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### A HISTOPATHOLOGIC EVALUATION OF THE GYRUS PLASMA SKIN RESURFACING SYSTEM (PSR) VERSUS A STANDARD CARBON DIOXIDE RESURFACING LASER IN AN ANIMAL MODEL

**Fitzpatrick, R. and Bernstein E.**

*Dermatology Associates, Encinitas, San Diego, CA; Charles River Associates, Philadelphia, PA*

**Background:** A variety of high energy, pulsed and scanned carbon dioxide ($CO_2$) lasers are available to perform cutaneous resurfacing. Gyrus Medical have developed a clinically versatile plasma device that is potentially as effective as a laser, at a lower cost, and without the need for the extensive safety precautions necessary when using lasers.
**Objectives:** To benchmark the energy outputs of the test device against an Ultrapulse $CO_2$ laser (the "control device"); to demonstrate that the test device is at least as good as the control device in terms of consistency of effect and post-procedural healing; and to enable detailed analysis of tissue response to the test device over time.
**Materials/Methods:** Three Yucatan mini-pigs were the subject of this study. Following anaesthesia, 5 experimental sites were marked along the psoas muscle on each side of the spine. Treatment was applied using either the test or control device, with one site remaining untreated as a control. Biopsies were taken from all treatment sites on Days 0, 2, 7, 14, 30 and 60 and processed to H&E staining. Blinded histopathologic examination was performed.
**Results:** Skin treated with the PSR device showed a range of tissue effects across the energy settings used. All treatment sites had fully regenerated epidermis by Day 14, with visible amounts of fresh collagen noted at the highest energy setting (4J).
**Conclusion:** The Gyrus PSR system provides an attractive alternative to standard $CO_2$ laser with good remodelling of tissue architecture. Epidermis regenerated after PSR treatment shows a smoother surface profile than adjacent untreated tissue.

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### EFFECTS ON MARKERS OF APOPTOSIS AFTER INTENSE PULSED LIGHT TREATMENT OF PHOTO DAMAGED SKIN

**David Kist and Brian Zelickson**

*University of Minnesota, Minneapolis, Minnesota*

**Background and Objective:** The purpose of this study was to evaluate the effects of the Photoderm on MMP-I, MMP-II, TIMP-II and Caspase III production in sun damaged skin.
**Study Design/Materials and Methods:** Two patients with sun damage were given informed consent for biopsy and Photoderm treatment. Pretreatment periorbital biopsies were taken and fixed in formalin. The patients then underwent two periorbital treatments 6 weeks apart using the photoderm set at 42 J/cm$^2$, 590 nm filter, pulse mode 2, pulse duration 4.5 msec, delay 10 msec. Biopsies were taken at six weeks after the last treatment. The biopsies were embeded in parafin, sectioned at 4 um, and labelled with antibodies against MMP-I, MMP-II, TIMP-II and Caspase III. The slides were analyzed by two blinded observers with light microscopy.
**Results:** MMP-I showed a 50% increase. MMP-II was increased up to 25%. TIMP-III was increased 25%. Caspase III increased up to 50%. Of particular interest was the localized increased expression of protein in the fibroblasts after Photoderm treatment.
**Conclusion:** This study demonstrated that subsurface resurfacing with the Photoderm can increase the expression of matrix metaloproteases, their inhibitors, and markers of apoptosis. This method achieves its results by stimulating the production of these proteins and enzymes by dermal fibroblasts and the epidermis. Altering the expression of these proteins and enzymes may reduce the chances of skin cancer formation in sun damaged skin.

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### MOLECULAR BASIS OF CONNECTIVE TISSUE REMODELING INDUCED BY $CO_2$ LASER RESURFACING

**Jeffrey Orringer, Gary Fisher, Sewon Kang, Timothy Johnson, and John Voorhees**

*University of Michigan, Ann Arbor, MI*

**Background and Objectives:** Relatively little is known regarding the molecular mechanisms of dermal extracellular matrix remodeling following $CO_2$ laser resurfacing for photodamaged skin. Our objective was to determine expression patterns of key genes involved in connective tissue remodeling following $CO_2$ laser treatment.
**Study Design/Material and Methods:** Focal areas of subjects photodamaged forearms were treated with two passes using the Coherent Ultrapulse laser (300 mJ, 60 W). Total RNA was extracted from skin biopsies, and mRNA levels of matrix-degrading metalloproteinases (MMP), procollagens (COL), and transforming growth factor-β isoforms (TGF-β) were quantified by reverse transcriptase real time polymerase chain reaction.
**Results:** $CO_2$ laser resurfacing resulted in marked induction of MMP-1 (collagenase 1), MMP-3 (stromelysin), and MMP-9 (gelatinase B), within 24 hours. Maximal induction (MMP-1 39,130-fold; MMP-3 1040-fold, MMM-9 61-fold, $n = 10$) was observed at seven days post treatment. MMP-1 and MMP-3 mRNA levels returned to near baseline by 28 days post treatment, whereas MMP-9 remained elevated. Induction of type I and type III COL was not observed until 14 days post treatment and remained elevated for at least 28 days. TGF-β1 and TGF-β3, but not TGF-β2, were induced within three days and remained elevated for 28 days.
**Conclusions:** $CO_2$ laser resurfacing affects repair of photodamaged skin by initially inducing MMP-mediated removal of actinically damaged collagen, and subsequently stimulating deposition of newly synthesized collagen.

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### IMPORTANCE OF THE WAVE ASPECT OF ELECTRONS IN REGARD TO THE MITOCHONDRIAL ENERGY TRANSFER

**L.Wilden and R. Karthein**

*Private office, Bad Füssing, Germany, TÜV Rheinland/Berlin, Köln, Germany*

**Summary:** Biochemical models of the cellular energy transfer regard the classical corpuscular aspect of electrons as the responsible energy carriers thereby ignoring the wave-particle dualism of the electrons and the import of radiation energy of this process.
**Results:** Because of the inherent wave-particle dualism of the electrons, it is obvious to regard radiation phenomena in order to explain the cellular energy transfer. The connection between the energy transport by radiation and the order in structures maybe understand, if structurally bound energy is released during the dissolution of structures (Oxidation of foodstuffs) or is again manifested (finally reduction of oxygen to water). Regarding the energy values relevant for the respiratory chain, the import of electromagnetic radiation of characteristic ranges of wavelengths on the cellular energy transfer becomes evident. Depending on its wavelength, electromagnetic radiation in the form of light can transfer energy to electrons. LLL-Light corresponds well with the characteristic absorption levels of the relevant components of the respiratory chain. This laser stimulation vitalises the cell by increasing the mitochondrial ATP-production.
**Conclusions:** With regard to the wave aspect it is possible to explain the increase of ATP-production by means of LLLL on a cellular level.