ISSN 1855-9913

Journal of the Laser and Health Academy
Vol. 2024, No.1; www.laserandhealth.com

Improved Vermillion Border Definition with Fotona's LipLase Er:YAG Lip Enhancement Protocol

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ABSTRACT

Laser technology has been used extensively for skin rejuvenation to address various skin concerns. In recent times, its application has been extended to lip rejuvenation to enhance the appearance and texture of the lips.

This article describes a micro-aesthetic enhancement to the traditional LipLase® protocol by adding a third step that outlines the vermilion border, resulting in a more defined lip, as with injected fillers, but without the downside of unwanted effects.

The LipLase® protocol is performed with the Erbium:YAG laser and uses a non-invasive SMOOTH mode. In three steps, it is applied first intraorally, secondly on the vermilion and finally by outlining the vermillion border, cupid´s bow and philtrum´s columns. The treatment is performed over four sessions with four-week intervals. There is a very good immediate response in patients, and even after months have passed patients can still see plumped lips. Maintenance sessions can be provided every 6 months for a long-lasting sustained result.

Key words: Lips, Er:YAG laser, non-ablative mode, SMOOTH mode, lip augmentation, dermal fillers.

Article: J. LA&HA, Vol. 2024, No.1; onlineFirst.
Received: December 21, 2023; Accepted: March 22, 2024

I. INTRODUCTION

Having a suitable shape and volume of the lips has become a sign of youth as well as beauty and sensuality, and therefore also a cultural trend. Nowadays, people are looking for procedures to give volume to the lips. In recent years, it has been reported that one of the most popular aesthetic procedures is the injection of fillers aiming to achieve lip augmentation. Fillers comprised 3.4 million procedures performed in the United States in 2020. Approximately 76% of these 3.4 million total filler injections utilized hyaluronic acid [1,2]. Although hyaluronic acid (HA) fillers have been Food and Drug Administration (FDA) approved, they have been associated with adverse outcomes [1]. These complications range from localized bruising, erythema, edema, migration, allergic response, hyperpigmentation, the formation of small nodules underneath the lips, to more serious sequelae such as nerve paralysis, infection or overfilled lips with poor aesthetic results [1]. As expected, the demand for no-downtime procedures, the fear of needles, and most importantly, adverse outcomes, have guided researchers to develop newer procedures that are safer and non-invasive.

A few years ago, a safer lip enhancement procedure named "LipLase" was developed, which is a 2-step non-invasive protocol with minimal downtime [3]. LipLase enhances the lip to give a fuller, more natural appearance using laser energy with thermal effects that result in collagen remodeling. Compared to fillers, this is a non-invasive treatment, with no puncturing of the skin, minimal discomfort, no downtime, and no known adverse outcomes.

The perception of "ideal" lips can vary based on cultural trends, personal preferences and individual facial features. However, certain general characteristics are commonly associated with aesthetically pleasing lips, including a well-defined vermillion border, balanced proportion, fullness and volume, symmetry, smooth texture, and a natural look. With the original 2-step LipLase® protocol, we addressed two of these features described above. LipLase rejuvenates, fills and plumps lips by providing volume. It also gives balance between the upper and the lower lips. It is important that the volume of the upper lip does not exceed the volume of the lower lip to have a natural look. The lower lip should be the same size or slightly larger than the upper lip to avoid side effects such as the "duck mouth" effect. But this protocol did not address the third characteristic of the "ideal lip", which was a well-defined vermilion border.

Given the need to address this feature, this article aims to update the protocol by adding a third step that outlines the vermilion border, resulting in more well-defined lips, similar to the effect caused by injected fillers. We would also like to provide the reader with an

overall review of the entire protocol using the Er:YAG laser from Fotona (SP Dynamis laser system – Fotona, Ljubljana, Slovenia).

II. MATERIALS AND METHODS

The LipLase® protocol is performed with the Erbium:YAG laser, which holds a unique

position because its wavelength has the highest absorption peak in water at 2940 nm [4]. It uses a non-invasive SMOOTH mode, which is basically a train of 6 interrupted micro-pulses adding up to a total of 200–350 milliseconds, which gradually increases the temperature by "pumping" the heat away from the surface deeper into the tissue. At the same time, the micro-pulses act as stimulators of regenerative signaling cascades[5]. The mechanism of action is based on thermally injuring the tissue in order to cause a regenerative response, resulting in an increase of the fibroblasts and other cells to induce reconstruction of an optimal physiological environment that enhances cell activity, hydration, and synthesis of collagen and elastin [4].

Before treatment, topical anesthetic cream (lidocaine 20% + Prilocaine 10% + Tetracaine 5%) is applied to the lips for a minimum of 30 minutes. Once the cream is removed, the laser treatment is started with the following parameters (Table 1).

Table 1: Parameters.

Laser source	Dynamis SP - Er:YAG (2940 nm)		
	Step 1: Intraoral	**Step 2**	**Step 3**
Pulse mode	SMOOTH Mode	SMOOTH Mode	XLP Mode
Fluence	9 J/cm²	6 J/cm²	3.2 J/cm²
Frequency	1.6 Hz	1.6 Hz	4.0 Hz
Handpiece	PS03X	PS03X	R11
Spot size	7 mm	7 mm	2 mm
# of Stacks	3	3	0
# of Passes	3	3	1
Sessions/Tx Interval	4 sessions every 4 weeks		
Cooling	No		

III. RESULTS

The first step uses an intra-oral technique and applies the 2940 nm Er:YAG set at SMOOTH mode using a patterned, non-ablative PS03X handpiece with 7 mm spot size, 9 J/cm² fluence and a frequency of 1.6 Hz., applying 3 stacks with 3 passes delivered in two rows along the inner region of the labial mucosa. The deepest row has approximately 6 treatment spots and the superficial row has approximately 4 spots, which depends on each patient´s mouth size (Figure 1). The purpose of the first step is to improve the perioral wrinkles, diminish the nasolabial folds and lift the labial commissure [6]. It also produces a decrease in the philtrum length, which is the distance between the base of the nose and the cutaneous mucosal line. With the natural process of chronological aging, the distance mentioned above starts to increase, resulting from sagging skin, which loses turgor and elasticity [7]. There´s evidence that shows that the first step decreases the philtrum length, helping to correct the elongation in this region, and also causes a vermilion eversion making the mucosa more visible so that the lips look plumper and more voluptuous [7].

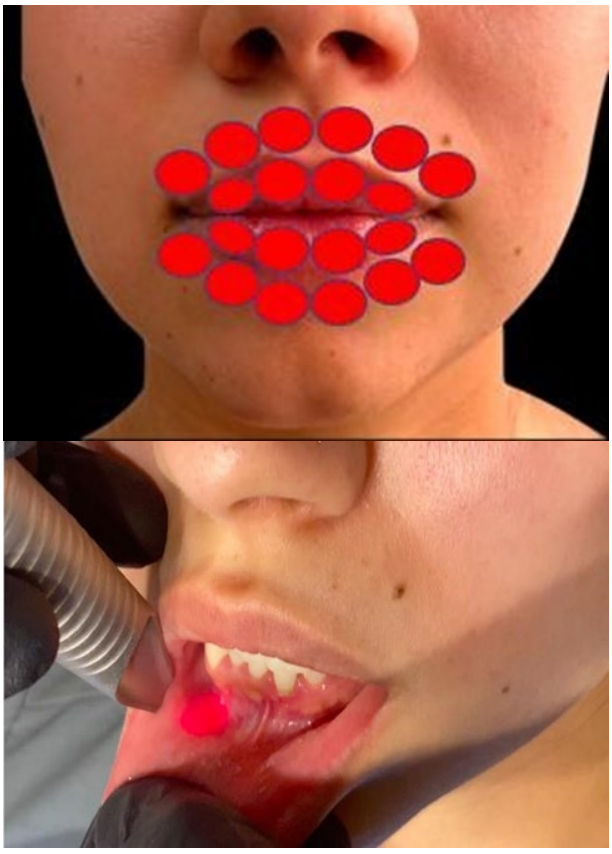

Figure 1: (left) Intra-oral laser application pattern. (Right) example of intraoral laser application.

Step 2 is done in the vermilion and uses the same parameters as step 1, (2940 nm Er:YAG, SMOOTH mode with the PS03X handpiece, 7 mm spot size, and frequency of 1.6 Hz) with a different fluence, done with 6 J/cm². By irradiating the vermilion, a thermal effect produces the response of stimulating collagen remodeling, leading to tissue tightening with the aim of achieving turgid lips [6]. This also creates controlled inflammation to achieve augmentation of the lip volume. 3 stacks with 3 passes are delivered in the vermilion, avoiding the commissures and trying to remain inside the labial margin (Figure 2, 4).

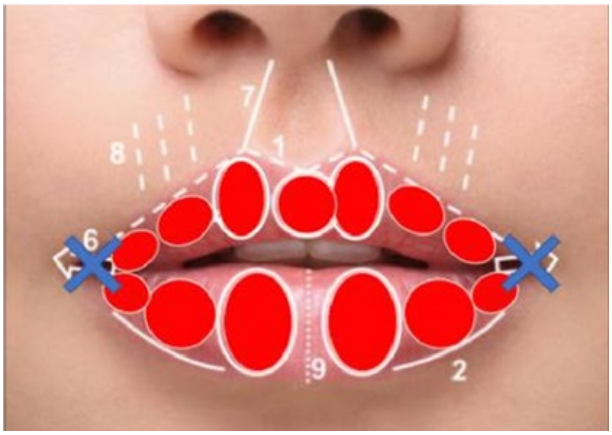

Figure 2: Schematic diagram of laser application; 1-cupids bow, 2-lower vermillion's border, 6-oral commissure, 7-philtral ridge, 8-cutaneous upper lip, 9-Line between lateral tubercles lower lip.

Figure 1: Laser application on the vermillion.

Two extra stacks should be done in the 2 lateral and medial tubercles of the upper lip, and the 2 lateral tubercles of the lower lip as shown in figure 4. These structures have an aesthetically ideal appearance when they have a little more volume than the rest of the vermilion, since they promote an anterior and lateral projection of the lips.

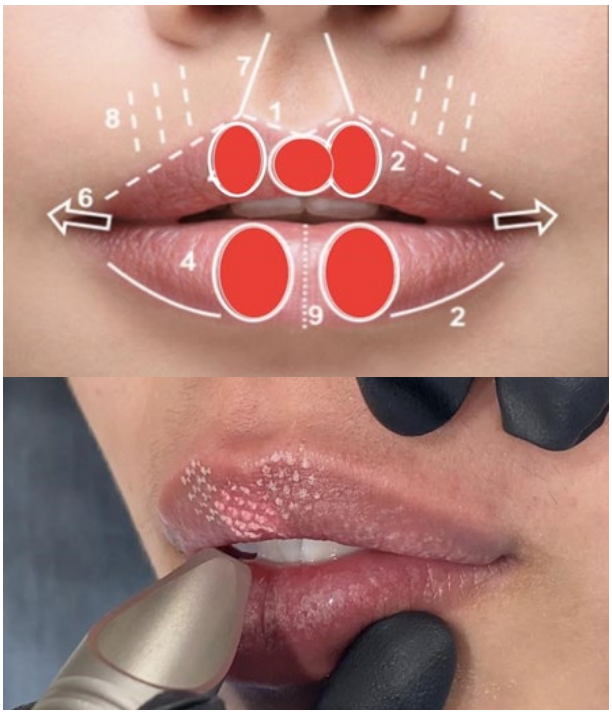

Figure 4: (left) Schematic diagram of laser application of extra stacks1-Cupid's bow, 2-vermillion's border, 4-vermillion, 6-oral commissure, 7-philtral ridge, 8-cutaneous upper lip, 9-line between lateral tubercles lower lip; (right) example of laser application.

The third and newest step added to this protocol consists of outlining the vermilion border and cupid´s bow, so the transition between the vermilion and the skin is more visible, creating a well-defined appearance of the lips. A full beam generated by the R11 handpiece is used to cover 100% density along the vermillion border. Due to the fact that the SMOOTH mode´s smallest spot size is set at 5 mm, which is too big to cover just the vermilion border, a 2 mm spot size is selected with the XLP ablative mode, which is the longest pulse duration to produce a thermal effect for creating a well-defined vermillion border. Set the fluence at 3.2 J/cm^2, and only one pass should be delivered over the labial margin on the vermillion to avoid a bigger ablation depth, and longer recovery time, creating a well-defined border.

Figure 2: Labial margin.

Figure 6: Laser application on the labial margin.

Lastly, a pass is performed over the skin outlining the cupid´s bow and philtrum columns to make them more visible. Normally, these anatomical structures are lost with the chronological aging process and outlining the cupid´s bow and the philtrum columns will help to restore a younger and better-defined appearance (Figure7).

Figure 3: After laser application.

Treatment sessions are performed at 4-week intervals for a total of 4 sessions. The treatment do not requires cooling. Patients have significant improvement in collagen after each session. However, since we lose collagen every day after the age of 25, the higher the number of sessions the better the overall outcome and longer lasting result. Local inflammatory response to the treatment is be expected immediately after the session, lasting approximately 24 hours. Surface peeling can follow, and a superficial scab on the vermillion border can appear lasting between 2 and 3 days. It is recommended to continually apply any moisturizing product available to minimize the extent of the peeling. Other recommendations are to stay hydrated, avoid pigmented lipsticks, vinegar and spicy food for at least 3 days after the procedure. The collagen formation or "neo-collagenesis" starts immediately after the session and continues for 30 days. Maintenance sessions can be provided every 6 months for a long-lasting sustained result.

a) Case 1

A 21-year-old female patient with Fitzpatrick IV received four sessions of the 3-step LipLase® treatment. Figure 8 shows photos of the entire evolution of the patient, before, immediately after the first procedure showing inflammation, 24 hours later with the superficial peeling, and after 2 months showing marked effects due to the collagen formation. The patient was very satisfied with the results and reported positive effects months after the final procedure. No side effects were observed.

Figure 8: Photos before and after the treatment.

b) Case 2

The following case is of a 37-year-old female patient with Fitzpatrick IV who received fourth sessions of LipLase®. Figure 9 shows an amazing effect after the 4th treatment due to the collagen production and remodeling, showing an improvement in the texture of the vermillion, with a very natural look.

Figure 9: Photos before and after the treatment.

c) Case 3

A 36-year-old female patient, Fitzpatrick III, who had previously injected Hyaluronic Acid in her lips received four sessions of LipLase® treatment (Figure 10).

Figure 10: Photos before and after the treatment.

d) Case 4

A 38-year-old female patient, Fitzpatrick IV, who received four sessions of LipLase®, showing a more defined vermillion border and cupid´s bow, without losing the lines, making the lips look more natural than with fillers (Figure 11).

Figure 11: Photos before and after the treatment.

IV. CONCLUSIONS

LipLase® treatment offers a promising solution for addressing various aesthetic concerns of the lip area, including hydration, volume loss, texture irregularities and an indistinct vermillion border. These concerns can be effectively addressed using the non-invasive Er:YAG laser in SMOOTH mode, which functions to stimulate collagen formation without the need to inject any foreign body as with fillers.

The cases presented show very good immediate responses with marked improvement, even at several months after the treatment sessions, due to neo-collagenesis. LipLase® treatment offers a non-invasive and effective solution for individuals seeking to enhance the appearance of their lips, offering improvements in hydration, texture and volume, all with minimal discomfort and no downtime.

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