Discussion

The biological control markers of hair following laser treatment may include hormones (androgens, 5-alpha-reducatase) non-steroidal (retinoic acid receptors, Vitamin D receptors, thyroid hormone receptors) growth factors (EGF, FGF), cytokines or stem cells. The role of stem cells in the formation of new anagen hair follicles makes these cells a logical target for destruction during light-based therapy to remove unwanted hair (1-3).

The SHR technique employs volumetric heating of the dermis, where the hair follicle is nourished and recycled. We speculate that since a certain temperature is required to eliminate hair follicles and their adjacent biological structures, it is apparent that temperature in the dermis, as a direct consequence of heat accumulation produced by the high average power of the SHR technique, can alter the hair structure and stem cell function. It is noted that although the fluence of each individual pulse delivered to the skin is relatively low (10J/cm^2), the rapidly-delivered pulses are, collectively, effective to heat the patient's dermis and to thermally injure the hair follicle.

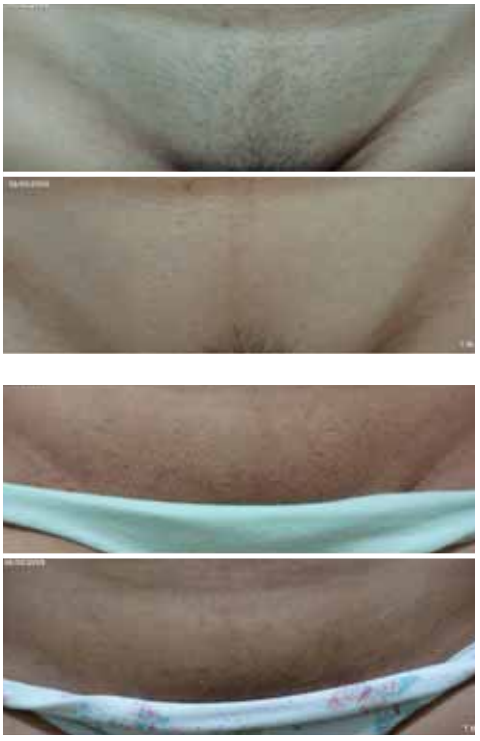
Since the hair follicle is at least in thermal equilibrium with surrounding tissue, and the hair follicle is sensitive to heat, under the repetitive and prolonged laser exposure conditions, the hair follicle is thermally prone to heat insult/damage. Also, heat propagation from dermis to hair follicles may be the reason for cytoplasma changes and vacuola formation and hyaline necrosis as observed in practically all immediately-after samples. Due to the very high average power, the melanin in the hair follicle that is acting as chromophore conduct, experiences temperature rise above that of the dermis temperature. We postulate that because the dermis is a good heat conductor, the temperature of the hair follicle does not drop below the temperature of the heated dermis. In fact, the duration of each pulse in the SHR mode is less than the thermal relaxation time of most of the hair follicles, allowing a certain amount of delivered energy to be localized within the hair follicle. Thus, it is assumed that the temperature of the heated hair follicles exceeds the temperature of the heated dermis.

Thus, once the sub-dermal layer is sufficiently heated (45ºC -50ºC), individual pulses only need to provide enough energy to the hair follicle to raise the temperature of the hair follicle from a temperature at or above the heated-dermis temperature, to a temperature (50ºC - 55ºC) effective to impair the function of biological elements responsible for hair re-growth such as hormones, growth factors, or stem cells.

Conclusion

The use of the SHR volumetric technique in patients with dark skin types may substantially reduce pain or discomfort and minimize severity of blistering, scabbing, crusting and hyper/hypopigmentation. In addition, little to no prolonged epidermal effects, such as redness and inflammation of epidermis and no downtime before (no topical anesthesia) or after treatment makes the SHR treatment more comfortable and safer than traditional lasers systems.

Clinical Results



Before and 3 months after 4 treatments

Photographs courtesy of: Tania Meneghel, MD

References

1. *Orringer JS et al. The effects of laser-mediated hair removal on immunohistochemical staining properties of hair follicles. J Am Acad Dermatol 2006;55:402-7*
2. *Lepselter J, Elman M. Biological and clinical aspects in laser hair removal. J Dermatol Treat 2004;15:72-83.*
3. *Cotsarelis G. Gene expression profiling gets to the root of human hair follicle stem cells. J Clin Invest 2006; 116:1922.*

Alma Lasers
Wellbeing Through Technology

US Headquarters
485 Half Day Road
Suite 100
Buffalo Grove, IL 60089
Tel +1-224 377-2000
Fax +1-224 377-2050
contact@almalasers.com

International Headquarters
14 Halamish st. P.O.B 3021
Caesarea Industrial Park
Caesarea, 38900, Israel
Tel +972-4-627-5357
Fax +972-4-627-5368
info@almalasers.com

PBSP10060901