The PAVE (peeling-assisted volume-enhancing) lift: A retrospective 6-year clinical analysis of a combined approach for facial rejuvenation

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Summary The peeling-assisted volume-enhancing (PAVE) lift is a single-stage approach that combines superficial musculoaponeurotic system (SMAS) plication techniques with fat grafting and different peeling agents. To evaluate the safety of this approach, we analyzed the records of 159 patients who underwent surgery between 2008 and 2014.

The percentage of complications observed was not higher than values reported in the literature for each treatment entity: surgical facelift: n = 3 haematomas (1.89 %), n = 2; temporary apraxia of the mandibular branch (1.26%); fat transfer: minor asymmetry in n = 5 cases (3.14%); peeling: temporary hyperpigmentation in trichloroacetic acid (n = 5; 3.8%) and phenol peels (n = 4; 3.1%), permanent hypopigmentation (n = 6; 5.6%), formation of skin miliae persisting longer than 2 to 3 months (n = 5; 4.6%) and prolonged erythema (n = 3; 0.28%) in phenol peels.

The single-stage use of chemical peels, autologous fat transfer, and surgical rhytidectomy was safe.

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Background

Together with the evolution of newly available techniques, expectations and demands in facial rejuvenation have grown.1 Many attempts have been made not only to understand the complexity of the multimodal process of facial aging but also to halt and reverse the process of extrinsic and intrinsic aging.

Facial aging is a complex, three-dimensional process defined by skeletal changes, volume loss, and gravitational descent.2,3 In addition, the aging of the skin itself, the gradual loss of elasticity, the reduction of skin appendages, and the decrease of dermal thickness enhance the aggravation of folds and wrinkles.4 Facial aging must be seen as a combination of all these factors, and thus cannot be satisfactorily addressed by purely surgical techniques limited to suspension, lift, and volume replacement.

Therefore, we introduced the peeling-assisted volume-enhancing (PAVE) lift as a multilayer approach toward facial rejuvenation that overcomes surgical limitations.5 It combines the well-known "lift-and-fill" facelift with different peels.6 The concept behind the PAVE lift is a combination of superficial musculoaponeurotic system (SMAS) plication and stacking techniques, with autologous fat transfer and a medium-depth peel, deep peel, or combination (mosaic) peel as a single-stage approach. For medium-depth peels on subcutaneous undermined areas, a 20–40% trichloroacetic acid (TCA) peel is applied, whereas a phenol/croton oil peel solution is applied for deep peels in nonundermined areas with intact vascular patency, such as the perioral, nasal/perinasal, or glabella regions.8,9

Even though all techniques and their beneficial rejuvenative effects are well known to plastic surgeons and the single-stage combination of lifting and filling is common, the literature lacks evidence on the safety of applying different peeling agents in previously subcutaneous undermined facial skin flaps. For this reason, we revised the charts of all our patients who underwent the PAVE procedure during the past 6 years to include the applied peel, the time until the return to socialization, and postoperative complications for comparison with those reported in the literature for each single entity.

Methods

The procedures were performed under intravenous (i.v.) sedation with remifentanil and propofol. After infiltration of both sides of the operative field with liposuction solution containing lidocaine 2% and adrenaline 1:80,000, liposculpting of the face and, if necessary, jowls and neck was performed. Subsequently, the facelift incision was performed, starting 2–4 cm cranial from the cranial helix pole, descending as a curved incision toward the lower helix pole. In cases of an Omega lift, the incision was prolonged, ascending retroauricularly in the retroauricular fold and then descending again along the occipital hairline, allowing lift of the neck. Facelift dissection was performed from this incision line by sharp dissection of the subcutaneous liposuction plane medially to the zygomatic–malar area, caudally below the mandible, and if necessary laterally to the infraauricular area until the occipital hairline. All patients underwent extended subcutaneous surgical undermining of the facial skin. The SMAS lift was performed with three to four 2/0 Vicryl plication sutures anchored in the preauricular fascia (Loré) and in the lateral platysma in the neck if necessary. The dissected facial skin was pulled upward following a vertical vector through the ear base, and the excess skin was removed sequentially from the caudal helix pole to the cranial pole. After skin closure of the facelift incisions, autologous fat transfer was performed in areas with soft tissue volume deficits using a modified Coleman’s technique (centrifugation at 2000 rpm for 2 min) with fat either from the liposculpture of the face/neck or, in cases of larger volumes, from the abdomen.

After the autologous fat transfer, the skin was cleaned with chlorhexidine solution and an ether/acetone (1:1) solution for defatting. If a phenol/croton oil peel was applied, the facial skin was treated for 6 weeks before the surgery with a topical skin agent containing hydroquinone 4% and ascorbic acid 1% six nights a week. TCA 25% full-face peels were applied in patients with Glogau type 2 skin and minor coloration disorders or early actinic keratosis. TCA 40% full-face peels were applied in patients with Glogau type 3 skin. Mosaic peels with TCA 40% in surgically undermined areas and phenol/croton oil in surgically nonundermined areas were applied in patients with Glogau type 4 skin. The TCA peels were applied for 3–4 min until even frothing and were then neutralized (Figure 1). The phenol/croton oil peels were applied in two to three layers (Figure 2) depending on the anatomical area, and an occlusive silicone tape dressing was applied for 24 h. After the TCA peels were applied, no topical agents were applied until the skin was shed; afterward, a panthenol cream was applied three times a day for 1 month. The regions peeled with phenol/croton oil were treated with a drying and disinfecting powder (bismuth trioxide, Bi₂O₃) for 6 days, and then with panthenol cream applied three times a day for 1 month. Sun protection was applied for 3–6 months.

The medical records of all patients who received the PAVE procedure between 2008 and 2014 were reviewed by the first, third, and the senior author in a double-data extraction technique. The first and the third authors extracted each half of the data for gender, age at procedure (min–max and median), lifting technique, additional surgical procedures (blepharoplasty, brow lift, or platysmaplasty), type of applied peel, time until return to socialization, and postoperative complications, while the senior author verified the extracted data to minimize data extraction errors.

The aesthetic outcome was documented by the first and the senior authors using standard photographic documentation obtained 6, 12, and 24 months postoperatively.

Results

From 2008 to 2014, 159 patients received the PAVE treatment and all patients were Caucasians. The demographics and results are presented in Table 1 and the complications in Table 2.

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All patients, even those with postoperative complications, reported high subjective satisfaction with the effect of facial rejuvenation (Figures 3–5).

Discussion

Surgical facelift techniques, volume fat grafting, and chemical peels all play an important role as single entities in the armamentarium for modern facial rejuvenation.

A new, well-informed generation of patients has begun to visit our offices. They have first-hand experience with skin rejuvenation procedures and increasingly ask for a more complete, intrinsic rejuvenation that goes beyond the well-known surgical "lift-and-tuck" approach.

The simultaneous combination of facelift techniques with a TCA peel was described in the mid-1990s as empirically safe; all 35 patients treated with a deep-plane facelift and a 35% TCA peel experienced a clinical improvement without increased morbidity.7 A preliminary study of Kaye’s introduction of the PAVE lift showed the positive effect of combining SMAS plication and stacking techniques, fat grafting, and peels in a multilayer single-stage approach.5

The present study retrospectively evaluated the safety of this combined approach over a 6-year period and is the first study to combine peeling procedures on subcutaneous undermined skin flaps with an SMAS lift and not a deep plane-lifting procedure in a single-stage, therefore demonstrating the safety of this approach.

Swanson analyzed the outcome of 93 patients treated with a deep-plane facelift and found that the average time off work was 24 days, with a mean time of 2.5 months until they were "back to normal".10 Considering that the reepithelialization period is well known to last 7–10 days after chemical peels,11 it is evident that a combined single-stage approach combining surgical and peeling-based rejuvenation techniques can reduce downtime.

The complications of facelift surgery are well known and have been described previously. Our percentage of complications (1.8%; n = 3 hematomas) is compatible with the value of 1.8% for hematomas described by Mustoe in a meta-analysis of 41 studies published between 2001 and 2013.12 Fisher’s exact test comparing the results of Mustoe’s meta-analysis with ours did not show any statistically significant difference (p < 0.001).

In our study, no adverse events related to fat grafting occurred except for minor volume asymmetry in n = 5 patients.
patients (3.1%) who required a second instance of fat transfer. Autologous fat grafting is generally regarded to be a safe procedure, but there are several reports of associated morbidity, such as cellulitis, fat necrosis or cysts or fat emboli, leading to loss of vision, hemiplegia, global aphasia, or even stroke.13

An important concern is the possible permanent hypopigmentation of phenol/croton oil-peeled areas, which occurred in six cases (Figure 6). Extensive informed consent is mandatory preoperatively, including information about temporary hyperpigmentation/hypopigmentation, prolonged erythema, and milia formation, as well as preoperative topical skin preparation.

One patient experienced cardiac arrhythmia after applying the phenol/croton oil peel, which is known to cause arrhythmias in the context of systemic absorption.14

Table 2 Complications of the n = 159 treated patients between 2008 and 2014 classified according to the treatment entity (surgical facelift, autologous fat transfer, TCA peel, and phenol/croton oil peel). We did not observe peeling-associated necrosis of the skin or hypertrophic scars in any of our patients.

<table>
<thead>
<tr>
<th>Complications</th>
<th>n = 159 patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>surgical facelift</td>
<td></td>
</tr>
<tr>
<td>hematoma requiring surgical revision</td>
<td>n = 2</td>
</tr>
<tr>
<td>hematoma treated by bedside drainage</td>
<td>n = 1</td>
</tr>
<tr>
<td>temporary neurapraxia of the mandibular branch</td>
<td>n = 2</td>
</tr>
<tr>
<td>autologous fat transfer</td>
<td></td>
</tr>
<tr>
<td>minor volume asymmetry</td>
<td>n = 5</td>
</tr>
<tr>
<td>prolonged swelling</td>
<td>n = 0</td>
</tr>
<tr>
<td>postoperative cellulitis</td>
<td>n = 0</td>
</tr>
<tr>
<td>fat necrosis</td>
<td>n = 0</td>
</tr>
<tr>
<td>TCA peel</td>
<td></td>
</tr>
<tr>
<td>temporary hyperpigmentation</td>
<td>n = 5</td>
</tr>
<tr>
<td>hypopigmentation (Figure 6)</td>
<td>n = 6</td>
</tr>
<tr>
<td>formation of skin milia over</td>
<td>n = 5</td>
</tr>
<tr>
<td>2–3 months</td>
<td></td>
</tr>
<tr>
<td>phenol/croton oil peel</td>
<td></td>
</tr>
<tr>
<td>temporary hyperpigmentation</td>
<td>n = 4</td>
</tr>
<tr>
<td>prolonged erythema (&gt;8 weeks)</td>
<td>n = 3</td>
</tr>
<tr>
<td>cardiac arrhythmia</td>
<td>n = 1</td>
</tr>
</tbody>
</table>

a Complete regression within 4 resp. 6 weeks.
b Complete regression within 3–4 months under complete sun protection and treatment with topical hydroquinone 4%.
c Completely reversible with adequate drug treatment.

Figure 3 A 62-year-old female patient preoperatively and 12 months postoperatively: SMAS full face and neck lift with Omega scar with upper and lower blepharoplasty; fat transfer: 0.5 cc upper lips; 0.5 cc lower lips, 1 cc nasolabial, 0.5 cc marionette folds, 0.5 cc infraorbital; and TCA 25% full-face peel.

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Even though Landau states that the incidence of cardiac complications in appropriately performed deep chemical peeling is lower than previously appreciated, a full health checkup, including electrocardiogram (ECG) and standard blood counts, is indispensable. Any known heart disease requires special precautions in collaboration with the anesthesia department, and in our opinion preexisting arrhythmia or conduction disorders, such as Wolff-Parkinson-White (WPW) syndrome, are an exclusion criterion, for the application of phenol/croton oil peels.

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Conclusion

In our study, the use of the adjuvant phenol/croton oil or TCA peeling techniques and autologous fat transfer together with surgical rhytidectomy has proven to be a safe and effective approach to overcome the limitations of conventional surgical lifts.

Patients’ downtime was decreased when the treatments were combined.

This approach is effective and safe when the limitations and contraindications are followed properly and the surgeon is experienced with each of the combined techniques.

Conflict of interest statement

The authors have no financial interests to declare in relation to the content of this article.

References


Figure 6  A 68-year-old female patient, 5 years after the PAVE procedure (Figure 5). Note the persistent perioral hypopigmentation.