SuperSMOOTH™: a Novel Hybrid Er:YAG Laser Modality for Fast, Effective, and Minimally Invasive Skin Rejuvenation – a Clinical Case Series

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ABSTRACT

The SuperSMOOTH™ modality marks a significant advancement in laser technology, made possible by Fotona's proprietary innovations in laser power supply technology. This cutting-edge novel hybrid approach integrates two well-known Er:YAG laser modalities from the multimodal Fotona4D® rejuvenation protocol into a single, streamlined treatment step, making the treatment faster, more effective and more comfortable. This clinical case series study introduces and evaluates the SuperSMOOTH™ treatment modality, which combines non-ablative thermal effects of Fotona SMOOTH® pulses with the superficial ablative peel of SupErficial™ micro short pulses in a single-step treatment. This dual-mode laser protocol for skin rejuvenation aims to enhance facial skin tightening, stimulate new collagen synthesis, and improve overall skin structure and function.

A prospective clinical case series was conducted on ten participants (Fitzpatrick skin types I–III) presenting mild to moderate signs of aging. Each participant underwent one or two SuperSMOOTH™ treatment sessions using either high or low pre-set parameters. Aesthetic outcomes were assessed using the Global Aesthetic Improvement Scale (GAIS), measurement of satisfaction with the treatment results, and responses to whether they would recommend the treatment to others.

Results showed improvement across all participants, with the highest mean GAIS scores observed for skin texture, softness and overall skin appearance (2). 9 out of 10 participants were "satisfied" or "very satisfied" with the treatment results, 1 felt "neutral", and all would recommend the treatment to others. No adverse events beyond expected erythema and mild peeling were reported. The laser therapy procedure was well tolerated without the use of anesthetics, with minimal downtime.

The SuperSMOOTH™ modality demonstrates a promising, safe, and effective approach to minimally invasive skin rejuvenation. By combining the benefits of both non-ablative and ablative Er:YAG laser technologies, it offers an efficient minimal-downtime solution for improving skin quality with a rejuvenation effect. Further studies with larger, more diverse populations and extended follow-ups are recommended to validate these findings and explore long-term outcomes.

Key words: SuperSMOOTH™, Er:YAG, controlled thermal remodeling, superficial peel, skin rejuvenation.

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I. INTRODUCTION

The demand for minimally invasive skin rejuvenation treatments has grown substantially in recent years, as patients increasingly seek effective results with minimal discomfort and downtime. Among other lasers used in dermatology, Er:YAG (2940 nm) lasers have gained prominence for their high absorption in water, therefore in the epidermal and dermal layer of the skin, resulting in the ability to target signs of aging, such as fine lines, skin laxity, and uneven texture through precise and controlled skin resurfacing laser treatment [1].

The classification of an Er:YAG laser skin resurfacing procedure as ablative or non-ablative (Fig. 1) depends on the dose or amount of laser energy delivered to the treated area, where the energy dose is defined by the pulse duration and fluence (F, expressed in J/cm²) [2].

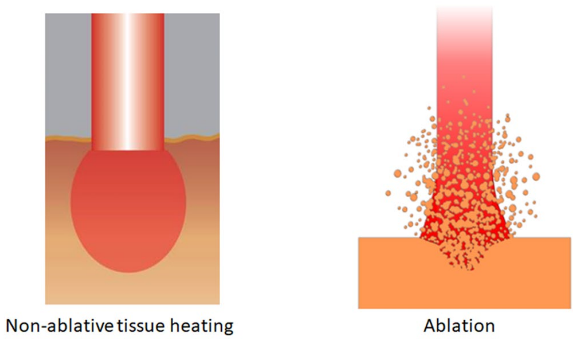

Fig. 1: Non-ablative and ablative resurfacing of soft tissue. On the left, the non-ablative laser pulse is displayed, where the thermally affected tissue is colored in red. On the right, the ablative laser pulse is displayed, where the top epidermal layer of soft tissue is being removed.

The Fotona SMOOTH® mode Er:YAG laser enables non-ablative skin resurfacing by leveraging a Dual-Tissue Remodeling (DTR) mechanism [3]. Initial controlled short-duration thermal shock pulses heat the upper layers of the skin and induce remodeling of the epithelial and connective tissues without any injury to the epithelia, based on the mechanism of intense heat shock biomodulation (i-HBM) [3, 4]. The following prolonged heat diffusion causes a reactive inflammatory and regenerative response that results in triggering collagen production and activation of regenerative signaling pathways, leading to activation of fibroblasts, synthesis of extracellular matrix proteins and general improvement of skin structure and function [5].

The use of non-ablative Fotona SMOOTH® Er:YAG treatment is well established in areas of aesthetic dermatology, gynecology, and ENT [4]. Non-ablative thermal resurfacing of the skin and mucosal tissue activates production of extracellular matrix and cell signaling processes related to skin regeneration. The increase in collagen, vascularization, epithelial thickness and fibroblast proliferation results in skin tightness, elasticity, overall rejuvenation and regeneration of the skin and mucosa [4, 6, 7]. The effects of the Er:YAG laser tissue remodeling are long lasting and the effects build up for weeks after the treatment, continuing up to 6 months following the treatment [4].

In Er:YAG ablative resurfacing procedures, the top epidermal layer of the skin is removed in a controlled manner in order to reduce cutaneous signs of aging [8]. The depth of ablation, as well as the thermal effects, can be modulated in Fotona's ablative resurfacing treatments by precise control of the delivered fluence (which determines the ablation depth) and the pulse duration (which determines the extent of thermally-affected tissue around the ablated area). For example, if more dramatic results are wanted and the patient can tolerate longer downtime, a more invasive deep and warm skin resurfacing technique can be used [9]. On the other hand, if a minimally invasive solution is preferred to improve texture and skin glow with minimum downtime, a superficial light peel with negligible thermal effects, as in the Fotona4D® SupErficial™ treatment protocol, can be delivered [10, 11, 12].

To combine the benefits of both ablative and non-ablative Er:YAG procedures, a novel SuperSMOOTH™ Er:YAG laser treatment modality was recently developed. The SuperSMOOTH™ modality combines a non-ablative Fotona SMOOTH® train of pulses, followed by one ablative SupErficial™ micro short pulse (MSP). The pulse structure was developed by utilizing proprietary Adaptive Square Pulse (ASP) pulse-shaping technology (Fig. 2) [13].

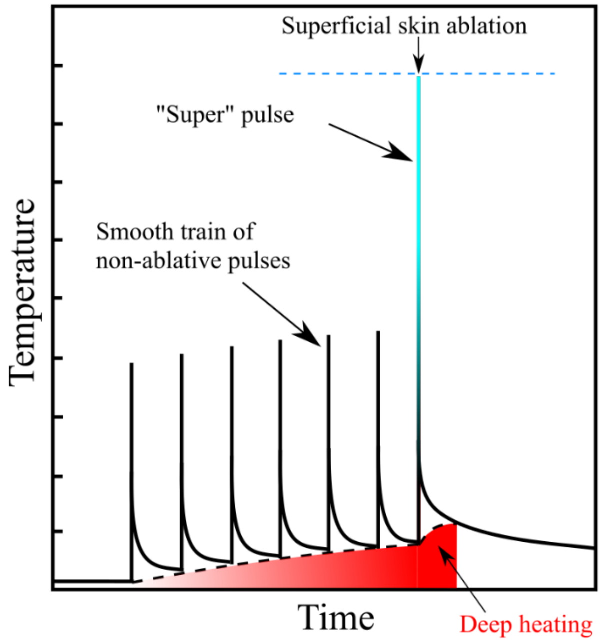

Fig. 2: An Er:YAG laser SMOOTH resurfacing streamlined pulse sequence (example for N = 6 is shown) resulting in higher temperatures, with 1 Er:YAG superficial gentle ablative pulse added at the end.

In SuperSMOOTH™ treatment, the Fotona SMOOTH® component creates a controlled thermal effect in the deeper layers of the skin, stimulating fibroblasts for new collagen synthesis, collagen remodeling, skin tightening, and tissue regeneration [4] The second component, the SupErficial™ mode [10] or MSP, provides a gentle peel through a very superficial ablation of the uppermost skin layer, targeting uneven textures and dullness for a brighter and more even complexion of the skin.

With this single-step laser stacking, Fotona's SuperSMOOTH™ modality marks a significant advancement in laser technology, made possible by proprietary innovations in the laser power supply. This cutting-edge hybrid approach integrates two Er:YAG laser modalities into a single, streamlined treatment step, making the treatment faster, more efficient and more comfortable.

By delivering both modalities nearly simultaneously, SuperSMOOTH™ may leverage the gate control theory of pain. This theory suggests that the transmission of afferent impulses through the spinal cord is influenced by the relative amount of activity through large and small diameter fibers [14]. This means that afferent signals from superficial ablation (conveyed through larger diameter Aβ and Aδ fibers) relative to signals due to intense heat (conveyed through small C fibers) attenuate the actual perception of pain [13].

This article describes the clinical benefits of

SuperSMOOTH™ in a series of patients, showing significant effects even in patients with more pronounced signs of ageing, positioning it as a promising innovation in the field of laser-based facial rejuvenation.

II. MATERIALS AND METHODS

a) Laser protocol

The SuperSMOOTH™ protocol was performed using Fotona's TimeWalker II® laser system with a PS03X handpiece (both manufactured by Fotona, d.o.o.). It was done in a single, streamlined, hybrid treatment step combining the Fotona SMOOTH® and SupErficial™ 2940 nm Er:YAG laser modalities.

One of the components, known as the "SMOOTH" step, delivers rapid sequences of 6 non-ablative Er:YAG pulses (Fig. 2) with the parameters described in Table 1.

The second superficial MSP component or so-called "Super" part of the hybrid pulse (Fig. 2) provides a gentle peel of the uppermost skin layer through cold superficial ablation. One micro-short laser pulse was delivered with fluence as seen in Table 1 below.

Table 1: SuperSMOOTH™ treatment parameters

Pre-sets		SMOOTH pulse	MSP pulse
High	Fluence	6 J/cm²	3.6 J/cm²
	Number of stacks	1 stack	/
	Delay between pulses	No delay	/
Low	Fluence	4 J/cm²	3 J/cm²
	Number of stacks	1 stack	/
	Delay between pulses	No delay	/

The SuperSMOOTH™ treatment modality is integrated into the TimeWalker® II laser system. The Graphical User Interface (GUI) (Fig. 3) shows fluence parameters for the "SMOOTH" and "Super" components, number of stacks, delay between the pulses, spot size, laser wavelength, handpiece and type of the pulse. Additionally, the GUI also provides information on the maximal final skin temperature increase following SuperSMOOTH™ pulse irradiation using the selected parameters. This information is displayed in a form of Fotona's proprietary Surface Temperature Parameter (STP) [15]. The STP parameter is normalized such that an STP value equal to 100% corresponds to the average patient's pain threshold temperature for SMOOTH® mode treatments in the absence of topical anesthesia.

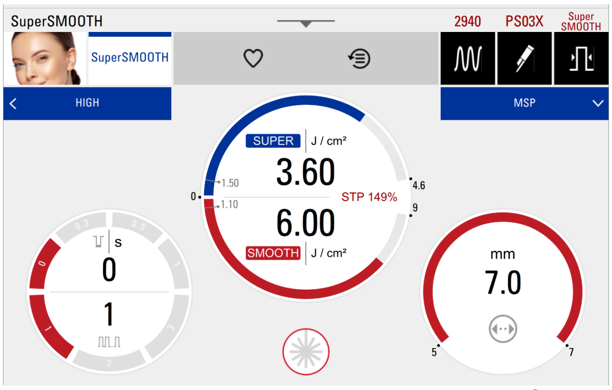

Fig. 3: Graphical User Interface on the TimeWalker® II laser device displaying the high pre-set parameters of the SuperSMOOTH™ protocol. Notice that the resulting STP value of 149% is substantially above the pain threshold of STP = 100% as calculated for a standard single mode of the SMOOTH® treatment. The observed patient tolerance for a substantially higher STP is attributed to the pain control effect of the delivered SuperSMOOTH™ modality.

High pre-set parameters were used for a more pronounced tightening and peeling effect. Low pre-set parameters were selected for participants with sensitive skin, and in cases where the high pre-sets could not be tolerated. When the high pre-set parameters are selected, the treatment is done with a fast-brushing method, performing three passes to cover the whole facial area. When the low pre-set parameters are selected, the treatment is done using a slow-brushing method, and only 1 pass is done to reach the whole coverage of the facial area that is being treated. Ablative pulses leave a whitish mark on the skin and can be used as a visual guide to optimize treatment coverage, as shown in figure 4 below.

Fig. 4: The SuperSMOOTH™ procedure using low pre-set parameters with visible whitish mark from the ablative pulse.

No anesthesia or air cooling was used before or during the treatment.

b) Participants

Altogether, 10 participants with Fitzpatrick skin types I-III who experienced mild skin sagging, fine lines and uneven skin texture participated in a prospective clinical case series study. The participants' mean age was 45 ± 15 years, including 7 females, and 3 males. A signed informed consent was obtained, and the procedure was performed according to the Declaration of Helsinki.

c) Treatment protocol

Each participant underwent either one or two treatment sessions, 3 - 4 weeks apart, using either low or high pre-set parameters of the SuperSMOOTH™ protocol. High pre-set parameters were used with 8 participants, while low pre-set parameters were used with 2 out of 10 who participated in the clinical case series (Table 2). In the group with high pre-set parameters, there were 6 females and 2 males, with mean age 49 ± 14 years. The group with low pre-set parameters had 1 female and 1 male participant with mean age 32 ± 9 years.

Table 2: Treatment session parameters and number of sessions per participant

Parameters	Participants	No. of treatments
High	P1	2
	P2	2
	P2	2
	P3	2
	P4	2
	P5	2
	P6	1
	P7	1
	P8	1
Low	P9	2
	P10	1

d) Evaluation protocol

Photographs of the participants were taken with a Samsung Galaxy S22 phone camera at baseline and 3 weeks after the final treatment. To evaluate the aesthetic improvement, the Global Aesthetic Improvement Scale (GAIS) was used for patient-reported aesthetic improvement. Participants' satisfaction with the overall treatment results was evaluated using a 5-point Likert scale, and the participants were also asked if they would recommend the treatment to others.

The GAIS is a 5-point scale used to assess aesthetic outcomes of the treatment, ranging from - 1 meaning "worse than before", to 3 meaning "very much improved" (see Table 3). With the GAIS scale, the participants evaluated their aesthetic improvement in skin texture, skin elasticity, skin laxity, fine lines, deeper wrinkles, skin softness, and overall skin appearance.

Table 3: Global Aesthetic Improvement Scale

Very much improved	3
Much improved	2
Improved	1
No change	0
Worse than before	- 1

Patient satisfaction with the results of the treatment was also evaluated using a 5-point Likert scale, where the participants were asked to rank their satisfaction with the treatment results from 1 (meaning "very unsatisfied") to 5 (meaning "very satisfied") as described in Table 4 below.

Table 4: Patient satisfaction with the treatment results using a 5-point Likert scale

Very satisfied	5
Satisfied	4
Neutral	3
Unsatisfied	2
Very unsatisfied	1

These evaluations were done 3 weeks after the final treatment session. At this time, they were also asked to indicate if they would recommend the treatment to others with a "yes" or "no" answer. Treatment discomfort and the occurrence of adverse events were monitored during and after the treatment sessions.

III. RESULTS

GAIS results, as presented in Table 5, show that all the participants evaluated their overall skin appearance as "improved", "much improved" or "very much improved".

Table 5: Patient-reported results from GAIS scale questionnaire

Participants	Skin texture	Skin elasticity	Skin laxity	Fine lines	Deeper wrinkles	Skin softness	Overall skin appearance
P1	1	1	1	0	0	1	1
P2	2	1	1	1	0	1	1
P3	3	2	2	2	0	2	2
P4	1	1	1	1	1	1	1
P5	3	1	1	2	2	3	3
P6	1	1	0	1	0	1	1
P7	1	2	2	2	1	2	2
P8	2	2	2	2	2	3	3
P9	3	2	0	2	0	3	3
P10	3	2	2	2	2	3	3

Mean GAIS results for specific skin features show that the highest improvement was achieved in skin texture, skin softness and overall skin appearance with a mean of 2, followed by fine lines and skin elasticity improvement with mean 1.5, skin laxity with 1.2, and finally deeper wrinkles with a mean score of 0.8. Notably, none of the participants scored any of the features evaluated by the GAIS scale with - 1 "worse than before". Results of the mean improvement scores for specific features are shown in Fig. 5.

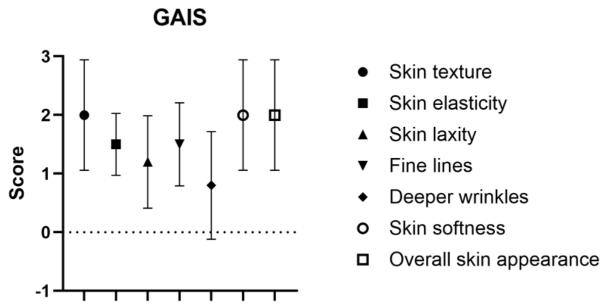

Fig. 5: GAIS scale for specific evaluated skin features. The graph shows mean results ± SD.

Both the GAIS scores of the participants separately, and the photos taken at baseline and 3 weeks after the final treatment session, demonstrate noteworthy improvement. In figure 6, a noticeable improvement of skin redness and skin texture can be seen. Figure 7 shows an improvement of skin texture and less visible deeper wrinkles on the forehead area after 2 SuperSMOOTH™ treatment sessions. In figure 8, improvement of fine lines around the eye area and skin elasticity can be noted. Improvement in under-eye skin texture and a skin-tightening effect is most evident with the participant presented in figure 9.

Fig. 6: Left image taken before the first session; right image showing the results 3 weeks after the final session. An improvement in skin texture and redness can be seen.

Fig. 7: Left image taken before the first session; right image showing improvement in deeper wrinkles and skin texture on the forehead area 3 weeks after the final treatment session.

Fig. 8: Fine-lines improvement around the eye area. On the left, image taken before the first session; on the right, image shows the results 3 weeks after the final treatment session.

Fig. 9: Left image taken before the first session; right image shows the results 3 weeks after the final treatment session, with improvement in under-eye skin texture and a skin tightening effect.

Satisfaction with the SuperSMOOTH™ treatment results measured with the 5-point scale demonstrates that 4 participants were "very satisfied", 5 were "satisfied" and 1 felt "neutral" about the results achieved with the treatment.

On the question of whether the participants would recommend the SuperSMOOTH™ treatment to others, all 10 participants answered with "yes". When asked about any additional observations, most participants noted that their skin felt softer, smoother, and more radiant and glowing following the treatment.

No adverse events other than the expected effects from laser therapy were reported. Discomfort during treatment was noted as tolerable, and no anesthetics or air cooling were used during treatment. All participants experienced erythema that subsided within 48 hours, and light peeling of the skin that lasted up to about 3 days post-treatment. For aftercare, only La Roche-Posay's Cicaplast Baume B5+ was used.

IV. DISCUSSION

A novel SuperSMOOTH™ Er:YAG laser rejuvenation technique, combining a Fotona SMOOTH® non-ablative train of pulses with a SupErficial™ ablative component, shows to be an effective and well-tolerated approach for facial rejuvenation with minimal downtime.

The combination of controlled thermal stimulation through a non-ablative Fotona SMOOTH® pulse [3, 4] combined with an ablative MSP pulse [8] in a single hybrid SuperSMOOTH™ pulse, appears to leverage the benefits of both laser modalities. This dual-action approach has shown to be effective based on the observed clinical improvements of the participants in this clinical case series. It has been reported previously that the thermal effect induces fibroblast activity, collagen neogenesis, and tissue remodeling [4, 5, 7, 11, 12], while the gentle ablative component targets surface irregularities and dullness, improving overall skin radiance and texture of the skin [4, 8, 10-12]. These results are consistent with previously reported benefits of non-ablative and ablative Er:YAG modalities used individually [3–5, 7-12] and suggest that their integration with the SuperSMOOTH™ protocol may produce combined effects.

All participants reported improvements in multiple skin quality parameters, including texture, elasticity, and fine lines, as well as improvement in overall skin appearance as assessed by the GAIS scale. Participants' satisfaction scores also showed overall satisfaction with the treatment results.

The treatment was safe, with minimal downtime, and was performed without anesthesia or air cooling. As described in Lukac et al. (2025), the gate control theory of pain may explain why the SuperSMOOTH™ modality, despite having a higher thermal load than the Fotona SMOOTH™ mode, results in lower overall perceived pain. This enables more aggressive treatment, which allows for better treatment results. No adverse events beyond the expected transient post-treatment erythema and mild peeling were observed. Figure 10 shows the expected erythema immediately after the treatment.

Fig. 10: Skin appearance right after the SuperSMOOTH™ treatment session.

A high level of patient satisfaction further supports the novel hybrid protocol, as 9 out of 10 participants reported being either "very satisfied" or "satisfied" with the treatment results. Only 1 felt "neutral" about the treatment results. Notably, all participants stated they would recommend the procedure to others, highlighting a strong endorsement of patient-perceived benefits.

Given the theory of the biological response of the skin tissue interaction with the laser [2-4], the results of this clinical case series aligns with expectations. The most significant improvements were observed in parameters related to skin texture, skin softness, and overall skin appearance (mean GAIS score 2), followed by skin elasticity and fine lines (mean 1.5), while deeper wrinkles showed more modest gains (mean 0.8) on a scale from - 1 to 3. This aligns with the expected physiological effects of non-ablative thermal stimulation, which predominantly improves superficial dermal characteristics and early signs of aging, rather than extensive remodeling of the deeper skin structures, which usually requires more aggressive resurfacing procedures to be effectively treated.

The SuperSMOOTH™ procedure can be an ideal solution as a "prejuvenation" procedure, suitable for younger patients that wish to prevent or delay the cutaneous signs of aging. For example, see figure 8, showing how fine lines around the eye area were removed following two SuperSMOOTH™ treatments on a young participant.

It should be noted that with some participants in this clinical case series, a significant improvement in the appearance of deeper, more pronounced wrinkles was also observed, suggesting the suitability of SuperSMOOTH™ as a treatment solution for all patients seeking a short and minimally invasive, yet effective skin rejuvenation procedure.

While promising, this clinical case series study has limitations. The sample size was small (n = 10), and the study population was limited to Fitzpatrick skin types I–III. As such, results may not be generalizable to broader or more diverse populations, including those with darker skin types that are prone to hyperpigmentation [1, 10] or with patients who may have different risk profiles. In addition, follow-up was limited to 3 weeks post-treatment. Although existing literature suggests that collagen remodeling and skin tightening effects post Er:YAG laser treatment can continue for up to 6 months post-treatment [4], long-term studies with more participants are needed to confirm the durability of effects observed in this study. Ideally, additional studies would include assessment of skin quality improvement using different objective methods such as dermatoscopic images and skin analysis systems.

Despite the above limitations, this clinical case series study provides early evidence supporting the efficacy and safety of the SuperSMOOTH™ modality as an innovative approach to minimally invasive skin rejuvenation. The streamlined, single-step application enabled by proprietary ASP pulse-shaping technology, offers practical advantages and provides a new solution for effective skin rejuvenation with minimal downtime.

V. CONCLUSIONS

The novel hybrid SuperSMOOTH™ Er:YAG laser treatment, which combines the skin tightening effects of the Fotona SMOOTH® modality with the skin resurfacing effects of ablative SupErficial™ MSP peeling, has shown to be an effective and safe skin rejuvenation technique with minimal downtime. In this clinical case series, the SuperSMOOTH™ modality achieved the highest improvement scores in overall skin appearance, skin texture, and softness of the skin, followed by fine-lines improvement, which aligns with the expected outcomes based on the known benefits of Er:YAG laser skin rejuvenation treatments.

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