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Pixel Screen Technology and FRAC3 – A Full Spectrum of Laser Skin Rejuvenation Treatments

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INTRODUCTION

Fractional laser skin rejuvenation has recently gained a lot of interest due to the fact that the remaining healthy tissue around the fractional damage spots can act as healing centers. The approach, to date, has been forming the fractional pattern as a two-dimensional matrix; resulting in the illuminated columns below the spots being damaged uniformly (see Fig.1 b). For ablative and skin-surface treatments this approach is very effective as it allows a 'lighter' variant of the traditional ablative procedure to be completed, with a lower density effect and faster recovery times. However, for non-ablative, deeper, skin-volume treatments this technique is non-selective with regard to local skin imperfections, and is therefore less suited for these particular procedures.
For this reason Fotona is also pioneering the novel FRAC3 laser treatment, based on their Nd:YAG Accelera pulse mode characteristics. The method produces a three-dimensional, fractional pattern within the epidermis and dermis, with damage islands located predominantly at the sites of minute skin imperfections and/or inhomogeneities (See Fig.1c). This self-induced fractionality has been found to be especially pronounced in skin with a higher number of aging imperfections.

FRACTIONAL TREATMENTS USING PIXEL SCREEN TECHNOLOGY

Fotona Er:YAG lasers have always offered a range of rejuvenation treatments with the ability to use Fotona's Variable Square Pulse technology to control the balance between ablation and thermal effects on the treated tissue. The spectrum of treatments possible ranges from pure cold ablation, through a balance of ablative and thermal effects, to solely thermal effects [1]. The Pixel Screen Technology (PST) works in conjunction with Fotona's highly-effective Er:YAG lasers. The Pixel Screen distributes the energy as an array of small point beams generating, very finely-focused, high-intensity treatment columns.

The treatment effect of the PST is to add a further level of control to the procedures above, with a smaller proportion of the skin surface being treated, and with the capability to fine-tune this further through the variation of the pixel density used. This less-invasive treatment modality significantly reduces downtime after the procedure.

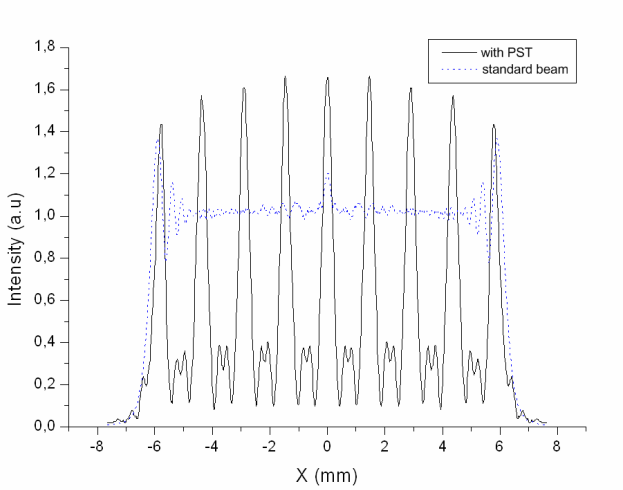

Fig. 2: The laser intensity profile for a standard Er:YAG laser beam (dotted line) and with Pixel Screen Technology (continuous line).

NOVEL THREE DIMENSIONAL FRACTIONAL TREATMENTS

While the action of more-conventional fractional techniques, such as those provided by the Fotona Pixel Screen, are well-known and have now been proven over a number of years, the novel FRAC3 treatment being pioneered by Fotona is not so widely known. Fotona utilize a special operating mode, Accelera, developed to enable short, sub-2ms pulses in their renowned high-performance Nd:YAG laser systems, to create self-selective treatment micro-zones within the skin [2]. The laser energy acts only on the minute skin imperfections within the skin volume, thus reducing the collateral damage and only creating localized 'damage islands'. With this selective, very-localized and three-dimensional distribution of the treatment effects, 'damage islands' are surrounded by unharmed healthy tissue which can then promote the speedy healing of the treated tissue.

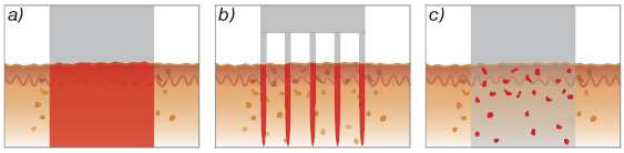

Fig. 1Laser induced damage islands as healing centers.

Skin surface measurements of the temperature distribution following treatment with an Nd:YAG laser in Accelera mode were performed in-vivo on patients' hands. Figure 3a shows a typical skin temperature profile following a standard 20 msec long Nd:YAG pulse, while Fig.3b shows the temperature profile following a short-duration Accelera pulse. Self-induced temperature fractionality can only be observed following illumination with the Accelera pulses, while with standard pulse durations heat conduction from the skin inhomogeneities to the surrounding tissue prevents temperature build-up, and thus no hot islands are observed within the skin [2]. Note, that the 'temperature islands' observed here were found to be more prevalent in older patients than in younger ones, meaning that this treatment modality is particularly effective within anti-aging therapies.

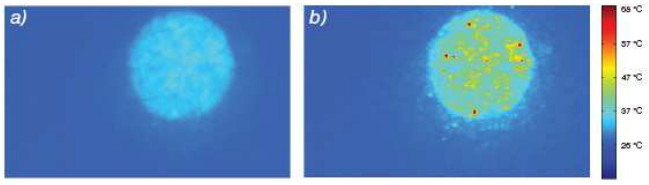

Fig. 3 Skin surface temperature profile.

Self-induced temperature fractionality was also observed deeper within the skin. Figures 4a & b show the temperature distribution following Nd:YAG pulses as seen in-vitro on a skin cross-section from skin excised from a female human belly. Figure 4a shows the typical skin temperature profile following a standard 20 msec long Nd:YAG pulse, and Fig. 4b shows the temperature profile following a short-duration Accelera pulse. Again, self-induced temperature fractionality can only be observed following illumination with the Accelera pulses.

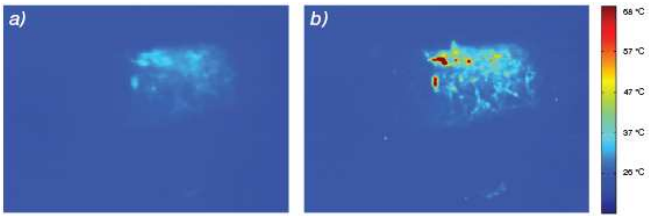

Fig. 4 Skin cross-section temperature profile.

Preliminary clinical results show the procedure to be more effective with substantially reduced healing times. Furthermore, no special optical device is needed, thus leading to better cost-effectiveness for the skin rejuvenation procedure as well.

One feature of this treatment modality is its requirement for relatively high energy and fluences at short pulse durations, meaning it is difficult to achieve with larger spot sizes. Thus, for larger area coverage and ease and speed of treatment, a scanner is the ideal beam delivery method. The Fotona S-11 scanner enables FRAC3 treatments to be quickly and easily carried out with optimal spot sizes, and an adjustable scan area of up to 42 cm^2.

Fig. 5 Fotona SP Plus Er:YAG/Nd:YAG combination laser system.

CONCLUSIONS

With the option of fractional treatments using both Er:YAG and Nd:YAG laser sources, especially with the three-dimensional, self-selective nature of Fotona's FRAC3 technology, Fotona is poised to be able to provide the most comprehensive range of anti-aging, rejuvenation and resurfacing treatments available.

The new Fotona FRAC3 laser method, in combination with Fotona's S-11 scanner, is promising to be the next step in improved laser skin rejuvenation procedures, with its efficacy, selectiveness, short healing time and cost effectiveness

REFERENCES

1. Matjaž Lukač Ph.D., Tom Sult M.D., Robin Sult R.N, New Options and Treatment Strategies with the VSP Erbium YAG Aesthetics Lasers, Journal of the Laser and Health Academy Vol. 2007; No.1/1; www.laserandhealth.com.
2. Martin Gorjan, Ladislav Grad Ph.D., Matjaž Lukač Ph.D., Three Dimensional Fractional Laser Skin Rejuvenation, IMCAS 2008 Abstracts Booklet, Posters, P28.

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