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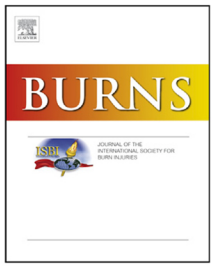

Moisturisers in scar management following burn: A survey report

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ABSTRACT

Scar management is a recognised key component of rehabilitation following burn. Moisturising often combined with massage is commenced once healing tissue has gained sufficient strength to tolerate surface friction, with the aim being to hydrate the dry scar. The studies on various moisturisers and creams provide some guidance on moisturiser selection, but many are inconclusive.

Objective: This survey aimed to determine the current expert opinion regarding moisturiser recommendations, including the basis for these recommendations, across the burns community.

Methods: A brief web-based survey was distributed to burn therapists via mailing lists of the Australian and New Zealand Burn Association (ANZBA), and American Burn Association (ABA) 'Occupational and Physical Therapist Burn Special Interest Group'.

Results: The fifty three respondents indicated that there were 29 different moisturisers commonly recommended in practice. Three main themes were indicated as influencing recommendations for moisturiser: the perceived effects on the scar/skin (48%); the general properties of the moisturiser (38%); the ingredients (14%). Therapists reported that the principle stimuli determining their recommendations were patient feedback and the choice of the previous burn therapist in their service. Many were also guided by medical staff, pharmacists and sales representatives. Only three respondents were able to provide citations for published evidence supporting their recommendations.

Conclusions: There is a paucity of evidence currently to support optimal moisturiser choice. This survey demonstrates that conflicting opinions are held on the ideal moisturiser brand, properties and ingredients. The recommendations made are based on low level evidence. Further research is required to inform clinicians which moisturiser to recommend to their clients. An ideal moisturiser should be one that is conducive to scar maturation, non- or minimally irritant, prevent skin drying, minimise transepidermal water loss and have no negative effect on barrier function.

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1. Introduction

Scar management is recognised as a key component of rehabilitation for burn survivors. This task is predominantly the responsibility of the burn therapist. The most commonly utilised and accepted conservative treatments of scars are pressure therapy [1], contact media [2], massage and skin care (moisturising, sun protection and management of folliculitis) [3]. There is evidence that massage has a positive effect on scars but it is less supportive than the evidence for pressure and contact media [4]. In particular, "moisturise and massage" is recommended to almost every patient who leaves the burn unit. A survey of burn rehabilitation therapy practices indicated that 81% of responding units routinely employ scar massage as part of their patients' treatment regimen [5].

Formation of a hypertrophic scar indicates damage to the dermal structures of the skin such as the sweat glands, hair follicles and oil glands [6]. This is supported by the common observation of the failure of hypertrophic burn scars to produce sweat or oils [3]. An additional characteristic of scars is that they have a higher rate of transepidermal water loss (TEWL) in comparison with normal skin [7,8], particularly those that have healed by secondary intention [7]. The combination of these factors, loss of moisturising structures and a high rate of TEWL, results in hypertrophic scars appearing dry and it is for these reasons that moisturiser is recommended to burn patients.

The belief that hydration of the scar will result in better scar outcomes is based on studies that investigate the mechanism of contact media action. Hydration of the epidermal keratinocytes was shown in an in vitro model to inhibit collagen and glycosaminoglycan production of dermal fibroblasts, that is, the production of scar tissue [9]. Moisturiser increases the water content of the stratum corneum, filling the spaces between partially desquamated skin flakes and the skin appears smoother [10]. It is unknown whether the moisturiser has an effect on the keratinocytes located just below the stratum corneum. In a comparison between the moisturiser, Eucerin® and the hydrocolloid dressing, DuoDerm Extra Thin® there was a reduction in itch and pain and an increase in pliability by both products which was proposed to be due to increased hydration [11]. The moisturiser Alhydran® was compared to liquid silicones and was shown to have as much of an effect on the hydration, and TEWL of the scars, as the silicones [12]. This study demonstrates that a moisturiser can have an effect on TEWL and potentially the scar outcome.

Itch is a common side effect of hypertrophic burn scars. Its management with moisturisers has been examined by Lewis et al. who compared aqueous cream to Medilixir® (a beeswax and herbal oil cream) [13]. The findings suggested that Medilixir® was more effective in reducing itch and there was an anecdotal observation reporting the skin was moist and supple in comparison to the aqueous group, which appeared dry [13]. Provase® has also been found to be an effective moisturiser to reduce post burn pruritus [14].

Massage is often commenced once the healed tissue has gained sufficient strength to tolerate surface friction, and is facilitated by lubricants (such as moisturisers) [15]. Cho et al. compared their standard rehabilitation treatment to standard rehabilitation treatment with scar massage (with moisturisers) [16]. The massage group had improvements in pain, itch, scar thickness, melanin, erythema, TEWL and skin elasticity [16]. The combination of lubricants used with the massage group included Rosakalm® cream, Emu oil, Oil and Physiogel® lotion [16]. However, due to the study design it is not possible to attribute if improvements were a result of the additional massage or moisturiser alone [16]. TEWL was one of the outcome measures taken and it may well be that the moisturisers used contributed towards this positive outcome as massage has not been demonstrated to have an effect on TEWL.

Perez et al. attempted to measure the effect of a moisturiser, Mederma® (with the active ingredient onion extract gel), on morphological features of the scar, specifically scar volume [17]. However, their subject numbers were low and apart from the scar volume measurements the results were subjective. Jenkins et al. attempted to determine if topical steroids or Vitamin E had an effect on range of motion, scar thickness, graft size and cosmetic appearance [18]. They concluded that neither was effective in altering the scar.

A recent systematic review conducted on the effectiveness of moisturisers specifically for burn scar outcomes identified only one citation with quantitative data to guide specific moisturiser choice [19]. This highlights the current lack of evidence supporting the burn therapists common practice of prescribing moisturiser as part of a scar management programme [19]. There is however, a range of readily available moisturisers available over the counter, with some making claims to reduce the appearance of scars.

Clients with scars view their health provider (therapist or other) as providing expert knowledge. It would therefore be expected that the health care provider would also be knowledgeable of any adverse effects from various over the counter preparations. Aqueous cream, for example, has been found to increase TEWL in healthy skin and decrease the thickness of the stratum corneum [20,21]. Propylene glycol is a known allergen in the dermatological literature and was found in 20% of moisturisers [22]. Fragrances are found in almost 70% of moisturisers, and parabens, which are preservatives, are found in 60% of moisturisers [22]. Yet these are the main sensitisers to adverse reactions that are attributable to moisturiser use [10]. It is likely that based on the above evidence, Serghiou et al. suggested the ideal choice of lubricant for burn scar massage is fragrance- and skin irritant-free and ideally has a minimum sun protection factor (SPF) of 15 incorporated [15].

In the absence of definitive evidence or a clinical guideline, particularly in the burns literature, this survey aimed to discover what are the currently recommended moisturisers, and the basis for these recommendations, amongst Australian and American Burns Association therapists in order to develop a consensus recommendation for burn scar management moisturiser selection.

2. Methods

A brief web based survey was developed by the authors of this study utilising SurveyMonkey® software (www.surveymonkey.com), and distributed to burn therapists via the Australian and

New Zealand Burn Association (ANZBA) 'Allied Health Group' and American Burn Association (ABA) American based 'Occupational and Physical Therapy Special Interest Group' (OPTSIG) mailing lists following receipt of local human research ethics committee approvals. The survey consisted of an initial five questions, as shown in Table 1.

Where question five *Do you recommend a second type of moisturiser?* was a "yes" response, the questions were repeated for a maximum of up to five moisturiser options. This survey was designed as a brief "snapshot" to minimise the burden on time for therapists completing the survey in order to maximise responses.

Contact lists for burns therapists were sourced from: the ANZBA 'Allied Health Group' (ANZBA AHG) (44 Occupational or Physiotherapists) and the ABA Occupational and Physical Therapy Special Interest Group (ABA OPTSIG) (406 Burns Therapists). An email inviting participation and a link to the survey was sent to a total of 450 PTs and OTs in the United States, Canada, Australia, and New Zealand with 86 emails returned as "undeliverable". After removal of undeliverable email addresses, and one from Australia who was a member of both ANZBA and the ABA, presumably the survey reached 363 therapists.

Potential recipients included:

- 262 from United States (US),
- 53 from Canada,
- 44 across Australia and New Zealand
- 4 from other countries.

Table 1 – Survey questions as distributed via SurveyMonkey® to burn therapists.

Question number	Question
1.	What is the location of the burn unit where you work (state & country)?
2.	What brand/type of moisturiser do you primarily recommend burn patients apply to active hypertrophic scars?
3.	From the knowledge you have acquired, what function/s do you believe this moisturiser performs? i.e. why do you recommend it?
4.	Where did you get information about this moisturiser that made you recommend it to your patients? -The last therapist that you took over from -The consultant -The pharmacist -Evidence (supply type/reference if able in the 'other' box below) -A sales rep/medical supply company -Previous patient recommendation -Other (please specify)
5.	Do you recommend a second type of moisturiser? -Yes -No (you will end the survey)

The survey period was open for responses for 3 months (16th June 2014 8th September 2014). Responses from this survey were summarized using the standard SurveyMonkey® software and manually by the primary author.

3. Results

3.1. *Geographic location of responders and predominant moisturiser recommendations*

As there were 53 total surveys completed and returned this resulted in a total response rate of 15%. The US response rate was 10% as there were 26 survey responses received, Australia had a 36% response rate (n=16) and Canada 21% (n=11). No responses were received from other countries or from ANZBA therapists in New Zealand.

There were 29 different moisturiser brands used in practice by the responders (Fig. 1). In the US, the most commonly recommended moisturiser by therapists was Eucerin® (42%, 11/26). Sorbolene (56%, 9/16) and aqueous cream BP (38%, 6/16) were the most commonly recommended in the Australian cohort, whilst recommendations in Canada were the most diverse with Glaxal Base® being the most commonly recommended moisturiser (27%, 3/11).

3.2. *Key factors influencing moisturiser recommendations*

Three main themes were indicated by respondents influencing their recommendations of moisturiser. These included the perceived effects on the scar/skin (48%), the general properties of the moisturiser (38%), and the ingredients (14%). Given these three themes however, there remains great variability in practice (Figs. 2–4).

3.3. *Effects on the scar*

The theme of the *perceived effect on the scar* (Fig. 2) was most commonly commented upon. It appears most responders believe their moisturiser of choice hydrates, moisturises and prevents dryness of the scar (n=46). Second to this was the impression that the moisturiser of choice reduced itch (n=20). Seventeen responders reported that their recommended moisturiser is also hypoallergenic or has a lower chance of causing an adverse reaction.

3.4. *Ingredients*

Of those therapists who commented on the ingredients, being unscented was the most popular response for *preferred moisturiser ingredients* (Fig. 3). Comments on whether the moisturiser was oil, water or petroleum based were contradictory with no clear preference being made.

3.5. *Properties of the moisturiser*

The *general properties of the moisturiser* theme perhaps showed the greatest variability in responses (Fig. 4). The most favourable property identified by therapists was that the moisturiser facilitates massage (n=16). Consumer led benefits

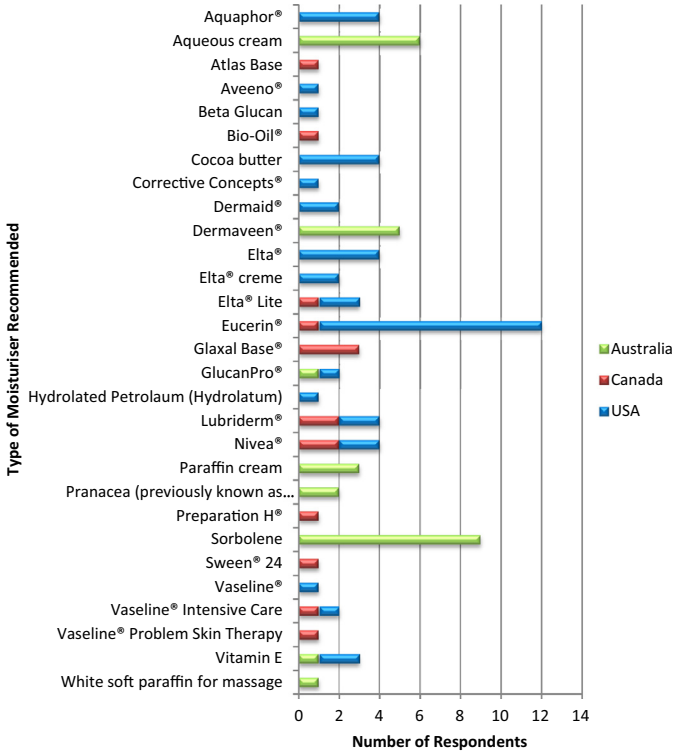

Fig. 1 – Moisturiser type recommended by country.

such as *being easy to find* and *a known brand* (n=12), and *at low cost to the patient or generically available* (n=7) were also considered by the therapists when recommending moisturisers. Other consumer led benefits reported by responders included ease of application, pleasant fragrance, easily removed, and will not cause pustules or abscesses. How long the moisturiser lasts before needing to be reapplied was a favourable feature of the moisturiser (n=11) which may be combined with the category of being thick and requiring fewer applications (n=6).

There were also a number of contradictory features reported by different responders, for example, preferences of *thick* versus *thin*,*long lasting* versus *easily absorbed* or *short acting*, and *greasy* versus *non greasy*.

3.6. *Sources of information for moisturiser choice*

Sources of *information influencing moisturiser choice* for therapist recommendations are shown in Fig. 5. Therapists recommending particular moisturisers reported that the main

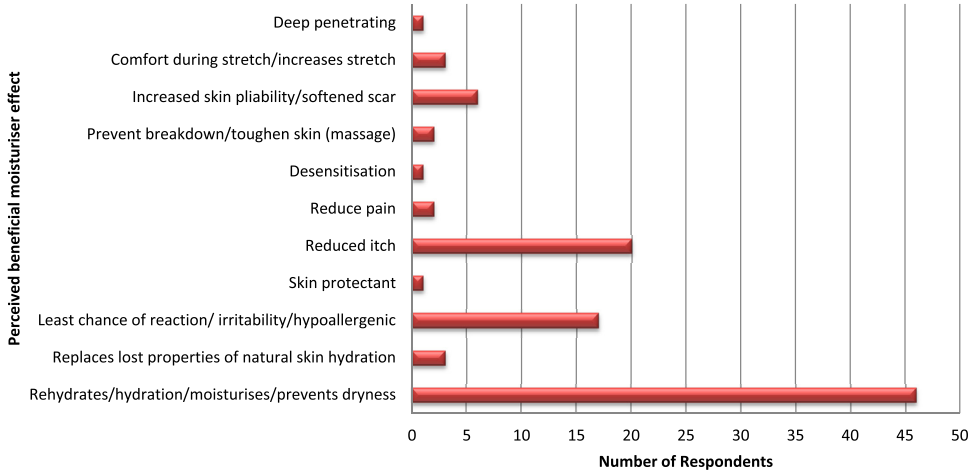

Fig. 2 – Perceived effects of the recommended moisturiser on the skin/scar.

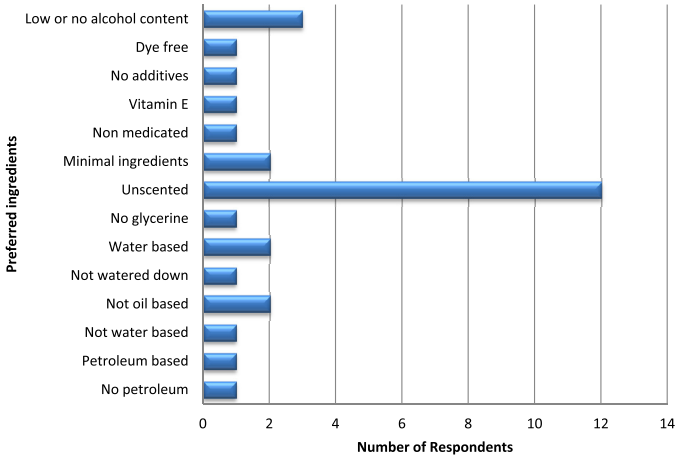

Fig. 3 – Preferred moisturiser ingredients.

source of *knowledge* providing the basis for their recommendations originated from patient feedback (17%) or the previous burn therapist in their service (16%). Many were also guided by medical staff (13%), pharmacists (8%) and sales representatives (11%).

Of the 13% of therapists who claimed their moisturiser of choice was based on evidence, only three respondents were able to provide citations supporting their recommendations. One respondent indicated there had been a small unpublished study at their unit. A citation provided by another appeared to assume that the reduction of pruritus observed from use of a shower and bath oil product would also result from a moisturiser made by same company [23]. Only one responder was able to provide appropriate references.

In the "Other" category the most common source of information for recommendations reported were that their burns team recommended the moisturiser or they based their recommendation on information gathered at a conference.

3.7. *Additional moisturiser choices*

In addition to their primary moisturiser recommendation, 60% (n=32) of respondents provided a second moisturiser

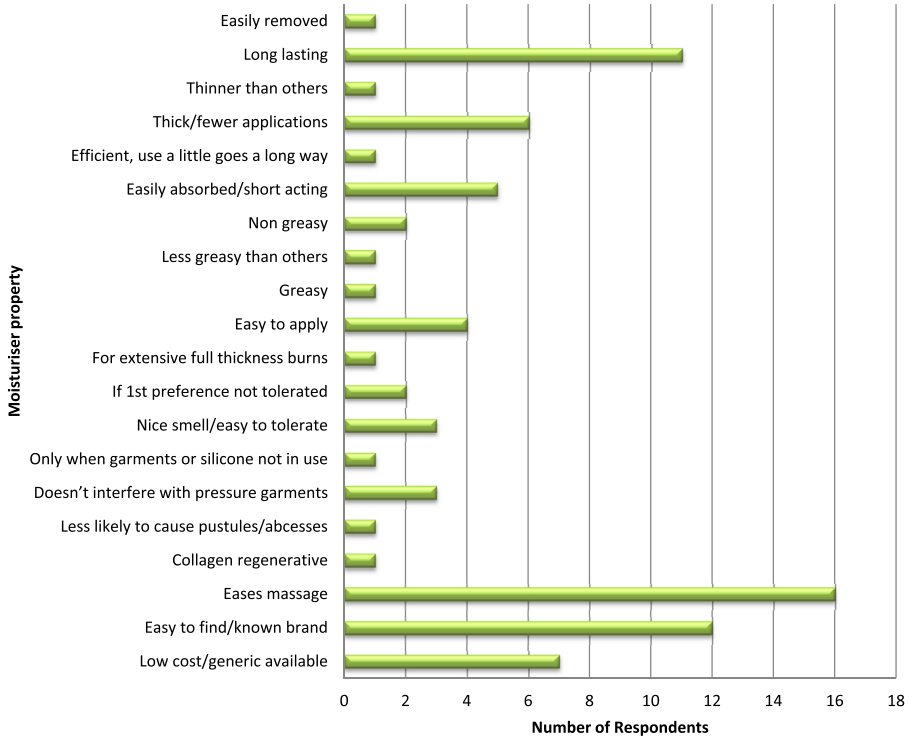

Fig. 4 – General moisturiser properties generating recommendations.

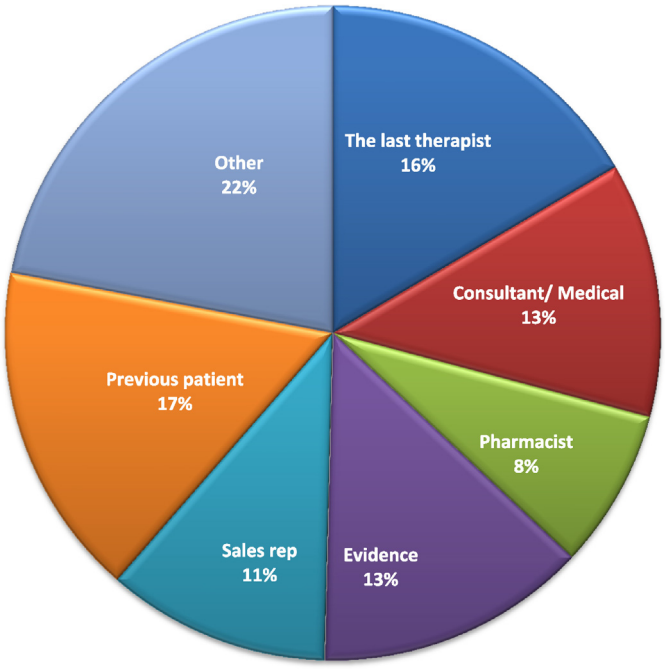

Fig. 5 – Sources of information regarding moisturiser choice.

recommendation, 17% (n=9) a third recommendation, 7.5% (n=4) a fourth recommendation, and 2% (n=1) a fifth recommendation. For subsequent moisturisers, reasons for recommendations included providing choice for improved patient acceptance or budget, along with alternatives in case of skin reactions, pruritus or allergies. In addition, some respondents indicated that they may use one moisturiser type with pressure garments and another for use without pressure garments.

4. Discussion

The results of this survey of therapists across Australia, the US and Canada show that there is no consensus on which moisturisers to recommended to patients. The ideal functions and properties of moisturisers for scar management also lacks consensus.

Although this study did achieve its aim of determining current moisturiser recommendations and the basis for these recommendations among respondents, it does show that moisturiser recommendations are based on very poor levels of evidence and there is little understanding of the effects of moisturisers on burn scars. The absence of adequate published literature in the burns field on the effect of moisturisers on scars, as determined by a recent systematic review [19], may be the most logical explanation as to why such diversity exists in regards to the type of moisturisers being recommended. Therapists must then utilise varied sources of information to base their recommendations upon.

The overall response rate was low, (15%). A 2013 meta-analysis found that the mode of survey delivery (online) typically will deliver the lowest of response rates (38%) and the response rates have been steadily declining over the years [24]. Scott et al. found that when comparing modes of survey delivery that online response rates were 13% [25]. The poor response rate for this survey may be due to the quality of the US list of email addresses in particular, as almost a quarter of the emails were returned as "undeliverable" and resulted in only a 10% response rate. It has also been reported that the US has the lowest response rates in comparison to other countries [24]. Therefore, the response rates observed in this survey are as to be expected for the location and mode of delivery.

The use of pressure garments may alter the choice of moisturiser recommended, as some moisturisers are associated with decreased long-term performance of pressure garments [26]. Vitamin E and petroleum-based creams have been shown to have deleterious effects on the tensile strength of pressure garment fabrics, hence are not recommended by garment manufacturers [27].

Positive effects of some ingredients were reported by therapists but it was the absence of fragrance that was most commonly identified as being a preferred feature of the moisturiser ingredients as they are well known to be an irritant. However, many therapists appear to be selecting a moisturiser primarily to lubricate for scar massage and their perceived effects on skin hydration rather than considering the effects of the moisturiser ingredients on the skin. Moisturiser selection was strongly guided by previous patient reports, which may assist in avoidance of products that are deleterious to the skin however, this approach for informing moisturiser choice, whilst patient-centred, is highly subjective. This evidence does not even rank on a levels of evidence table where the lowest level, level 5, is expert consensus [28].

Although there is a lack of published burns-specific literature in this area [19,29], dermatological research may provide some guidance. It has been reported that aqueous preparations containing sodium lauryl sulfate (SLS) at concentrations at or below 1%, such as the aqueous cream BP recommended by many Australian burn therapists, actually

elevates transepidermal water loss (TEWL) and causes cutaneous irritation [20,21,30–34]. Previously reported as the "standard treatment" for moisturisation and massage in some burns units [13], aqueous cream BP is a readily available and relatively cheap moisturiser that is fragrance- and colour-free. Its formulation consists of purified water, white soft paraffin, cetearyl alcohol, SLS, liquid paraffin, and phenoxyethanol. The application of aqueous cream BP in subjects with healthy skin has been shown to increase TEWL and disrupt the normal skin maturation processes [20]. Chronic application of aqueous cream BP also increases the rate of skin turnover and contributes to thinning of the stratum corneum [20]. This is particularly concerning in burn, as scar tissue has been shown to have increased TEWL when compared with healthy skin [7,35], and this effect is compounded in spontaneously-healed scars when compared to scars after skin grafting [7]. A comparison study between aqueous cream BP and a bees wax/herbal oil cream, reported anecdotally that newly healed skin in the bees wax/herbal oil group "appeared supple and moist" when compared to that in the aqueous BP group [13]. Healing skin in the latter group was reported as appearing dry in contrast [13].

Other ingredients such as humectants (lactic acid, urea, pyrrolidine carboxylic acid (PCA)), preservatives (benzoic acid, sorbic acid), and propylene glycol (at concentrations of 2–10% under occlusive conditions or where a history of dermatitis exists) have also been reported to cause negative skin reactions such as burning/stinging sensations and allergy [27]. Propylene glycol is one of the ingredients contained in Sorbolene which was the most commonly recommended moisturiser in Australia. The ingredients in Eucerin® recommended by most US therapists all appear to have low allergenic properties. Documented reports of negative interactions with the remaining products currently used were not investigated as part of this study.

4.1. *Future directions*

TEWL appears to be one of the most important considerations regarding future research in the area of moisturisers' effect on scars. Aqueous cream BP increases TEWL yet silicone gel sheeting has been shown to decrease and normalise TEWL by occlusion and this in turn reduces hypertrophic scar proliferation [8,35,36]. Hence the action of decreasing TEWL through the use of moisturisers as part of scar management, should theoretically result in increased skin hydration, reduction of scar activity and improvement of skin pliability. More studies of similar quality and content such as that assessing Alhydran® are required [12].

Therefore, data on TEWL may be a useful outcome measure in product research and development prior to its adoption for use in the burn population. TEWL outcomes for a product could be reported for each moisturiser thereby informing therapists who are making recommendations to patients with hypertrophic scars.

Future research should focus on the identification of ingredients that proffer positive and negative effects, rather than focussing on individual moisturiser types and brands. This may assist in negating the issues of international availability, as well as bias introduced through corporate sponsorship arrangements.

5. Conclusions

Despite the common use of moisturisers as part of burn scar management, there is currently a paucity of published evidence to support the optimal moisturiser choice. There is also a lack of consensus amongst burn scar management therapists surveyed across Australia and North America to guide a specific recommendation on moisturiser choice. The ideal moisturiser should be conducive to scar maturation, be low irritant, prevent skin drying and negative effects to barrier function, and minimise TEWL. Experimental studies on this topic are warranted and should include objective outcome measures such measures of scar thickness, erythema, TEWL, sebum levels of the scar and measures of scar elasticity. Recommendations for practice should ensure that moisturiser ingredients are non-irritant and where pressure garments are used, non-deleterious to garment effectiveness. Cost, patient preferences and dermatological history should also be taken into consideration for all recommendations.

Conflict of interest

There are no conflicts of interest from any of the authors.

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