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Silicone Thermoplastic Sheeting for Treatment of Facial Scars: An Improved Technique

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Silicone thermoplastic sheeting has been used successfully in the management of hypertrophic and keloid scars resulting from thermal burn injuries. A technique is described that incorporates silicone thermoplastic sheeting for fabrication of a compression face mask. This technique combines the moldability of thermoplastic splinting materials with the therapeutic surface of silicone, yielding the advantages of both in a one-step process.

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INDEX WORDS: thermal injury, burns, scars, hypertrophic, keloid, silicone plastic sheeting

BURNS THAT PENETRATE into the reticular dermis heal with the formation of scar tissue unless skin grafts are performed. Scar tissue is a mass of newly synthesized collagen produced by dermal fibroblasts in response to the stimulus of the injury. This collagen is thicker, more disorganized, and more closely packed than that of the associated uninjured dermis.[1]

Dermal burns heal either through keloid or hypertrophic scar formation.[2] Keloids are thick mounds of scar tissue characterized by excessive amounts of collagen.[3,4] Hypertrophic scars are raised above the level of the surrounding tissue and may be hard with a red coloration. Such scars may produce disabling contractures.[1] Keloids differ from hypertrophic scars in that they continue to grow over time, and invade surrounding healthy tissue beyond the original wound. Hypertrophic scars are more common in larger dermal injuries such as burns and scalds. The onset of keloids is gradual in contrast to that of hypertrophic scars, which develop soon after the traumatic injury.[2]

Treatment for keloids and hypertrophic scars has included: surgical excision,[5] steroid injections into the scar,[5,6] radiation therapy,[7] pressure therapy using thermoplastic sheeting,[8,9] and silicone gel therapy.[10-12]

Pressure has long been known to cause thinning of the dermis, which can be harmful to normal skin tissues. For example, bed-ridden patients frequently develop decubiti (bedsores) of the sacral and ischial areas.[13] Under special circumstances, pressure has also been shown to be therapeutic and has been used successfully in the treatment of scar tissue.[8,9] Pressure scar therapy results in a hypoxic state of the dermis, altering the structure of endothelial cells and pericytes (capillary-associated fibroblasts), resulting in a softening and flattening of hypertrophic and burn scars.[8,14]

Since 1982, silicone gel has been used as an effective modality in burn-scar management to soften and reduce scars in a shorter time than is requested by traditional pressure therapy.[10,11] The efficacy of silicone gel has been demonstrated to be independent of pressure, temperature, oxygen tension, or occlusion.[11] A possible mode of action has been hypothesized to be the creation of a static electrical field generated from friction on the silicone surface, with a resulting inhibitory effect on scar tissue.[15] An interaction between the negatively charged ions of the gel and the ionic charges of the tissue fluids may

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be a critical factor in hypertrophic and keloid scar involution.[15]

This report describes the use of Silon-SES, silicone thermoplastic sheeting (JOBST Institute, Inc, Charlotte, NC), for burn stent fabrication. Silon-SES is made from a mixture of polytetrafluorethylene (PTFE) and silicone. PTFE is added to provide strength and durability to the silicone. The advantage is a thinner, more durable, and comfortable burn stent. The moldability of the material allows an improved custom fit, while incorporating the advantages of silicone therapy. The therapeutic effect is obtained through silicone contact rather than pressure, resulting in a significantly more comfortable stent, with better patient compliance.

Technique

1. A facial moulage is made using irreversible hydrocolloid (Fig 1). It is imperative to capture an area approximately 1 to 2 cm beyond the area to be covered by the completed pressure stent.
2. After disinfection, the facial moulage is poured with improved stone in a conventional manner to a thickness of 1.5 in. Because of the large surface area and size of the cast, heat and expansion from the setting reaction may cause cracking of the stone cast if poured in one step. To prevent this from occurring, the improved stone should be poured in two to three layers, allowing initial setting to occur after each pour. The borders of the impression should be captured in the stone.
3. When the stone has set (45 minutes), the cast is recovered and inspected for flaws or defects.
4. The borders of the stent are outlined on the cast. Any irregularities or rough areas resulting from scars or hair should be slightly sanded to ensure a smooth adaptation of the stent material to the cast.
5. The stent material, Silon-SES, is heated and adapted over the cast. The material is heated evenly on a vacuum-forming machine (Orbit Manufacturing, Inc, Batavia, OH) until it slumps between 1.5 to 2 in. The machine is then used to closely adapt the material to the stone cast (Fig 2).
6. A separating disc is used to trim the border of the stent. Openings are made for the eyes and mouth, and the edges are smoothed with a felt wheel and rubber point.
7. Close adaptation and fit of the stent are confirmed on the patient. Location and design of head gear is important to ensure that even pressure will be applied. A superior midline strap passes over the head and branchs off on the back of the head to connect with the stent bilaterally just above the ear level (Fig 3A-3C). An additional strap attaches below the ears, level with the commissure of the mouth. Slots are cut into the stent at the described

Figure 1. A facial moulage of a burn victim is completed with irreversible hydrocolloid.

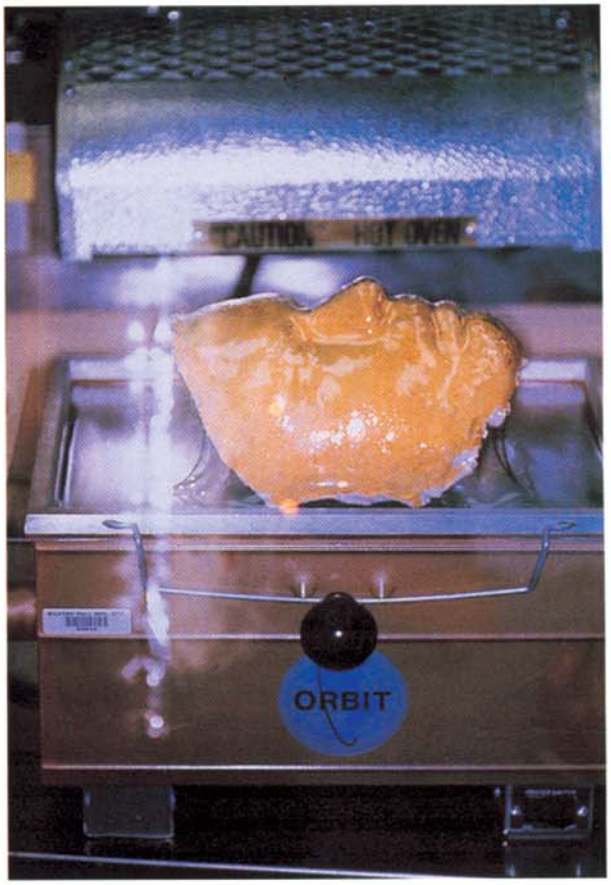

Figure 2. Silon-SES is adapted to a facial cast using a vacuum-forming machine.

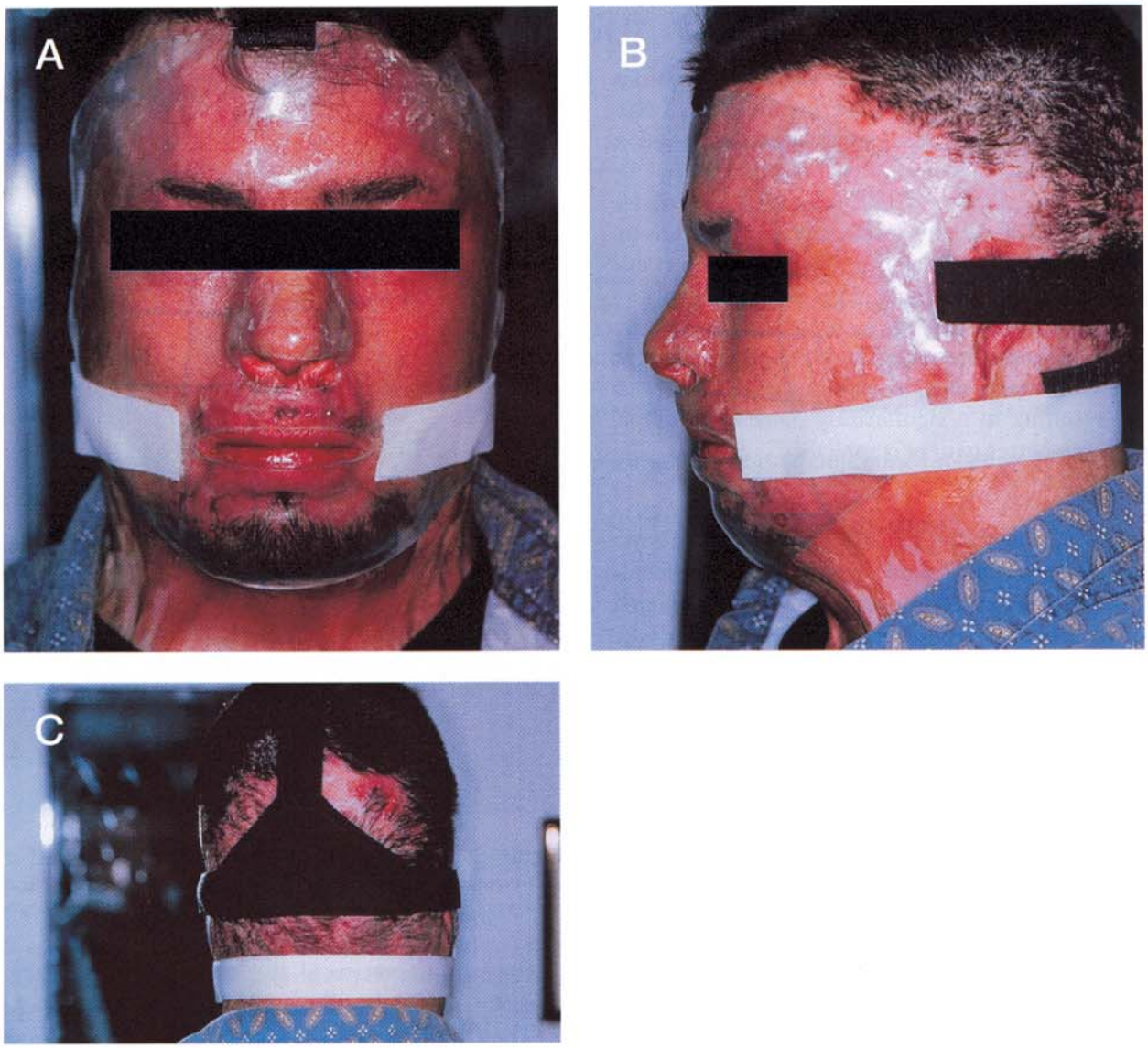

Figure 3. (*A*) Frontal view of Silon-SES burn stent with straps. (*B*) Headgear straps are positioned above and below midline to ensure that pressure is applied evenly by the silicone thermoplastic stent. Straps are secured by Velcro. (*C*) Posterior view demonstrating strap position.

locations. Velcro strap material is passed through the slots and secured by the patient.

8. The stent should be worn a minimum of 12 hours per day. Straps can be adjusted for comfort by the patient, with a snug fit to ensure close adaptation of the silicone to the face.
9. Burn stents are generally worn indefinitely; however, discontinuation of stent therapy by the patient occasionally occurs when continuing improvement is no longer visible. Daily home care by the patient involves washing the stent with a mild soap detergent and warm water to remove skin oils and surface grime.

Summary

A technique for the fabrication of burn stents has been presented. A silicone thermoplastic splinting material is used to incorporate the therapeutic benefits of silicone with a moldable custom-fitted burn stent.

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