

Essential intervention No. 4

Scar management and control

KEY OBJECTIVES

- To know the characteristics of scar tissue as it progresses through the remodelling phase.
- To know the difference between a hypertrophic scar and keloid.
- To know how to identify whether a scar is immature or mature.
- To know how to care for the scar and adhesions with compression, massage, stretching, exercise, and progressive splinting.
- To know when pressure garments are indicated and when they are no longer effective.

When a normal wound heals, the body increases vascularity to form granulation tissue for restoring the damaged skin. Granulation tissue contains fibroblasts, which are the cells that synthesize mucopolysaccharides and collagen fibres that are necessary for the development of new connective tissue.

Myofibroblasts are specialized fibroblasts that are responsible for wound contraction during normal wound healing. The alpha-smooth muscle actin within myofibroblasts becomes organized in filamentous bundles, called stress fibres. This allows the retractile movement producing wound contraction. The myofibroblast is a key cell for the connective tissue remodelling that takes place during wound healing and fibrosis development.

Scarring is the body's normal wound-healing response, in which fibroblasts deposit layers of collagen. Contraction of the wound is an ongoing process influenced by myofibroblasts. Sometimes the formation of scar tissue occurs faster than the collagen is broken down, resulting in an excessive production and deposition of collagen called fibrosis. Repeated injury and repair cause the myofibroblasts to secrete an extracellular matrix (ECM) which leads to organ and tissue fibrosis. Excessive fibrosis causes stiffness and interferes with function.

Normal scar tissue progresses from being weak and easily broken down, to being red and prominent, to finally becoming thin and pale. As scar formation progresses during the remodelling phase, large bundles of collagen accumulate (*Figure 5.4.1*). The tissue shortening and collagen are then stabilized by synthesis of ECM by the myofibroblasts. As long as the scar appears redder than normal, remodelling is still under way.



Figure 5.4.1 Bundle of type I collagen in remodelling phase



Figure 5.4.2 Effects of light pressure or compression on scar tissue

The scar tries to blend in both cosmetically and functionally. This remodelling process takes from about three weeks to two years. The scar can be assessed by looking at the pigmentation, pliability, height, and vascularity. A mature scar is soft, pliable, flat, and has normal vascularity (does not blanch with pressure).

Remoulded skin is more fragile, having a tensile strength of about 70–80% of the original skin. When closure of the wound is initially achieved, the tensile strength is about 15% of the normal – meaning that the wound remains very weak. The new skin must be protected from injury. Trauma leads to oedema and increases the risk of infection that can lead to inflammation. Chronic inflammation can cause the skin to thicken and become less elastic (fibrosis).

Studies suggest that adding tension during the healing process increases the tensile strength of all soft tissue structures and bones. Splinting, serial casting, movement, and activity are ways of applying slow, long-duration stress on healing scar tissue to remodel it to a new position.

Prolonged uninterrupted immobilization leads to loss of tensile strength and disorganization of collagen fibre. The application of constant light pressure or stretch to a new scar while it is maturing is a simple way to minimize scar volume and force collagen fibres into a more orderly formation (Figure. 5.4.2).

Hypertrophic scarring and keloids

Hypertrophic scars and **keloids** are abnormal responses to wound healing caused by hyperactive production of collagen. A **hypertrophic scar** is an **overgrowth of skin involving only the wound area**, which develops 6–8 weeks after skin re-epithelialization. It tends to be more common in areas of high tension and movement. The earlobes, anterior surface of the neck and chest wall are also common places for hypertrophic scars. Initially they are raised, red, and itchy, and will spontaneously flatten with time.

In hypertrophic scarring, there is an overproduction of collagen fibres. They twist around each other in a rope-like fashion, causing the irregular shape of the nodules (*Figures 5.4.1 and 5.4.2*). These collagen-filled nodules later develop into thickened, rigid scar tissue (fibrosis), which causes contractures. Hypertrophic scar bands can restrict movement and circulation. They are frequently seen near or over joints.

It has been known for many years that the application of controlled, consistent pressure to the surface of an immature hypertrophic scar will – in time – reduce the scar and leave a smooth, softer and pliable skin surface. In figure 5.4.2, the effect of pressure on healing scar tissue is illustrated.

Keloids are an overgrowth of the connective tissue involving the wound area, as well as the normal peripheral skin outside the wound area (they are larger than the initial wound boundary). They are grossly elevated and may be itchy, hard, and hypersensitive.

They can develop for up to a year after injury and persist indefinitely. There tends to be a genetic predisposition for keloid development. The treatment of keloids is difficult and frequently unsatisfactory.

General treatment methods for immature scars

In the ulcerated lesions of Buruli ulcer, extensive areas of the skin must frequently be excised and the open areas covered by skin grafts. Once healing of the grafted site (and also the donor site) has taken place, these sites often develop hypertrophic scars. If the development of scar hypertrophy is not controlled, crippling disfigurement is likely as a result of severe contractures and the unchecked formation of thickened scar tissue.

REMEMBER Hypertrophic scar

- An excessive response to wound healing.
- Most common in areas of high tension and movement.
- Seen as an overgrowth of skin as it tries to heal.
- Raised, red, itchy and does not encroach on normal tissue.
- Begins to develop 6 to 8 weeks after skin re-epithelialization.

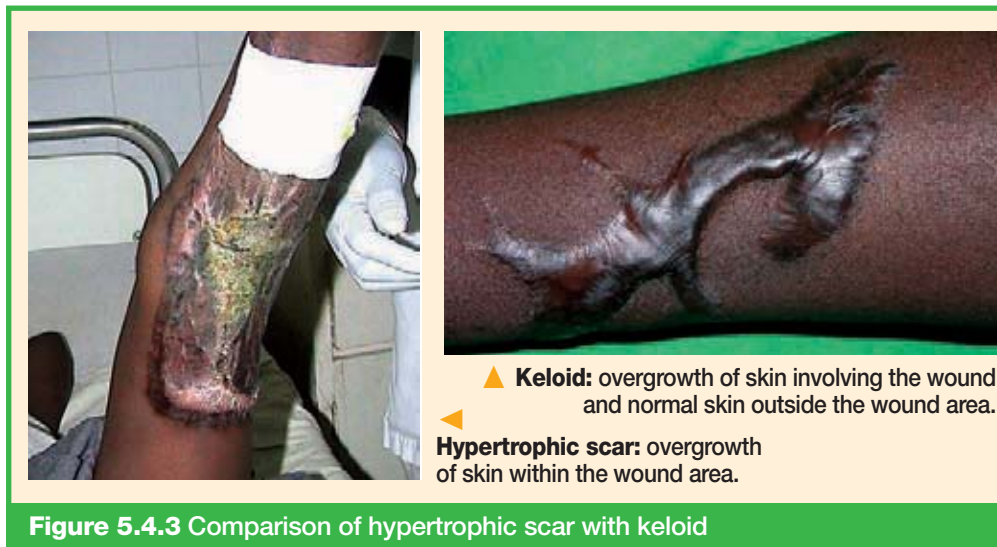


Figure 5.4.3 Comparison of hypertrophic scar with keloid



Some of the interventions used for immature hypertrophic scars are compression, serial casting, surgery, and psychological support. Light compression can be obtained with elastic bandages when the wound is open or closed. However, bandages can be difficult to apply, cumbersome, and aesthetically not pleasing. After the wounds have healed, the use of custom-made elastic pressure garments facilitates constant compression until the scar has matured (12–18 months). These garments are less restrictive, but the person needs emotional support from the family and HCW to encourage compliance in using them.

The best results of compression are seen when pressure is applied 23 hours a day until scar maturity. In difficult areas such as the axilla, the elbow, the knee, the thumb web space, digital spaces, the neck, and nose, compression is obtained by using foam rubber inserts under the bandages or pressure garment (Figure 5.4.5). When using foam rubber, make sure that it does not irritate the skin and that the person does not have allergies to rubber products. If soft tissue contractures exist, they are treated with serial casting or splints (Figure 5.4.6). **It is important to note that mature scars, which are usually older than one year, will not benefit from compression by either bandages or pressure garments.**

Figure 5.4.5
Use foam rubber inserts to improve compression in difficult-to-compress areas and to protect areas that will be splinted in an antideformity position



Figure 5.4.6
Use serial casting or splinting to decrease soft-tissue contractures and improve movement



Specific treatment method – pressure garments

Pressure garments have been used extensively in the treatment of scars after burn injuries, and these garments can also be applied to scars from Buruli ulcer. Pressure garments are custom-made garments constructed from elastic fabric (elastonet), which provide and maintain adequate pressure over scarred areas and yet allow normal movement of the body.

The type of garment is planned according to the position and extent of the scar. Sleeves, hand gauntlets, gloves, trousers, socks, vests, masks, and chin straps are made according to measurements for each individual. The pressure garments must be carefully measured and designed, to provide sufficient pressure without being too restrictive. They must be worn 23 hours per day for 6–18 months, or until scar maturation has been achieved.

The technique for making these garments is not addressed in this manual, but workshops can be held to teach local health workers and seamstresses how to measure, design a pattern, cut, stitch, fit, and teach the affected person how to wear and care for the garment. Periodic replacement is needed, depending on the person's activities, weight, and growth – usually every 3–4 months.

IMPORTANT THINGS TO KNOW ABOUT PRESSURE GARMENTS

- Pressure garments can only be applied once the wound is closed – therefore, measurements can only be taken once this stage has been reached.
- Upon referral, the scar should be assessed to determine if it is immature or mature (scar colour or pigmentation, height, vascularity and pliability); only immature scars can be helped by a pressure garment.
- The wound size and location on the body are noted.
- The garment is planned, keeping the specific area of scarring in mind. For example, if the scar is over a joint, the area above and below the joint should also be incorporated. A good rule is to make the garment 5 cm longer on either end so that adequate compression is achieved.
- Circumferential measurements are taken according to established guidelines.
- All measurements are decreased by 20% and the pattern is drawn up for each specific body part.
- The fabric is cut out and stitched to specifications.
- The garment is fitted and adjustments are made. Extra care is taken to ensure that pressure is applied correctly. The garment should not be too restrictive and should allow full movement of the affected limbs.
- Once the garment fits correctly, a second set should be made.

- The following instructions for wear and care should be provided:
 - the garments should be worn 23 hours per day,
 - every garment should be washed daily with a mild soap, rinsed well and dried in an airy room, or outside, but not in direct sunlight,
 - if a wound breaks down, wearing of the garment should be discontinued for a few days until the wound has healed,
 - the garment should always fit snugly, and the person should return to the health centre if it becomes too large or too tight due to weight loss or weight gain. The fit of the garment can also be affected by deterioration of the fabric. In this case a new set of garments should be made,
 - generally the garments should be worn for 12–18 months or until scar maturation has been achieved.
- A scar has reached maturity when it is soft, flat, pliable, and displays normal vascularity (does not blanch to pressure).
- Some scars will benefit from the application of splints to maintain a specific joint position.
- Compliance in using the garment will be dependent on support and encouragement by health workers and family.

REMEMBER

Why pressure garments? When are they not useful?

- Pressure garments are essential to smooth, soften, and maintain elasticity of the skin during the maturation process and to prevent hypertrophic scarring and the subsequent formation of contractures. Once the skin has gained elasticity, joint mobility is regained and severe contractures can be avoided.
- Pressure garments (*Figures 5.4.7 and 5.4.8*) are used in conjunction with other rehabilitation interventions such as massage, exercise, activity, and sometimes splinting.
- ***It is important to note that mature scars, which are usually older than 1 year, will not benefit from the application of pressure. Therefore, it is not necessary to make garments for persons with such scars.***
- No pressure garments should be applied in the presence of open wounds. Foam inserts and crepe or elastic bandages should be used to apply pressure until the wounds are fully healed.

REMEMBER Difference between immature and mature scar

Immature scars are:	Mature scars are:
– usually less than one year old	– usually more than one year old
– thick and firm	– soft
– elevated or raised in height	– flat
– not easily pliable	– pliable
– red or pinkish in colour	– display normal vascularity
– blanch with pressure	(do not blanch with pressure)

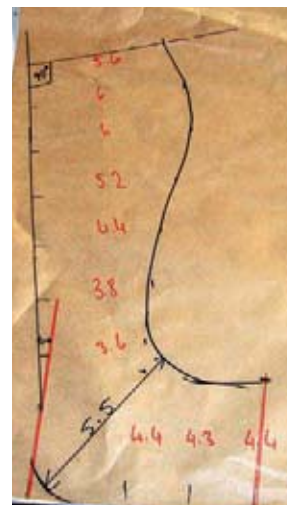
Pressure garment construction

Figure 5.4.7



Mature scar ▲

▼ Immature scar



1. ASSESS THE SCAR. The wound must be closed and the scar immature.

2. PLAN AND MEASURE. The circumference is then reduced by 20% and the pattern made and cut out.

Types of pressure garments Figure 5.4.8



3. SEW, FIT, and EDUCATE about use and care of garment.



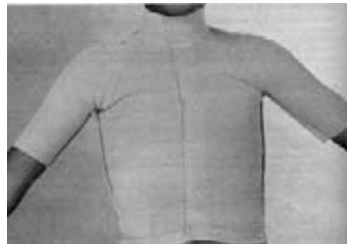
Face



Arm



Hand



Vest



Leg



Foot

Specific treatment method – massage

There are many massage techniques, each having a specific purpose. In Buruli ulcer, massage is usually used in combination with exercise and compression. The primary use of massage in BU is to decrease adhesions of the skin to other soft tissues (such as ligaments, tendons, and muscles) and bones, which can restrict motion.

Oil is used in the manipulation of soft tissues. Massage can also help decrease oedema and desensitize hypersensitive scars (see additional information in intervention sections on **Oedema control** and **Management of pain**). It is important that the person affected by BU, the family, and health workers are taught how to manipulate the soft tissues **without** creating blisters or inflammation. Sometimes nearby joints and soft tissues require massage. Frequently, persons affected by BU will note that scars seem more flexible and that the scar is less itchy or painful after oiling and massage.



Teach the person how to massage by demonstrating and then practising it. ▲



Ask the person to show you how he or she massages, to see if he or she has learnt correctly. ▲



A dry wound frequently cracks open and can be painful. ▲



Skin becomes more flexible by soaking the area and massaging in oil. The massage and active movement help to reduce the dorsal foot adhesions and decrease hypersensitivity. ▲

Figure 5.4.9 Massage to scar, to decrease adhesions and decrease hypersensitivity

REMEMBER

About care of scars

- Oil-based creams and lubricants alleviate dryness and itching sensations.
- Very limited gentle deep massage should be performed on newly healed or grafted skin. Blisters can be easily created with superficial massage.
- Open wounds should not be massaged, although surrounding closed border areas can be.
- Restrictive fibrous bands should be mobilized to free both movement and circulation. Friction massage is done transversely across the grain of the fibres.
- Light constant compression should be used with immature scars until they mature.
- Light constant compression is achieved with bandages, pressure garments, inserts, and splints.
- Protect immature scars from exposure to the sun, as they will burn and blister easily.
- Protect immature scars from injuries caused in daily activities from friction or by rubbing from clothing.
- Avoid aggressive, repetitive type exercises and activities.