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# Treatment of Acne Scars with Liquid Silicone Injections: 30-Year Perspective

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**BACKGROUND.** This article addresses the use of liquid injectable silicone as both an immediate and long-lasting treatment for broad-based, depressed acne scars. The only filler substance that maintains precision and permanence in improving and/or correcting these types of acne scar defects is medical-grade liquid silicone.

**OBJECTIVE.** We describe five patients with a history of acne scarring who showed improvements from injections of liquid silicone at the initial treatment session and lasting over a 10-, 15-, and 30-year follow-up period.

**METHODS.** Monthly liquid silicone injections using a technique known as the microdroplet, multiple-injection approach.

**RESULTS.** This article documents the safety, effectiveness, and precision of silicone in addition to highlighting the fact that its permanence is what distinguishes it from other filler materials.

**CONCLUSION.** As a precise and permanent filling substance used for soft tissue augmentation, liquid injectable silicone can improve and/or eliminate depressed, broad-based acne scars through a technique known as the microdroplet, multiple-injection approach.

JAY G. BARNETT, MD, AND CHANNING R. BARNETT, MD, HAVE INDICATED NO SIGNIFICANT INTEREST WITH COMMERCIAL SUPPORTERS.

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SOFT TISSUE augmentation is sought to enhance various body contours and to restore soft tissue loss associated with both normal aging and with diseases and trauma damaging to cutaneous structures. Such tissue augmentation can be achieved with certain filler materials. Many fillers have been used for correction or restoration of facial contour deformities.<sup>1</sup>

## Filler Material Requirements

For a filler material to be useful in correcting soft tissue abnormalities, it should be able to produce long-lasting, esthetically pleasing cosmetic results with a minimum of undesirable reactions.<sup>1</sup> An ideal filler would be one that is autologous, painless on injection, easy for the physician to use with respect to material injectability and injection techniques, and inexpensive. It would also be preferred if such a filler were long-lasting while producing minimal side effects, such as bruising, bleeding, infection, scarring, migration, tissue loss, or reaction. In addition, physicians in the United States would hope that this material was approved by the Food and Drug Administration (FDA).

Critical factors associated with filler agents and their use include injection technique (skill of administration)

and defect selection.<sup>1</sup> Fillers have been used to correct postoperative facial deformities, various types of acne scars, cutaneous diseases such as lipodystrophy, and trauma-induced atrophy, as well as nasolabial, perioral, periorcular, and glabellar wrinkles and folds.<sup>2-7</sup> It should be noted that the only liquid filler substance that maintains precision and permanence in improving and/or correcting soft tissue defects is medical-grade liquid silicone, a silicone preparation purified and sterilized so that it can be used for medical and biologic purposes.<sup>8</sup> Artecoll (Rofil Medical International, Breda, the Netherlands), consisting of 20 volume percent of microspheres of polymethylmethacrylate and 80 volume percent of bovine collagen,<sup>9</sup> does not maintain its correction, and the statement that the collagen in the Artecoll solution is replaced by an equal amount of your own collagen is not proven.

## Acne Scarring

Acne can produce many different types of skin defects, including inflammation and/or scarring. Scarring resulting from acne can be described as deep, shallow, wide, pitted, ice pick, depressed, hypo- and hypertrophic, keloidal, or hypo- and hyperpigmented. The choice of technique for correction, therefore, is dependent on the type of scar or acne defect. Several techniques for facial acne scar revision have been described. These include laser, dermabrasion, shave excision, punch elevation, punch excision with full-

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thickness graft replacement, silicone or collagen augmentation, electrodesiccation, and scar reduction with intralesional corticosteroids.<sup>10,11</sup>

In the case of pitted, ice pick, depressed, or broad-based acne scars, soft tissue augmentation can aid in repairing and restoring the appearance of the skin's surface. However, owing to the fibrous nature of both pitted and ice pick scars, the benefit of treating these two types of scars is limited compared with the benefit obtained in treating depressed or broad-based scars. Use of augmentation in the treatment of broad-based depressed scars was first reported in 1983; the two filler substances mentioned at this time were silicone and collagen.<sup>10</sup>

Over the course of 30 years, a few thousand patients have been treated for different types of acne scars. Minor bruising and bleeding at the injection site can occur with treatments, but persistent swelling or redness does not occur. Although no significant adverse reactions have occurred in any of these patients, a few (less than 10) have had areas of overcorrection, meaning that the scar was injected with slightly more silicone than was needed. Such overcorrections required minor surgical corrections, such as shave excision, light electrosurgery, and/or injections of small quantities of low-concentration triamcinolone acetonide.

## Silicone

Silicone, in the currently FDA-approved "off-label" filler substances SILIKON 1000 (Alcon, Fort Worth, TX, USA) and ADATO SIL-OL 5000 (Bausch and Lomb, Rochester, NY, USA) (both are purified polydimethylsiloxane), is a generic name for a group of polymers based on the element silicon that range in viscosity from fluids to solids.<sup>12</sup> The compound polydimethylsiloxane is the most widely used silicone in medical implants. Silicone in elastomer (solid) form is extensively used in medicine, for example, in intravenous fluid tubing and implanted prosthetic devices. Silicone gel is mainly used for breast reconstruction and breast enlargement.<sup>13,14</sup> Although technique dependent, the advantages of liquid injectable silicone over other liquid injectable filler substances are its precision and permanence.

Liquid injectable silicone readily fulfills most of the criteria for an ideal filling substance.<sup>15</sup> It is a clear, odorless, tasteless, colorless, and stable substance. The mechanism of action in achieving both a cosmetically pleasing and a safe result is believed to be a combination of the displacement of the dermal connective tissue by silicone microdroplets and possibly by the production of thin-walled collagen capsules that surround the silicone microdroplets.<sup>16</sup> Liquid injectable silicone does not harden or soften, remains unaltered within the range of human body temperature, and is chemically unchanged by exposure to air, most chemicals, and sunlight. It can be stored for long

periods of time at room temperature and does not allow for the growth of microorganisms.<sup>15</sup>

Concerns about its long-term safety and adverse tissue reactivity have been raised in numerous articles.<sup>17-19</sup> Silicone has been implicated in a variety of local and systemic adverse inflammatory reactions.<sup>20</sup> Treatment-site reactions, including erythema, pain, tissue induration, pigmentation, ecchymosis, excessive tissue elevation, and migration of the injected material to local and distant areas, have been reported. More severe complications, including subcutaneous nodules, granulomas, cellulitis with nodule formation, skin induration, ulceration, and local lymph node enlargement, have also been reported.<sup>21</sup> Following injections of large amounts of silicone, physicians have reported tissue destruction and scarring, acute pneumonitis, and granulomatous hepatitis.<sup>22-25</sup> In the last 15 years, there has been great controversy regarding the relationship between silicone breast implants and the development of systemic disease.<sup>26</sup> However, Hochberg and Perlmutter demonstrated in 1996 that there is no evidence of a significant statistical association between the two.<sup>27</sup>

Despite these concerns, the long-term experience of physicians skilled in the administration of liquid injectable silicone has shown it to be safe and efficacious for soft tissue augmentation.<sup>15,28</sup> Although not entirely biologically inert, liquid injectable silicone has been shown to have the least physiologic reactivity of most foreign materials.<sup>29</sup> Additionally, it lacks mutagenic, carcinogenic, and teratogenic effects; no true allergies to silicone have been documented. None of the above-mentioned reports have associated any such side effects or complication with the use of silicone for acne treatment, in which only very small volumes of the material are employed. Often most granuloma-related reports are associated with impurities in the silicone and silicones associated with other substances.

## Injection Technique

Both for minimal patient discomfort and for ease of administration, the method of choice for correction of depressed, broad-based acne scars remains the technique of injection that is referred to as the microdroplet, multiple-injection approach.

Each depressed, broad-based acne scar can be injected at different points in one treatment session. At each puncture point, minute amounts of liquid silicone ranging from 0.02 to 0.1 cc per puncture are injected below the depressed defect at the level of the deep dermis or superficial subcutaneous layer. When a minute amount of medical-grade liquid silicone is injected into the defect, it is thought that a monocellular fibrotic capsule forms around each silicone particle. The microparticles are thus prevented from migration, which allows for a stable implant with permanent results.<sup>30,31</sup> Newly deposited collagen may also minimally help fill in the depressed defect.<sup>10</sup>

The injections are made using a luer-lok syringe with an appropriately sized needle depending on the viscosity of the liquid silicone being used. With depressed, broad-based acne scars, the 1,000-centistoke viscosity liquid silicone is used almost exclusively with a 27-gauge  $\frac{1}{2}$ -inch needle. When using the 5,000-centistoke viscosity, a 25-gauge  $\frac{5}{8}$ -inch needle can be used. The higher the centistokes, the greater the viscosity and the more difficult it is to pass the material through smaller-gauge needles. One thousand-centistoke viscosity liquid silicone can readily go through a 27-gauge  $\frac{1}{2}$ -inch needle, whereas 5,000-centistoke viscosity liquid silicone can do so only with great effort or force. In other countries, liquid silicones are available with less viscosity than 1,000 centistokes, thus enabling an even smaller-gauge needle to be used for the injections.

Raising of the depressed defect can be seen as the liquid silicone is injected. Where indicated by the size of the defect, multiple sessions to correct the defect in stages rather than at one time are preferable to prevent overcorrection and to minimize the amount of liquid silicone used. Using the microdroplet, multiple-injection approach, small amounts of silicone are injected at the correct depth in the tissue at monthly intervals, usually requiring only a few treatments. Allowing about a month between treatment sessions enables the scar to stretch, reconfigure, or accommodate to the presence of the liquid silicone. With appropriate administration, the silicone stays permanently where it is placed, neither shifting nor drifting with time. Having the silicone in the corrected scar does not limit employing other treatments in the area, such as surgery, dermabrasion, laser, and chemical peeling. Of course, if the area of the corrected scar is surgically moved or removed afterward, the liquid silicone in the repaired scar will go with it.

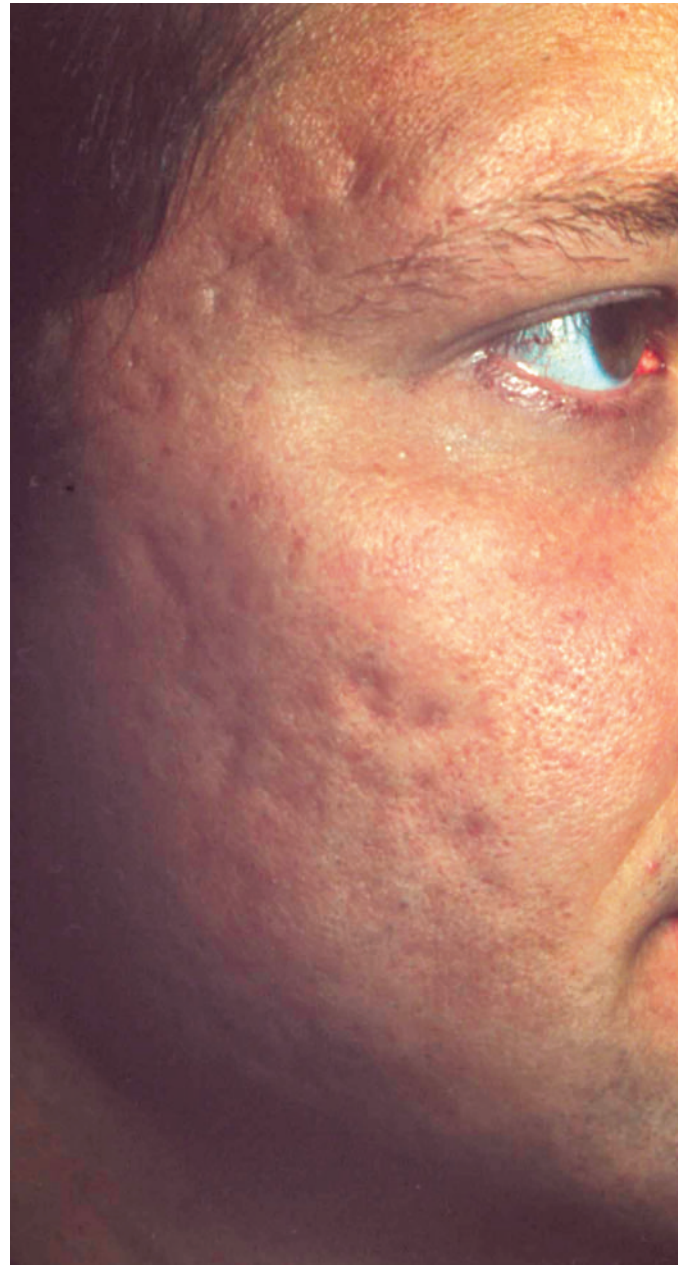
### Cases of Acne Scarring Benefiting from Silicone Injections

The patients illustrated (Figures 1 to 12) are representative of the immediate and long-term benefits of liquid silicone injections in treating depressed, broad-based, acne-type scars. In all five cases, the 350-centistoke viscosity medical-grade liquid silicone was used because that was the only medical-grade liquid silicone available at the time.

#### *Cases 1 and 2: Results Immediately (10 Minutes) after Initial Injection of Liquid Silicone*

##### **Case 1**

A 23-year-old man presented with numerous depressed, soft, broad-based acne scars on his face. His cystic acne of several years duration had been successfully treated using oral isotretinoin (Accutane). At the initial visit, each of the depressed, facial acne scars on his temples, cheeks, and preauricular areas was injected with liquid silicone. A total



**Figure 1.** Case 1: pretreatment.

dose of 1.4 cc was used. The pretreatment (see Figure 1) and immediate post-treatment (10 minutes after injection; see Figure 2) images reveal the permanent correction of his acne scars.

##### **Case 2**

A 42-year-old woman presented with numerous depressed, soft, broad-based acne scars on her face, particularly on her temples. Over 20 years ago, she had a facial dermabrasion. At the initial treatment, the acne scars on her face were injected with a total dose of 0.8 cc of liquid sil-

icone. The pretreatment (see Figure 3) and immediate post-treatment (10 minutes after injection; see Figure 4) images reveal the immediate correction of her acne scars.

*Case 3: 10-Year Follow-Up after Treatment of Facial Acne Scars with Injection of Liquid Silicone*

A 31-year-old man presented with depressed, fibrous, broad-based acne scars of 10 years duration on the right



Figure 2. Case 1: 10 minutes after treatment.

side of his chin. These acne scars were injected with liquid silicone twice at monthly intervals. A total amount of 0.4 cc of liquid silicone was used. The pretreatment (see Figure 5) and 10-year follow-up (see Figure 6) images reveal the long-term permanent correction.

*Case 4: 15-Year Follow-Up after Treatment of Facial Acne Scars with Injection of Liquid Silicone*

A 28-year-old man presented with numerous depressed broad-based acne scars on his face of many years duration. These acne scars were injected with liquid silicone four times over 2½ years, with a total dose of 1.2 cc used. The pretreatment (see Figure 7) and 15-year post-treatment follow-up (see Figure 8) images reveal the long-term permanent benefit.

*Case 5: 30-Year Follow-Up after Treatment of Facial Acne Scars with Injection of Liquid Silicone*

Thirty years ago, a 29-year-old woman presented with several depressed, soft, broad-based, facial acne scars on her facial cheeks. These acne scars were conservatively injected six times over 4 years with a total dose of 1.8 cc of liquid silicone used. The pretreatment (see Figure 9) and

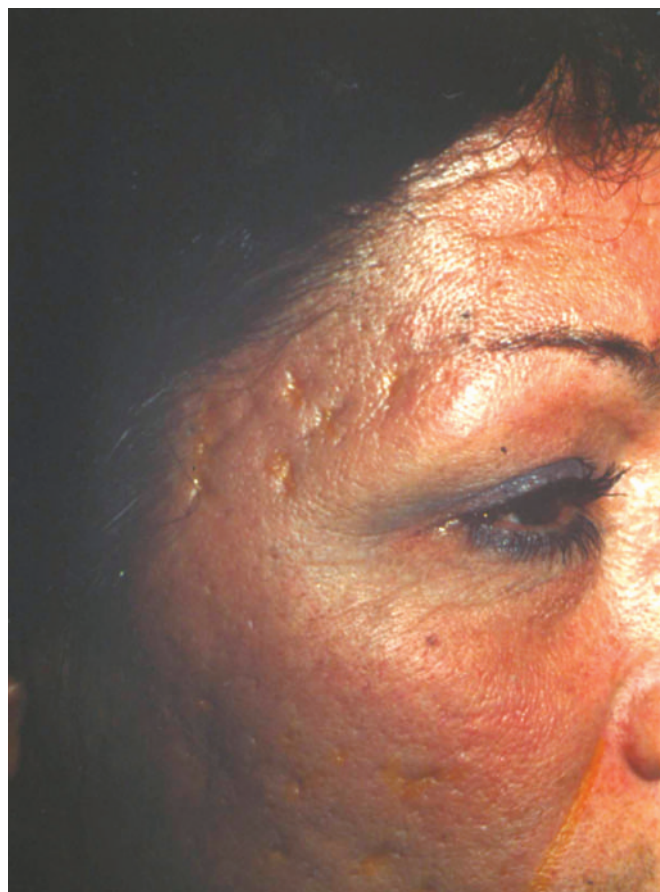


Figure 3. Case 2: pretreatment.

30-year follow-up (see Figure 10) images of the right side of her face, along with the pretreatment (see Figure 11) and 30-year follow-up (see Figure 12) images of the left side of her face, reveal the long-lasting, efficacious, and

safe use of pure liquid silicone injections in the treatment of depressed, broad-based acne scars.

## Discussion

As observed in the previously described representative cases, the results of treating acne scars with liquid injectable silicone are perceivable in just several minutes, are long-lasting, and are dependent on the type and severity of the acne scars being treated.

By placing small amounts of silicone at the correct depth in the tissue at monthly intervals over several months, one also reduces the risk of overcorrection. Minor overcorrections (ie, injecting too much liquid silicone into a particular defect) can usually be minimized or eliminated using various injections and/or minor surgical techniques. Surgical techniques include shave excision or light electrodesiccation. On occasion, one may need to inject small amounts (one-tenth of a cubic centimeter) of triamcinolone acetonide in low concentrations into the overcorrected defect.

The use of liquid silicone injections in instances such as those described above can obviate the need for other surgical procedures and for the use of any other filler materials, most of which would not duplicate the degree of improvement obtained simply and easily by liquid silicone injections. With this injection technique, the patient can obtain an immediate and permanent scar correction without the inconvenience, pain, and cost of other treatments.

Although not forgiving if used incorrectly, liquid injectable silicone used appropriately, carefully, and con-



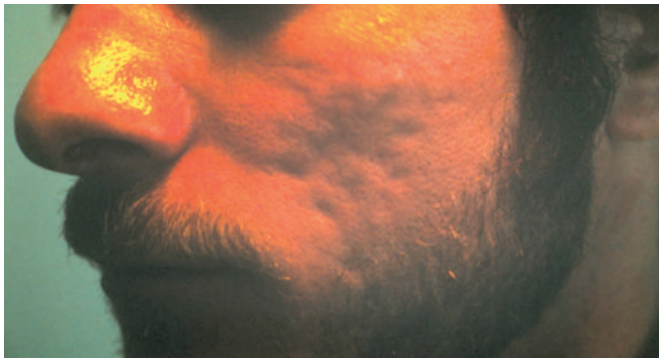
Figure 4. Case 2: 10 minutes after treatment.



Figure 5. Case 3: pretreatment.



Figure 6. Case 3: 10-year follow-up.



**Figure 7.** Case 4: pretreatment.



**Figure 8.** Case 4: 15-year follow-up.



**Figure 9.** Case 5: right side, pretreatment.



**Figure 10.** Case 5: right side, 30-year follow-up.

servatively has proved very safe and very effective as a soft tissue filler for 30 years. In addition, initiation and continuation of such tissue correction can help reduce or even overcome the psychological burden associated with acne scarring.

In 30 years of using liquid silicone injections in situations such as those outlined above, only occasional minor bruising and, rarely, overcorrection and/or discoloration of a scar have occurred. Most importantly, no serious complications have ever been encountered.

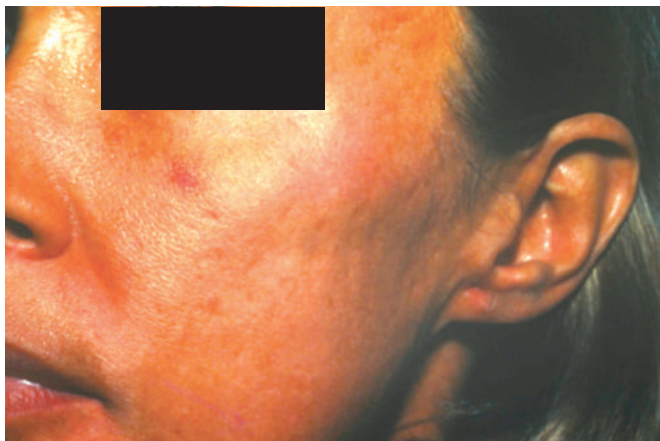


Figure 11. Case 5: left side, pretreatment.



Figure 12. Case 5: left side, 30-year follow-up.

## Conclusion

Given that acne scarring carries a great psychological and physical burden for many patients, there is a strong desire for correction of resulting deformities. Moreover, as the

population continues to age, the desire and need to maintain a youthful, refreshed, and vibrant physical appearance have shaped the world of soft tissue augmentation and rehabilitation. Driven by patient demand and manufacturer interest, the use and development of filler substances for correction and enhancement have grown tremendously in the past few years. However, even with the development of many new filler materials, liquid silicone, which is safe, effective, and precise, still remains the only permanent liquid filler approved for “off-label” use by the FDA.

We have described several patients with a history of acne scarring who show significant improvements from injections of liquid silicone at the initial treatment session and lasting over a 10-, 15-, and 30-year follow-up period. This article documents the safety, effectiveness, and exactness of silicone in addition to its permanence.

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