THERAPEUTIC UPDATE


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Acne Scarring

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Acne affects 80% of people 11 to 30 years old with up to 95% of these patients ultimately left with some degree of scarring.[1] Acne is the most common cause of facial scarring and results in considerable physical and psychiatric morbidity. Of those patients who end up in our offices seeking help, the choice of treatment is generally dictated by several factors including the severity and morphology of lesions, patient expectations, cost, and the side effect profile.

Before initiating treatment, it is important to give the patient a handheld mirror and explain to them the difference between active acne lesions, post-inflammatory hyperpigmentation (PIH), and true scarring. Too often a patient is frustrated by what they perceive as extensive scarring when they truly have severe PIH, thus requiring a very different set of treatments than those used for scarring. Acne scars can be either hyertrophic or atrophic. Hypertrophic scars respond well to repeated intralesional injections of corticosteroids, which is generally considered the first-line therapy.[2] Intralesional 5-fluorouracil (5FU), which has been shown to reduce fibroblast proliferation, is also very effective, especially when combined with the 585-595nm pulsed dye laser (PDL).[3] Fitzpatrick describes a protocol of using 0.9cc of 50mg/cc of 5-FU (ie, 45mg) combined with 0.1cc of 10mg/cc of Kenalog in the same syringe with 0.05cc injected per site, with 1cm between sites.[3] Injections are combined with PDL treatment at 6 J/cm^2 with the laser being performed first. Injections are initially performed as often as 2 to 3 times per week until response is noted at which point the interval can be increased to every 2 to 4 weeks.

The majority of acne scars are atrophic and can be categorized based on morphology as rolling, boxcar, or icepick.[4] Rolling scars are depressed, distensible scars that, of the three types, are generally considered the most responsive to treatment. Boxcar scars are punched-out, u-shaped scars that often require punch excision techniques. Ice pick scars are narrow, v-shaped scars that extend to the subcutaneous fat and also often require surgical intervention. Approaches to the treatment of atrophic acne scars can be divided into three general categories: resurfacing techniques, dermal fillers, and surgical techniques. It is critical when treating acne scars to appropriately manage patient expectations, explaining that scarring is permanent. Thus the goal of treatment is always improvement of, not elimination of their scars. It is also important for providers to keep in mind that what might seem like a minor, even trivial improvement to us, may be life changing for a patient who has had a face full of scars looking back at them in the mirror for 20 years.

Resurfacing Techniques

Dermabrasion

Dermabrasion removes the epidermis and part of the upper dermis and thus can be utilized to treat shallow, rolling, or boxcar scars. The outcome is largely technique and operator dependent with potential risks including sustained erythema and PIH. The technique has somewhat fallen out of favor with the advent of the fractional resurfacing lasers, but dermabrasion still has a place in the armamentarium as a low-cost treatment option with relatively little down time. Dermabrasion can also be performed prior to chemical peels to increase the depth of penetration of the peeling agent.

Chemical Reconstruction of Skin Scars (CROSS)

Trichloroacetic acid (TCA) CROSS involves the serial application of 90 to 100% TCA to scars using a narrow wooden applicator until a white frost appears. The application of TCA results in necrosis of the epidermis and of dermal collagen with subsequent reorganization of the dermis and an ultimate increase in volume.[5] The procedure is repeated at 4 week intervals for 3 to 4 treatments. TCA CROSS is a relatively quick and easy office procedure with minimal down time and low cost to both patient and practitioner. TCA CROSS may offer some degree of efficacy even for ice pick scars that would otherwise require punch excision. Because the treatment area is so focal, CROSS can be safely utilized in patients with skin of color, although most advise priming with hydroquinone 4% and tretinoin 2 weeks before treatment.[6] Risks of TCA CROSS include atrophy that typically improves spontaneously as well as post-inflammatory hyperpigmentation (PIH), which

is usually transient. While TCA cross has been demonstrated to be less effective than fractional CO2 lasers,[7] it is certainly a reasonable option for patients (and physicians) seeking a low cost treatment with no downtime. As with any treatment, proper management of expectations is the key.

Skin needling

Although utilized since 1995 for many dermatologic indications, there has been a recent renewed interest in skin needling particularly as it pertains to the enhanced delivery of topical medications. Small needles attached to a rolling or stamping device penetrate 1.5 to 2mm into the dermis creating wounds in the papillary dermis that stimulate wound healing and promote tissue remodeling over several months. Skin needling is another technique that has minimal to no downtime and relatively low cost. The small wounds created can also be utilized to enhance topical drug delivery such that combining needling with chemical peels may yield improved results compared to needling alone. A 2012 study of 30 subjects randomized to receive 5 treatment of microneedling alone versus 5 treatments of microneedling plus 35% glycolic acid showed a statistically significant (P=0.001) higher rate of improvement in the glycolic acid group (62% vs 31%).[8] Microneedling is generally considered to be safe although one case report from July of 2012 described the development hypertrophic "tram-track" scars after two treatments of needling with 2mm needles spaced 2mm apart.[9] The case prompted authors to recommend the use of needles smaller than 2mm when treating over bony prominences such as the zygoma or temple.

Non-ablative fractional lasers

Non-ablative fractional lasers create microthermal zones of injury in the lower epidermis and dermis while leaving the stratum corneum intact. Devices such as the erbium-doped glass 1550nm laser are some of the most commonly utilized in the treatment of acne scars because of their safety profile. Multiple treatment sessions are the rule, however, with the effects of the first treatment often not realized until after the second or third treatment. A total of 4 to 6 sessions are generally required to obtain the optimal result, but for those patients unable to tolerate any professional or social downtime, non-ablative fractional treatments may be the best approach. A 2012 study of 87 subjects with atrophic acne scars treated for 6 sessions every 3 weeks with the Lux1540 (Palomar, Burlington, MA) reported 92% of patients with "marked" improvement defined as >50% improved from baseline.[10] Confocal microscopy performed before and after treatment revealed that bright, irregularly arranged coarse collagen present before treatment was ultimately replaced by fine, net-like reticulated collagen fibers around hair follicles. Thus, it appears that the mechanism of action involves the replacement of old, defective collagen in the dermis with new, more organized collagen stimulated by the microthermal zones of injury.

Fractional CO2 lasers

For many years, the fully ablative 10,600nm CO2 was the gold standard for the treatment of acne scars. With the advent of fractional lasers, we were able to harness the power and efficacy of the CO2 laser without the extensive down time and burdensome side effects. A typical fractional CO2 protocol entails herpes simplex prophylaxis, pre-treatment with hydroquinone for skin of color patients, topical anesthesia, variable settings dependent on the device, 1-2 passes, and post-procedure occlusive ointment for up to a week.

A literature review of 20 clinical studies utilizing CO2 lasers for acne scarring published between 2008 and 2013 suggested that although all 20 studies yielded "positive" results, there were substantial limitations to the body of research overall. There was a lack of standardization across all the studies which included differences or complete lack of pre-treatment scar severity assessment, different numbers of treatments or passes per treatment, different settings and devices, and different post- treatment improvement scales.[11] Another important gap in the fractional CO2 literature includes lack of data on long-term outcomes.

The standard approach when using fractional CO2 for acne scarring is to perform a full-face procedure, treating the scarred areas as well as the surrounding normal skin. A 2013 study by Schweiger and colleagues sought to address whether a full face treatment is truly necessary or whether a FAST (focal acne scar treatment) technique might be equally efficacious with fewer adverse effects. In a retrospective study of 6 patients treated with fractional CO2 (Mixto Lasering Inc, Italy), they noted subjective improvement of at least 60% in all patients, and most important, there was no apparent delineation between the treated and non treated skin.[12] The authors suggest that perhaps a focally aggressive approach (14-16 Watts, Index 8, 15% coverage, 2 passes) only in the area of the scars might be equally efficacious and better tolerated than a full face treatment at more conservative settings. Notably, the protocol also includes an erbium glass fractional laser treatment one month post treatment to address any remaining PIH.

Radiofrequency (RF)

Fractional RF devices such as the E-Matrix (Syneron-Candela, CA) are quickly gaining popularity in the arena of acne scarring because of the relative ease of performing the procedure and the favorable safety profile particularly for skin of color patients. Unlike lasers, RF devices utilize thermal energy to create deep dermal heating without a target chromophore and thus are said to be "color-blind." A 2013 split-face study of 20 Thai patients compared the efficacy of 3 monthly treatments with the E-Matrix fractional RF to the non-ablative Fraxel re: store (Solta, CA) for the treatment of atrophic acne scars[13]. Both devices resulted in statistically significant improvement

as assessed by both subjects and physician evaluators with no significant difference in efficacy between the devices. The Fraxel re:store was noted, however, to be significantly (P<0.001) more painful than the E-matrix (mean of 7.75 on a 10-point scale vs 5.90).

Dermal Fillers

Hyaluronic acid

One of the cornerstones of acne scar treatment is the use of dermal fillers. Fillers are generally most effective on shallow, rolling scars and ineffective on ice pick scars. HA fillers such as Juvederm (Allergan, Irvine, CA) and Restylane (Medicis, Scottsdale, AZ) can be used as monotherapy or in combination with subcision to raise atrophic acne scars. As always, one advantage of the HA fillers over more permanent fillers is their reversibility in the event of over-correction or patient dissatisfaction. Although HA fillers are not permanent, there is some evidence to suggest that the mechanical effect of placing the HA stretches dermal fibroblasts leading to neocollagenesis and a more sustained, long term effect.[14] Belotero (Merz Aesthetics, Greensboro, NC) may be particularly well-suited to treat acne scars because of its low G', low viscosity, and zones of high and low density that allow the material to insinuate into areas of scarring. Of note, simply stretching the skin with tumescent saline can offer some degree of improvement and may be a cost-effective way for patients to "preview" the effect of dermal fillers prior to committing to the procedure.

Silicone

One of the first fillers to be utilized in cosmetic dermatology was silicone. While many have abandoned the use of silicone due to safety concerns, others continue to champion the use of pure, medical-grade silicone as an effective and safe treatment for acne scars. Data regarding the use of silicone for acne scars is limited to case series, the largest of which was published by Barnett in 2005 where he reports his experience using silicone for over 30 years in several thousands of patients. He reports that he has had no major adverse events with only minor bleeding and bruising at the injection site and fewer than 10 patients with over-correction of scars.[15] Silicone must be administered using a micro-droplet technique over a series of several sessions to avoid over-correction. This is in contrast to HA in which the final degree of correction is, for the most part, appreciable before the patient leaves the office.

Polymethylmethacrylate

Artefill® (Suneva, San Diego, CA) is a long-lasting dermal filler comprised of 20% polymethylmethacrylate (PMMA) microspheres suspended in 80% bovine collagen that was FDA approved in 2006 for the correction of nasolabial folds. While the collagen is absorbed over time, the microspheres remain as a scaffold for the development of new collagen and are large enough such that there is no migration from the site of injection. The effects of Artefill remain for approximately 5 years or more. Suneva Medical announced in 2013 that its multi-center, industry-sponsored clinical trial of the use of Artefill for acne scars met its endpoints for efficacy with statistical significance. They plan to seek an FDA approved indication for the use of Artefill for acne scarring, and if successful, would be the only on-label filler for acne scarring on the market. Two concerns regarding the use of Artefill include the need for skin testing prior to administration (because it contains bovine collagen) and the risk of granuloma formation. According to the manufacturer's guidelines, the skin test site must be observed for 4 weeks after placement, which may be a deterrent for patients seeking treatment on or soon after the day of their consultation. True granuloma formation is virtually unheard of with the third-generation product and was exceeding rare (1:5,000) even when using the second-generation product Artecoll.[16] It is believed that what might be perceived as "granulomas" are actually nodules of product that form as a result of being placed too superficially.

Autologous fibroblasts

One of the latest trends in dermal fillers is the use of autologous fibroblasts in which the patient's own fibroblasts are harvested from post-auricular punch biopsies, cultured, and then injected into contour defects. Theoretically, the use of living cells has the potential to provide a longer-lasting, dynamic treatment effect compared to that obtained using an inert, artificial substance. Similarly, autologous fibroblasts offer a treatment alternative for patients who are seeking "natural" therapies or who are "allergic to everything." A multi-site, prospective, double-blind, split-face, placebo-controlled trial of 99 subjects with distensible acne scars demonstrated treatment success (defined as a two-point improvement on a 5 point scale) in 43% of subjects versus only 18% in the placebo group as assessed by the subjects[17]. Interestingly, the degree of improvement as assessed by the physician evaluator was much more modest: 59% of the treated group met the primary endpoint compared to 42% in the placebo. The results not only emphasize a strong placebo effect in the treatment of acne scarring but also highlight an important clinical correlate, which is that what may seem like a nominal degree of improvement to physicians is potentially a meaningful and life-changing improvement for the patient. Skeptics of the new technology question whether the relative benefit will outweigh the cost, particularly in an era with widely available, highly effective and safe synthetic dermal fillers.

Surgical Techniques

Punch excision and subcision

Ice pick and boxcar scars that extend into the fat generally will not respond to dermal fillers or resurfacing techniques. Often the best approach for these unsightly scars is to remove the defect via punch excision and linear closure with subsequent resurfacing. Rather than closing the defect, a punch graft

harvested from posterior auricular skin can also be placed. Subcision has long been utilized in the treatment of acne scars, particularly rolling acne scars with dermal banding and tethering. A large bore needle is inserted into the mid dermis and using a fanning technique, the dermal bands are released allowing the base of the acne scar that was previously bound down to rise closer to the surface of the surrounding skin. Bleeding and subsequent clot formation then occupies the potential space created when the bands are released. Subcision is often combined with dermal fillers, which can be used as a more sustainable material to fill in the potential space rather than the clot alone. The procedure is relatively easy to perform and is low cost with main side effects including mild bleeding and bruising. A randomized, split-face study comparing subcision to 100% TCA in 20 patients with rolling acne scars showed significantly (P= 0.001) better reduction in scar depth with subcision.[5] Additionally, more pigmentary alterations were noted in the TCA group.

Conclusion

A combination approach that considers both the patient's and the physician's limitations generally has the best chance for success. The face of an acne scarred patient is often a landscape of mixed terrains with rolling scars that require filler with resurfacing and deeper boxcar or ice pick scars that need surgical approaches. While emerging technology will no doubt improve outcomes for acne scar patients, we would be wise to remember that prevention of scarring via an appropriately aggressive acne treatment regimen is always the best strategy.

Disclosure

The author has not disclosed any relevant conflicts.

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