Introduction

It has been estimated that roughly 30–50% of the US population snore and almost one-third suffer from sleep apnoea. However, only 5% have been diagnosed and treated.1, 2 Snoring and sleep apnoea result from obstructed airways. This can be an outcome of many different factors, such as anatomic deviations, tumours, polyps, allergies, large adenoids and tonsils, a large uvula or a long soft palate.3–6 Heavy snoring is sometimes called “heroic” snoring and may affect bed partners, even causing marital conflict.

Snoring is not sleep apnoea and sleep apnoea is not snoring. Still, many patients with loud snoring also have obstructive sleep apnoea (OSA). An overnight sleep study known as polysomnography should be conducted on severe snorers to conclude if they have OSA. During the sleep test, the number and length of possible apnoic periods is recorded, and oxygen levels, heart rhythm (EKG), body position and bruxism are examined. Treatment can be discussed after the sleep study results have been evaluated.

In OSA syndrome, several breathing pauses may cause a significant decrease in blood oxygen level and cardiac arrhythmia. OSA syndrome is life-threatening with long-term effects resulting in lung and heart problems.7 This may also interact with the brain’s restorative REM sleep periods and cause concentration, memory and mood problems. Daytime sleepiness, morning headaches, sexual dysfunction, hallucinations and short-term memory loss are other problems related to OSA.7–9
Non-surgical treatment options for patients suffering from OSA include oral appliances, palatal implants, weight loss, alternative medicine and continuous positive airway pressure (CPAP) masks. Surgical methods include laser-assisted uvulopalatoplasty or uvulopalatopharyngoplasty, radiofrequency tissue ablation and palatal implants.12–14

_Laser treatment option: NightLase_

Among other treatments, a minimally invasive laser treatment is now available. In this method, laser light is used for non-ablative thermal heating of the tissue, which subsequently causes shrinking of the collagen fibres. This phenomenon opens up the airways and reduces snoring and sleep apnoea. There are many benefits of treatment with NightLase (Fotona), such as no need for anaesthetic, no pain and only three short 20-minute sessions with immediate results. This case presentation describes the treatment of patients with OSA using an Er:YAG laser, with a long-term follow-up period of 28–36 months. These clinical cases are part of an uncontrolled study to evaluate the usefulness of the laser in snoring and sleep apnoea treatment.

_Materials and methods_

Patients with different OSA levels are included in this case report, all from a general dental practice. Ten patients were randomly selected and five typical cases are presented here visually, in terms of preoper-

Figs. 3a–c. Case #1. Pre-op Class 4 (a). Class 1 after three treatments (b). Class 2 at recall 36 months post-op (c). Figs. 4a–c. Case #2. Pre-op Class 4 (a). Class 1 after three treatments (b). Class 1 at recall 28 months post-op (c).
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Figs. 5a–c. Case #3. Pre-op Class 4 (a). Class 1 after three treatments (b). Class 1 at recall 36 months post-op (c).

Figs. 6a–c. Case #4. Pre-op Class 4 (a). Class 1 after three treatments (b). Class 2 at recall 28 months post-op (c).

Figs. 7a–c. Case #5. Pre-op Class 4 (a). Class 1 after three treatments (b). Class 2 at recall 36 months post-op (c).

ative, postoperative and recall photographs. Three patients used a CPAP mask before treatment. All of the patients gave their consent for the treatment protocol using the Er:YAG laser and for the clinical photographs taken pre- and postoperatively to be used in presentations. All of the treatments were performed from late 2011 to the first quarter of 2012. No anaesthetic was administered. Mallampati classification (Fig. 1) was used before and after the treatments. All of the treatments were performed with a LightWalker AT laser (Fotona)—other Fotona models can be used too. Before each treatment, the effects of the Er:YAG laser treatment were explained to the patient (Fig. 2a). A fractional laser beam (Fig. 2b) was used with a PS04 handpiece at minimally invasive settings according to the manufacturer’s protocol:

– The laser beam is fired at soft intra-oral tissue with a repetition rate of 10 Hz in LP mode.
– The laser beam is manually delivered across the target, either vertically or horizontally (depending on the region).
– Several passes are performed across each region (with well-defined overlap).

– The treated tissue is thermally processed and consequently shrinks.
– Sessions are scheduled at appropriate time intervals.
– Total delivered pulses vary per patient from 10,000 to 15,000.

Clinical case #1

The patient was a 46-year-old female patient. Medical anamnesis established severe OSA with related headaches and daytime drowsiness. Intra-oral examination showed Mallampati Class 4. The postoperative result showed Class 1 (Figs. 3a–c).

Clinical case #2

The patient was a 42-year-old female. Medical anamnesis included severe OSA and use of a CPAP mask. The greatest concern for the patient was her heavy snoring causing relationship problems. Intra-oral examination showed Mallampati Class 4. The postoperative result was Class 1 (Figs. 4a–c).

Clinical case #3

The patient was a 30-year-old male and former ice-hockey player, lately unable to exercise at all owing to his becoming out of breath immediately owing to severe OSA. He had been using a CPAP mask for two years with discomfort. His Mallampati Class 4 was reduced postoperatively to Class 1 (Figs. 5a–c).

Clinical case #4

The patient was a 45-year-old male with snoring and breathing problems, causing relationship stress. His Mallampati Class 4 was reduced postoperatively to Class 1 (Figs. 6a–c).

Clinical case #5

The patient was a 56-year-old male with moderate OSA, which was causing relationship problems, as well as sleeping problems, a sore throat and morning headaches. His Mallampati Class 4 was reduced postoperatively to Class 1 (Figs. 7a–c).
**Results**

All of the patients using a CPAP mask were able to discontinue use of the mask after the first treatment. After the third treatment, patients reported improvement of more than 85%. Average improvement after one treatment session was 51% and after the second session, 61% (Fig. 8).

All of the patients were satisfied and stated that they would recommend NightLase therapy. None reported discomfort or pain during or after the treatment. Only one mentioned dry mouth postoperatively. All of the patients reported that they could breathe much more easily and that motion-related exhaustion had disappeared; quality of life was also better without daily headaches.

**Discussion**

Both snoring and sleep apnoea are the cause of several health issues and are potentially life-threatening.8 Still, most patients are unwilling to undergo treatment owing to multiple side-effects, unsuccessful non-surgical and surgical treatments, and uncomfortable procedures.15

In the treatments presented in this article, the success rate was over 85% (Fig. 8). Even after 28–36 months, the results remained good. NightLase is an easy treatment to perform, with no pain during or after the treatment. Therefore, it can also be repeated with minimum discomfort to the patient. The procedure is safe with no need for anaesthetic or medication. Consequently, it allows a good night’s sleep and better quality of life for the patient and his or her partner sharing the same bed. However, patient selection with proper examination and exclusion criteria are important to identify the therapy needed.

**Conclusion**

NightLase is a safe and very successful treatment for reducing snoring and sleep apnoea, and is supported by evidence-based dentistry. It is a minimally invasive treatment with no need for special arrangements, either pre- or postoperatively. Since no anaesthetic is needed, the treatment is well accepted by patients. Long-lasting effects—from 12 to 36 months—allow for high overall satisfaction among patients.

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Ablation of Dental Hard and Soft Tissue with 9.3 µm CO₂ Solea Laser

_Dr. Joshua P. Weintraub, USA_

**Introduction**

As a practicing general dentist, I am always thinking about the next clinical challenge. Like any general dentist, I regularly encounter a vast array of dental problems in need of attention. Having the best instruments at my disposal is of the utmost importance to achieve optimal results. Over the past several years, I have used multiple lasers operating at various wavelengths to manage treatment involving enamel, dentin, alveolar bone and soft tissues of all types. These lasers include erbium (2.9 µm), Nd:YAG (1.064 µm), diode (0.81 µm) and most recently, an all-new CO₂ laser that operates at 9.3 µm. CO₂ lasers operating at 10.6 µm have been around for decades and have long been considered the gold standard for soft tissue ablation, but soft tissue was all that could be cut with that particular wavelength. In this paper, I will discuss how I use the Solea laser (developed by Convergent Dental Inc.), a 9.3 µm CO₂ laser for hard, soft, and osseous tissue. Solea utilises isotopic CO₂ as a medium and uses a wavelength of 9.3 µm. Unlike other lasers, this wavelength has chromophores of both hydroxyapatite and H₂O, allowing it to vapourise all tissue in the oral cavity. In addition to the unique wavelength, Solea is the first and only dental laser to use computer controls to optimise beam delivery. Before a procedure, I simply choose one of the three "tissue types" (Enamel, Dentin, or Soft Tissue). The beam that comes out of the laser has a diameter of 0.25 mm, but computer-controlled motors, called galvos, move tiny mirrors inside the handpiece to create patterns yielding multiple spot sizes ranging from 0.25 mm up to 1.25 mm. The galvos give me the right size pattern for the job at hand. Again, the computer plays a role in making sure that the right amount of energy is delivered in the right size pattern. The combination of a unique wavelength and computer controls make Solea an instrument suitable for a wide range of applications.

**Case 1: Fractured amalgam and recurrent decay**

The first case exhibits the use of Solea on enamel and dentin. The patient, a 69-year-old female, presented with tooth sensitivity. The exam revealed a fractured amalgam and recurrent decay on #27 MOL (Figs. 1a and 1b). No local anaesthetic was used on this vital tooth, but topical anaesthetic (TAC 20 comprised of Lidocaine 20% Tetracaine 4%, Phenylephrine 2%) was used for the interproximal matrix/wedge. Solea was used to outline the preparation using the Enamel Setting until dentin was reached: 0.25 mm spot size, 15 µs pulse duration, 100% mist, 20%–100% variable speed foot pedal. The amalgam was then removed with a high speed handpiece (Kavo Electrotorque) and 245 bur. I was able to use the bur without anaesthetic because of the profound anal-
The analgesic effect achieved by starting with Solea. The prep was continued using Solea on the Enamel Setting: 1.00 mm spot size, 15 µs pulse duration, 100% mist, 10%–100% variable speed foot pedal. The prep was completed and decay was removed using Solea on the Dentin Setting: 1.00 mm spot size, 70 µs pulse duration, 100% mist, 20%–100% variable speed foot pedal. The cavosurface margins were beveled with a diamond bur to complete preparation (Fig. 2). The tooth was prepared for restoration with Scotchbond Universal (3M). A layer of EsthetXflow (DENTSPLY), approximately 0.5 mm thick, was placed on the gingival floor of the proximal box. Restoration was completed with Tetric EvoCeram Bulk Fill (Ivoclar Vivadent) and finished (Figs. 3 and 4).

Prior to the development of the Solea laser, I would not have considered performing this procedure without anaesthetic; whether I was using an erbium laser, a laser in conjunction with a conventional hand piece or a conventional handpiece alone. Solea's consistent analgesic effect made the procedure easy and predictable, while the precision with a 0.25 mm spot size made it possible to create a gingival trough adjacent to the amalgam without hitting the amalgam itself. A major advantage of not anaesthetizing the patient is that checking occlusion was simplified. Most importantly, it was a better experience for the patient as she reported no discomfort during or after the procedure and was delighted to “not feel numb”.

Case 2: Open flapped crown lengthening

This case involved #s 16 and 14, adjacent to edentulous #15 site (Fig. 5). Seen radiographically with bone level indicated with red arrows (Fig. 6), #16 mesial and #16 distal had inadequate tooth structure due to decay coronal to the alveolus. The patient, a healthy 73-year-old female, was deciding between receiving an implant to replace #14 or a fixed partial denture from #s 16 to 14 with pontic #15. She was encouraged to seek an implant treatment instead of fixed partial denture (bridge) due to longevity, especially with her caries susceptibility. Tooth #14 had endodontic treatment and needs a core and full coverage restoration. Tooth #16 will be treated conservatively with a composite restoration if the patient does not choose a fixed partial denture or full coverage (if partial denture is fixed). For the progression of this case in the photos, a red arrow is used in the distobuccal of tooth #14 to denote a reference point relative to tissue level, etc. See the pre-operative photo of #14 distobuccal (Fig. 7).

The patient was anaesthetized with 1.7 ml septocaine, 4% with epinephrine 1:100,000 and 1.8 ml of bupivacaine 0.5% with epinephrine 1:200,000. Solea was used instead of a scalpel for flap incisions. The initial Solea incision was made along the crest of the edentulous ridge using Soft Tissue Setting: 0.25 mm spot size, 65 µs pulse duration, 1% mist.

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For ablation of alveolar bone, Solea was used on the Dentin Setting: 1.00 mm spot size, 75 µs pulse duration, 100% mist and 50%–100% variable speed foot pedal. This setting was used to ablate alveolar bone to establish the biologic width while exposing sufficient tooth structure coronal to the alveolus for proper restoration. The spot size was switched 0.25 mm for more precise control on the bone adjacent to the tooth structure. Note the good blood perfusion of the alveolar bone. The red arrow shown after bone ablation prior to suturing (Fig. 10) shows the bone level relative to a reference point near the cementoenamel junction. The flap is shown prior to approximation and suturing (Fig. 11). The level of the alveolar bone was checked radiographically prior to closure with the bone level indicated with red arrows (Fig. 12a). The flap was closed and sutured with four interrupted 3.0 silk sutures. The distal buccal of #14 can be seen with improved gingival tissue position immediately after suturing, as indicated by a red arrow at the reference point (Fig. 12b).

The patient was prescribed chlorhexidine 0.12% rinse, twice per day for ten days and 500 mg of azithromycin on day one, and 250 mg on days two through five. The patient returned for suture removal nine days post operatively, healing well, with no evidence of infection. The patient returned nine days post-operatively, healing well without evidence of infection. The patient did not return until five months later. Ridge and gingiva around #s 16 and 14 were healthy (Figs. 13a and 13b) with normal periodontal probing.

Case 3: Removal of benign oral lesion

The third case is a healthy 76-year-old male patient, presenting with an uncomfortable oral lesion. General dentists routinely encounter these types of cases. The patient had a fibroma-like lesion on the right lateral border of the tongue. The lesion was 5 mm x 5 mm x 3 mm (Fig. 14).

It was ulcerated (de-epithelialized), which was likely the cause of his discomfort. His regular dentist was out of town, and I was seeing that dentist’s emergency patients. I gave the patient three options: seeing an oral surgeon for evaluation and possible excision, reevaluation in a week by his regular dentist, or for me to remove the lesion with Solea that day. The patient chose removal by Solea that day. First, topical anaesthetic was applied (TAC 20 comprised of lidocaine 20%, tetracaine 4% and Phenylephrine 2%). The lesion was excised using Solea on the Soft Tissue Setting: 0.25 mm spot size, 60 µs pulse duration, 1% mist and 40%–80% variable speed foot pedal. This left a clean, blood free surgical site (Fig. 15).

The specimen was preserved in formalin and sent to a pathology lab. After excision, although there was no bleeding, I briefly lased the surgical site with Solea using the Soft Tissue Setting: 0.25 mm spot size, 20 µs pulse duration, no mist and 10%–30% variable speed, to form a "laser bandage" by lightly cauterizing the surgical site (Fig. 15). The patient reported no discomfort either during the procedure or postoperatively. The pathology report stated that the lesion consisted of fibrovascular connective tissue with fibrinoid necrosis and acute inflammation. The patient...
I returned five days later for a routine postoperative visit. The surgical site had healed extremely well (Fig. 16).

**Conclusion**

These cases show that Solea, a 9.3 µm CO2 laser, is a technology that dramatically improves the dental experience for both the practitioner and patient. The speed and precision of the laser allows me to be more efficient while achieving better clinical outcomes. Although local anaesthetic was used in one of the cases discussed in this paper, I actually perform 93% of my hard and soft tissue procedures without anaesthesia. Most crown and bridge procedures and more extensive periodontal surgeries (like Case 3 above) typically require anaesthesia, but these are the only exceptions. In soft tissue applications, there is minimal bleeding which maintains a clean surgical site and the reduced need for sutures. Because of this, I take on procedures that I would have referred out prior to having Solea and I am able to complete these procedures approximately 50% more quickly and with more precision than I could achieve with traditional tools. For my patients, the experience during surgery is dramatically improved and after the procedure they have much less post-operative discomfort. According to feedback from my patients, they love not having to get an injection, hear the “drill”, or feel the vibrations. Patients love that I can work in multiple quadrants during the same visit, reducing their number of appointments, and so do I. Patients are amazed by the experience and are surprised when they find out that this technology is not more common among my peers. I am grateful to be able to practice in a time where such incredible instruments are available.

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