extensively described in the literature, and suggested as superior to other treatments due to the fast healing, reduced pain and discomfort, clean and dry operating field, and stable results.14-16 The formation of pre-existing coagulations on the treated wound surface reduces postoperative pain. Laser light may also “seal” the wound and prevent bleeding.17 The patient treated in the case presented here required only an ample local anaesthesia with infiltration per quadrant delivered segmentally across the working area. The operating field was dry and void of any profuse bleeding. Nearly the entirety of the hyperpigmented lesions had the superficial layers of tissue removed. Healing was wound-free with no report of pain, infection, or discomfort. At as early as 10 days postoperatively the area was nearly entirely healed with radical results in tissue colour and contour. The literature reports the expected chromosomal and degrees of regeneration following re-epithelialization by various modes of treatment. Depigmentation by laser ranks low (1.16%) in terms of percentage repigmentation (Table 2).

Conclusion
B.W.YK laser therapy for epidermal epidermolysis can successfully alter blue –black/dark brown gingiva to uniform pink colour with numerous benefits for both clinician and patient. The results can be dramatic for patients with hyperpigmentation, remaining stable over the long-term, contributing greatly to an aesthetically pleasing smile.

References
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