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Facial Skin Rejuvenation Using Cold Atmospheric Plasma Combined with Vitamin C: Biometric and Ultrasound Assessments

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ABSTRACT

Introduction: Cold atmospheric plasma (CAP) has emerged as a novel non-ablative, non-thermal modality in aesthetic dermatology. It promotes skin rejuvenation via controlled generation of reactive oxygen and nitrogen species. CAP enhances microcirculation, stimulates fibroblast activity, and promotes the remodeling of collagen and extracellular matrix, offering potential synergistic effects when combined with antioxidants like vitamin C.

Materials and Methods: A 34-year-old woman with Fitzpatrick type III skin presented with dullness, textural irregularity, and early fine lines. She underwent eight weekly treatments using a floating-electrode dielectric barrier discharge device at 7.4 W. To evaluate the additive effect of antioxidants, one half of her face received plasma alone, while the other half received plasma followed by 10% topical vitamin C. Skin parameters—including hydration, elasticity, transepidermal water loss (TEWL), pigmentation, dermal–epidermal thickness, perfusion, oxygenation, and tissue water index—were assessed using Corneometer, Cutometer, Tewameter, dysfunctional uterine bleeding ultrasound, TIVITA hyperspectral imaging, and colorimetry. Thermal changes were monitored via forward-looking infrared imaging.

Results and Discussion: Both halves of the face exhibited improvements in hydration, clarity, and overall skin tone. However, the side treated with plasma plus vitamin C demonstrated significantly greater increases in firmness, elasticity, dermal density, and collagen-associated thickness. TEWL decreased more substantially on that side, indicating enhanced barrier function. Hyperspectral imaging confirmed improved perfusion and oxygenation without any thermal adverse effects.

Conclusion: CAP effectively promotes skin rejuvenation, and the combination therapy using vitamin C provides additional benefits in collagen remodeling, elasticity, and barrier restoration. These findings suggest CAP as a promising non-invasive intervention for facial rejuvenation.

Keywords: Collagen remodeling, Cold atmospheric plasma, Non-thermal therapy, Skin rejuvenation, Vitamin C

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