SILICON GEL SHEETING IN THE MANAGEMENT OF HYPERTROPHIC SCARS

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With advances in reconstructive foot and ankle surgery to improve function and motion, an unfortunate increase in the degree and extent of hypertrophic scars has developed. Early range of motion protocols following procedures for conditions such as hallux limitus, enhance joint range of motion, but unfortunately may result in an increased tendency for hypertrophic scar formation. If a simple and effective, non-invasive technique could be identified to aid in the treatment and prevention of scar hypertrophy, it would provide a service to patients following reconstructive surgery.

Symptomatic scars about the foot and ankle are less a problem of cosmesis than of symptomatology, due to shoe wear needs. Hypertrophic scars occasionally resolve spontaneously, however, many remain permanently. Substituting a painful joint for a painful scar, therefore, may not be a fair trade. Silicon gel sheeting and its application in the treatment and prevention of hypertrophic scars in the podiatric patients will be examined and evaluated.

MATERIALS AND MECHANISM

Silicone gel sheeting® (Dow Corning Wright) is a soft, slightly adherent, semi-occlusive material fabricated from medical grade silicone polymer. Chemically, the material is a cross-linked polymethylsiloxane polymer. A mesh is added to reinforce and strengthen the polyester fabric. The sheet measures 3.5 ml in thickness. Currently, it is available in 10 cm x 10 cm sheets which are sterile packaged. This surface size will provide twenty-five 2 cm x 2 cm pieces. The gel sheet can be extended 41.8% of its original size, which is close to that of skin (40%). It is thus effective to cover joints.

The mode of action of silicone gel sheeting is unknown. The specific cause of hypertrophic scar formation is unknown as well. In fact, there is no animal model for scientific study of hypertrophic scars. According to Ahn, this presents a rather perplexing dilemma for scientific study. Quinn found the mode of action of silicone gel sheeting to be independent of pressure, temperature, oxygen, occlusiveness, or silicone absorption within the scar. Current theories suspect either a hydration phenomenon or interstitial fluid dynamic changes.

The hydration theory is explained by the occlusive nature of silicone gel that leads to increased hydration of the outer horny layer of the skin. This hydration results in an increased skin permeability to water soluble compounds. A hydrated outer layer of skin overlying a hypertrophic scar permits diffusion of interstitial soluble proteins in the direction of the skin surface. This allows low molecular components of inflammation to escape and is thought to contribute to scar maturation. The hydration theory is further promoted by Sawada who has recently reported the use of silicone gel in a cream base, not gel sheeting. He noted good results in the extremities in cases unresponsive to silicone gel sheeting. He hypothesized that the cream maintains closer contact over the entire scar, especially in areas of

unusual body contour. This increased contact was hypothesized to improve hydration and, therefore, the efficacy of the treatment.

The origin of use of silicone gel sheeting is unknown as well as no individual is credited with identifying silicone gel as a specific treatment modality. Silicone gel has been used as a filler under pressure garments in the treatment of hypertrophic scars from burns.

CLINICAL PROTOCOL

Close contact between the silicone gel sheeting and the scar area is critical. This does not imply compression of the material onto the scar. It is recommended that contact be maintained over a continuous twelve-hour period. A longer contact time does not appear to be efficacious, however, and actually promotes an unwanted dermatitis reaction.

The hypertrophic scar to be treated is thoroughly cleansed and rinsed. The silicone gel sheeting should not be used over open or draining areas. The material is then cut to fit the scar. The piece of silicone gel sheeting is then secured to the area of the scar with tape or an elastic-type dressing. The material may be worn beneath the sock and shoe if it is comfortable to the patient. Clinical experience has shown that wearing the material at night secured with tape and a sock is most comfortable. This procedure can be continued for several months. If no change has been noted by two months, a response is unlikely. The material can be reused over several treatment days and is replaced only when dried or cracked, demonstrating a loss of elasticity. A single 10 cm x 10 cm sheet is more than enough material for most podiatric applications. Although prepackaged sterile, the material need not be utilized sterile.

CLINICALLY ILLUSTRATED TECHNIQUE

Figure 1. Unopened package of silicone gel sheeting as provided by the manufacturer.

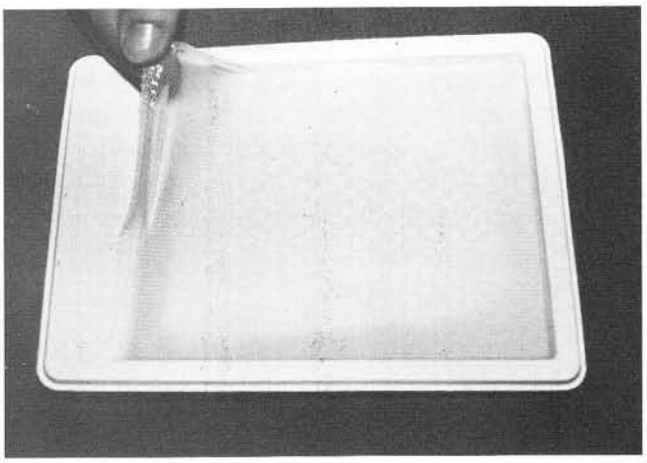

Figure 2. Silicone gel sheeting being raised from its plastic supportive tray.

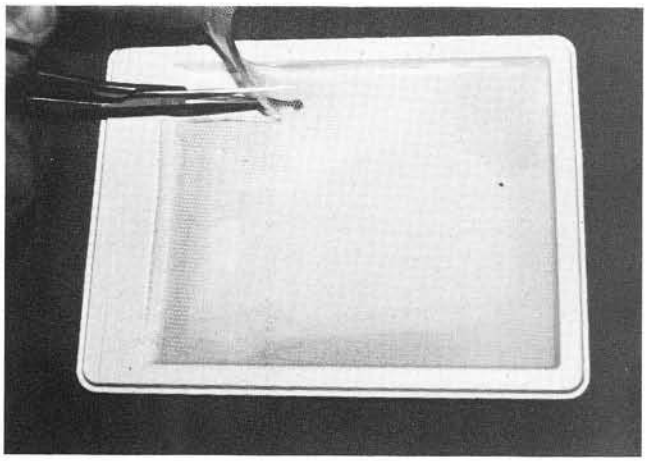

Figure 3. The ease of cutting and contouring of the silicone gel sheeting from the tray is demonstrated. Sterile technique is not necessary.

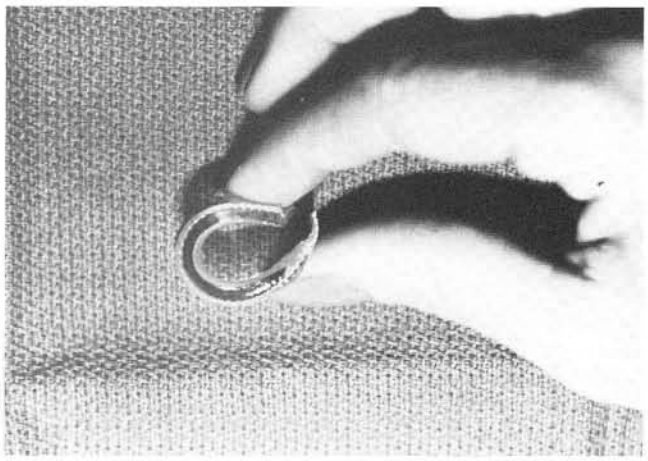

Figure 4. The flexibility of the silicone gel sheeting can be identified. Close examination reveals the polyester mesh that reinforces the outer-surface.

Figure 5A. The silicone gel sheeting has been applied to a scar on the medial aspect of the first metatarsophalangeal joint.

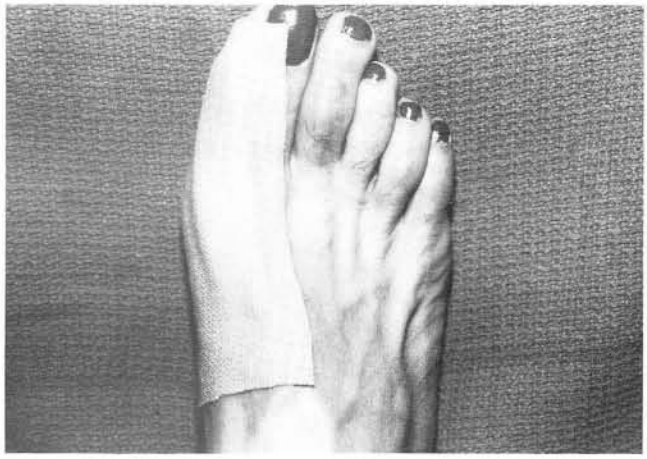

Figure 5B. Adhesive tape can be used to maintain a tight contact between the silicone sheeting and the surgical scar.

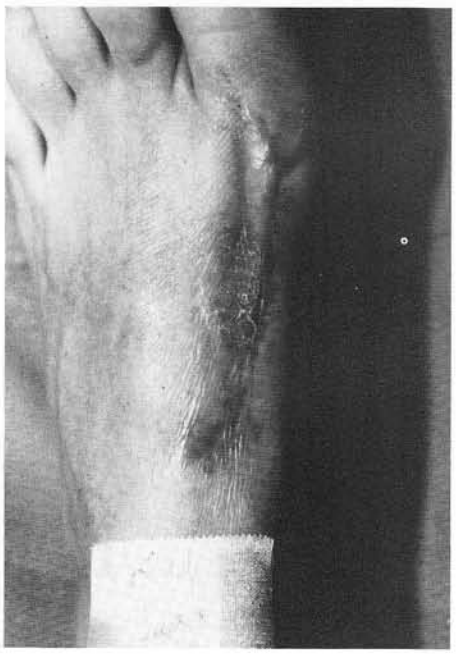

Figure 6. Dermal reaction from over-utilization of the silicone gel sheeting (approximately 20 hours per day over a three day period). This reaction was effectively controlled in several days with a topical hydrocortisone cream.

Figure 7A. Four months postoperative, first day of treatment with silicone gel sheeting on a hypertrophic scar.

Figure 7B. Four weeks of treatment with resolution of the proximal aspect of the hypertrophic scar.

Figure 7C. Seven weeks following treatment there is a continued loss of hypertrophy of the scar throughout its entire length with only the most distal aspects showing persistent hypertrophy.

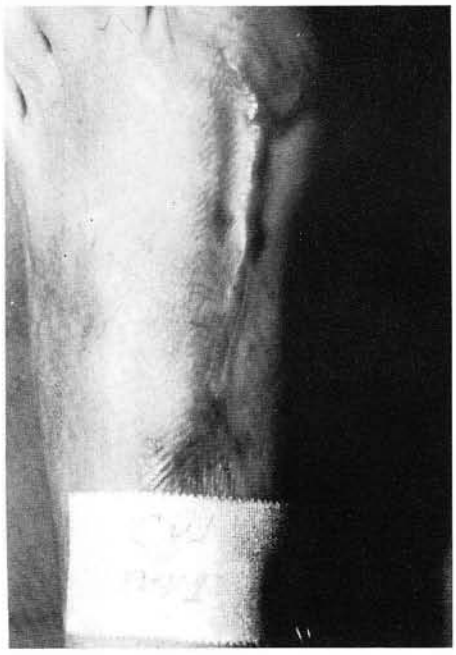

Figure 8A. Seven months following injury, the initial day of treatment of a hypertrophic scar secondary to a laceration on the medial aspect of the foot.

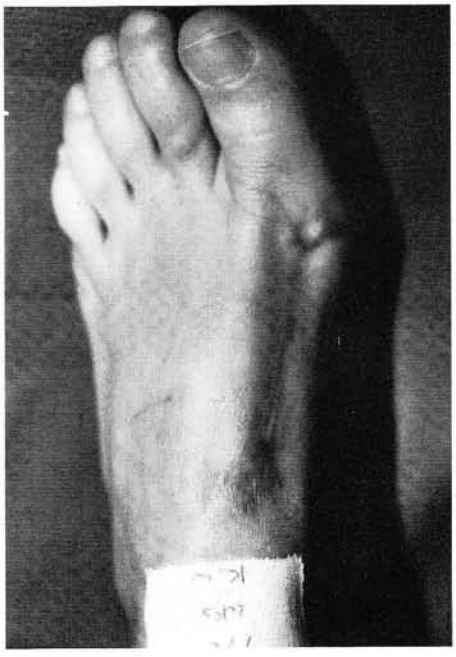

Figure 8B. Nine and one-half weeks of treatment demonstrating significant reduction in scar hypertrophy.

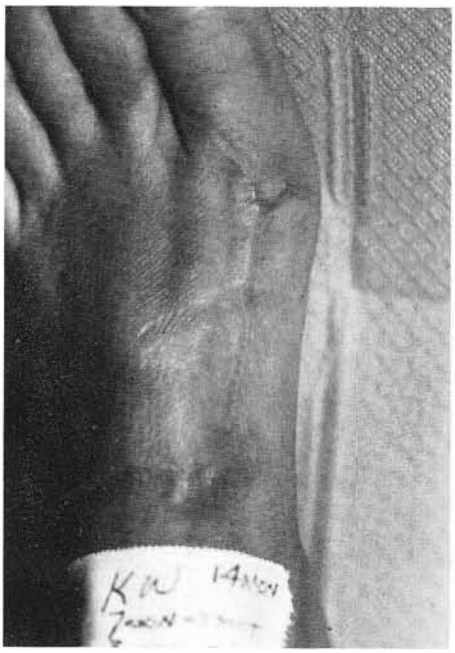

Figure 8C. Three months following conclusion of the treatment demonstrates maintenance of reduction of the hypertrophic scar.

Figure 9A. Hypertrophic scar over dorsal medial aspect of the first metatarsophalangeal joint, eight weeks postoperatively.

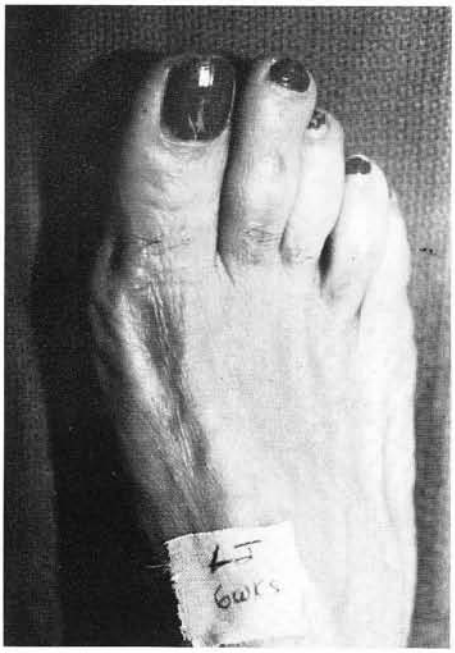

Figure 9B. Four weeks of treatment with significant resolution of scar hypertrophy.

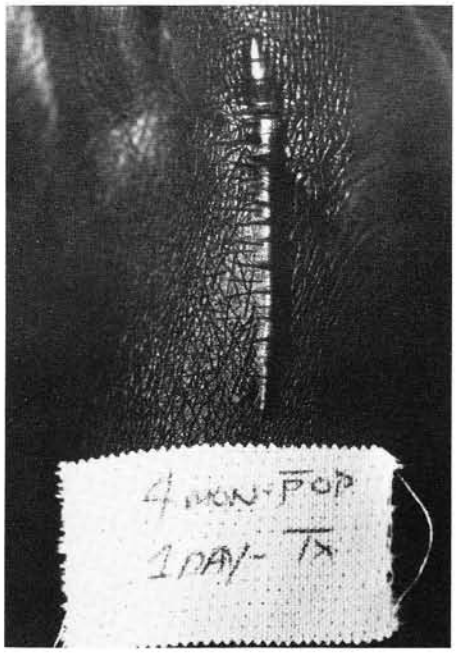

Figure 10A. Four months postoperative surgical scar on initial day of treatment.

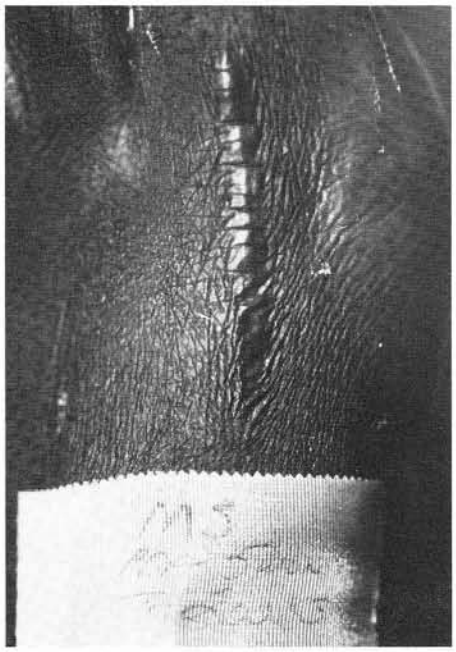

Figure 10B. Four weeks of treatment with significant reduction in scar hypertrophy.

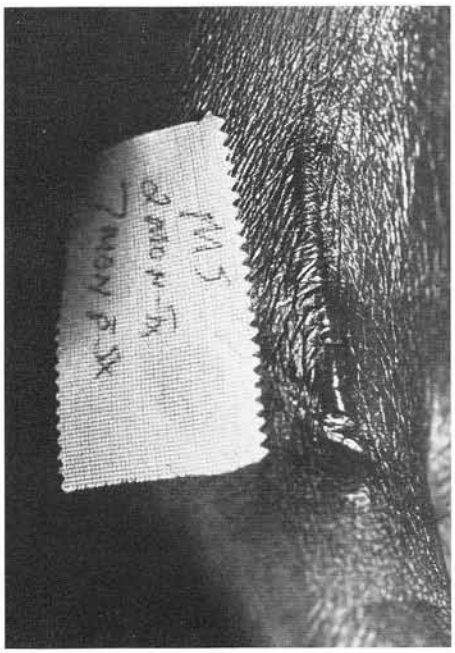

Figure 10C. Seven months postoperative, after 2 months of treatment with significant loss of scar hypertrophy.

CONCLUSION

Silicone gel sheeting has been found to be an effective means of treating hypertrophic scars. The literature has noted anywhere from 80 to 100% response of hypertrophic scars to this treatment program. It does not appear that the age of the scar affects response to treatment. When compared to the pain and cost of corticosteroid injections, it is a very reasonable and cost effective modality. When compared to compression therapy, which must be maintained for twenty-four hours daily for up to six months it is a reasonably effective treatment option.

The new areas of research in silicone gel sheeting will revolve around prevention and prophylaxis. Early studies are encouraging, in that silicone gel sheeting may provide some degree of prevention of hypertrophic scars in areas where hypertrophy can be expected. For the podiatric surgeon, in cases such as hallux limitus when motion is critical and hypertrophy may be inevitable, silicone gel sheeting may provide an important adjunctive measure in the management of postoperative surgical scars.

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