ISSN 1855-9913

Journal of the Laser and Health Academy
Vol. 2020, No.1; www.laserandhealth.com

Non-Ablative Resurfacing of Mucosal Tissue by SMOOTH-Mode Er:YAG laser

(Submitted for presentation at the 3rd LA&HA Super Symposium 2020; online Sept/Oct 2020)

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SUMMARY

Er:YAG laser is generally known as an ablative laser that can be used for a number of resurfacing procedures, most frequently performed in dermatology [1, 2]. While ablative laser resurfacing procedures have been found to be extremely effective, a major disadvantage is the erosion of large surfaces, necessitating long recovery and introducing risks of infections, scarring or hyper- and hypo-pigmentation [3, 4]. For this reason, it has been proposed to utilize the unique superficial absorption characteristics of Er:YAG also for less invasive, non-ablative treatments [5-7]. Non-ablative Er:YAG laser treatments which are performed by delivering a series of low-fluence pulses inside a super-long SMOOTH pulse have gained significant popularity in recent years [8], and their use has expanded from dermatology into gynecology for treatment of urinary incontinence and vaginal atrophy related to the GSM [9-12], otorhinolaryngology for minimally invasive treatment of snoring [13-16], and as well in aesthetics where the intraoral SMOOTH treatment has been demonstrated to represent a safe, painless, and effective treatment option for accentuated nasolabial folds (NLFs) wrinkles [17-18].

The expression "resurfacing" generally implies removal of the tissue [19]. During ablative resurfacing the tissue is vaporized immediately. On the other hand, with non-ablative resurfacing the removal occurs later when the epithelial and connective tissue is devitalized and replaced. For example, histological studies of fractional non-ablative resurfacing procedures have shown the laser-affected tissue to be extruded through the heat-induced channels over the course of several days following the treatment [20, 21].

With the less aggressive SMOOTH mode treatments, the delayed tissue replacement process is less evident. The long-term effects of SMOOTH technology on cutaneous and mucosal tissues have been histologically evaluated, as were its short- and long-term clinical effects [8, 22-26]. We are however missing information about immediate laser treatment-related changes that are occurring within the treated tissue. To that end we conducted a pilot study to which 40 healthy female patients with regular periods, aged between 30 and 49 years, were recruited. They were allocated into active and control group. The active group received a single session of intravaginal laser treatment using the G-Runner handpiece, following the IntimaLase® vaginal laxity protocol [11]. Treatment was performed in the first half of participants' menstrual cycles, day 11 average (range: day 8–13). The control group with comparable demographic characteristics received no treatment. Cytological samples were obtained for evaluation from the upper third of both vaginal walls prior to laser treatment, immediately after, the next day, after two days and 6 days after the laser session. In the control group two samples were taken during the baseline visit, whereas further sampling followed the same scheme as in active group.

A significant exfoliative effect ($p<0.0005$) of superficial cells of the vaginal mucosa epithelium was observed to occur following the SMOOTH pulse stacking treatment, with the "peeling" effect taking place over the course of one week (see Fig. 1).

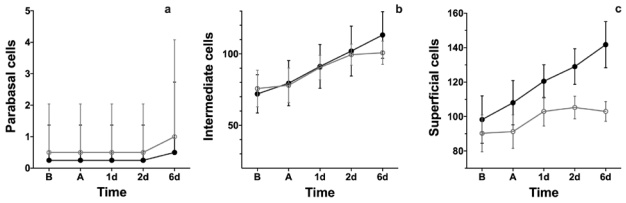

Fig. 1: Cell counts in vaginal specimens during the course of the study, *a* parabasal cell, *b* intermediate cells, *c* superficial cells. Empty circles represent control group, full circles represent active group.

We believe that because vaginal and buccal epithelia are structurally and microscopically similar [27], the presented findings apply also to the treatments of oral mucosa. This is supported also by the fact that due to the scarcity of sizeable specimens of normal oral mucosa, studies on vaginal mucosa are commonly used as a substitute for studies of buccal mucosa [28, 29].

Our study thus demonstrates that although the exfoliation of the vaginal epithelial cells is a natural process, there is a significantly increased tissue removal following the non-ablative SMOOTH mode treatment. In conclusion, this type of treatments is in reality "delayed ablative", and therefore belongs to the

category of non-ablative resurfacing procedures. We hypothesize that the observed tissue removal process represents an initial stage of the restructuring process, which further on leads to mucosal tissue regeneration.

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