Oncologic Applications for Silicone Gel Sheets in Soft-Tissue Contractures

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Occupational therapists who specialize in burn rehabilitation and hand rehabilitation have routinely used scar management techniques to reduce scar formation and keep soft tissues supple and pliable. The materials often used include silicone elastomers and closed cell foams. The literature reports the use of silicone gel in the treatment of burn-scar contracture (Ohmori, 1988; Perkins, Davey, & Wallis, 1983; Quinn, 1987; Quinn, Evans, Courtney, & Gaylor, 1985; Wessling, Ehleben, Chapman, May, & Still, 1985).

Another category of patients who experience skin contractures and hypertrophic scarring are persons with oncologic conditions requiring resection adjacent to or overlapping a major joint. These resected regions are often treated further but are traumatized with radiation therapy. Usually, fibrosis of soft tissues develops over the course of 2 years after completion of radiation (Wallace, 1980). Soft tissues contract and lose their elasticity and flexibility. The person is left with permanent, irreversible contractures resulting in loss of motion and frequent pain.

In the hope that silicone gel sheets may increase motion in this population and therefore increase their ability to perform functional tasks, we began using these sheets in the occupational therapy department at Memorial Sloan-Kettering Cancer Center in New York City with patients who have scar banding and soft-tissue contractures. The major categories of oncologic conditions we have addressed are (a) the breast cancer surgery population who have undergone axillary node dissection with or without follow-up radiation therapy, (b) the head and neck cancer population who have undergone radical neck dissection followed by radiation, and (c) the upper extremity soft-tissue sarcoma population after resection and before and after radiation therapy.

Clinical Evidence

The action of silicone gel is not well understood. Quinn (1987) studied the water vapor transmission rate of silicone gel and found it to be almost half that of skin. After use of silicone gel there is a fluid or moisture buildup under the gel pad that remains absorbed in the skin. Quinn hypothesized that the water may be absorbed within the skin in a reservoir, probably the stratum corneum (Quinn et al., 1985). Silicone is permeable to water and allows gas exchange. Pressure, temperature, oxygen tension, and occlusion do not appear to greatly affect the action.

Between 1988 and 1990, we used silicone gel as part of the occupational therapy program to treat 20 oncologic patients with postsurgery contracture. Although this number of patients is not large enough to draw any conclusions, our results of improved range of motion and appearance and pliability of traumatized tissue indicate that the use of silicone gel with such patients warrants...
further study. The following case studies are representative of this population.

**Case 1**

L.C. is a 43-year-old woman who was treated from 1 month after a modified radical mastectomy through 6 months after the mastectomy. The patient had myofascial scarring extending from the elbow to the pelvis on the right side through the area of the breast incision. She also had early adhesive capsulitis. Range of motion on evaluation was limited in the glenohumeral joint from 0° to 85° of shoulder flexion, 0° to 80° of abduction, and 0° to 60° of external rotation. The patient also had decreased range of motion of combined movements of the elbow with shoulder flexion. She complained of characteristic pain consisting of skin tightness and pulling during all shoulder movements. Despite 19 weeks of vigorous 30-min semweekly treatment sessions including aggressive active and passive range of motion, mobilization, ultrasound vibratory techniques, and the application of one silicone gel pad directly to the axillary incision site, the patient failed to progress beyond 0° to 160° of forward flexion and abduction and 0° to 70° of external rotation. A physical examination showed that the patient had dimpling in the midcostal region of the flank, extending over a 5-cm radius surrounding the exit sites of her drain, which was consistent with myofascial contracture. A second silicone gel sheet was applied directly over the dimpled area. Within 2 weeks of use of the second pad, the patient regained full range of motion of her right shoulder in all planes of movement.

**Case 2**

J.P. is a 64-year-old man with epidermoid cancer of the base of the tongue with metastases to the left cervical lymph nodes. The patient underwent a left radical neck dissection, tracheostomy, and 7,000 rads of radiation therapy. He presented decreased range of motion in the cervical spine and left shoulder, pain with muscle spasm in the same distribution, positive scar banding in the left lateral neck on combined right cervical spine rotation, lateral flexion and extension to the right side, decreased strength in his left proximal musculature, and decreased stability of his left scapulohumeral region associated with spinal accessory nerve sacrifice secondary to neck dissection. On initial evaluation, glenohumeral motions were limited to 0° to 140° of active forward flexion, 0° to 90° of abduction, 0° to 30° of external rotation, and 0° to 70° of internal rotation. Cervical spine motion was as follows: flexion within normal limits, hyperextension 0° to 10°, left lateral rotation 0° to 30°, and right lateral rotation 0° to 20°.

In addition to a treatment program of hot packs, aggressive range of motion, sensory reeducation including the use of textures and vibration, strengthening to the scapular muscle retractors and elevators, and use of a shoulder support, the patient was begun on a scar management program that involved the use of a silicone gel sheet to the left lateral neck, which covered the incision and the primary site of radiation. The patient was instructed to wear the silicone pad at all times, except when bathing and 1 hr afterward. Within 2 weeks, the patient's shoulder motion had improved to 0° to 160° of forward flexion, 0° to 150° of abduction, 0° to 80° of external rotation, and 0° to 90° of internal rotation. Left lateral rotation of the neck improved to 0° to 55°, and right lateral rotation of the neck improved to 0° to 45°. Additionally, the scar band on the left lateral neck became flat, soft, and supple. The patient used his silicone gel pad for a period of 2 to 3 months following initiation of treatment. His wearing schedule was 23 hr per day. The pad was secured in place with a stockinette cervical strap with touch-fastener closures. The patient complied with all aspects of his self-treatment program.

At follow-up evaluations 6 months and 1 year after treatment, his skin and soft tissues continued to be soft and pliable on palpation of the left lateral neck. The patient had had no deleterious effects associated with radiation fibrosis, as might have been expected.

**Case 3**

T.M. is a 28-year-old man with resection of embryonal rhabdomyosarcoma in the distal two thirds of his left upper arm. He had a local recurrence of the tumor 3 months after initial resection at the same site, followed by treatment with brachytherapy and two courses of chemotherapy.

Five months after the second surgery, the patient complained of decreased mobility of the left upper extremity progressive over an 8-week period. He had developed an elbow flexion contracture (90° to 150° of extension to flexion active range of motion). He had multiple scars with obvious muscle tissue loss in the left central and lateral distal upper arm. Muscle tightness was noted throughout the length of the biceps. The patient also had a radial nerve palsy and accompanying paresthesia in the left hand.

Occupational therapy treatment included passive and active assistive and active range of motion exercises, contraction and relaxation techniques, fabrication of dynamic and static orthotic devices for his left wrist and hand, wrist and hand muscle strengthening, fine coordination activities, and prevocational activities. Treatment in physical therapy included tendon and muscle-belly massage and ultrasound. Progress was slow and steady, achievable only in small increments. The patient attended therapy two to three times per week for 9 weeks.

Five weeks into treatment, scar management techniques were added to his treatment program because of
persistent elbow flexion contracture. A silicone gel pad was applied to the antecubital fossa overlying the incisional scar and held in place with a tubular support bandage. His wearing schedule was 23 hr per day. Within 1 month, the patient regained full active range of motion.

**Case 4**

H.L. is a 62-year-old man with synovial cell sarcoma of the left medial elbow. Five weeks after surgery, he had decreased range of motion with pain of the left elbow and forearm. The patient had an incision extending from the distal third of the humerus to the midshaft of the forearm on the medial surface. Active range of motion on evaluation was 0° to 120° of extension and flexion of the elbow and 0° to 80° of forearm supination. The patient also had hyperesthesia in an ulnar nerve distribution of the hand. Mild edema was present from the digits to the elbow. The patient's occupational therapy program consisted of active assistive and active range of motion exercises to the left elbow and forearm, hand strengthening exercises using medium-grade therapy putty, retrograde massage, and the use of mild compression garments to decrease edema and scar management techniques. A silicone gel pad was applied over the entire length of the incision in an attempt to manage the scar. The pad was secured in place with a stockinette and was worn 23 hr per day. The patient used the gel pad for 3 weeks before initiation of radiation therapy treatment in addition to the treatment described. Full range of motion in the left elbow was observed within 1 week of initiation of its use. At follow-up evaluations 1 month and 9 months after treatment, his range of motion continued to be within normal limits and his scar continued to be smooth, soft, and pliable despite its being the primary site of radiation therapy.

**Discussion**

The use of silicone gel has been previously reported in the use of burns and burn-scar management. Silicone gel appears to improve hydration of the stratum corneum of immature hypertrophic scars.

Patients with cancer who have undergone medical treatments involving surgical resection and, frequently, radiation treatment, also appear to benefit from the use of silicone gel pads to prevent scar formation. This treatment appears to be most effective during the period of immature scar formation when collagen and other soft-tissue structures are at risk for developing fibrotic changes, which result in loss of elasticity and scar banding and, frequently, consequent loss of motion with pain. In our experience with patients with cancer, the use of silicone gel up to 4 months after trauma has resulted in optimal appearance and pliability of traumatized soft tissues.

In all the cases we have described, our patients returned to a full spectrum of vocational and avocational activities within 4 to 6 weeks of initial rehabilitation treatment. The decrease in soft-tissue scarring seemed to increase the patients' ease of painfree participation in daily activities, according to their subjective reports.

**References**


