

Reduction of Superficial Thermal Injury Using Cryogen Spray Cooling in Conjunction with Nd: YAG Laser for Cartilage Reshaping of Composite Cartilage Flaps: Preliminary Investigation

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Objective: Lop ear deformity is a cosmetic concern. In conventional surgery, a standard for correction has been established, but currently laser-assisted reshaping of the ear cartilage might be an option. One possible side effect is thermal injury. Cryogen spray cooling (CSC) plays an important role in drawing laser-generated heat from the skin. The objective of our study is to find the proper parameters for laser-assisted reshaping of ear cartilage in conjunction with cryogen spray cooling.

Methods: Composite cartilage flaps were designed using New Zealand rabbit ears. A skin incision through the perichondrium exposed a 5mm wide strip of cartilage on the posterior auricle surface. Flat parts of the ears were manually deformed with a jig and maintained in this new position during irradiation. The exposed cartilage was irradiated on the concave surface with an Nd: YAG laser at 10W, 15W, and 20 W. CSC was applied to the convex, non-irradiated side of the tissue for reducing thermal injury to the graft. The ears were maintained in the deformation angle for 15 minutes after irradiation and serially examined for 14 days. The thermal damage of 10 W without CSC was limited within the cartilage layer. For 15 and 20 W, CSC was delivered: 1) continuously, 2) controlled, and 3) not delivered for comparison.

Results: 20W without CSC, caused full penetration injury, while 15W with no CSC caused only minor epidermal thermal injury. The cartilage exposed to 20W with controlled CSC retained its new shape to the highest degree above all others, and the thermal injury was minimal. Although most levels of laser and CSC yielded a high degree of reshaping over an acute time period, ears exposed to 15W without CSC and 20W with controlled CSC after 14 days retained their shape better than those treated at 10W without CSC.

Conclusion: Spatially selective photocoagulation of cartilage by repetitive application of a short cryogen spurt during continuous Nd: YAG laser irradiation has been demonstrated in the rabbit ear animal model. This procedure may be effective for treatment of lop ear deformity.

Key words: cryogen spray cooling, Nd: YAG laser, cartilage reshaping

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