

Silicone therapy for the treatment and prevention of problematic scars: a practical guideline



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Annually, about 100 million people worldwide develop a scar (Sund, 2000). Most wounds heal without problems; however, a proportion of people form raised, problematic, painful, itchy, or red scars. Historically, and more recently, it is estimated that about 40 to 70% of all patients that undergo surgery develop hypertrophic scars as a result (Deitch, 1983; Murray and Pinnel, 1992; Sund, 2000). After a rapid growth phase for up to 6 months, these scars regress slowly over a period of multiple years (Kant et al, 2019; Gauglitz et al, 2011).

The most common types of problematic scars are atrophic, hypertrophic and keloid scars. Hypertrophic scars are broad and elevated, and therefore can be conspicuous. While hypertrophic scars grow within the borders of the original wound and eventually become smaller, keloids grow beyond the original wound borders, do not become smaller on their own, and are difficult to treat (Limandjaja et al, 2020).

Also, keloids tend to cause more discomfort, itchiness and sometimes pain when compared to hypertrophic scars. The incidence of keloid scars is 6 to 16% in individuals with dark skin (Niessen et al, 1999); in individuals with lighter skin, they occur less frequently. It can sometimes still be difficult to determine whether a scar is hypertrophic or keloid (Limandjaja et al, 2020).

In both keloid and hypertrophic scars, there is a derailment of the normal wound healing cascade, and an upregulation of collagen synthesis, deposition, and accumulation. An important and convenient non-invasive first-line strategy in the treatment and prevention of hypertrophic and keloid scarring is silicone treatment (Neligan et al, 2013). Silicone therapy can both prevent problematic scar formation, accelerate the maturation phase and relieve symptoms such as itch and pain (Neligan et al, 2013). However, there are still some uncertainties about the mechanism of action, the clinical effects, and the optimal duration of silicone therapy. This article aims to offer a practical guideline for medical professionals for the use of silicone therapy in scars.

What are silicones?

Silicones that are used for scar therapy are elastomers. They can have a solid rubber-like appearance, or they can have a more liquid, gel-like form. The matter of cross-linking of the elastomers determines the consistency of the silicone material (Berman et al, 2007).

Mechanism of action

One of the primary benefits of silicone therapy is increased hydration of the skin. By occluding the skin with silicones, trans-epidermal water loss (TEWL) via evaporation in the skin decreases. In this manner, fresh scar tissue will be provided with optimal moisture levels. As a result, the appearance of scars improves: they become lighter, more pliable, and they flatten (Berman et al, 2007).

Indications for the use of silicones

Silicone scar therapy can be used for the treatment of hypertrophic and keloid scars caused by surgery, burns, and other trauma. Those are raised, thickened, red or dark-coloured scars that can be itchy and painful, or cause aesthetic issues that may affect the individual. These types of problematic scars are also known to cause a significant impairment on patient quality of life (Bock et al, 2006). Keloid scars in particular have a more aggressive growth pattern, where they extend over the original wound.

Silicones are an easy-to-use local, well-tolerated first-line therapy for these problematic scars. They also have a preventative value in the

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treatment of scars: they can be useful in patients with an increased risk of developing problematic scars, as well as being advised for use post-surgery on certain high-risk areas on the body.

It should be noted that a patient with hypertrophic scars after severe (deep) burns should be admitted to a specialised burn centre, as additional therapy is presumably necessary in such cases.

PREVENTION OF PROBLEMATIC SCARS

Excessive scar tissue can have far-reaching consequences and the impact of problematic scars on quality of life can be extensive.

Scars can cause functional, psychological, symptomatic and cosmetic complaints (Bock et al, 2006; Gibson et al, 2018; Nitescu et al, 2012). Wounds that are closed under tension, or wounds that have had prolonged healing time, are at risk of resulting in hypertrophic scars.

Therefore, appropriate surgical techniques and adequate wound care are important in the prevention of problematic scarring, especially in traumatic wounds. Nevertheless, there are areas on the human body where scars are at an increased risk of developing hypertrophy, even if adequate wound care is applied. The main areas that are associated with poor-quality scars are the chest, the lower face, the upper back, ears, neck, and shoulders. An untreated hypertrophic scar is in most cases still hypertrophic after one year (Mahdavian Delavary et al, 2012). Young age is also a risk factor for hypertrophic scar development (Lawrence et al, 2012). Furthermore, hypertrophic scars in younger patients tend to regress slower when compared to older patients (Kant et al, 2019). Therefore, younger patients are at risk for having hypertrophic scars for a prolonged period.

Patients who have had hypertrophic or keloid scars in the past are also at an elevated risk of developing problematic scars. Also, patients with dark skin complexions are more prone to developing problematic scars, especially when it comes to keloid scars. In the aforementioned 'risk groups', silicones are effective in preventing the formation of hypertrophic scars (Lawrence et al, 2012). Silicone therapy (both gels and sheets) has proven to outperform other locally applied agents such as Vaseline and onion extract cream in post-operative scar prevention (Hsu et al, 2017).

Gels or sheets?

The clinical effects of silicone gels are a less studied subject, when compared to silicone gel

sheets. However, there is clinical evidence that shows silicone gels are effective in accelerating the maturation time and in reducing the hypertrophy rate of fresh post-surgical scars as well (Wang et al, 2020). Moreover, silicone gels and sheets seem to exert similar clinical effects in the prevention of problematic scars (Signorini and Clementoni, 2007; Lin et al, 2018). Silicone gels are invisible when dried, and therefore they are an attractive option for scars in visible areas, especially on the face. Some silicone sheets require fixation with adhesive tape, where silicone gels don't.

Clinical effects of silicone therapy

Silicone sheets have proven to result in reduction of thickness, erythema, pain, itchiness, and pliability of hypertrophic scars (Chang et al, 2018). See cases 1 and 2, which show the clinical effects of both silicone gel and sheets (BAPSCARCARE GEL and BAPSCARCARE T) on a keloid scar on the right external malleolus after an accident and on a hypertrophic scar on the forearm after surgery.

In combination with compression therapy

Compression therapy is, next to silicone scar therapy, also one of the most widely used and studied tools in the treatment of severe problematic scars, predominantly after burns. Compression garments require correct fitting, where adequate pressure underneath the garment should be reached. It can be challenging to maintain the patient's compliance to compression therapy. Combined use of compression and silicones has demonstrated more positive effects in some studies than either of those individual therapies alone (Li-Tsang et al, 2006), although one study showed silicone monotherapy to be more effective than combined therapy (Steintraesser et al, 2011). When problematic scars result from deep dermal burns and are more severe, the patient should be referred to a specialised burn care unit for alternative and (frequently) combined scar therapy.

PRACTICAL GUIDELINES

How to use silicones on scars

The silicone gel or sheet should be applied to the scar, extending approximately 1–2cm beyond the scar margins. When using silicone gel, it should be applied twice daily and the patient should wait until the gel has dried before putting clothes on that cover the area. Some silicones sheets and gels also contain adequate

Case 1. Keloid scar after road trauma

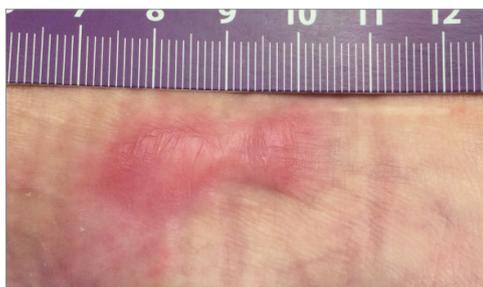
Patient age	38 years
Gender	Female
Cause	Soft tissue loss on the right external malleolus after accident
Why scar treatment?	Keloid scar
Start scar treatment	3 months after accident
Type of therapy	7 months BAPSCARCARE T (during the night) in combination with BAPSCARCARE gel (during daytime)



3 months after accident, start of therapy



2 months after start of therapy



3 months after start of therapy



Further treatment with BAPSCARCARE gel and sheets (T)

Conclusions of the medical team

- Significantly reduced thickness
- Improved vascularity
- Improved pliability of the skin.

Patient experience

- Improved overall appearance of the scar
- Both BAPSCARCARE T and BAPSCARCARE gel are easy to apply
- BAPSCARCARE gel is invisible and non-sticky after application
- Choice for using gel during the day because of wet environment (patient works as fitness instructor).

Case study: Prof. C.M. Durante MD, Rome, Italy

UV protection, so the skin that is covered can safely be exposed to sunlight.

Therapy duration: when to start?

In patients at increased risk of hypertrophic or keloid scarring – and in patients who have previously developed an abnormal or problematic scar – silicone therapy should start when full re-epithelialisation of the wound is reached, within about 2 weeks of wound closure. Scar hypertrophy develops in most cases (96%) within a 3-month period after surgery, as shown

in a study by Mahdavian Delavary et al (2012); therefore scar therapy should start in the early phases of healing, highlighting the importance of routine scar assessment after surgery. Nevertheless, silicone treatment has also proven to be effective in scars that have been present for more than 12 months (Wiseman et al, 2019). However, it is believed that optimal results will be seen when silicones are applied to scars that are still immature: when they are red, thickened, and cause clinical symptoms like itchiness and pain. This period of immaturity can last for over a year.

Case 2. Surgical intervention

Patient age	38 years
Gender	Female
Cause	Multiple fractures of the right forearm, surgery to ensure realignment (plates)
Why scar treatment?	Early stage hypertrophic scar development
Start scar treatment	7 weeks post surgery
Type of therapy	4 months BAPSCARCARE T in combination with BAPSCARCARE gel



Anterior view: 7 weeks after surgery, start of therapy



Anterior view: 4 months after start of therapy



Posterior view: 7 weeks after surgery, start of therapy



Posterior view: 4 months after start of therapy

Conclusions of the medical team

- Significantly reduced vascularity (redness)
- Less pigmentation
- Improved flexibility of the skin
- Reduced scar thickness
- Advised to continue the therapy
- Combining the silicone sheet with the silicone gel, results in a higher compliance.

Patient experience

- Improved overall appearance of the scar
- Both BAPSCARCARE T and BAPSCARCARE gel are easy to use.

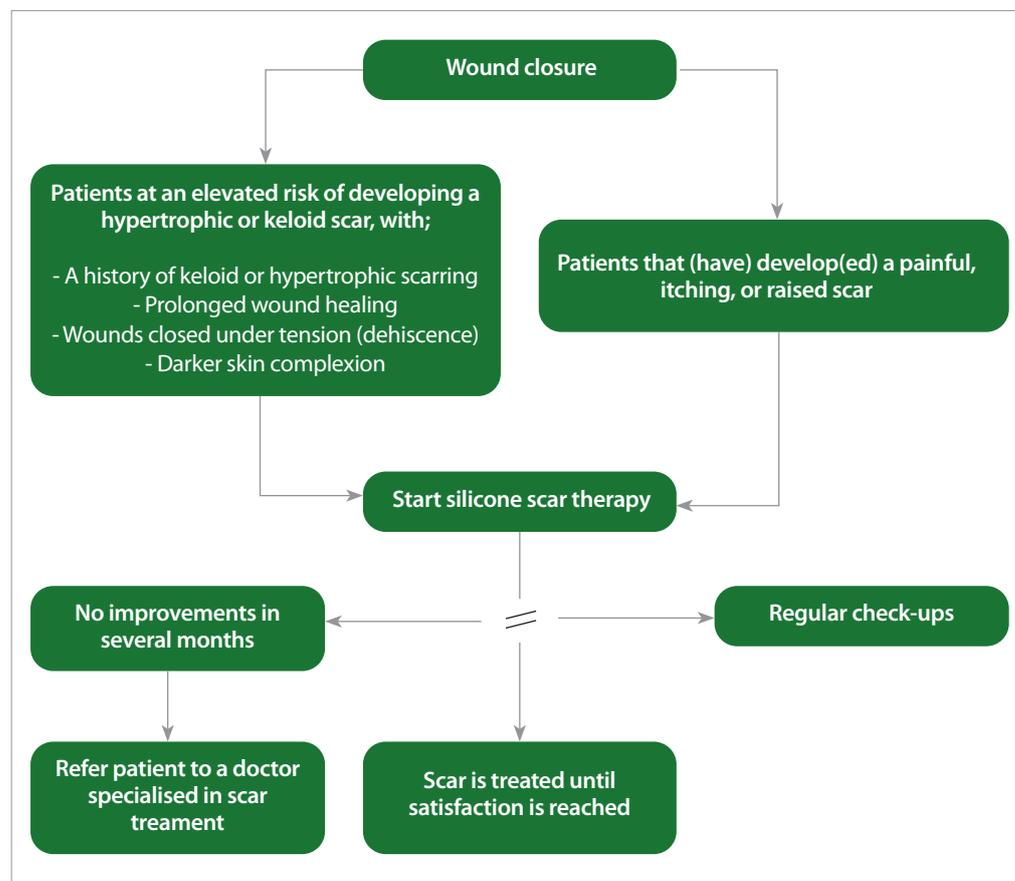
Case study: Prof. C.M. Durante MD, Rome, Italy

Therapy duration

Silicone products should ideally be worn for between 12 and 24 hours a day, but significant improvement in problematic scars has also been observed when therapy is maintained for at least 4 hours per day (Wittenberg et al, 1999). Because silicone scar therapy is well-tolerated in general, building up to a daily duration of 24 hours is advised to maximise the beneficial effects of silicones on scars. Silicone sheets that do not require daily rinsing can be applied immediately for a long time duration.

In general, total therapy duration – for both hypertrophic and keloid scars – should be at least 2 to 3 months, while a treatment period of 6 months can prevent recurrence (Berman et al, 2007; Wittenberg et al, 1999; Westra et al, 2016; Gold et al, 2014; Lyle and Plastic Surgery Educational Foundation DC, 2001). In cases where scars stay in the immature phase for a prolonged period, the total treatment period can in some cases be longer than 6 months. When the treated scar doesn't show any improvement over several months, the patient

Figure 1. Scar treatment algorithm



should be referred to a board-certified plastic surgeon or dermatologist to consider additional scar therapy. Figure 1 displays a proposed scar treatment algorithm.

Adverse effects

Potential adverse effects that can occur from silicones are mild, and they are mainly associated with silicone gel sheets. These can include itchiness, skin rash, maceration of the skin, and malodour. These symptoms can be resolved easily by a temporary break from treatment (Nikkonen et al, 2001). A steady build-up phase of the silicone sheet is therefore advised in order to ascertain whether the product is well tolerated on the skin.

Rinsing

In order to minimise potential adverse effects, proper hygiene and a structured washing routine are necessary when using silicone sheets. Patients should wash the silicone sheet and area of skin being treated once a day, with hypoallergenic soap and clear warm water, and it should be air-dried or patted dry with a lint-free cloth. There are also silicone products that do not require daily rinsing; for example, the silicone product BAPSCARCARE T (BAP Medical, The Netherlands).

SUMMARY

- Silicones are an easy-to-use and well-tolerated first-line treatment option for both prevention and management of hypertrophic or keloid scars.
- Silicones should be applied as a preventative measure directly after wound re-epithelisation in high-risk patients: those who have previously experienced hypertrophic or keloid scarring, patients with dark skin complexion, young patients, patients with problematic wound healing, and patients with wounds in high-risk areas.
- In patients who develop red, raised, painful, or itchy scars, silicones should be applied early (between 2 weeks and 3 months) and as a first-line measure. The same advice applies for patients who already have developed a scar with one of the aforementioned characteristics. Therapy duration should be at least 3 months, for a minimum of 12 hours daily.
- Employing a steady build-up phase, plus daily rinsing of the skin and the silicone sheet (for most silicone products), is important to minimise possible adverse effects. **WINT**

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