

LASERS

EFFECTS OF ARGON AND NITROGEN PLASMA PULSES ON THE SKIN AND SKIN APPENDAGES IN AN IN VIVO ANIMAL MODEL

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Background: For medical purposes, plasma can be generated from inert gaseous sources in a device by ultra-high frequency generators and emitted to target tissue at a pulse duration in the milliseconds. However, there are few studies about the effect on skin by nitrogen or argon gaseous plasma devices.

Objective: We aimed to evaluate argon- and nitrogen-plasma pulse-induced tissue reactions in the skin and skin appendages of an in vivo animal model.

Materials and Methods: Argon and nitrogen plasma pulses were noninvasively delivered to in vivo rat skin at various experimental settings. Specimens were histologically evaluated following H&E and Masson's trichrome staining.

Results: Day-0 specimens, which were treated with argon plasma, presented thinning of the epidermis, mild to moderate inflammatory cell infiltration in the upper dermis, and thermal tissue reactions in the sebaceous glands; Day-21 tissues exhibited complete recovery of epidermal and dermal components. At low-energy settings of 1.0 J, 1.5 J, and 2.0 J, nitrogen plasma treatments generated noticeable tissue coagulation at the depths of 31.5 \pm 8.3 µm, 94.9 \pm 16.9 µm, and 171.6 \pm 19.7 µm, respectively, at Day 0 and remarkable increases in fibroblasts and collagen fibers in the upper dermis at depths of 79.7 \pm 8.6 µm, 98.7 \pm 14.0 µm, and 134.6 \pm 10.8 µm, respectively, at Day 21. At high energy settings of 2.5 J and 3.0 J, nitrogen plasma treatments generated marked tissue coagulation at the depths of 381.7 \pm 33.6 µm and 456.3 \pm 75.7 µm, respectively, at Day 0 and extensive increases in fibroblasts and collagen fibers in the dermis.





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Conclusions: Treatment with argon plasma induces microscopic changes in the epidermis, dermis, and sebaceous glands without generating excessive thermal injury, whereas that with nitrogen plasma elicits energy-dependent thermal coagulation in the epidermis and dermis with remarkable neocollagenesis.



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