Simultaneous Rhytidectomy and Full-Face Carbon Dioxide Laser Resurfacing

A Case Series and Meta-analysis

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Background: The combination of facial rhytidectomy and full-face carbon dioxide laser resurfacing would theoretically provide for superior aesthetic rejuvenation of the face, but some reports have advised against this combination (particularly using chemical peel). However, significant differences exist between previous studies of combination therapy.

Objective: To evaluate these differences and determine protocol for care and carbon dioxide laser settings for resurfacing when done in combination with full-face rhytidectomy.

Design: (1) A case series of 30 patients treated in a private practice over 26 months with simultaneous rhytidectomy and full-face laser resurfacing; (2) a meta-analysis of 3½ years of literature reporting the same combination procedure (453 patients). Variables evaluated include rhytidectomy technique, laser type and settings, postoperative care, complications, and outcome analyses.

Outcome Measures: Rate of postoperative complications, premorbidity, previous surgery, concurrent procedures, postoperative dressings, and follow-up status.

Methods: For the present case series, all patients treated in our practice with simultaneous rhytidectomy and full-face carbon dioxide laser resurfacing from February 1999 through April 2001 were included. The indications, risks, techniques, and alternatives of the planned procedures were discussed with the patients preoperatively. All patient questions were discussed and answered, and documented informed consent was obtained prior to surgery. All procedures in this case series were performed at the Meridian Plastic Surgery Center in Indianapolis, Ind, by the same primary operating surgeon (S.W.P.). Information evaluated in this case series included postoperative complications, premorbidity, previous surgery, concurrent procedures, postoperative dressings, and follow-up status.

Results: Among the 30 patients treated over our 26-month case series accession period, there was no evidence of flap loss, skin slough, infection (viral or cellulitic), or hypopigmentation. Settings for laser resurfacing were determined. Of the 453 patients included in our meta-analysis, 1 (a smoker) sustained a 2-cm full-thickness flap necrosis, and 4 sustained varying degrees of skin slough in the postauricular area without full-thickness necrosis. The complication rate did not differ from that of rhytidectomy alone.

Conclusion: Simultaneous rhytidectomy and full-face carbon dioxide laser resurfacing can safely provide a dual cosmetic benefit option for aesthetic rejuvenation of the face.

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The combination of rhytidectomy with simultaneous full-face laser resurfacing remains a rarely used option for the dual cosmetic benefit of rejuvenation of the face. This combination could treat skin laxity and inferomedial dermatochalasis as well as the signs of surface aging such as fine rhytids, keratoses, and lentigines of the facial skin.

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While this technique has been previously documented, significant differences exist between these studies. The goal of this case series and meta-analysis is to illustrate these differences, evaluate the safety of combining these techniques, and discuss settings and variations in technique used on a large number of patients over 3 years.

From Carithers and Koch Facial Plastic Surgery, Des Moines, Iowa (Dr Koch), and Perkins Hamilton Facial Plastic Surgery, Indianapolis, Ind (Dr Perkins).
full-face laser resurfacing. Outcomes included incidence of complication and determination of safety of this procedure. The techniques for rhytidectomy as well as type of laser used and methods for delivery of laser energy varied from study to study, and these differences were analyzed.

RHYTIDECTOMY TECHNIQUE

A modified deep-plane (biplanar) rhytidectomy was performed.10 After submental, submandibular, and jowl liposuction and anterior cervical platysma plication, the neck skin was undermined completely. The postauricular skin flap was then elevated in the immediate subcutaneous plane and connected with the neck skin elevation. Dissection in the temporal region was performed in the subgaleal supratemporalis fascia plane to the lateral orbital rim. Dissection was continued down near the upper border of the zygomatic arch in this plane.

Subperiosteal release of the lateral orbital periosteum was performed. In the event of an inferior sideburn incision, a disconnected temporal incision and dissection was performed. Preauricular skin subcutaneous dissection was begun at the level of the helical insertion in the subcutaneous plane and extended to the lateral orbital “crow’s feet” region. Subcutaneous dissection was continued approximately 5 to 7 cm medially in the preauricular region connecting down to the elevated neck and postauricular flap (Figure 1) to visualize all the way down below the mandibular margin into the neck.

An incision was then made in the superficial musculoaponeurotic system (SMAS) extending from the inferior border of the zygomatic arch at the malar eminence diagonally down to the level of the earlobe and then continuing inferiorly 1 cm in front of the anterior border of the sternocleidomastoid. Dissection was carried out underneath the platysma muscle approximately 3 to 4 cm. Just above the mandibular margin, dissection was continued superficial to the masseter muscle over the premasseteric fascia.

Dissection was then begun in the malar region just above the zygomatic buttress in the subcutaneous plane extending just inferior to the orbicularis oculi muscle. This dissection required release of strong dermal attachments to the malar eminence. Elevation was then extended superficial to the level of the zygomaticus muscle into the midcheek region. This technique differs from the standard deep plane approach in that there is a significant amount of skin elevated in addition to the SMAS creating 2 separate flaps for later biplane vector suspension. The suspension of the midface and jowl tissues was accomplished by advancing the SMAS–subcutaneous skin unit in a posterior-superior fashion.

The superior triangular portion of the SMAS was advanced, and the redundant preauricular portion excised. This was suspended with buried 0 polyglactin 910 suture (Vicryl; Ethicon Inc, Somerville, NJ) at the level of the helical insertion and the postauricular mastoid fascia. Polydioxanone sutures (3-0) were then used to reenforce the platysma-SMAS unit in the mastoid, infra-auricular, and preauricular areas.

The skin was advanced in a more posterior vector with 4 to 6 cm of undermined skin in the preauricular region remaining. The skin from the neck was advanced to the posterior mastoid hairline. A single suspension in the high postauricular region was performed and the hair-bearing portions reapprorimated with staples. The skin was sutured with running interlocking 5-0 plain catgut sutures. Just prior to the closure, a drain was placed in the neck portion of the wound on either side.

LASER RESURFACING TECHNIQUE

The face had been preoperatively washed with Septisol (Sandent Co, Murfreesboro, Tenn). A Coherent UltraPulse 5000 laser (Coherent Inc, Palo Alto, Calif) was used for full-face laser resurfacing. The first laser pass on the face, except for the upper and lower eyelids and preauricular area, was performed at a fluence of 300 mJ, a power of 60 W, and a density of 0 with square pattern generator size 9. The surface char was removed with wet and dry 4 × 4-in gauze. The second pass on the full face included the first pass on the eyelids and preauricular area and was performed at a fluence of 230 mJ, a power of 50 W, and a density of 5 (a rectangular pattern of size 6 was used on the eyelids) (Figure 2). The surface char was removed. A second pass was made over the eyelids at a fluence of 200 mJ, a power of 40 W, and a density of 4. This setting was also used for feathering the jawline and for selected deep rhytids of perioral, glabellar, and forehead regions. A chamois color was often obtained with visible tightening with desiccation of the skin.

A Silon TSR dressing (Bio-Med Sciences, Bethlehem, Pa) was applied to the full face. An Aquaphor-coated (Beiersdorf Inc, Norwalk, Conn), nonadherent single-layer dressing was applied over the periauricular areas and Combine-Abdominal padding (Hermitage Hospital Products Inc, Niantic, Conn) overlaid and secured with a light compressive facial garment over-night (Figure 3).

All dressings and drains (except Silon) were removed in 12 to 24 hours. The Silon TSR remained in place until postoperative day 4, at which time the patient began water-sealed gauze cleaning and reapplication of an Aquaphor barrier 5 to 6 times a day. Application of anti-inflammatory cream was started when complete reepithelialization had occurred (usually 7 to 8 days). A skin care and make-up consultation was done on postoperative day 10, and the patient resumed normal activities, with reasonable discretion, at that time.

RESULTS

CASE SERIES

A total of 27 women and 3 men, all nonsmokers (aged 41-70 years), underwent simultaneous rhytidectomy and full-face carbon dioxide laser resurfacing with the Coherent UltraPulse 5000 laser with computer pattern generator from February 1999 to April 2001. Twenty-nine of the 30 patients underwent other procedures simultaneously: most common were blepharoplasties (17), forehead lifts (9), augmentations of the cheek-lip grooves with expanded polytetrafluoroethylene (Gore-Tex; W.L. Gore & Associates, Flagstaff, Ariz) (6), and chin implants (4).
Five patients had simultaneous trichloroacetic acid with Jessner solution chemexfoliation of the neck. All patients received occlusive dressing (Silon TSR) to the laser-treated areas postoperatively for 3 days and were then maintained with an Aquaphor barrier through postoperative day 7. Follow-up ranged from 1 to 15 months with standard follow-up visits on days 1, 3, and 7 as well as at 1 month, 3 months, 6 months, and 1 year postoperatively.

Complications included hypertrophic scarring in a 67-year-old woman in an area of a previous traumatic scar on the right superior malar area (a nonundermined area) with right lower lid ectropion that resolved with serial cortisone injections. One 48-year-old woman had delayed reepithelialization of the right cheek in an area of remotely previous traumatic laceration with 2 subsequent scar revision procedures. There was no incidence of skin-flap loss or skin slough and no cases of secondary infection (herpetiform, bacterial, or fungal) in this patient group.

META-ANALYSIS

Nine studies, including 453 simultaneous rhytidectomy and full-face laser resurfacing procedures from 1997 through May 2000 were analyzed (Table).

A total of 384 patients were treated with the Coherent UltraPulse laser and 69 patients with the Sharplan SilkTouch and Sharplan FeatherTouch lasers (ESC Sharplan Medical Systems Inc, Norwood, Mass).

Face-lift technique varied among the patient cohort. Most patients (n=298) were treated with a rhytidectomy technique of subcutaneous flap elevation combined with sub-SMAS dissection and SMAS plication. Skin flap elevation length remaining after suspension varied from 1 to 6 cm. All procedures included direct laser resurfacing of the subcutaneously undermined flap.

Laser settings varied by fluence, power, and beam density (Table). The subcutaneously undermined skin flaps were treated with settings from as high as 350 mJ and 100 W in 100 patients by Jackson et al1 to as low as 175 mJ and 30 W with a single pass in 106 patients by Graf et al2 Roberts et al9 treated the skin flap portion of the face with 300 mJ and 60 W with density 5. Ramirez and Pozner7 also used 300 mJ and 60 W with density 5 with 1 pass, stating “the area up to the preauricular incision was faded with 1 pass by angling the hand piece so the beam density was less dense laterally.”

Guyuron et al4 in 82 patients, used 300 mJ and 60 W with density 4, with “one pass over undermined areas.” Bisaccia et al10 used 250 mJ with density 5 with 1 pass over undermined skin. Mayl and Felder4 used the Sharplan FeatherTouch laser at a setting of 36 W over the subcutaneously undermined flap, stating “typically the energy density used over facial flaps is 80% of the first pass made over the central face areas.” The 26 patients treated by Achauser6 with the Sharplan Silk Touch laser were resurfaced with power settings “between 16 and 18 W,” and “a very light treatment with defocused, widely spaced laser spots was used in the preauricular area.”

Complications were minimal in all 9 studies (Table). Within the 453-patient cohort, complications included 1 patient (0.2%) with a 2-cm preauricular flap necrosis. This patient was a smoker and continued to smoke perioperatively. A total of 4 patients (0.9%) had minimal postauricular skin slough/loss. All 4 sloughs were in nonlasered skin areas. Six patients (1.3%) had perioperative secondary superficial infections (3 bacterial, 2 herpetiform, 1 fungal). Two patients sustained areas of hypertrophic scarring in nonundermined malar areas. One patient had necrosis in the lateral oral commissure area that was not undermined and another had increased scleral show that resolved with time.

COMMENT

Earlier studies in simultaneous undermining and resurfacing advised against this practice because of skin necrosis after treatments with chemical peels.11-13 Spira et al9 best summarized the mind-set of this era, advising to never “insult the skin by peeling and undermining the same area simultaneously.” Advances in resurfacing means and techniques as well as improvements in face-lifting techniques have led to increasing use of flap elevation and simultaneous exfoliation. With the present case series and meta-analysis, we describe a large cohort of patients who have undergone this combined tech-
nique and review the literature to include outcomes as well as documented guidelines for the safe use of simultaneous treatment.

Simultaneous rhytidectomy and full-face laser resurfacing is becoming an increasingly considered option for complete cosmetic rejuvenation of the face, and while this technique has been published previously, wide variations exist. Jackson et al. were the most aggressive, using settings of 350 mJ, 100 W, and density of 6 with the first pass and 300 mJ, 60 W, and density of 6 on the second pass. Barrier therapy with either Flexzan (Poly-Medica Industries Inc, Port St Lucie, Fla) or petroleum-based products was continued for 14 days postoperatively. "There is no doubt that the postoperative period is a difficult one, but with a dedicated and enthusiastic staff, this can be managed satisfactorily." This differed considerably from Graf et al., who used 175 mJ at 30 W with 1 pass over a “small undermined skin flap in the preauricular area.” Both studies, however, noted satisfaction in patient results with a dual cosmetic benefit apparent.

Granted, these are large cohorts, but data on the amount of undermined skin that is resurfaced are critical to the analysis of the safety of this procedure. The amount of undermined skin that is resurfaced varies with rhytidectomy technique. Even within cohorts and study periods, the rhytidectomy technique should be noted when evaluating the aggressiveness of laser therapy. Graf et al. noted, “the rhytidectomy was carried with deep undermining at the SMAS-platysma level after a brief subcutaneous approach.” The initial techniques of Jackson et al. within their 100-patient cohort involved limited elevation of the SMAS together with skin tightening, leaving “virtually no undermined area remaining.” This tech-

### Studies of Simultaneous Rhytidectomy and Full-Face Laser Resurfacing

<table>
<thead>
<tr>
<th>Source</th>
<th>No. of Patients</th>
<th>Laser*</th>
<th>Laser Settings</th>
<th>Rhytidectomy Technique</th>
<th>Complications (No. of Patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramirez and Pozner,† 1997</td>
<td>9</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, 60 W, density 5; central midface, 2 passes; cheeks, 1 pass (the area up to the preauricular incision was faded with 1 pass by angling the hand piece so the beam density was less dense laterally)</td>
<td>Bilplanar rhytidectomy</td>
<td>Herpetiform infections (2), minor skin slough in the postauricular area (2)</td>
</tr>
<tr>
<td>Mayl and Felder,‡ 1997</td>
<td>43</td>
<td>Sharpplan FeatherTouch</td>
<td>7 W, 1-2 passes, silk, eyelids; 7 W, 2-3 passes, silk, preauricular area; 18 W, 1 pass, silk, forehead and central face; 36 W, 1 pass, feather, flap</td>
<td>Undermining lateral to the nasolabial fold with SMAS plication</td>
<td>2-cm area of hypertrophic scarring that was not over undermined skin (1)</td>
</tr>
<tr>
<td>Guyuron et al.,§ 1997</td>
<td>82</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, 60 W, density 4, (One pass to the undermined areas)</td>
<td>Not provided</td>
<td>Skin necrosis in lateral oral commissure that was not undermined (1)</td>
</tr>
<tr>
<td>Fulton,† 1998</td>
<td>17</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, 60 W, density 5, 3 passes, face; 250 mJ, 50 W, density 4, 2 passes, eyelids prior to rhytidectomy</td>
<td>5- to 6-cm skin flap with SMAS plication</td>
<td>2-cm preauricular flap necrosis (1)</td>
</tr>
<tr>
<td>Bisaccia et al.,§ 1998</td>
<td>40</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, density 5, face, except eyelids and skin flap; 250 mJ, density 5, skin flap and eyelids</td>
<td>Skin flap with SMAS plication</td>
<td>Minor postauricular skin slough (1), postoperative skin irregularity due to secondary infection (1)</td>
</tr>
<tr>
<td>Graf et al.,§ 1999</td>
<td>106</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, 60 W, 2 passes, nasal, frontal, lips and cheeks; 175 mJ, 30 W, 2 passes, eyelids; 175 mJ, 30 W, neck and small undermined skin flap in preauricular area</td>
<td>Skin flap with SMAS imbrication “brief subcutaneous approach”</td>
<td>Localized superficial bacterial infection (2), superficial fungal infection (1)</td>
</tr>
<tr>
<td>Achauer et al.,§ 2000</td>
<td>26</td>
<td>Sharpplan SilkTouch</td>
<td>16-18 W; central face, 3 passes; cheeks, 2 passes; (very light treatment with defocused, widely spaced laser spots was used in the preauricular area)</td>
<td>&lt;3-cm skin flap with SMAS imbrication</td>
<td>Increased scleral show resolved with time (1)</td>
</tr>
<tr>
<td>Jackson et al.,† 2000</td>
<td>100</td>
<td>Coherent UltraPulse</td>
<td>350 mJ, 100 W, full face, 1 pass; 300 mJ, 60 W, full face, 1 pass</td>
<td>&quot;Biplanar”</td>
<td>Postauricular skin slough (1)</td>
</tr>
<tr>
<td>Roberts et al.,§ 2000</td>
<td>30</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, 60 W, density 5, face except eyelids and skin flap; 300 mJ, 60 W, density 5, skin flap</td>
<td>Undermining to 3 cm posterior to nasolabial fold with SMAS plication</td>
<td>Hypertrophic scar (1)</td>
</tr>
<tr>
<td>Present study</td>
<td>30</td>
<td>Coherent UltraPulse</td>
<td>300 mJ, 60 W, density 6, face except eyelids and preauricular area; 250 mJ, 50 W, density 5, eyelids and preauricular area</td>
<td>Biplanar 5- to 7-cm skin flap with SMAS imbrication</td>
<td>Hypertrophic scar in nonundermined area (1), delayed epithelialization in area of previous traumatic scar (1)</td>
</tr>
</tbody>
</table>

*Coherent UltraPulse, Coherent Inc, Palo Alto, Calif; Sharpplan FeatherTouch and SilkTouch; ESC, Sharpplan Medical Systems Inc, Norwood, Mass.
†SMAS indicates superficial musculoaponeurotic system (flap).
Figure 4. A 68-year-old woman preoperatively (A) and 6 months after simultaneous rhytidectomy and full-face laser resurfacing (B).

Figure 5. A 60-year-old woman preoperatively (A) and 5 months after simultaneous rhytidectomy, full-face laser resurfacing, endoscopic forehead lift, upper and lower eyelid blepharoplasty with ptosis repair, chin implant, and micropigmentation eyeliner (B).
nique evolved to leave a 2- to 2.5-cm-wide preauricular area, which was aggressively lasered with "no increased problems related to the resurfacing procedure." Perkins\textsuperscript{10} used combined elevation of the skin and SMAS leaving 4 to 5 cm of subcutaneously undermined skin in the preauricular area to be included in the laser resurfacing (Figure 1).\textsuperscript{10}

Just as the amount of undermined resurfaced skin is critical to clear evaluation of the value of this combination procedure, so too is the aggressiveness of laser resurfacing. Different areas of the face often require different levels of laser treatment. This is true whether or not a simultaneous procedure is performed.\textsuperscript{15} To truly analyze the value of simultaneous procedures, one must perform each one as if it were being done alone (which has been done in the present case series, but not in all published reports).\textsuperscript{10} Full-face laser resurfacing alone, in most practices, is performed at settings and passes greater than 1 pass at 175 mJ and 30 W, as done by Graf et al.\textsuperscript{2} Before performing this laser procedure over skin that has undergone "a brief subcutaneous approach" and declaring it safe and effective, one must study the approaches and complications carefully, including using meta-analyses such as the present one.

Skin slough after rhytidectomy alone has a reported rate of 1.1% to 3%.\textsuperscript{16} Analysis of complications in the present large cohort reveals outcomes no different from those of rhytidectomy alone with regard to flap loss and skin slough, most of which occurred in the postauricular areas not associated with laser therapy. Superficial infection, whether bacterial, fungal, or herpetic, occurs at rates from 2% to 7% with laser resurfacing alone, despite prophylactic therapy.\textsuperscript{17} The outcomes with regard to superficial infection in the present review of combination treatment did not differ from that rate, regardless of the theoretic alterations in underlying vascularity secondary to concomitant rhytidectomy. All studies in the present meta-analysis used perioperative prophylactic pharmacotherapy.

In conclusion, as rhytidectomy and resurfacing techniques have improved, so too have the options for combined rejuvenation of the face. Simultaneous rhytidectomy and full-face laser resurfacing continues to evolve into an increasingly considered option. Despite early reports advising against it, simultaneous treatment can be performed safely and effectively. The present combination case series and meta-analysis of 493 cases illustrates many options for combined therapy with varying techniques and settings. With complication rates no greater than those of rhytidectomy or laser resurfacing alone, simultaneous rhytidectomy and full-face laser resurfacing can safely provide a dual cosmetic benefit option for aesthetic rejuvenation of the face (Figures 4, 5, and 6).

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REFERENCES


Quotable

When we speak of knowledge, we always refer to explicit knowledge—the knowledge I am able to pass on to others. However, two other areas are far more important: the implicit knowledge related to oneself and visual knowledge. It is not directly communicable, it becomes apparent from our actions: decisions are made in response to a “gut feeling,” people say. These three kinds of knowledge come together in the creative act.

*Ernst Pöppel*

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