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Two-year follow-up: radiosurgery better than laser

After 2 years of study, surgeons find that radiosurgery causes less heat damage than laser in blepharoplasty fat resection.

by David Bruce Welch, MD, and Paul Bryar, MD
Special to OCULAR SURGERY NEWS

An optimal instrument for the dissection, isolation, vascular coagulation and resection of fat pockets in blepharoplasty surgery must minimize the extent of excessive lateral heat diffusion. Too little heat diffusion during lipoplasty may result in vision-threatening hemorrhage. Too much lateral heat diffusion distorts tissues, interfering with precise and appropriate fat resection. Excessive lateral heat spread increases the degree and duration of postoperative inflammation, prolonging the recovery and increasing the risk of cicatrix formation.

Surgeons have used electrocautery, high-fluence carbon dioxide (CO_2) lasers, electrosurgery and ultrahigh radio frequency-modulated surgery (RFMS) for fat resection in blepharoplasty. Electrocautery uses electrical energy to heat a filament that becomes a red-hot electrode; incisions of human tissue are associated with extensive lateral heat damage. Pulsed, high-fluence CO_2 lasers require pulse stacking with increasing of lateral heat diffusion and fat pockets must be coagulated prior to fat resection. This is necessary in both RFMS or CO_2 laser-assisted fat resection during cosmetic blepharoplasty.

"When tissue is placed between the electrodes, contact by the active electrode tip results in an incision."
— David Bruce Welch, MD, and Paul Bryar, MD

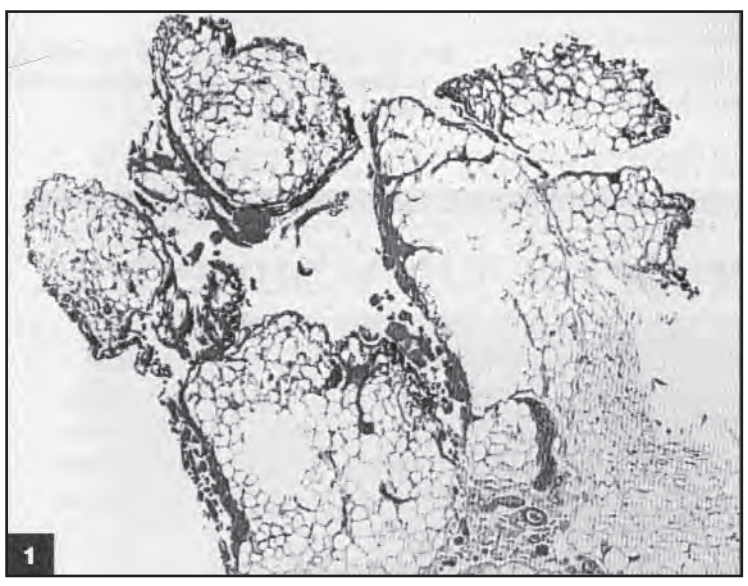
Two-year follow-up

During the last two years we have used either RFMS (Surgitron DF Surge, Ellman International) or a pulsed CO_2 laser (UltraPulse, Lumenis) for fat resections on patients undergoing routine cosmetic transconjunctival lower eyelid blepharoplasty.

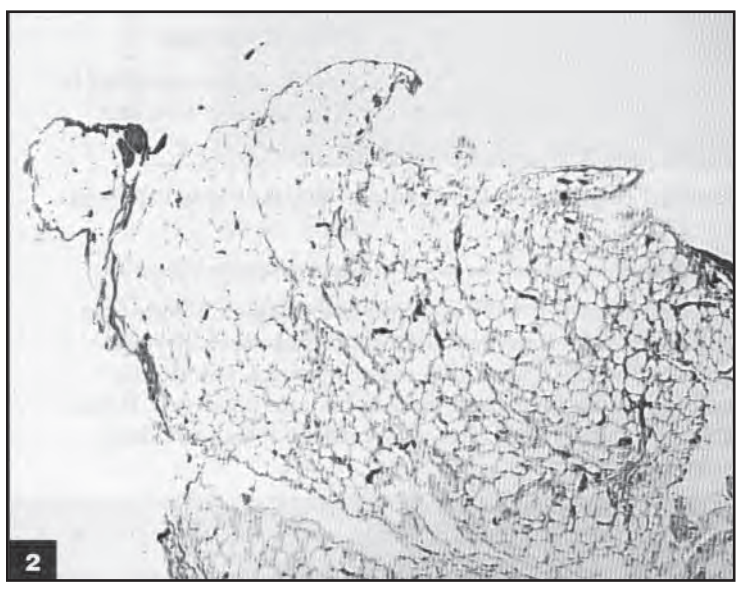
Some yellowing of the incision margins and base were consistently observed with the laser incisions. Longer dwell time is necessary with the CO_2 laser to excise fat, compared with RFMS. We compared histopathologically the extent of lateral thermal damage in fat resected during lower eyelid blepharoplasty using these two surgical modalities.

Following the prolapse of redun-

(Radiosurgery results, continued on page 80)



Surgical margin of tissue excised with the CO_2 laser.



Surgical margin of the tissue excised with RFMS.

possible char formation via a cumulative heat sink phenomenon.

Electrosurgery and RFMS use fine delivery tips (active electrode) to transmit a current to a passive electrode (antenna). When tissue is placed between the electrodes, contact by the active electrode tip results in an incision. The incision occurs because of the tissue's natural resistance. A constant (non-modulated) energy waveform facilitates surgical cutting with enough thermal effect to close fine blood (less than 0.5 mm in diameter).

RFMS was first introduced in 1970. By using ultrahigh-frequency, low-temperature radio waves (4 MHz) a microfiber wire electrode can develop pressure-free incisions on tissue contact with no char to the incision margins and base. Larger-caliper blood vessels (greater than 0.5 mm in diameter) in both orbital and preaponeurotic

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Radiosurgery results

(continued from page 79)

dant central preaponeurotic fat during lower eyelid blepharoplasty, the fat from one lower eyelid was excised using the CO_2 laser in a quasi-continuous wave mode at 8 W using a 0.2-mm focal tip. Fat from the contralateral lid was excised using RFMS in a cutting mode at 65 W with a fine-point needle electrode (Vari-tip).

"Damage was determined by observing specific tissue changes such as cell lysis, irregularities in intact cell membranes and thickening and disruption of intercellular collagen."
— David Bruce Welch, MD, and Paul Bryar, MD

After resection the fat was placed in 10% neutral buffered formalin and paraffin blocks were made. Then 5-µm-thick sections were cut, placed on glass slides and stained with hematoxalin and eosin. The pathologist was masked regarding the instrumentation used for the resection of each specimen.

Results

Previous studies have described structural changes induced by various lasers on animal and human tissues. Nuclear and cytoplasmic changes have been observed. Nuclear changes include pyknosis, changes in chromatin patterns and nuclear necrosis. Cytoplasmic changes include loss of cell structures with preservation of the cell membrane. Coagulation necrosis and reduction of cells to an amorphous mass can also be seen.

Thermal damage at the margins of the resected tissue were assessed by measuring the depth of thermal injury. Damage was considered positive if any of the histologic changes described were present. This was determined by observing specific tissue changes such as cell lysis, irregularities in intact cell membranes and thickening and disruption of intercellular collagen. The amount of lateral tissue damage in each specimen was measured by a micrometer under 20X magnification power.

Two photomicrographs of the pieces of resected fat are shown. The surgical margin is at the top of each of the photomicrographs. The tissue that was excised with the CO_2 laser (figure 1) shows more extensive thickening of the collagenous septae and cell membranes than the tissue excised with RFMS (figure 2). These thermal changes are more prominent at the edge of the resection and extend deeper into the tissue when comparing tissue to that resected by RFMS. An average of 257 µm of damage is observed with the CO_2 resected fat vs. an average of 148 µm of damage with RFMS (H&E stain 10X magnification).

"Minimizing lateral thermal damage at the edges of fat resected during blepharoplasty should facilitate healing."
— David Bruce Welch, MD, and Paul Bryar, MD

Ultrahigh RFMS resection of fat during lower eyelid blepharoplasty produced less thermal damage than the CO_2 laser. Prior to fat excision, medium-to-large blood vessels (greater than 0.5 mm in diameter) in harm's way must be selectively coagulated prior to fat resection.

When using the CO_2 laser, these vessels were closed by using a defocused beam proximal to the incisional plane. When using ultrahigh RFMS, the vessels were clamped with steel forceps and were coagulated by conducting energy along the forceps by contact to the forceps with the Vari-tip.

Minimizing lateral thermal damage at the edges of fat resected during blepharoplasty should facilitate healing. The natural resistance of the fat to be resected by ultrahigh RFMS facilitates resection with less peripheral thermal damage than with the pulsed CO_2 laser. OSN

For Your Information:
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■ Ellman International Inc. can be reached at 3333 Royal Avenue, Oceanside, NY 11572-3625, (516) 569-1482; (516) 594-3333; (800) 835-5355; Fax: (516) 569-0054 www.ellman.com

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