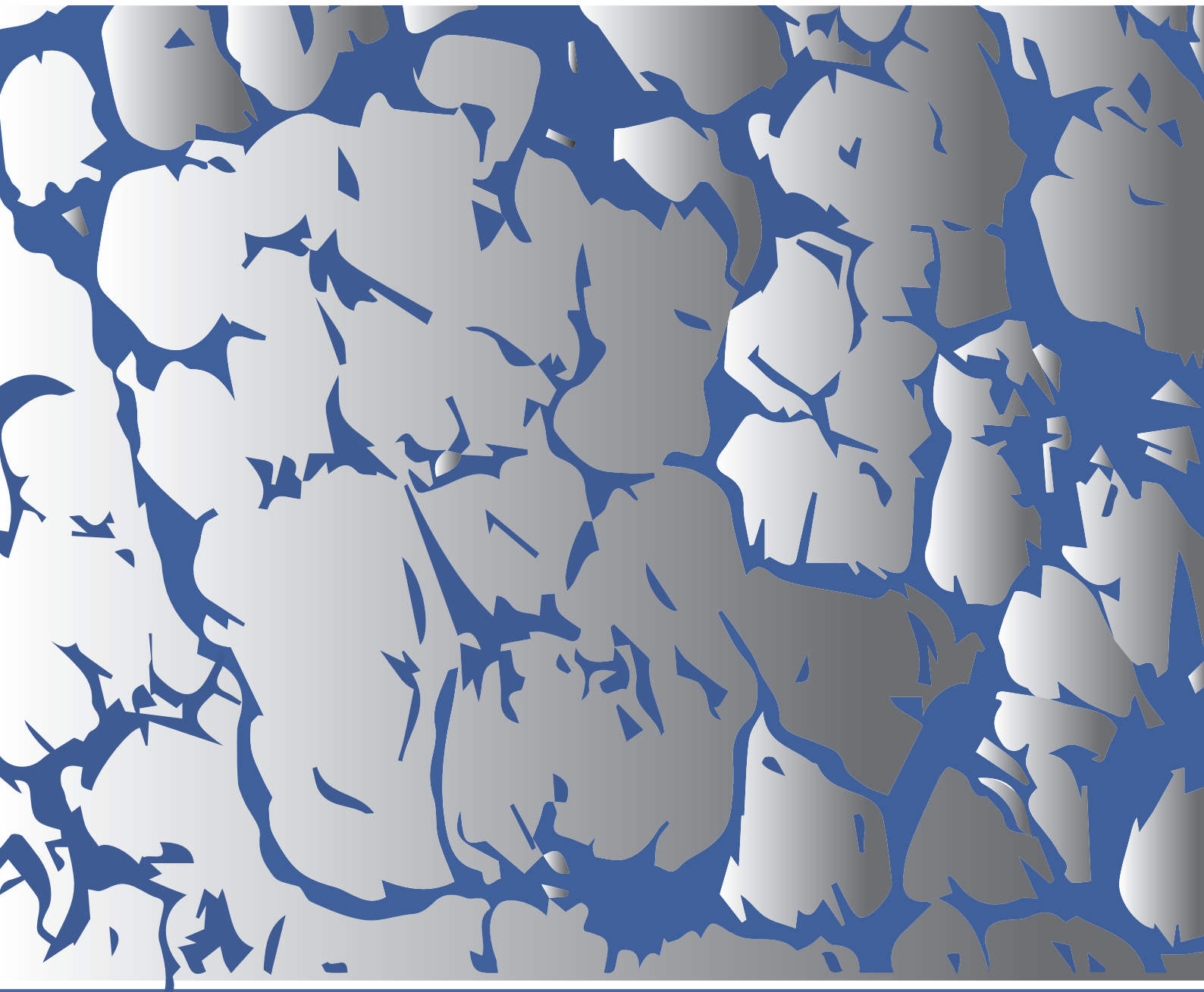


CONSENSUS DOCUMENT

MANAGEMENT OF HYPERKERATOSIS OF THE LOWER LIMB: Consensus recommendations



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Foreword

This document is a practical guide to the management of hyperkeratosis of the lower limb for all healthcare professionals involved in the care of patients with hyperkeratosis or those who are at risk of developing the condition, such as specialist nurses, district nurses, practice nurses, GPs, and podiatrists.

It offers pragmatic clinical recommendations for all aspects of care and introduces a novel, stepped approach to management, covering assessment, treatment and management of patients with hyperkeratosis, prevention of recurrence, and prophylactic measures for patients who may be at risk of developing the condition. The document also presents outcome measures that can be used to assess the efficacy of prevention and treatment interventions.

There is currently no standardised strategy or evidence-based national guideline for the management of hyperkeratosis and the condition is poorly represented generally in the medical literature. This document is therefore based on the best available evidence, supported by the consensus opinion of an expert working group of key opinion leaders from a wide range of disciplines, including lymphoedema, wound care, diabetes, dermatology and general practice. It aims to build on the success of the All Wales guidance on hyperkeratosis, which drew largely from the experience of its Tissue Viability Nurse Forum (AWTVNF, 2014).

In producing consensus recommendations, the expert working group recognises the many challenges facing healthcare professionals in this field, such as time constraints hindering a holistic approach, lack of cohesive national or local strategies for managing hyperkeratosis, and limited experience with newer, more efficacious technologies.

With these issues in mind, this document seeks to improve understanding of hyperkeratosis and equip healthcare professionals with the knowledge and skills necessary to recognise and treat this chronic condition effectively.

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Understanding hyperkeratosis of the lower limb

Hyperkeratosis of the lower limb is a common skin condition that typically affects patients with lymphoedema and chronic venous insufficiency (ILF, 2012). It is seen in both genders, all racial and ethnic groups and people of all ages (although it is more common in older people) (Jakeman, 2012). Data on the incidence of hyperkeratosis are sparse. One estimate has suggested that hyperkeratosis affects 10–20% of the Western population (Jakeman, 2012); another survey of members of the All Wales Tissue Viability Nurse Forum (AWTVNF) found that between 20–80% of the patients on their caseloads had hyperkeratosis of the lower limb (AWTVNF, 2014). It is the experience of the group that hyperkeratosis of the lower limb is under-recognised and under-diagnosed.

As highlighted by the AWTVNF survey, there is no standard management approach across Wales. This is likely reflected across the rest of the UK, given the lack of evidence-based national guidelines for managing hyperkeratosis and the poor evidence base for treating the condition. However, if left untreated, or sub-optimally treated, hyperkeratosis can degenerate into a progressive cycle of colonisation, infection, skin breakdown and, potentially, sepsis (Wounds International, 2012; AWTVNF, 2014).

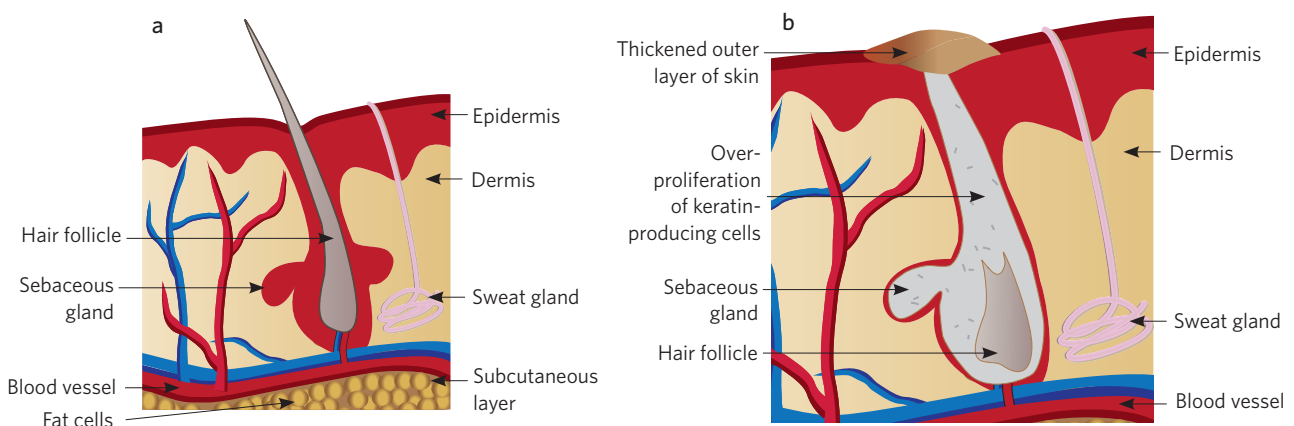
Pressure from the thickened stratum corneum can make hyperkeratotic skin feel uncomfortable (AWTVNF, 2014). Formation of cracks between the hyperkeratotic scales can cause inflammation and pruritus (Moncrieff et al, 2013), and allow bacteria and fungi to enter the lower layers of the skin (Day and Hayes, 2008). If left unchecked, this can lead to cellulitis (Wounds International, 2012; AWTVNF, 2014). Treating hyperkeratosis once it has become severe can be challenging, making effective use of adjunctive therapies (such as compression) difficult.

There are straightforward strategies that all healthcare professionals can follow that could help them correctly identify and effectively manage hyperkeratosis, as well as preventing it from developing in the first place.

WHAT IS HYPERKERATOSIS OF THE LOWER LIMB?

Hyperkeratosis of the lower limb is an abnormal thickening of the outer layer of the skin (the stratum corneum) localised to the lower leg and foot, and associated with an over-proliferation of keratin-producing cells (Figure 1) (EWMA, 2005; ILF, 2012; AWTVNF, 2014). Due to the natural variation in depth of the stratum corneum, the degree of skin thickening depends on where the hyperkeratosis occurs; for example, it will be thicker on the soles of the feet than on the ankle.

Figure 1: Anatomy of normal skin (a) and skin with hyperkeratosis (b)



BOX 1: Corns and callus

Thickening of the stratum corneum is the skin's natural defence against trauma or irritation; for example, from poorly fitting shoes. Corns and calluses – a form of hyperkeratosis – may develop in response to repetitive friction on the plantar aspect of the foot. Treatment would typically involve debridement of thickened skin/callus and replacing the inappropriate footwear, and/or wearing cushioning pads, insoles or individualised footwear (AWTVNF, 2014). This document does not cover hyperkeratosis due to corns and calluses; refer to a podiatrist for specialist foot management (FDUK, 2014).

IMPACT ON THE PATIENT

Patients are often acutely embarrassed by the physical appearance of their skin, the flaking of the hyperkeratotic scales and the unpleasant odour caused by bacterial or fungal colonisation (Brown, 2011; Jakeman, 2012, AWTVNF, 2014). These factors can cause distress and lead to anxiety, depression and social isolation (Wounds International, 2012; AWTVNF, 2014).

Some health professionals may believe that hyperkeratosis does not require active management; however, by addressing lower limb issues holistically, better outcomes can be achieved. Regular skin care for the affected area must be reviewed and administered with the same diligence as treatment for a wound.

WHO GETS HYPERKERATOSIS?

Little is known about the pathogenesis of hyperkeratosis or why it occurs in particular patients. The factors listed in Table 1 appear to contribute to its development in some cases.

TABLE 1: Factors that may contribute to the development of hyperkeratosis

Contributing factor	Notes
Lymphoedema/chronic venous insufficiency (Beldon, 2006; Barron 2007; ILF, 2006; ILF, 2012; Moffat et al, 2007; Whitaker, 2012)	<ul style="list-style-type: none">■ Abnormal collection of protein-rich fluid in extravascular tissue resulting from sub-optimal lymphatic drainage can lead to skin changes such as hyperkeratosis■ Hyperkeratosis is also seen in patients with:<ul style="list-style-type: none">— Chronic venous disease— Venous hypertension— Idiopathic venous eczema— Elephantiasis
Neuropathic diabetes (Cheer et al, 2009)	<ul style="list-style-type: none">■ In diabetic patients with motor involvement (motor neuropathy), shearing and friction forces may lead to hyperkeratotic callus■ Anhydrosis can cause dry skin (autonomic neuropathy), which may progress to hyperkeratosis (particularly around the heel)
Chronic recurrent eczema and other skin conditions (Drugs.com, 2015; Prakash et al, 2013)	<ul style="list-style-type: none">■ Prolonged inflammation may cause dry skin and scaling, and eventually progress to hyperkeratosis■ Hyperkeratosis is also associated with psoriasis and lichen planus■ Venous hypertension, which may be an underlying cause of hyperkeratosis, leads to skin changes including increased pressure in the capillaries, which causes dilation and leakage of fluid into the subcutaneous cells and interstitial spaces, causing oedema. This leads to reduced tissue oxygenation and gaseous exchange is slowed
Infrequent skin cleansing	<ul style="list-style-type: none">■ Infrequent skin cleansing leads to a build up of skin scales and plaques, while removal of loose tissue by cleansing aims to prevent hard areas of tissue becoming pressure points beneath dressings and compression
Lack of holistic assessment and treatment (Lindsay, 2007)	<ul style="list-style-type: none">■ Many practitioners cite time constraints and infection control as rationale for not cleansing; indeed, washing of the lower limbs is a controversial issue for many healthcare professionals■ However, it is important to always provide holistic assessment and treatment of skin ailments that may be associated with conditions such as leg ulceration (e.g. hyperkeratosis)

Diagnosing hyperkeratosis

PERFORMING A SKIN ASSESSMENT

Diagnosis of hyperkeratosis should be based on a detailed clinical history and physical inspection of the skin. A thorough skin assessment involves taking a history of the patient's skin condition, and a medical and psychosocial history, ensuring all skin conditions are reviewed. A history of the patient's bathing routine and all skin care products used should also be documented. Physical assessment should review skin colour, moisture levels, temperature, texture, mobility, and categorisation of any skin lesions present (primary or secondary) (Hess, 2010).



Figure 2: Hyperkeratosis in the diabetic foot (image supplied by Activa Healthcare)

IDENTIFYING HYPERKERATOSIS

Hyperkeratotic skin may appear red and dry with brown or grey scaly patches; an example of hyperkeratosis is given in Figure 2, with hyperkeratotic plaques of increasing severity shown in Figure 3 (page 4) (ILF, 2012; Jakeman, 2012).

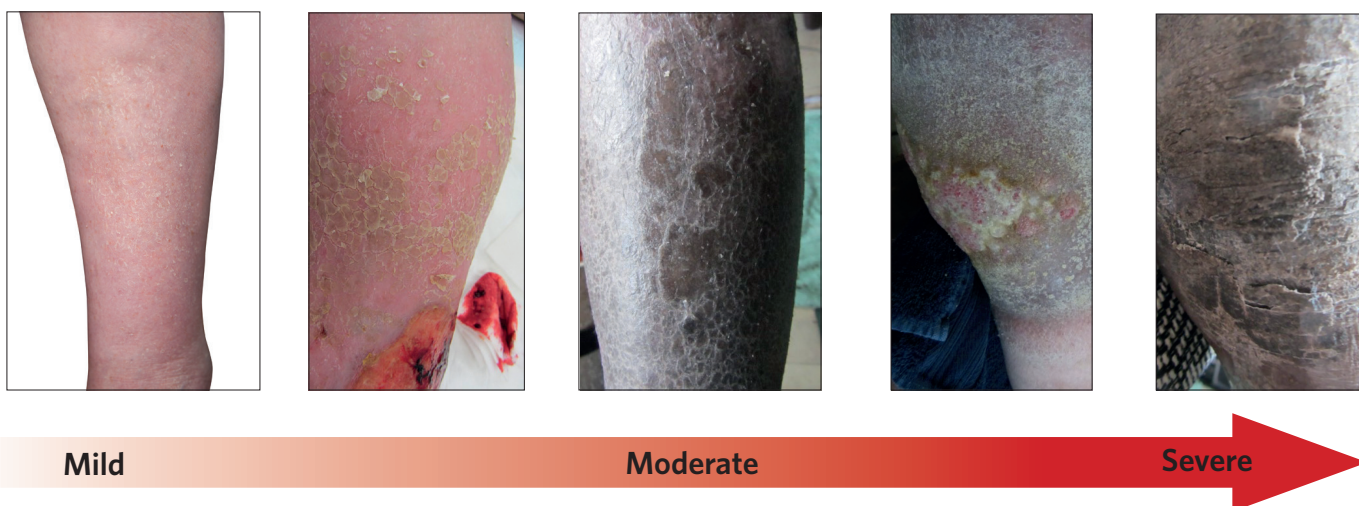
Hyperkeratosis may involve a small isolated area of the skin or, in its more advanced stage, cover the entire circumferential surface of the lower limb, appearing as deepened plaques with crevices.

If there has been regular emollient use or once soaked, it may be possible to easily lift off the scales without causing bleeding (unlike a psoriatic plaque, which cannot be removed without causing some epidermal trauma). If, however, the scales are firmly attached to the skin, they should not be removed.

Healthcare professionals should watch for signs and symptoms suggestive of malignant disease. If first-line management is not successful then a patient may need to be referred to a dermatologist. Wherever malignancy is suspected, biopsy will be required to confirm the diagnosis (Jakeman, 2012).

It is important to distinguish hyperkeratosis from other visually similar conditions before starting treatment (Table 2, page 4) (Jakeman, 2012). In particular, Bowen's disease is easy to mistake for hyperkeratosis (Moffat et al, 2007); a patch of Bowen's disease is characterised by a red scaly area that is usually whiter than hyperkeratosis, firmly adherent, and typically grows slowly (British Association of Dermatologists, 2010).

True hyperkeratosis should also be distinguished from dry skin or crust (although crust may be present with hyperkeratosis). In patients over 65, skin dryness is a natural aging change due to reduced sweat and sebum formation, along with a compromised skin barrier. Environmental factors, such as dry central heating and excessive washing further aggravate the problem. This dryness is rarely due to any systemic disease or a primary dermatological condition. Crust is the dried residue of skin exudate like serum, pus, or blood, is generally linked with excessive exudate or lymphorrhea, and can be washed off (Hess, 2010). Dry skin, both mild and excessive, should be managed with cleaning or debridement and emollients – all of which reduce the economic burden on the healthcare system.



Mild

Moderate

Severe

Figure 3: Timeline of hyperkeratosis severity (images supplied by Activa Healthcare)

TABLE 2: Differential diagnoses for hyperkeratosis	
Condition	Signs/symptoms
Hyperkeratosis	<ul style="list-style-type: none"> ■ May present as red, dry skin with brown or grey scaly patches that do not flake away when the skin is brushed ■ In some cases, patches may be removed without bleeding to reveal underlying healthy skin; this should be carried out by a skilled healthcare practitioner ■ May cover small, isolated areas or the entire circumference of the lower leg ■ Can be associated with odour due to the presence of bacteria and fungi
Dry skin/crust	<ul style="list-style-type: none"> ■ Crust is normally secondary to leakage from the skin or a wound that has dried out, or a build up of dried skin or wound care products ■ Dry skin flakes without multiple layers ■ Associated with excessive exudate on the skin; crusts dissolve on washing and do not recur when the exudate is under control
Bowen's disease/squamous cell carcinoma	<ul style="list-style-type: none"> ■ Often there are no symptoms present, although the surface may catch on clothing (pain or itching might suggest invasive disease) ■ Presents as a red, scaly patch that grows very slowly
Varicose eczema	<ul style="list-style-type: none"> ■ Red, inflamed, itchy, and may weep
Psoriasis	<ul style="list-style-type: none"> ■ Dry, red and covered with silver scales ■ Characteristically see tiny bleeding points when the scales are lifted off ■ May cause itching and soreness
Lichen planus	<ul style="list-style-type: none"> ■ Blue-red (violaceous) in colour, slightly raised papules, which are shiny and have a flat top ■ Typically has a lacy-white firmly adherent 'scale' (Wickham's striae), but may develop thicker scales (hypertrophic lichen planus) ■ Typically very itchy

Managing hyperkeratosis

The management of hyperkeratosis is composed of three phases:

1. Prevention
2. Treatment
3. Maintenance.

Patients may move back and forward through the three phases according to the degree of control achieved, as shown in Figure 4.

STEPPED APPROACH TO MANAGING HYPERKERATOSIS

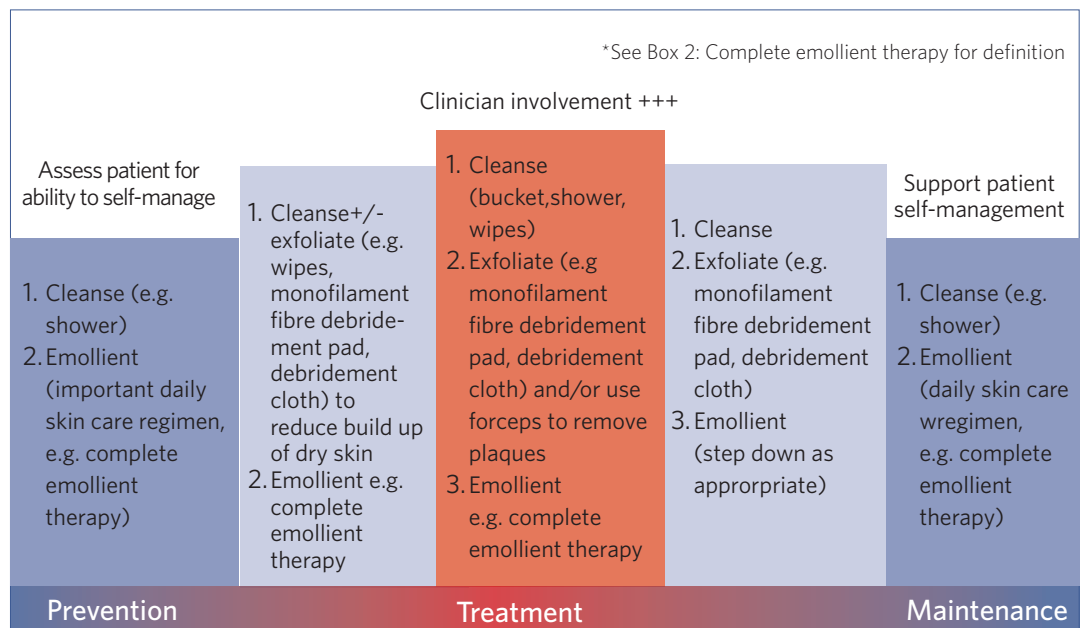
The expert working group advocates a stepped approach to the management of hyperkeratosis over these three phases. The aim is to prevent hyperkeratosis developing in at-risk patients, or in those with symptoms (e.g. very dry flaky skin), to achieve early control and sustain this by stepping up or stepping down treatment as necessary. The focus is preventing development of or rapidly minimising symptoms, and optimising skin health by starting treatment at the most appropriate level.

Supported patient involvement is encouraged for the lower steps (dark blue columns, Figure 4) according to the willingness and competence of the patient and/or their carer. Healthcare professional involvement becomes more necessary at the higher steps (light blue/red columns), and is essential during the treatment phase.

Within this stepped approach, an effective management strategy consists of:

1. Holistic assessment
2. A structured skin care regimen
3. Aftercare and patient involvement.

Figure 4: Stepped approach to the management of hyperkeratosis



1. HOLISTIC ASSESSMENT

Hyperkeratosis is a manifestation of other clinical problems, so a detailed, holistic assessment of the patient's health needs should be undertaken. It is vital to identify and treat any underlying causes, such as venous hypertension, chronic oedema or lymphoedema (AWTVNF, 2014). Where the diagnosis is unclear, the patient should be referred to the most appropriate specialist (e.g. vascular surgeon, podiatrist or dermatologist); for example, if signs and symptoms of venous disease are present, then consider referring the patient to secondary care as per NICE guidance CQ 168 (NICE, 2013).

Factors that may contribute to the development of hyperkeratosis were discussed earlier (Table 1). Preventative strategies should be focused on, but not be limited to, patients with these contributing factors. As part of the holistic assessment, patient education should be provided and their willingness to participate in their own care evaluated.

2. STRUCTURED SKIN CARE REGIMEN

A skin care regimen should aim to cleanse and remove any products or product residue, prepare the skin using exfoliation, and replenish the skin barrier using emollients.

Cleansing

The cornerstone of prevention, treatment and maintenance is thorough skin hygiene. Tap water or saline may be used to cleanse the lower limbs with the option to step up to an antimicrobial cleanser to prevent infection where appropriate.

TABLE 3: Pros and cons of cleansing methods		
Cleansing method	Pros	Cons
Shower	<ul style="list-style-type: none"> ■ Allows thorough cleansing of whole body ■ Cleansing agents are washed away ■ Improves patient wellbeing 	<ul style="list-style-type: none"> ■ Potential contamination, alteration of skin pH, and drying of at-risk skin from shampoos, shower gels, etc (NOTE: these should not be used by anyone with a skin problem, or the very young or very old, as they can compromise the skin barrier)
Bath	<ul style="list-style-type: none"> ■ Allows thorough cleansing of whole body at once ■ Improves patient wellbeing 	<ul style="list-style-type: none"> ■ Water should not be too hot for vulnerable skin ■ Patient immobility can make bathing impractical ■ Risk of contamination from shampoo, bath and shower gels (see above)
Lined bucket	<ul style="list-style-type: none"> ■ Inexpensive and effective ■ Encourages patient/clinician engagement ■ May improve patient wellbeing ■ Softens the hyperkeratosis ■ Good for immobile patients 	<ul style="list-style-type: none"> ■ Heavy to move when full of water ■ Not permissible in some areas due to health and safety concerns ■ Edges of the bucket have the potential to damage vulnerable skin if caught ■ Must be lined with a disposable bag that fits well
Lined basin	<ul style="list-style-type: none"> ■ Inexpensive ■ Less heavy than a bucket when full 	<ul style="list-style-type: none"> ■ Not practical for larger limbs/patients ■ May be difficult to bend down to reach lower leg
Licensed cleansing wipes	<ul style="list-style-type: none"> ■ Convenient, easy to use, and patients can self-manage ■ Maintains independence for dexterous and mobile patients ■ Minimal moving and handling concerns ■ Safe to use over wound beds 	<ul style="list-style-type: none"> ■ Expensive ■ Increased environmental impact ■ Excipients (e.g. methylisothiazolinone) may cause contact dermatitis ■ Potential for cross-contamination if not used appropriately
Pods/sachets/cans of cleansing solution (i.e. normal saline)	<ul style="list-style-type: none"> ■ Convenient to use 	<ul style="list-style-type: none"> ■ Suitable only for wound irrigation, but insufficient for skin cleansing

BOX 2: Complete emollient therapy

The term 'Complete emollient therapy' (CET) was coined in 1997 by Professor Mike Cork (Cork, 1997). CET entails using:

- A soap substitute
- A bath oil, and
- A leave-on emollient.

Soap substitute

These are a type of emollient that can be used instead of traditional soap for washing, showering and bathing. Options include Oilatum, Cetraben or Doublebase (leave on moisturisers); or Dermol 600, Oilatum wash (washes).

Bath oil

There are two main types of bath oil:

- Those that form a film on the surface, but leave a slippery residue on the bath
- Those that disperse through the water (roughly two capfuls per 20cm of water); Balneum, Oilatum and Aveeno are examples.

Leave-on emollient

Leave-on emollients are applied directly to the skin and left to soak in. These are discussed later (See 'Emollients' page 11).

For additional information (page 9 of linked document):

http://www.pcds.org.uk/ee/images/uploads/bulletins/Spring_bulletin_2013-web.pdf (Moncrieff, 2013).

Frequency of cleansing

Where the patient is self-caring, the limb should be washed once a day using a shower, bath, bucket, basin or bathing/cleansing wipes, according to local protocols and taking the pros and cons of each method into consideration (Table 3). Always check local protocols with regards to method of cleansing.

If daily cleansing is not possible, for example, because the patient is wearing compression bandages, once or twice weekly cleansing may be adopted; compression systems that maximise good skin care should always be considered. For example, self-applied, adjustable compression systems (e.g. hosiery kits and compression wraps) may allow easy removal by patients for daily cleansing, exfoliation and application of emollients. Patients receiving a home visit should be advised to shower or bathe immediately before the arrival of the healthcare professional.

Cleansing agents

Harsh detergents (e.g. traditional soap, shower gel, bubble bath, shampoo) should not be used as they can compromise the skin barrier and allow potential pathogens and allergens into the deeper layers of the skin (Moncrieff et al, 2015). Instead, CET should be adopted, whereby harsh detergents are replaced with a soap substitute, a bath oil and a leave-on emollient (Box 2) (Cork and Danby, 2009). Aqueous cream is not recommended for skin washing or as an emollient in patients with or who are at risk of developing hyperkeratosis (see The Aqueous Cream Debate, Box 5, page 13).

A soap substitute should be used with water to cleanse the leg using a disposable cloth. About half to one teaspoonful of soap substitute should be mixed in the palm of the hand with a little warm water and spread over damp or dry skin, or dissolved in water in a bucket or basin (BDNG, 2012).

Any residue on the skin should then be rinsed off (for example, in a shower or bath) and patted to remove excess water with a towel. Care should be taken, however, to dry thoroughly between skin folds and toes (e.g. with a paper towel) to help prevent fungal infection. Rubbing of the skin should be avoided as this can cause damage to the skin (BDNG, 2012). Patients should be reminded to take measures to reduce the risk of slipping when using emollients in a bath, shower or on a tiled floor.

Single-use bathing and cleansing wipes (i.e. Cavilon™) that combine a cleanser and skin conditioner may be used instead of water. These wipes are a convenient and safe way to cleanse, with no bucket required. However, their use has a high impact on the environment and may increase costs.

Exfoliation

Exfoliation has been described as 'intensive care for the legs' and is a vital component of a structured skin care regimen (BDNG, 2012). Exfoliation may also be referred to as mechanical debridement (Box 4, page 8). Removing dry, scaly skin by exfoliation:

- Allows emollients to penetrate, and may also help to prevent skin tears (Stephen-Haynes and Carville, 2011)
- Relieves the pressure and discomfort caused by scaly skin
- Improves the physical appearance of the skin
- Improves patient wellbeing.

Frequency of exfoliation

The decision as to how often exfoliation should take place should be patient-centred, bearing in mind

BOX 3: Venous leg ulcer management

More information on optimising skin care in patients with venous leg ulcers is given in the consensus recommendations for venous leg ulcer management (available at: www.woundsinternational.com) (Harding et al, 2015).

BOX 4: Definition of debridement

Debridement is defined as the act of removing necrotic material, eschar, devitalised tissue, serocrusts, infected tissue, hyperkeratosis, slough, pus, haematomas, foreign bodies, debris, bone fragments or any other type of bioburden from a wound with the objective of promoting wound healing (Strohal et al, 2013).

that daily exfoliation may be too frequent for inflamed or vulnerable skin. In patients with hyperkeratosis, exfoliation should ideally be carried out each time the skin care process is undertaken, and wherever possible in patients with compression bandaging. A compromise must be made in order to balance the benefits of compression with good skin care: the expert working panel recommends exfoliation twice a week in this group.

Optimal use of appropriate bandaging and/or hosiery will rapidly reduce limb volume in patients where oedema is present. However, there may initially be some dry, scaly skin that will need to be removed before reapplication of compression, in order to maximise its benefit, with emollients applied to maintain skin integrity (Whitaker, 2012).

Exfoliation techniques

Exfoliation methods commonly used to manage or prevent hyperkeratosis include:

- Physical methods
 - Monofilament fibre debridement pad (e.g. Debrisoft[®]): prevention and active management
 - Forceps: active management
 - Gloved fingers: active management
 - Wooden tongue depressor: active management
 - Pre-moistened debridement cloth (e.g. UCS[™] Debridement): active management
 - Washing with lined bucket/basin or cloth: active management
- Chemical methods
 - Salicylic acid: active management

The method selected should meet the clinical needs of the patient and be appropriate to the level of competence of the healthcare professional, taking into account the pros and cons given in Table 4 (page 10). Indeed, exfoliation is only needed when there is dry, flaky skin apparent; depending on how vulnerable the skin is, exfoliation may be too harsh. Regardless of method, removal of the skin scales of hyperkeratosis must be safe, pain-free and atraumatic (Whitaker, 2012). Before starting the exfoliation process, any loose hyperkeratotic plaques should be removed. These should be easy to lift off and should not cause pain or bleeding; if plaques are not easy to lift, emollients should be used. Where possible, the process should be repeated on a daily basis, or when the patient is reviewed if they are being treated in the community, until the plaques have all lifted away.

Monofilament fibre debridement pad

The National Institute for Health and Care Excellence (NICE) recommends the monofilament fibre debridement pad, Debrisoft, for the management of patients with lower limb hyperkeratosis (NICE, 2014). Visual examples before and after use of a monofilament fibre debridement pad are provided in Figure 5. This product is available as a sterile, single-use pad consisting of monofilament polyester fibres cut with angled tips designed to penetrate irregularly shaped areas, and remove devitalised skin and wound debris. The pad is backed with polyacrylate and is soft and flexible to allow for gentle debridement and cleansing (NICE, 2014). In practice, the monofilament fibre debridement pad should be used as soon as there is evidence of plaque formation and discontinued when plaques are absent. If plaques return, use of the pad should be recommenced.

Evidence shows that the monofilament fibre debridement pad (Bahr et al, 2011; Gray et al, 2011; Stephen-Haynes and Callaghan, 2012; NICE, 2014):

- Is a fast and effective method of debridement
- Can remove hyperkeratotic skin on the lower limb with improvement in skin condition
- Could require fewer nurse visits than other debridement methods
- Is convenient and easy to use
- Is well tolerated.



Figure 5: Top: Before using a monofilament fibre debridement pad. Bottom: After using a monofilament fibre debridement pad (images supplied by Activa Healthcare)

The pad must first be moistened with 20–40ml of water or saline; the soft, fleecy side can then be used to gently wipe the surface of the skin using long, sweeping strokes (or for a wound, in a circular motion), for a minimum of 2 minutes. Hyperkeratotic tissues are lifted and bound within the monofilament fibre debridement pad and removed from the skin. One or more new pads are required for each leg; this will depend on the size of the area and severity of hyperkeratosis. The pad should be replaced when it becomes covered with debris, which stops the fibres from working effectively. Emollients must be removed from the skin prior to use of the pad in order to achieve an optimal effect. In addition, emollients should not be put in the water in the bucket or basin during the cleansing stage, prior to exfoliation with the monofilament fibre debridement pad, as is normal practice.

The monofilament fibre debridement pad can be used by all healthcare professionals working in the community, and by patients. Its ease of use may encourage patients to take an active role in their care and undertake exfoliation of their own hyperkeratosis and dry skin (Wounds UK, 2015).

Forceps/gloved fingers/tongue depressor

Manual removal of scales using forceps, gloved fingers or a tongue depressor may also be undertaken, although several sessions may be needed to remove all the scales. Single-use forceps are the manual method of choice, although these are more expensive than the alternatives. The hyperkeratotic skin must first be softened with an emollient (AWTVNF, 2014).

This option is useful where the hyperkeratosis has thickened or crevices have developed, in order to penetrate further. However, there is potential to cause trauma with manual removal, especially where the patient has fragile skin, so the process should be undertaken by an experienced clinician.

Salicylic acid

Topical preparations of salicylic acid (3% or 6%) (e.g. Diprosalic) can be used to help exfoliate skin scales (AWTVNF, 2014). Salicylic acid's ability to slowly erode the epidermis is useful for dry or hyperkeratotic skin (Pray, 2010); however, it carries a contraindication for patients with diabetes at risk of neuropathic ulcers (Jakeman, 2012). Use of salicylic acid in patients with diabetes could produce an infection resulting from this skin erosion, potentially leading to the patient losing a limb (Pray, 2010). As such, it should be used only while there is ongoing professional input and only on the hyperkeratotic skin, not on the surrounding healthy skin.

Pre-moistened debridement cloth

There is evidence that the pre-moistened debridement cloth can be used to remove hyperkeratosis with minimal trauma, as well as cleansing and hydrating the surrounding skin (Downe, 2014). Where moving and handling is a concern (i.e. in bedbound patients), using the pre-moistened debridement cloth may facilitate whole limb cleansing.

Other exfoliation methods

There is some debate around the use of hydrocolloid dressings, hydrogels, and paste bandages for exfoliation. While it is known that some dressings products can cause skin sensitisation in some patients (Beldon, 2006), they are widely used in patients with eczema for dry and itchy skin, and there is some evidence for their use as treatment with and without steroids for psoriatic plaques.

TABLE 4: Pros and cons of the exfoliation methods used to treat and prevent hyperkeratosis			
Method	Indication	Pros	Cons
Monofilament fibre debridement pad	Prevention Management Maintenance	Easy to use for patient and clinician Rapid results Cost-effective Well tolerated Evidence-based	May require a prescription in the community setting
Forceps, gloved fingers, tongue depressor	Management	Forceps/tongue depressor — Removes scale and plaques — Rapid results — Easy to use for patients and clinicians — Available in many clinical settings Gloved fingers — Available in many clinical settings — Can feel for resistance and gauge when to stop use	Trauma risk/potential to cause pain Associated risk of infection Time consuming to use; several sessions may be required
Pre-moistened debridement cloth	Management Maintenance	Convenient and easy to use	May require a prescription Risk of skin sensitisation
Salicylic acid	Management	Will soften and remove scales, causing the outermost layer of skin to shed	As with all hydroxy acids, it is possible that prolonged exposure or high concentrations may cause burns or infections Carries a contraindication in certain patients, i.e. those with diabetes Requires prescription
Hydrogel sheets and hydrocolloid dressings	Management	May help to remove hard plaques	Takes time to work (days to weeks) Requires a prescription

Emollients

The stratum corneum forms an effective barrier that restricts water loss from the body and prevents infiltration of harmful irritants; dry skin conditions are synonymous with a skin-barrier defect, and are caused by loss of water from the stratum corneum (Moncrieff et al, 2013). Emollients are lipid-based substances that occlude the skin surface and encourage build up of water within the stratum corneum (Marks, 2001; BDNG, 2012). Their clinical effects are to soothe, smooth and hydrate the skin by (BDNG, 2012; BNF, 2015):

- Reducing the clinical signs of dryness (e.g. roughness and skin scaling)
- Reducing painful sensations, such as itching and tightness.

Emollients are vital for the prevention and treatment of dry skin conditions such as hyperkeratosis and for the promotion of skin health (BDNG, 2012). Emollients re-grease the skin whilst cleansing, and are buffered, so maintain the normal surface pH. They should not be viewed as an adjunct, but as a key component of a structured skin care protocol (Moncrieff et al, 2015). Indeed, it has been agreed that emollients should be the first-line therapy for all dry skin conditions (Moncrieff et al, 2013; Proksch and Lapachelle, 2005).

Types of emollient

There are many emollients on the market, but they are not all the same, and they are only effective if they are used appropriately (Moncrieff et al, 2015). The amount of lipid, and the number and concentration of other active ingredients, varies between products, resulting in a range of formulations with different physical and clinical effects.

Simple emollients are based on lipids alone with varying amounts of water (plus stabilisers and preservatives). Products with a higher lipid content are more greasy or waxy than those with a lower lipid content, and so are better at trapping water (BDNG, 2012).

Conversely, more complex emollients contain additional ingredients with specific therapeutic actions:

- **Humectants, such as urea, glycerol, propylene glycol, lactic acid**
 - Boost hydration by attracting and retaining water in the stratum corneum
 - Prevent high transepidermal water loss (TEWL) for considerably longer than simple emollients (Moncrieff et al, 2015), extending the duration of activity to at least 12 hours (Moncrieff, 2013)
- **Antiseptics, such as benzalkonium, chlorhexidine**
 - Control bacterial load/infection
- **Antipruritics, such as urea, lauromacrogols**
 - Reduce itching
- **Ceramide (major lipid component of lamellar envelope in stratum corneum)**
 - Helps maintain an effective skin barrier
- **Topical antibiotics (should be avoided)**
 - Preparations containing an antibiotic should only be considered if infection is present or a frequent complication (BNF, 2015).

Emollient products may also be formulated to offer extra benefits such as enhanced skin absorption or penetration, and may be provided in a dispenser to reduce the risk of cross-contamination or as a spray to help treat skin in difficult to reach places.

Finally, the mode of hydration also differs between products. Greasy emollients (e.g. those containing petroleum) tend to work by occlusion, trapping moisture into the skin. Emollients containing humectants work actively by drawing moisture into the stratum corneum from the dermis (BDNG, 2012). Other emollients contain a mixture of occlusive and humectant substances that work together to draw water into the epidermis and trap it there (BDNG, 2012).

Selecting an emollient

The choice of an appropriate emollient depends on (BNF, 2015):

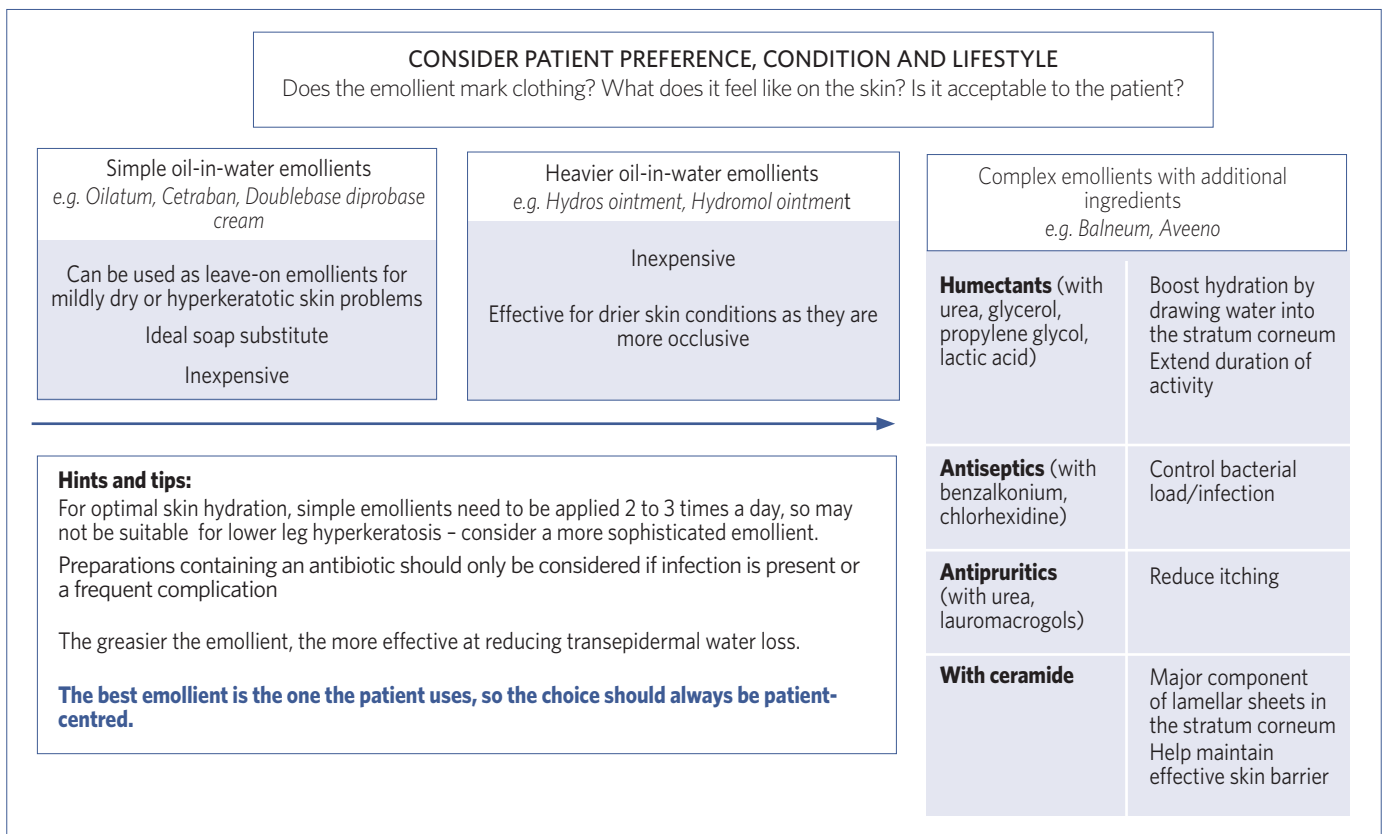
- The severity of the condition
- The site of application
- Patient preference.

Involving the patient in the decision-making process helps to ensure the chosen product is cosmetically acceptable and meets the needs of their lifestyle (e.g. number of daily applications and speed of absorption) (Lawton and Langeon, 2009). This in turn encourages patient concordance with treatment (BDNG, 2012).

Patients may respond in very different ways to products with broadly similar ingredients; what works well for one patient may not have the same effect in another. While generic products should be used where therapeutically beneficial, it is often more appropriate to prescribe a branded product (in line with the local formulary), having worked with the patient to find out which product they prefer (BDNG, 2012). To avoid confusion and ensure clinical efficacy, it is important that the entire multidisciplinary team is consistent with the product they prescribe for an individual patient.

Figure 6: Selecting an appropriate emollient

Figure 6 provides a visual guide of the emollient choices available, and indicates when to step up or down.



BOX 5: The aqueous cream debate

The role of aqueous cream as a leave-on emollient or as a washing product has become contentious (BDNG, 2012; Moncrieff et al, 2013). Recent studies (largely in children with eczema) have shown that aqueous cream weakens the epidermal barrier and actually increases transepidermal water loss (Cork et al, 2003; Danby et al, 2011). Others have questioned the evidence for damage when aqueous cream is used as a soap substitute (BDNG, 2012) and the *British National Formulary* states that it may be used as alternative for soap in the bath for dry or scaling skin disorders (BNF, 2015). In line with current consensus, the expert working group does not advocate the use of aqueous cream in patients with or at risk of developing hyperkeratosis (Moncrieff et al, 2013).

Applying emollients

It is recommended that an adult should apply 250–600g of emollient per week (for the whole body) (BDNG, 2012; NICE, 2007). The *British National Formulary* recommends 100–200g for both legs for 1 week, and 200 ml of a lotion.

However, the amount of emollient required will depend on the area being treated, frequency of application (i.e. TEWL factor) of the emollient, and whether a soap substitute is being used in conjunction. For example, in an adult, each lower limb requires about 6 fingertip units per day (3 g); as such, if an emollient is applied once a day (e.g. Balneum®) to the whole of both lower legs, 6 g per day of emollient will be needed (50g per week). On marked hyperkeratosis, more generous use of emollients may be useful.

Recommendations for applying emollients are as follows:

- Wash hands before applying emollients to reduce the risk of cross-contamination (BDNG, 2012)
- Keep fingernails short and smooth to avoid causing trauma to the skin (BDNG, 2012)
- Apply emollients gently to the skin in a downward motion to avoid the hair follicles becoming blocked (Beldon, 2006)
- It is not necessary to rub the product continuously into the skin until it is absorbed completely; doing so can generate heat and exacerbate any pruritus (BDNG, 2012)
- If using emollients alongside topical steroids, apply the emollient first and allow it to dry for about 30 minutes before applying any steroid preparation (BDNG, 2012)
- Bear in mind that older skin tends to be drier; warm environments such as care homes with permanent central heating and no humidification may further increase this dryness
- The *British National Formulary* contains a warning about fire risk with paraffin-based emollients. Paraffin-based products that are in contact with dressings or clothing can be easily ignited, with the risk increasing when preparations are applied to a large part of the body or if the dressings/clothing are soaked with ointment (MHRA, 2008).

Emollients should be stored in a cool location and not used once the expiry date has been exceeded; the expiry date is reduced once opened. Products containing urea will smell strongly of ammonia once the product has deteriorated (BDNG, 2012), and may be an irritant to the stratum corneum.

Emollients that prevent water loss from the skin (TEWL) can be applied once a day (e.g. Balneum), ideally after washing, to trap any moisture in the skin (BDNG, 2012). Emollients that have a higher TEWL will need to be applied more frequently to maintain efficacy.

Healthcare professionals should demonstrate the application of emollients to all patients to facilitate self-care and promote concordance. The effects of emollients are short-lived and they should continue to be applied even after improvement occurs (BNF, 2015). This is a lifelong intervention, with the frequency of application depending on the product and its individual guidelines. Patient's skin conditions and their emollient requirements will change throughout their lives, and these changes also need to be taken into account when choosing which emollient to use (Lawton, 2009; Dyble and Ashton, 2011).

3. AFTERCARE AND PATIENT INVOLVEMENT

Role of patients, carers and family members

Promoting self-care (daily hygiene plus regular skin care) is a key determinant of positive outcomes (Whitaker, 2012; Pidock and Jones, 2013). The maintenance phase presents a great opportunity for the patient, their carer and/or family member, to take ownership of any aspects of the skincare regimen they feel comfortable with. Patient education helps patients to adhere to their treatment and can increase their confidence to take on additional components of management.

Assessing patient involvement

When assessing patient and caregiver involvement in the care plan, both willingness and competence should be taken into account. It is important not to assume that patients, carers or family members will be willing or able to take responsibility for a skin care regimen. In addition, the degree of involvement may increase or decrease with time as the condition transitions between prevention, treatment and maintenance, and as the patient, carer or family member gains confidence (Wounds International, 2015 – to be published). For example, patients may be happy to self-care during the maintenance phase, but not during the treatment phase.

Asking questions such as the following can help to assess the degree of engagement with self-care:

- Are you willing and able to wash your legs?
- Are you willing and able to exfoliate your skin?
- Are you willing and able to apply an emollient?
- How often can you perform these actions?
- Would you prefer to use bucket, shower, basin?
- Are you in compression that has to stay on for a certain number of days?
- Are you able to remove and reapply your compression? If necessary, do you have anyone who can help you do this?
- Do you have access to tools required to facilitate self-care (e.g. a long-handled sponge or body brush?)
- Can you recognise when your treatment is working and when to ask for more support?
- Are you willing to contact a healthcare professional for advice if you think there is deterioration to your skin?

These questions can be revisited at various points in the management cycle (Figure 7).

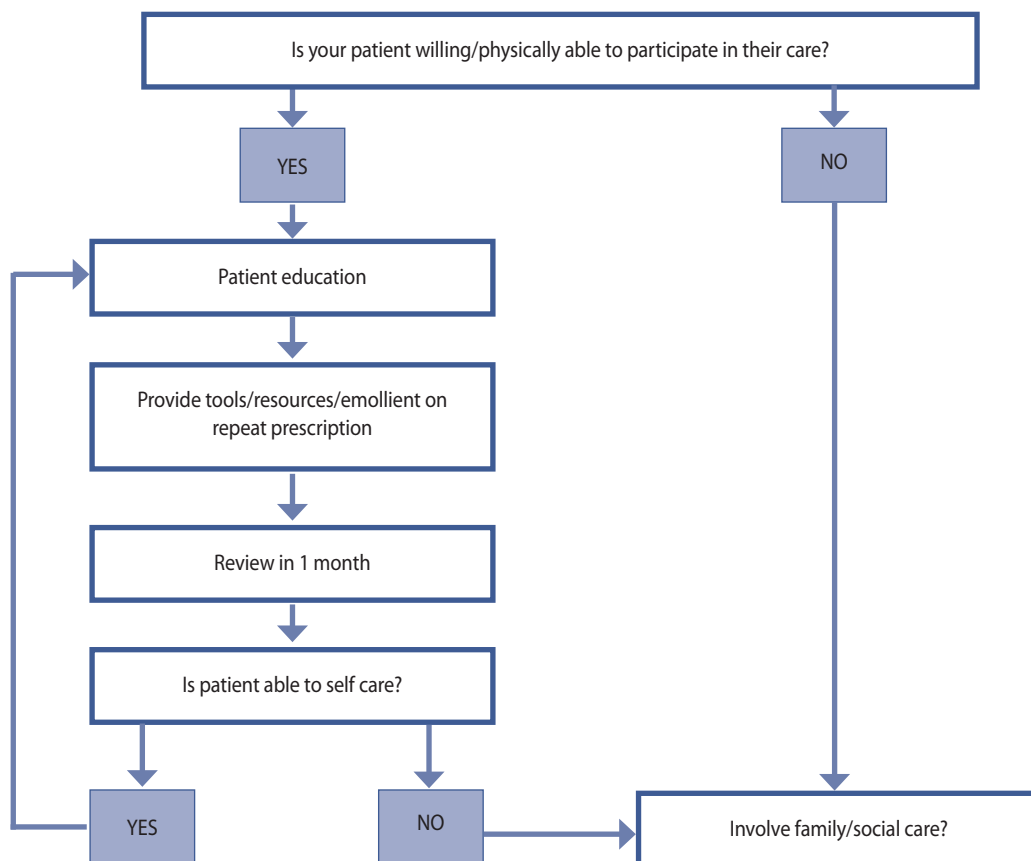
Patient education

Patients, carers or family members may initially feel daunted by the prospect of taking over a skin care regimen that has previously been carried out by a nurse. Advice and care planning with healthcare professionals can help to maximise patients' independence and, ultimately, prevent worsening of their condition. Over-medicalising the information given to patients and carers can be off-putting and may make self-care seem like a responsibility they are not qualified to take on.

Patient education should consist of:

- Written information (e.g. a leaflet) reinforced by verbal information that should help patients understand:
 - The chronic nature of hyperkeratosis
 - The consequences of not following the recommended treatment regimen (infection, cellulitis, varicose eczema, odour, unsightliness)
 - How to look after their skin
 - When to seek help (early signs of regression and red flags)
 - Who to contact
 - How to access maintenance support
 - Clinician's contact details.

Figure 7: Involving the patient, carer or family member in the management of hyperkeratosis



- An individualised care plan for carer, patient or nurse:
 - Details of skin care regimen
 - Frequency of interventions
 - Storage of products/lifespan once opened (emollients).

As a part of long-term management, it will also be important to ensure the patient understands that their hyperkeratosis has an underlying cause (i.e. venous hypertension, chronic oedema or lymphoedema), and how to manage their long-term health condition; for example, using compression and/or skin care.

BOX 5: Measuring outcomes

Outcome measures that can be used to assess the efficacy of interventions include:

- | | | |
|---|---|---|
| <ul style="list-style-type: none"> ■ Improvement in skin condition <ul style="list-style-type: none"> – Removal of hyperkeratosis – Prevention of recurrence ■ Patient feedback <ul style="list-style-type: none"> – Satisfaction with management – Impact on quality of life – Itching – Odour – Episodes of cellulitis | <ul style="list-style-type: none"> ■ Concordance <ul style="list-style-type: none"> – Percentage of patients exfoliating – Percentage of patients using emollients – Degree of concordance exhibited by patients/carers ■ Progression along the management pathway <ul style="list-style-type: none"> – Timescale for improvement at each stage | <ul style="list-style-type: none"> ■ Cost analysis <ul style="list-style-type: none"> – Cost of daily care – Impact on long-term costs ■ Identification of at-risk patients (e.g. implementing preventative phase earlier) |
|---|---|---|

PATIENT REVIEW

Patients should be reviewed at each contact with a healthcare professional (e.g. whenever carrying out a Doppler study to measure ankle brachial pressure index, or applying compression therapy to a patient with a venous leg ulcer). These visits present a valuable opportunity to assess the skin for the development of hyperkeratosis or recurrence in a person who has previously been treated, and to assess whether a skin care regimen is working in a patient in the treatment phase of management.

Patients who are self-caring should have a key worker as part of the long-term conditions framework (Department of Health, 2005), and should be provided with written and verbal information explaining when and how they should contact the healthcare professional for a review. Any concerns should prompt a rapid referral back into the relevant service. It is worth considering the potential role of local pharmacists in flagging up the need for review, for example, referring a patient with hyperkeratosis that is identified when supplying and fitting hosiery, or highlighting if emollients are no longer being collected.

During patient review, healthcare workers should consider whether the skin is improving satisfactorily or if there are signs that hyperkeratosis is developing, and whether each aspect of the skin care regimen is working effectively. It is important to document and communicate to the multidisciplinary team the rationale for a particular therapy choice, in order to minimise the chance of prescription-switching and ensure that the patient maintains access to repeat prescriptions. As discussed earlier, it is important to watch vigilantly for malignancy; for example, if an area is not responding in the same way as the surrounding skin or looks abnormal. If in doubt, patients should be referred urgently to a dermatologist.

FREQUENTLY ASKED QUESTIONS AND ANSWERS

What is hyperkeratosis?	Hyperkeratosis is an abnormal thickening of the outer layer of the skin caused by the multiplication of keratin-producing cells (cells that help keep the skin waterproof).
Why have I got hyperkeratosis?	Little is known about how hyperkeratosis develops, but there are a number of factors that may contribute; for example, lymphoedema (chronic swelling in the body's tissues), problems with blood flow, neuropathic diabetes, chronic recurrent eczema or other skin conditions, infrequent skin cleansing, or care that does not take the skin into account.
Why should I treat this (for patients or professionals)?	Hyperkeratosis indicates that the underlying skin or tissue is unhealthy. Accurate assessment and diagnosis can identify potential causes, which may need further investigation or treatment. Treatment should address the causes and effects simultaneously. If this is done, there is less risk of infection and the skin will be better nourished, as well as looking and feeling better.
How long does it take to treat hyperkeratosis?	Time to healing can vary depending on the severity of the hyperkeratosis. Patients should move between the prevention, management and maintenance stages of treatment until improvement is seen in the skin.
How often and what technique should I use for treatment?	Cleansing: cleansing should be frequent, daily where possible (once/twice weekly for patients with compression). Exfoliation: frequency of exfoliation should be patient-centred, bearing in mind the condition of the skin; it should ideally be carried out every time the skin care process is undertaken, and wherever possible in patients with compression. Emollients: frequency of application depends on the type of emollient, from once a day at minimum. Emollient effects are short-lived and they should be applied until improvement is seen.
When should I seek medical advice?	If treatment does not seem to be working or there is deterioration in the skin, the advice of a medical professional should be sought.
How can I prevent further episodes of hyperkeratosis?	Hyperkeratotic skin is a sign of an underlying health condition, so care should be taken to understand what the cause is and how this should be treated in order to prevent future episodes.

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