

## Tissue Responses to CO<sub>2</sub> Laser in Coagulation Mode

— with Reference to the Effect of Irradiation Parameters on the Severity of Necrosis  
and the Subsequent Tissue Recovery —

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We conducted this study to examine the effect of laser irradiation parameters on the severity of necrosis and the subsequent tissue recovery.

Laser irradiation to the rat dorsal skin was achieved with the parameters of 600  $\mu$  sec. pulse duration and 6 msec. off time with different peak power (2.5 – 7.5 W) and irradiation time (10 – 40 sec.). On the 1st, 3rd, 5th, and 7th days after irradiation, the skin was dissected, fixed with paraformaldehyde, and embedded in paraffin. The sections were stained with H-E and Masson's trichrome for histological observation. Immunohistochemical detection of the stress protein Hsp 70 was performed to identify and measure the depth of necrosis.

On the 1st day after irradiation with peak power of 2.5 W, the surface dermis showed basophilic change with increased homogeneity of fiber structure, indicating collagen denaturation, whereas no visible histological changes were evident in the deeper dermis. In the 5.0 W groups, the area of collagen denaturation extended with occasional superficial evaporation. The demarcation of collagen denaturation by the infiltration of neutrophils occurred in the specimens of the 7.5 W groups.

When the peak power being equal, the longer the irradiation time, the deeper area underwent necrosis, but the difference between the irradiation times was not significant. On the other hand, with a constant energy density, the dermal necrosis deepened and the collagen denaturation widened as the peak power increased.

Re-epithelialization was complete on day 3 in the 2.5 W groups, while on day 7 in the 5.0 W groups. The replacement of the laser-made necrotic tissue by newly formed connective tissue was complete by day 7 in both groups, but no regeneration of hair follicles occurred in the 5.0 W groups.

The present study shows that higher peak power is more effective in increasing the depth of dermal necrosis than longer irradiation time, although the higher power results in more prominent tissue destruction and the resultant delay of tissue recovery.

Key words : CO<sub>2</sub> laser, rat skin, coagulation necrosis, Hsp70, wound healing