Staphylococcus aureus and atopic eczema

What are the therapeutic implications?
A. INTRODUCTION

Atopic eczema (synonymous with atopic dermatitis) is a common chronic skin condition mainly affecting children and follows a remitting and relapsing course. It is characterised by intense itching, redness, inflammation and exudation. It affects mainly the flexor surfaces of the elbows and knees, as well as the face and neck.

Estimates of the prevalence of eczema vary but it has been reported recently that the recorded incidence and lifetime prevalence of patients with eczema has increased in England in the new millennium. With almost 1 in 9 of the population experiencing the condition at some point in their lives, eczema is now one of the most common chronic conditions to affect the English population.  

A vicious circle can develop, where itching and scratching damage the skin and increase inflammation, which in turn increases the itch. Scratching can damage the skin and cause bleeding, secondary infection and thickening of the skin (lichenification).

The combination of a vicious itch-scratch cycle with frequent flare-ups has long been known; however it is only relatively recently that the extent of the involvement of Staphylococcus aureus (S. aureus) in atopic eczema has been recognised.

This booklet provides a review of key data published on the link between S. aureus and atopic eczema. Extracts from papers are provided for easy reference, together with a diagrammatic summary of the role of the bacteria in the exacerbation of the disease. Finally, there is a review of how these recent developments in our understanding of the pathophysiology of atopic eczema can be of practical relevance to the successful management of this often debilitating and distressing condition.

The precise cause of atopic eczema is unknown but immunological, genetic and environmental factors play a role. It often has a genetic component that leads to the breakdown of the skin barrier. This allows ingress of trigger factors such as irritants, allergens and microorganisms which can make the eczema worse.

Itchy skin (pruritus) is a major symptom of atopic eczema. A vicious circle can develop, where itching and scratching damage the skin and increase inflammation, which in turn increases the itch. Scratching can damage the skin and cause bleeding, secondary infection and thickening of the skin (lichenification).

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B. INCIDENCE OF STAPHYLOCOCCUS AUREUS

A defective skin barrier

The skin acts as an effective barrier to the external environment preventing the ingress of allergens and microbes while preventing water loss through the skin. In atopic eczema the skin barrier is compromised, in part due to decreased production of skin lipids leading to dryness, fissuring and penetration of environmental toxins, allergens and microbes such as S. aureus. This results in inflamed, itchy and possibly infected skin.

Skin colonisation

In patients with atopic eczema there is an increased incidence of S. aureus in both lesional and non-lesional skin. Nasal carriage of S. aureus is also higher in patients with atopic eczema.

Reported colonisation of S. aureus

- NON ATOPICS Nasal carriage (10-45%)
- NON ATOPICS Skin excluding perianal (<10%)
- ATOPICS Nasal carriage (75%)
- ATOPICS Eczematous lesion (93%)
- ATOPICS Non-involved skin (76%)

Skin adherence of S. aureus

Increased colonisation of atopic eczema patients with S. aureus may be due to increased adherence of the bacteria to the stratum corneum.

Skin surface lipid deficiency in atopic eczema patients may also play a critical role in S. aureus colonisation.

Aly R., Maibach H.I. & Shinefield H.R. Archives of Dermatology 1977;113:780-782


‘Atopic dermatitis is thought to be a multifactorial disease. Staph. aureus overgrowth appears to be a neglected component. More than 90% of patients with chronic lichenified plaques carried this pathogen. Indeed, Staph. aureus was overwhelmingly the dominant species with counts exceeding 10^5/cm^2 in about half of the patients. The skin flora for atopic dermatitis was even more pronounced in the acute, exudative form of the disease. Staph. aureus was recovered 100% of the time with a mean density of 4.147,000 organisms per cm^2 in acute lesions. In only five of twenty patients was the density less than 10^3/cm^2. Despite these huge numbers, the lesions did not look infected. Only in the acute exudative form was there any hint of a harmful effect of Staph. aureus, visible as a slight eosinophilic and thin crust.’

‘A question of major importance is whether these extraordinarily high numbers of Staph. aureus represent secondary infection or harmless colonisation. Staph. aureus is not a customary member of the cutaneous microflora except for occasional resident status in the periphery.


‘Patients with atopic dermatitis, who are invariably colonised with Staphylococcus aureus, showed changes in the lipid compositions before and after treatment. Skin lipids which moderate microbial growth may be suppressed in atopic dermatitis permitting the overgrowth of S. aureus.’

‘Staphylococcus aureus is usually the dominant species in the normal skin flora. The common resident sites are the nose, axilla, perineum and toes. The relative rarity of colonisation by S. aureus on normal skin sites contrasts dramatically with the high carriage rate in all patients with atopic dermatitis and cutaneous infection is one of the factors that plays a role in the aggravation of this condition.’

‘The role of S. aureus may be to aggravate atopic dermatitis or prevent the resolution of the lesions. Not only is it found in lesions, where it may be recovered with an average density of about 2 x 10^6 organisms/cm^2 in acute lesions, but it is also the dominant organism on the clinically normal skin of these patients, although the density is lower.’

Noble W.C. British Journal of Dermatology 1998;139:9-12

‘The normal bacterial skin flora in humans is composed of three major groups of Gram-positive bacteria, the coryneform bacteria, the micrococci and the staphylococci, with only a minor component of Gram-negative bacilli. This is chiefly because the skin is a comparatively dry habitat, with available water as the chief factor controlling growth; exclusion of skin is a potent way to reduce the number of bacteria on the skin. Gram-negative bacilli require more available water than Gram-positive bacteria and this probably controls their population density.’

‘The factors that permit skin colonisation in eczema, or conversely prevent colonisation in normal individuals, are not known, but since the essential fatty acids are more toxic to S. aureus than to the coagulase-negative species, and since a deficit of essential fatty acids may result in a poor skin structure, this may form part of the equation.’

Noble W.C. British Journal of Dermatology 1993;129:181-184

‘Staphylococcus aureus has a peculiar ability to colonise the skin of patients with atopic dermatitis. We examined the possibility that this might be due to a specific ability of this pathogenic staphylococcus to adhere to atopic stratum corneum. We used an in vitro model to show that S. aureus does have an unusual ability to adhere to atopic corneocytes when compared with corneocytes obtained from patients with other cutaneous diseases, including psoriasis. Protein A – a component of the staphylococcal cell wall – may be responsible in part for this adherence phenomenon. This trait did not extend to other Gram-negative bacteria tested.’


‘Various factors are involved in the altered skin colonisation of S. aureus in AD including an altered epidermal barrier, increased bacterial adhesion, defective bacterial clearance, and decreased innate immune responses.’

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Baker B.S. Clinical and Experimental Immunology 2006;141:1-9

‘Various factors are involved in the altered skin colonisation of S. aureus in AD including an altered epidermal barrier, increased bacterial adhesion, defective bacterial clearance, and decreased innate immune responses.’

‘S. aureus are tightly attached to the uppermost corneocytes, and can penetrate the epidermis via the intercellular spaces probably as a result of lipid deficiencies in AD skin. In AD, the average pH of the skin is slightly more alkaline, and sphingolipid levels are decreased in both lesional and nonlesional stratum corneum. In addition, the dryness and cracking of AD skin, as a result of transdermal water loss caused by altered lipid content, may facilitate bacterial colonization. Furthermore, Th-2 cytokines such as IL-4 in atopic skin increase expression of fibrinogen and fibrinogen receptors that mediate the adhesion of S. aureus to stratum corneum.’

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‘The present study revealed that the bacterial cells tightly attached to the uppermost corneocytes and could penetrate the epidermis via the intercellular spaces. Fibillar and amorphous structures, which were positive for ruthenium red stain and might be derived from products of S. aureus cells, plasma components, or a mixture of both, were found between the S. aureus cells in contact with each other and between S. aureus cells and corneocytes.’

The findings in this study, especially penetration of S. aureus into intercellular spaces of the epidermis, strongly suggest that skin surface lipids in AD patients are deteriorated.’

Baker B.S. Clinical and Experimental Immunology 2006;141:1-9

‘Various factors are involved in the altered skin colonisation of S. aureus in AD including an altered epidermal barrier, increased bacterial adhesion, defective bacterial clearance, and decreased innate immune responses.’
C. THE PATHOPHYSIOLOGICAL ROLE OF STAPHYLOCOCCUS AUREUS

A number of studies investigating the pathogenic role of S. aureus in atopic eczema have been published. Findings show that S. aureus releases exotoxins that act as superantigens and are potent immunostimulators. The exact role of these exotoxins and the subsequent immune reaction stimulated have been widely investigated and reported.


‘. . . several possible mechanisms for a pathogenic role have also been suggested. There may be a direct chemical irritation or a non-specific reaction of the protein A component of the bacterium with immune cells. Great interest has been shown in possible mechanisms involving superantigens. The superantigen theory proposes that S. aureus exacerabtes or maintains skin inflammation to atopic eczema by secreting a group of toxins, which are capable of stimulating large populations of T-lymphocytes distant from the eczematous site, giving rise to widespread activation of existing lesions. Several lines of investigation support a role for superantigens in atopic eczema. First, it has been shown that such toxins can be produced by S. aureus isolated from atopic eczema patients, and that these patients’ T-lymphocyte expansion consistent with superantigen stimulation has occurred. Second, most atopic eczema sufferers make specific IgE antibodies directed against superantigen toxins found on their skin. Third, a correlation has been found between the presence of these antibodies and the severity of the eczema. Finally, the application of one specific superantigen to the skin has been shown to induce skin changes of erythema and thickening of the skin.

‘. . . as a consequence of such findings, it is not surprising that a large number of products with anti-staphylococcal properties have been developed for the treatment of atopic eczema. Such skin injuries are additionally infected and are not protected by the skin barrier. It is believed that children with atopic dermatitis have cytokine imbalance with increased production of some cytokines and decreased production of other cytokines. It is believed that children with atopic dermatitis have cytokine imbalance with increased production of some cytokines and decreased production of other cytokines.


‘A defective skin barrier does not entirely account for the increased susceptibility that AD patients have to skin infection because patients with psoriasis have also been reported to have reduced skin barrier function. However, patients with AD experience four times more skin infections than patients with psoriasis. Importantly, decreased innate immune responses have been found in AD, as compared with psoriasis skin.’


‘Further studies and our previous report show that 70-80% of all the patients tested had a significantly higher incidence of circulating IgE antibodies specific for SEA and/or SEB (P<0.001) compared with those in two control groups. Because the staphylococcal exotoxins seem to penetrate the injured skin barrier in patients with AD more easily than they do an intact skin barrier these findings strongly support the possibility that in the majority of AD patients SEA and SEB have a role in exacerbation and prolongation, and as a trigger of AD through IgE-dependent immunization. Even in patients with mild AD, staphylococcal toxins might have similar effects on the lesions as those in patients with severe AD.’


‘To study the mechanisms by which S. aureus might exacerbate AD, Leung et al characterized the toxins produced by S. aureus isolates from AD patients. More than half of the AD patients had S. aureus that secreted identifiable toxins, primarily the superantigen toxins SEA, SEB and TSST-1. As a proof of concept, Stragan et al studied the effects of SEB applied to intact skin and the uninvolved skin of patients with AD. They reported significant erythema and induration following application of SEB to uninvolved normal-appearing AD skin. Three of the six AD subjects studied experienced a flare of their disease in the elbow flexures ipsilaterally to where the SEB patch was applied. These authors concluded that superantigen toxins can exacerbate and sustain the inflammation associated with AD.’

‘...these findings raise the possibility that epicutaneous application of superantigenic toxins could aggravate allergic responses.’


‘...these data may also explain the clinical observation that many flares of eczema correlate with high colonization counts of S. aureus on the skin and that the skin rash frequently resolves when S. aureus is eradicated or drastically reduced following antibiotic therapy.’


‘...these findings suggest the possibility that local production of exotoxin at the skin surface could cause IgE-dependent mast cell degranulation. This degranulation and several important consequences. First, the acute release of histamine and other mediators could trigger the itch-scratch cycle which exacerbate AD. More important, mast cell degranulation results in the local release of mediators, cytokines, and leukocyte chemoattractant factors that result in late-phase inflammatory reactions. Since patients with AD are colonized with S. aureus, the continuous release of exotoxins into the skin may promote the chronic inflammatory condition found in AD.’

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Kemp A.S. & Campbell D.E. Journal Paediatric Child Health 1996;32:4-6

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It is known that S. aureus causes a ‘vicious circle’ in atopic eczema. Release of superantigenic exotoxins activates large populations of T cells, resulting in release of cytokines, IgE and inflammatory mediators. This contributes to the exacerbation and maintenance of skin inflammation in atopic eczema patients. This also permits more S. aureus to infiltrate the inflamed and disrupted epidermal barrier thus reinforcing the cycle.
D. CLINICAL IMPLICATIONS OF STAPHYLOCOCCUS AUREUS

COLONISATION OF THE SKIN

Severity of eczema

Colonisation of atopic eczema patients with S. aureus has been well documented as has the role of S. aureus derived superantigens in atopic eczema. In this section the clinical implications of S. aureus colonisation and the effects this may have on disease severity are reported.


‘The bacterial flora of the skin was assessed quantitatively in 50 children with eczema, aged 6 months to 14 years, referred to the hospital for the first time. Twenty non-atopic controls with an unrelated non-infective disorder were also studied.

‘Bacterial colonisation of the skin was consistently more common and greater in amount from patients compared with controls. Staphylococcus aureus was the most common pathogen isolated from patients only; from the worst affected area of eczema in 74% of patients and from an uninvolved skin site in 30% of patients. Quantitative assessment showed that the density of colonisation was proportional to the severity of eczema.’


‘On the whole, the colonisation rate of bacteria and the positive rate of S. aureus were distinctly higher in lesional than in nonlesional skin of patients with eczema and AD. The differences were highly significant. There were positive correlations between the bacterial colonisation density and the severity of eczema and AD. By comparing the flora distribution and constituent ratio in patients with eczema and AD, we found that the positive rate of S. aureus in the AD group was distinctly higher than in the eczema group, not only in lesional skin but also in nonlesional skin. This shows that S. aureus infection plays a more important role in the pathogenesis of AD.’


‘The goal of this study was to evaluate the frequency and role of Staphylococcus aureus infection in patients with atopic dermatitis (AD). In 81 children, ages 2 months to 9 years, assessed for moderate to severe AD, 308 samples from the cutaneous lesions were obtained and analysed. S. aureus was isolated in 52 children (64.2%).’

‘Our data demonstrate the importance of S. aureus in the clinical manifestation of AD and, in particular, its role in worsening the eczematous lesions of the face, neck, and perineum in children manifested of AD and, in particular, its role in worsening the disease severity, and in our study the infection rate of AD was higher in patients with severe AD (SCORAD ≥ 40, 70.2% of infected patients) than in patients with moderate AD (58%).’

Motola C., Potter P.C., Weinberg E.G., Malherbe D. & Hughes J. Journal of Allergy and Clinical Immunology 1986;78:583-589

‘In this study the group of patients with anti-S. aureus IgE antibodies had a higher prevalence of superficial pustules. The 70% nasal carriage of S. aureus in the group with anti-S. aureus IgE antibodies was higher than reported in normal subjects (30% to 40%). This may be a contributing factor to the high prevalence of skin lesions in these patients. The eradication of S. aureus from the nasal reservoir and eczematous skin would appear to be a logical step in the treatment of these patients. Our results also indicate that patients with atopic dermatitis who have developed these antibodies tend to have more severe disease. Adult patients who had anti-S. aureus IgE invariably had a history of long-standing severe disease since childhood. It is likely that the presence of anti-S. aureus IgE antibodies may predict a more chronic course and less favourable outlook for patients with atopic dermatitis.’


‘The skin of patients with atopic dermatitis exhibits a striking susceptibility to colonization and infection with Staphylococcus aureus. In this context it has been previously shown that S. aureus-derived superantigens could function as classic allergens, inducing production of functionally relevant specific IgE antibodies.’

‘Twenty-five children (34%) were sensitized to staphylococci (45% to S. aureus, 45% to S. epidermidis and 10% to S. saprophyticus).’

‘Our results confirm the possible role of colonization with S. aureus as an aggravating factor in AD. S. aureus was isolated from the antecubital fossa (94%) of our patients, either from the skin (11%) or the anterior nares (6%) or, as in most cases (77%), both together. This suggests the nose may act as a reservoir of S. aureus strains, which are spread over the skin surface by autoinoculation. The fact that the nasal and cutaneous strains produced the same toxins in most cases supports this hypothesis. Of our patients, 50% carried S. aureus on both clinically affected and unaffected skin, and cultures could be grown from both acute and chronic lesions, which is in keeping with the data reported by other groups.’

传输和再治疗

Atopic eczema patients colonised with S. aureus may act as carriers or ‘reservoirs,’ leading to transmission of the bacteria and possible infection to other subjects. Similarly, these S. aureus ‘reservoirs’ may lead to re-colonisation of patients following S. aureus eradication therapy.


‘Staphylococcus aureus colonization is common in atopic dermatitis (AD) and can exacerbate the disease. Additionally, some evidence shows that patients with AD may act as reservoirs for S. aureus transmission to others. This study compared S. aureus colonization in AD patients and their caregivers with control patients and their caregivers... AD patients had a significantly greater carriage of S. aureus from lesional and clinically normal skin as well as the hand. Significant increases in carriage of S. aureus were found in the anterior nares and hands of caregivers to AD patients compared with control caregivers. Topical corticosteroids did not affect recovery of S. aureus. There was a significant correlation between recovery of S. aureus from lesional skin and recovery from the anterior nares (p<0.002) and hands (p<0.001). These findings suggest that the anterior nares and the hands may be important reservoirs and vectors for the transmission of S. aureus to lesional skin and to close contacts of these patients.’


‘Nasal carriage of S. aureus is common among the general population (up to 35% carriage rate) and is highest among patients with atopic eczema (39-82% colonised). Of the 17 patients with nasal S. aureus carriage in this study, only one did not have S. aureus skin swab culture, one of these had previously been treated with antibiotics. A further possible explanation for the persistence of S. aureus despite prior antibiotic treatment is colonization of the parent having pre-colonisation of the child. Only 3 of 16 parents had nasal carriage of S. aureus; however, in all these cases the children were also colonised with S. aureus. It seems likely that parental S. aureus carriage influences S. aureus colonisation in the child.’


Transmission and recolonisation

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E. THERAPEUTIC IMPLICATIONS OF STAPHYLOCOCCUS AUREUS COLONISATION OF THE SKIN

a) Controlling S. aureus levels

Treatment guidelines for atopic eczema in children have been published recently by the National Institute for Health and Clinical Excellence (NICE). A stepwise approach for the management of atopic eczema is advocated by tailoring the treatment step to the severity of the condition. Emollients should form the basis of atopic eczema management supplemented with topical corticosteroids and possibly leading on to more potent topical immunomodulatory preparations in severe disease.

When S. aureus is involved, NICE recommends the following management strategies.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Use for</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systemic antibiotics active against S. aureus and streptococcus</td>
<td>Widspread bacterial infections</td>
<td>1-2 weeks</td>
</tr>
<tr>
<td>Topical antibiotics, including those combined with topical corticosteroids</td>
<td>Localised clinical infection</td>
<td>Maximum of 2 weeks</td>
</tr>
<tr>
<td>Flucloxacillin</td>
<td>First-line treatment of S. aureus and streptococcal infections</td>
<td>As indicated</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>First-line treatment of S. aureus and streptococcal infections in the case of allergy to flucloxacillin or flucloxacillin resistance</td>
<td>As indicated</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>First-line treatment of S. aureus and streptococcal infections in the case of allergy to flucloxacillin or flucloxacillin resistance and intolerance to erythromycin</td>
<td>As indicated</td>
</tr>
<tr>
<td>Antiseptics such as triclosan or chlorhexidine</td>
<td>Adjunct therapy for decreasing bacterial load in cases of recurrent infected atopic eczema</td>
<td>Avoid long-term use</td>
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Recommendations for the management of S. aureus eradication in non-clinically infected atopic eczema, however, are not given. In this situation systemic or topical antibiotics may be used but have the potential for development of resistance. Antimicrobial emollients offer a therapeutic option by reducing bacterial load and repairing the defective skin barrier. This breaks not only the S. aureus superantigen induced ‘vicious circle’ in atopic eczema but also the ‘itch-crawl’ cycle.

Abec D. & Memp M. British Journal of Dermatology 1999;139:15-16.

‘Discussion on the importance of microbial factors on the pathogenesis of eczema and the therapeutic implications for the treatment of eczema began more than 100 years ago. Since then, our knowledge concerning the complex interactions between microbes and skin inflammation has improved dramatically and today the Gram-positive bacterium, Staphylococcus aureus, is recognized as an important triggering factor for the maintenance of skin inflammation and acute exacerbations of the genetically determined skin disease atopic dermatitis (AD).’

‘The improved knowledge of the pathophysiological importance of S. aureus in AD, combined with the positive correlation between the severity of eczematous lesions and the colonization with S. aureus, forms the rationale for an anti-staphylococcal option by reducing bacterial load and repairing the defective skin barrier. This breaks not only the therapy in patients with AD.’

‘Since the barrier dysfunction of the skin and chronic inflammation are characteristic of atopic dermatitis, long-term clinical management should emphasize prevention, intensified and individually adapted skin care, reduction of bacterial colonization by means of local application of lotions containing antiseptics such as triclosan and chlorhexidine, and – most important – the control of inflammation by the regular use of topical corticosteroids or topical calciumum inhibitors.’


‘Quantitative bacteriological assessment before treatment showed that heavy colonization of the skin with Staphylococcus aureus was present in nearly all patients even in the absence of overt infection.’

‘During the present study a reduction in the bacterial load was noted to be associated with clinical improvement, suggesting that control of skin colonization with Staphylococci may prove clinically beneficial in the treatment of atopic dermatitis.’

‘A topical programme for the reduction of staphylococcal colonization consists of chlorhexidine or topical antibiotics such as mupirocin applied in the nares.’

‘Patients with atopic dermatitis almost invariably harbour S. aureus on their skin. The microorganisms could be isolated from 93% of the skin lesions of 41 children with atopic dermatitis compared with 32% of non-atopic controls. Sudden aggravation and ‘weeping’ should alert the clinician to the possibility of S. aureus infection.’


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In children, before and after the diagnosis of IgE-mediated sensitization, measures that prevent exposure to allergens should be beneficial. The current therapy of atopic dermatitis is reactive – treating the flares – but management should include early and proactive intervention with effective and continued control of the skin inflammation and S. aureus colonization. This strategy has proved to be effective in reducing the number of flares.

When applied early in infancy, it could potentially help to reduce later sensitization to environmental antigens and autoallergens. 


‘We show here that the concurrent use of intermittent intranasal mupirocin treatment and dilute bleach baths led to significant improvement in the severity of moderate/severe AD. Decreased EASI scores at the 1-month visit, after a 2-week course of cephalosporin therapy, might have been predicted. However, the continued improvement in EASI scores in the treatment arm at the 3-month visit, as well as the significant differences in the extent of involvement and severity of AD between the treatment and placebo groups despite the course of antibiotic therapy, supports the therapeutic benefits of sodium hypochlorite baths and intranasal mupirocin treatment in AD. Furthermore, the statistically significant reductions in EASI scores at 1 month and dramatically at 3 months for body sites exposed to the dilute bleach baths but not for the unexposed head and neck regions provide clear evidence that the addition of dilute bleach baths to intranasal mupirocin treatment decreased the severity of AD.’

‘The use of this easy nonantibiotic approach to inhibit overgrowth of organisms is preferable to the use of antibiotics, which may promote further S. aureus resistance. The potential for development of bacterial resistance to mupirocin ointment, however, should not be neglected.’


‘Since S. aureus infection can exacerbate acute AD, and colonization may promote chronic skin inflammation, use of anti-staphylococcal therapy should be considered in patients with poorly controlled AD. However, antibacterials should be reserved for the patient who is heavily colonized or infected with S. aureus and where it is clear that infection with S. aureus is an important trigger factor. Antibiocals known to be effective against S. aureus include erythromycin, rifampicin, clarithromycin, and the cephalosporins ceftaroline used.’

‘Unfortunately, the increasing prevalence of MRSA in the community has made treatment options more difficult for some patients. In such patients, clindamycin, fusidic acid, or combination therapy with trimethoprim-sulfamethoxazole and intranasal mupirocin can be effective in eliminating MRSA infection. Other therapies for AD that may be useful in suppressing bacterial infection include 0.3% gentamicin ointment, antiseptics such as chlorhexidine or triclosan, and phototherapy.’

‘Because of the increased risk of MRSA that may occur with frequent dose of mupirocin ointment, measures that prevent exposure to allergens should be beneficial. The current therapy of atopic dermatitis is reactive – treating the flares – but management should include early and proactive intervention with effective and continued control of the skin inflammation and S. aureus colonization. This strategy has proved to be effective in reducing the number of flares.

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‘A multipronged approach is required for treatment of chronic inflammatory skin diseases such as AD and psoriasis. Characterization of each patient’s skin disease reaction pattern and the reduction of exacerbating factors are critical for effective management. Factors that must be considered and eliminated include infection, irritants, allergens and emotional stress. Appropriate use of anti-inflammatory agents and immunomodulatory agents to reduce skin inflammation is critical for a successful outcome.’

‘Recently, we have found that when T-cells are stimulated with bacterial superantigens, as compared with other stimuli, they become insensitive to the immunosuppressive effects of corticosteroids... Taken together, these data indicate the importance of combining immunomodulatory and/or anti-inflammatory therapy with the eradication of bacteria secreting superantigens as an effective therapeutic option for chronic skin diseases such as AD. In this regard, it is also important to maintain skin barrier function by using intensive skin hydration and emollient regiments that reduce invasion of surface bacteria and the ichthycrat cycle that can also lead to cytokine release and inflammation.’


‘Although most atopic dermatitis patients studied were colonized with S. aureus (43/48 [80%]), methicillin-resistant S. aureus was isolated from only seven atopic dermatitis patients (7/48 [14%]). Patients colonized with S. aureus were more likely to be male, to have been previously hospitalized, and to have a topical calcineurin inhibitor in combination with a topical steroid, and less likely to have used topical antibiotics. Brusella analysis, however, revealed that only previous hospitalization was independently associated with an increased risk of methicillin-resistant S. aureus colonization. We observed that 80% of atopic dermatitis patients were colonized with S. aureus, and that of these patients, 16% of colonized patients were colonized with a methicillin-resistant strain. Methicillin-resistant S. aureus colonization was found to be significantly associated with previous hospitalization. Evidence also indicates that topical calcineum inhibitors used in conjunction with topical steroids is associated with increased S. aureus colonization, while topical antibiotic use appears to decrease S. aureus colonization.’


‘A typical programme for the reduction of staphylococcal colonization consists of chlorhexidine or topical antibiotics such as mupirocin applied in the nares.’

‘Patients with atopic dermatitis almost invariably harbour S. aureus on their skin. The microorganisms could be isolated from 93% of the skin lesions of 41 children with atopic dermatitis compared with 32% of non-atopic controls. Sudden aggravation and ‘weeping’ should alert the clinician to the possibility of S. aureus infection.’


‘A typical programme for the reduction of staphylococcal colonization consists of chlorhexidine or topical antibiotics such as mupirocin applied in the nares.’

‘The improved knowledge of the pathophysiological importance of S. aureus in AD, combined with the positive correlation between the severity of eczematous lesions and the colonization with S. aureus, forms the rationale for an anti-staphylococcal therapy in patients with AD.’

‘Even in the absence of clinical signs of active infection, patients with AD profit from a reduction of S. aureus density due to the presence of these bacteria on the skin. In those cases antiseptics such as chlorhexidine or triclosan can be added to emollients and successfully used for the treatment of larger skin areas.’
b) Development of bacterial resistance

Treatment of widespread infected eczema relies on the use of systemic antibiotics or topical antibiotics if the infection is confined to a smaller area. However, as the disease involves periods of exacerbation which may be frequent or prolonged, the regular or long term use of antibiotics can lead to development of resistance. Resistance to the antibiotic fusidic acid has been increasingly reported in the UK and appears to be correlated with increased topical use and with an increased incidence in dermatology patients.

Use of alternative topical antimicrobials such as antiseptics reduces the risk of resistance developing due to their generally non-specific modes of action. Antiseptics are not generally prone to development of bacterial resistance because they work by several mechanisms, including physical means, in contrast to antibiotics which tend to rely on a single mode of attack such as interfering with a specific enzymatic function.

Thetopu - Federsin K. British Journal of Dermatology
1999;139:1-3

‘Any doctor using antibiotics should be aware of the increasing worldwide problem with multi-resistant bacteria, with the majority of hospital-based infections in some countries being caused by these bacteria. Proper use of antibiotics is therefore mandatory for any physician, including for dermatologists, who treat bacterial infections of the skin. Detailed knowledge is needed of when to use topical versus systemic antibiotics, and for how long such treatments should be given.’

‘It is likely that the anatomy and physiology of normal skin is a sophisticated defense system against the growth of pathogenic microorganisms. This is shown indirectly through the bacterial contamination of atopic skin, where the normal skin barrier is broken both physically through scratching and because of a changed content of lipids and sebum secretion.’

‘Thus, a recent study of patients admitted with atopic dermatitis showed a colonization of 74% among the patients; 88% of the S. aureus were penicillin resistant and resistance was observed against two or more antibiotics in 38% of the isolated strains.’


‘Skin disinfectants, such as chlorhexidine or povidone-iodine reduce the numbers of all organisms, and emergence of resistance is unlikely following application to the skin. Although often less effective than antibiotics in the treatment of skin infections, every effort should be made to use skin disinfectants when an antibacterial effect is required. New non-toxic effective topical disinfectants are required, and more controlled trials on older agents may be worthwhile. Topical use of antibiotics should be discouraged, and those which are valuable for systemic treatment of severe infections, e.g. gentamicin and fusidic acid, should preferably not be used topically at all.’

Shah M. & Mohanraj M. British Journal of Dermatology
2003;148:1018-1020

‘The results from our study suggest there is an almost identical level of fusidic acid resistance in both non-dermatological hospital and community patients which is 10%. This compares with a statistically significant different level of 80% for dermatological patients (P<0.001 when analysed using the t-test). Our results suggest that patients with eczema are more likely to show cultures of fusidic acid-resistant S. aureus. This may be as a result of inappropriate use of topical antibiotics.’

‘Although topical fusidic acid has been available for over 20 years, we feel this rapidly emerging resistance is a recent phenomenon. The resistance rate is nearly 10% in our general population and 50% in dermatology patients. This seems to be the correct time to convey the message of restrictive use of fusidic acid to health care professionals.’

‘In our own area we have reminded our general practitioner colleagues about the problems of antibiotic resistance and the need to restrict use of fusidic acid. We suggest that fusidic acid-containing preparations are used to treat acute skin infections in the short term only. Dermatologists and general practitioners should consider alternatives to topical antibiotics for treating chronic eczema. Topical fusidic acid should only be used for short periods and not on a regular or prolonged basis. If possible, topical antiseptic preparations should be used to treat skin infection. If action is not taken now, the future use of fusidic acid will be compromised.’

Expersen F. British Journal of Dermatology 1998;139(Suppl 53):4-8

‘The increased prevalence of bacterial resistance is one of the major problems of medicine today. Antibiotic resistance can be defined as the situation where the minimal inhibitory concentration is greater than the concentration obtainable in vivo. Resistance genes are easily transferred among bacteria, especially bacteria on skin and mucous membranes. In dermatological patients the most important resistance problems are found among staphylococci, Propionibacterium acnes and, to some extent, streptococci. Staphylococcus aureus strains have developed worldwide resistance to penicillin due to beta-lactamase production in > 90% of cases, and methicillin resistance is now a major problem with resistance levels of > 50% in certain areas of the world. These resistant strains are often multi-resistant, and include resistance to erythromycin and tetracycline, with resistance to quinolones developing rapidly... To limit the development of antibiotic resistance, it is necessary to establish an antibiotic policy (prescription rules, reimbursement strategy, development of both national and local guidelines, and limitations on non-medical use).’


‘Skin staphylococci and streptococci are known to exacerbate atopic dermatitis, but the prevalence changes that occur with age are unknown. This study examined the age-related prevalence and antibiotic resistance of these pathogenic bacteria in children with atopic dermatitis and suspected skin infections.’

‘Medical records of 130 children with atopic dermatitis referred to a regional center, who had skin swabs taken for suspected infection, were studied retrospectively. All patients carried Staphylococcus aureus. The prevalence of methillin-sodium-resistant (P<0.05) and fusidic acid-resistant (P<0.001) S. aureus tripled from infancy to school age.’


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Anon. 1998;138:959-961

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Fusidic acid should only be used for short periods and not on a regular or prolonged basis. If possible, topical antiseptic preparations should be used to treat skin infection. If action is not taken now, the future use of fusidic acid will be compromised.’


‘In 2001, a study carried out over 4 months in Dewsbury and District Hospital showed that FRSA was significantly higher in dermatology patients compared with other hospital patients and primary-care patients (P<0.001). In patients whose cultures showed FRSA, 96% had been given topical FA compared with only 29% of patients whose cultures showed fusidic acid-sensitive S. aureus (P<0.001). It was concluded that high use of topical FA may have contributed to high levels of resistance.’

‘A local education campaign followed to try to reduce inappropriate prescriptions of topical FA. Written guidelines were issued to general practitioners encouraging use of antiseptics and restriction of topical FA to short periods to treat skin infection. The present study was carried out 3 years later in the same hospital. The aims were to assess whether the guidelines had affected the number of prescriptions and the use of topical FA, and whether there had been any effect on the level of FRSA.’

‘One new finding was the emergence of methillin-resistant S. aureus (MRSA) in 11% of dermatology patients (5 of 46) in 2004 compared with 0% in 2001. Only one of these patients had both MRSA and FRSA.’

‘Although we have showed a significant fall in hospital and community prescriptions as well as use of topical FA in dermatology between 2001 and 2004, there has not been a corresponding drop in FRSA seen in dermatology patients. In addition, there has been an increase in FRSA seen in the community and other hospital specialties.’

‘We suggest that the reason for the remaining high levels of FA resistance is the development of an FRSA reservoir in our community. This is an observational study and therefore a direct cause and effect between FA use, and resistance cannot be established. There may be a 2-3 year period before FA resistance clears from our community. We still advocate restricted close control of topical FA prescriptions even though restriction in our area has not shown a decrease in FA resistance. This advice seems safest in order to avoid possible further rises in FRSA- and FA-resistant MRSA, pending further studies to establish a cause between continued use of topical FA and resistance. Limited topical FA treatment for 2 weeks was shown not to increase the rate of FRSA in post-nares and skin and nasal swabs in one small study. However, we suggest the use of topical FA should be avoided in areas where there is already a high level of resistance, particularly in patients with atopic eczema.’
F. RATIONALE FOR USING THE DERMOL RANGE OF ANTIMICROBIAL EMOLLIENTS

a) The importance of formulation to patient compliance

Complete emollient therapy is widely accepted as the mainstay of treatment for dry, atopic eczema patients and those with xerosis, to rehydrate and maintain the skin barrier function. Owing to their hydrating and occlusive effects, emollients can also increase the permeation of topically applied medicines. Thus, if emollients are used regularly, they can help to reduce the reliance on topical corticosteroids.

Various emollient preparations are available for this purpose, designed for use either by direct application to the skin, or indirectly as a bath water additive, or in the shower. However, many of these preparations are entirely oily in character and are unpopular with patients due to their messiness and greasiness, which may soil clothing and the bath surroundings.

In the 2007 NICE review on atopic eczema in children, the following guidelines were given in relation to patient choice of emollients and soap products:

- Healthcare professionals should offer children with atopic eczema a choice of unperfumed emollients to use every day for moisturising, washing, and bathing. This should be suited to the child’s needs and preferences, and may include a combination of products or one product for all purposes.

- Similarly guidelines for the management of atopic eczema developed by the Primary Care Dermatology Society (PCDS) and British Association of Dermatologists (BAD) state the following:

  - Continual treatment with complete emollient therapy (combinations of cream, ointment, bath oil and emollient soap substitute) will help provide maximal effect.

Empowering the patient to choose a product they like will improve compliance and lead to improvements in the skin condition as illustrated in the following study.


‘Compliance with the complex treatment regimen for managing atopic eczema is likely to be much less than 50 per cent. An audit of new referrals to our paediatric dermatology clinic revealed that none of the children was being treated with emollients or topical steroids in accordance with best practice guidelines. Intensive education from specialist dermatology nurses resulted in an 800 per cent increase in the use of emollients and an appropriate use of mild and moderate potency topical steroids. This resulted in an 89 per cent reduction in the severity of the eczema.’

‘In order to enhance children’s compliance with their treatment regimens we have developed a child-oriented approach – “Skin Wars!” – to teach them about eczema and its treatment.’

‘Part of this education allows children to pick their favourite emollient from a tray containing all of the emollients in the BNF. This method empowers them to use their chosen emollients.’

The Dermol range of antimicrobial emollients has been especially formulated to offer significant convenience and ease of use – advantages designed to maximise patient compliance. They also benefit from the inclusion of benzalkonium chloride and chlorhexidine dihydrochloride which work synergistically as antimicrobial agents. This is discussed further on page 16.

On dry skin…

Dermol Lotion is specially formulated to be absorbed rapidly into dry skin to relieve symptoms quickly, without being messy or greasy. It is also a pleasant, easy to use and cosmetically acceptable soap substitute.

On very dry skin…

Dermol Cream is a highly emollient cream formulated with the humectant glycerol to preserve moisture in the skin. It also works as a soap substitute.

Under the shower…

Dermol Shower Emollient as well as being an effective emollient, is also a non-ionic soap-substitute cleanser, helping to remove scalar debris from the skin, without stripping it of natural oils.

In the bath water…

Dermol Bath Emollient is a liquid bath additive which, formulated as a true emulsion, disperses thoroughly in warm water, to evenly coat the whole body.

b) Clinical evaluation of the Dermol Range

i) Evaluation of Dermol Lotion

An open study to evaluate patient acceptability/tolerability and effectiveness of Dermol Lotion in the management of chronic dry and pruritic skin conditions, especially eczema and dermatitis, in infants and young children.

- 40 children (average age 6 years) receiving emollients for eczema/dermatitis were enrolled in a single centre GP study.
- Patients substituted their previous emollient for Dermol Lotion for two weeks.

Results after 14 days

Table 1 - Clinical effectiveness of Dermol Lotion

| Clinical effectiveness | Fisher | Fisher + base | Hydration | Dryness | Itching | Rash
|------------------------|--------|--------------|-----------|---------|---------|------
| Absent                 | 7      | 0            | 0         | 18      | 6       | 6    |
| Poor                   | 7      | 18           | 0         | 0       |         |      |
| Fair                   | 10     | 15           | 2         | 0       |         |      |
| Good                   | 12     | 2            | 0         | 0       |         |      |
| Excellent              | 11     | 0            | 0         | 0       |         |      |

Conclusions

- These results confirm the effectiveness and ease-of-use/acceptability of Dermol Lotion in the management of these skin conditions.
- Dermol Lotion provided significant relief of itching and dryness in over 75% of cases where these symptoms were present.
- Dermol Lotion was generally well liked by patients in terms of effectiveness and ease-of-use, when compared with those they had used previously.
- Dermol Lotion was also found to be satisfactory by all patients who used it as a soap substitute.

See back page for Prescribing Information.
ii) Evaluation of Dermol Cream

A study to evaluate hydration, acceptability and clinical efficacy of Dermol Cream in patients with dry skin conditions such as eczema/dermatitis.

- 100 patients (adult, elderly or children ≥2 years) receiving prescribed emollients for dry/pruritic skin conditions were enrolled in this four centre GP study.
- Patients substituted their previous emollient for Dermol Cream for two weeks.

Results after 14 days

Table 3. Clinical effectiveness of Dermol Cream in reducing dryness and itching (%)

<table>
<thead>
<tr>
<th>Emollient characteristics</th>
<th>Excellent</th>
<th>Good</th>
<th>Satisfactory</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>36</td>
<td>26</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Consistency</td>
<td>25</td>
<td>51</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Baseline</td>
<td>30</td>
<td>58</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Time to absorb</td>
<td>25</td>
<td>49</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Soothing</td>
<td>36</td>
<td>44</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Smoothing</td>
<td>39</td>
<td>42</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Just</td>
<td>39</td>
<td>41</td>
<td>19</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4. Patient acceptability of Dermol Cream (%)

- For relief of dry skin – 66% of patients preferred the new emollient compared to 12% who preferred their previous treatment (p=0.001).
- For relief of itching – 60% of patients preferred the new cream compared to 13% who preferred their previous treatment (p=0.001).
- Use as a soap substitute – 66% of patients rated Dermol Cream as excellent or good as a soap substitute.

Conclusions

- Dermol Cream was generally well liked by patients.
- A statistically significant number of patients preferred Dermol Cream to their previous emollient for the relief of itching, dryness and in terms of cosmetic acceptability.
- It performed well as a soap substitute.

iii) Evaluation of Dermol Bath Emollient

An open clinical study to evaluate Dermol Bath Emollient as an adjunct in the treatment of dry skin conditions.

- 54 patients aged 1-88 years attending a hospital out-patient clinic with dry skin conditions e.g. eczema, ichthyosis or psoriasis were recruited.
- Patients added 30ml to their baths and continued using regular topical therapy for up to 12 weeks.

Results

Table 5. Comparison with previous preparations

- Patients found the preparation convenient and easy to use and 74% patients rated the bath emollient as ‘much better’ or ‘better’ than previously used preparations.
- 70% of patients reported that they were ‘pleased’ or ‘very pleased’ with the effectiveness of the product.
- 98% patients found the bath emollient to have ‘good’ or ‘very good’ dispersal in water.
- 87% patients experienced satisfactory cleansing with the product.

Conclusions

- In the opinion of the supervising Consultant Dermatologist, enhanced patient compliance helped to reduce the quantity and potency of adjunctive topical steroid use.
- Dermol Bath Emollient was found to have a useful role to play in the management of patients with dry skin conditions.

See back page for Prescribing Information

c) Antimicrobial efficacy of the Dermol range

Studies previously listed in this booklet confirm the important role S. aureus plays in the pathogenesis of atopic eczema. The Dermol range of products has been designed not only to provide ideal emollient characteristics but also, importantly, to include antimicrobial activity, so as to help reduce the viability and proliferation of S. aureus, and thereby improve the prospects for treatment.

Dermol Shower Emollient, Dermol Lotion and Dermol Cream employ the advantageous combined (synergistic) effect of two antimicrobial agents, benzalkonium chloride 0.1% and chlorhexidine dihydrochloride 0.1%. Together they provide effective and synergistic antimicrobial activity when applied directly to the skin, or used as a soap substitute, and with both at low concentration, the risk of skin irritation is minimised.
i) Antimicrobial efficacy studies on Dermol Lotion both in vitro and in vivo

In vitro antimicrobial activity of Dermol Lotion compared with a bland emollient cream (containing a preservative).1

- Test samples of each emollient were inoculated with S. aureus.
- Samples were taken at regular intervals over a 30 minute period.

**Results**

**Table 3**

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Sampling time (min)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermol Lotion (left)</td>
<td>1</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&lt;5</td>
<td>&gt;5</td>
<td>&gt;5</td>
<td>&gt;5</td>
</tr>
<tr>
<td>Bland emollient cream</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>&gt;5</td>
<td>&gt;5</td>
<td>&gt;5</td>
<td>&gt;5</td>
<td>&gt;5</td>
</tr>
</tbody>
</table>

**Conclusions**

- The study confirmed the rapid bactericidal effect of Dermol Lotion.

- In contrast, bacterial overgrowth actually increased after treatment with the bland emollient cream (containing only a preservative).

- By contrast, the reduction in viable bacterial count obtained with the bland emollient was much slower, and likely attributable to the carry over from the preservative ingredient necessarily present in all such water-containing emulsified preparations.

ii) Antimicrobial efficacy studies on Dermol Bath Emollient both in vitro and in vivo

In vitro cutaneous antimicrobial activity of Dermol Bath Emollient compared with a bland emollient cream (containing a preservative).1

- This in vivo test used direct application of Dermol Lotion or a bland emollient cream, to the toe webs of each foot of healthy volunteers as a recognised model for S. aureus colonisation in atopic patients.

- Bacterial cell counts were estimated from microbial samples taken immediately before and 6 hours after application.

**Results**

**Table 6**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Total count</th>
<th>S. aureus count</th>
<th>Initial</th>
<th>After 1h</th>
<th>After 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Dermol Lotion (right foot)</td>
<td>2000</td>
<td>204</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bland emollient cream (left foot)</td>
<td>1260</td>
<td>360</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>Dermol Lotion (left foot)</td>
<td>3000</td>
<td>88</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bland emollient cream (right foot)</td>
<td>2160</td>
<td>460</td>
<td>460</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusions**

- Dermol Lotion produced a significant reduction in the indigenous population of viable colony-forming bacteria, including staphylococci, which was sustained even 6 hours after application.

- In contrast, bacterial overgrowth actually increased after treatment with the bland emollient cream (containing only a preservative).

- Given that bacteria proliferate rapidly on the skin and would be expected to recover over such a 6 hour period, the observed reductions in viable counts confirm the persistent bactericidal activity of Dermol Lotion.

See back page for Prescribing Information

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1. **Shown as percentage reduction in S. aureus count (1 exposure).**
2. **Shown as percentage median reduction in S. aureus count (1 exposure).**
3. **Shown as percentage reduction in S. aureus count (3 exposures).**
4. **Shown as percentage reduction in S. aureus count (1 exposure).**
5. **Shown as percentage reduction in S. aureus count (1 exposure).**
6. **Shown as percentage reduction in S. aureus count (1 exposure).**
7. **Shown as percentage reduction in S. aureus count (1 exposure).**
8. **Shown as percentage reduction in S. aureus count (1 exposure).**
9. **Shown as percentage reduction in S. aureus count (1 exposure).**
10. **Shown as percentage reduction in S. aureus count (1 exposure).**
d) Avoiding antimicrobial resistance

Recently, concerns have been raised about the use of antimicrobial agents, particularly topical antibiotic preparations, and the development of bacterial resistance. A number of published studies have reported increased incidences of bacterial resistance to antibiotics, such as methicillin with the development of MRSA and resistance to fusidic acid (see Section E – Therapeutic Implications). As a result of this and in order to preserve fusidic acid as a systemic antibiotic for the treatment of serious life-threatening infections, alternative antimicrobial agents may be used.

Antiseptics are effective antimicrobial agents, which can avoid bacterial resistance by virtue of their non-specific bactericidal mechanisms of action as illustrated in the diagram below.

![Antibiotics - how they work](Image)

**Figure 5**

The antimicrobial agents in Dermol Lotion, Cream and Shower Emollient are benzalkonium chloride and chlorhexidine dihydrochloride, both present at the relatively low concentration of 0.1%. These are known to act synergistically to enhance their activity and, being antiseptic rather than antibiotic, are most unlikely to induce resistant strains of micro-organisms.

To summarise, the Dermol range contains antiseptics at a low concentration to avoid irritation and as they are very unlikely to induce resistance to antibiotics, they can be considered a very useful choice for routine use.

e) Efficacy of the Dermol range against resistant strains of *S. aureus*

**Routine infection control using a proprietary range of combined antiseptic emollients and soap substitutes – their effectiveness against MRSA and FRSA.**

Summary of data presented at the 18th Congress of the EADV in Berlin, October 2009

- The Dermol range was tested against FRSA and MRSA according to the rigorous European Standard (EN1276) normally applied to disinfectants and antiseptics used in non-clinically sensitive circumstances.
- Neat samples of Dermol Lotion, Shower and Cream and 1% dilution of Dermol Bath were inoculated with MRSA or FRSA either in the presence of bovine serum albumin (BSA) to mimic clinically ‘dirty’ conditions or without BSA to mimic ‘clean’ conditions.
- Samples were taken at specified intervals over a 30 minute period.

**Results**

**Table 7: Activity of Dermol Cream, Dermol Lotion and Dermol Shower against FRSA and MRSA**

<table>
<thead>
<tr>
<th>Contact (min)</th>
<th>FRSA (clean)</th>
<th>MRSA (clean)</th>
<th>FRSA (dirty)</th>
<th>MRSA (dirty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&lt;3.5</td>
<td>&gt;4.6</td>
<td>&lt;3.6</td>
<td>&gt;5.7</td>
</tr>
<tr>
<td>5</td>
<td>4.8</td>
<td>5.3</td>
<td>4.1</td>
<td>5.2</td>
</tr>
<tr>
<td>10</td>
<td>4.9</td>
<td>5.4</td>
<td>4.0</td>
<td>5.4</td>
</tr>
<tr>
<td>15</td>
<td>4.9</td>
<td>5.6</td>
<td>4.0</td>
<td>5.4</td>
</tr>
<tr>
<td>30</td>
<td>4.8</td>
<td>5.6</td>
<td>4.0</td>
<td>5.4</td>
</tr>
</tbody>
</table>

- The Dermol range exhibited significant antimicrobial activity against FRSA and MRSA.

**Dermol Bath (1% dilution)**

<table>
<thead>
<tr>
<th>Contact (min)</th>
<th>Log kill (clean)</th>
<th>Log kill (dirty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&lt;3.5</td>
<td>&gt;4.6</td>
</tr>
<tr>
<td>5</td>
<td>4.8</td>
<td>5.3</td>
</tr>
<tr>
<td>10</td>
<td>4.9</td>
<td>5.4</td>
</tr>
<tr>
<td>15</td>
<td>4.9</td>
<td>5.6</td>
</tr>
<tr>
<td>30</td>
<td>4.8</td>
<td>5.6</td>
</tr>
</tbody>
</table>

- The Dermol range is an antiseptic armamentarium (even against FRSA and MRSA) and being antiseptic rather than antibiotic, they are unlikely to induce bacterial resistance.

**Conclusions**

- The Dermol range exhibited significant antimicrobial activity against FRSA and MRSA.

- The Dermol range of antiseptic emollients are designed for chronic use on sensitive skins and can be used in a variety of ways as soap substitutes, body washes, leave-on preparations and even for bathing.

- The Dermol range are a useful addition to the infection control armamentarium (even against FRSA and MRSA) and being antiseptic rather than antibiotic, they are unlikely to induce bacterial resistance.

**Table 8: Activity of Dermol Bath (1% dilution) against FRSA and MRSA**

<table>
<thead>
<tr>
<th>Contact (min)</th>
<th>Log kill (clean)</th>
<th>Log kill (dirty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&lt;3.5</td>
<td>&gt;4.6</td>
</tr>
<tr>
<td>5</td>
<td>4.8</td>
<td>5.3</td>
</tr>
<tr>
<td>10</td>
<td>4.9</td>
<td>5.4</td>
</tr>
<tr>
<td>15</td>
<td>4.9</td>
<td>5.6</td>
</tr>
<tr>
<td>30</td>
<td>4.8</td>
<td>5.6</td>
</tr>
</tbody>
</table>

- The Dermol Bath even at 1% dilution achieved ≥5 log reduction against FRSA (and very nearly the same reduction against MRSA) after 20 minutes under ‘clean’ conditions and a reasonable kill of close to 4 log reduction (99.99%) by 20 minutes under ‘dirty’ conditions.
f) Dermol Lotion used as an antimicrobial soap substitute

Dermol Lotion has been shown to be as effective against methicillin resistant S. aureus (MRSA) as it is against methicillin sensitive S. aureus (MSSA) as shown below.

<table>
<thead>
<tr>
<th>Strain of S. aureus</th>
<th>Dilution of Dermol Lotion</th>
<th>Control</th>
<th>Total viable count</th>
<th>Contact time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSSA</td>
<td>Undiluted</td>
<td>10^6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10 x dilution</td>
<td>10^5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MRSA</td>
<td>Undiluted</td>
<td>10^5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10 x dilution</td>
<td>10^4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

No viable counts were detected in the negative controls.

The average RF value was 3.02 for Dermol Lotion.

Dermol Lotion killed between 99.8 and 100% of microorganisms.

Conclusions

The FDA recommendation for removal of bacteria is a 2 log_10 reduction after 1 wash and 3 log_10 reduction after 10 washes with a medicated soap.

Dermol Lotion showed an average of 3 log_10 reduction after just one wash and therefore far exceeds the FDA requirements for a medicated soap.

Further uses of Dermol antiseptic emollients

Potential problems arise in those patients going into hospital for elective surgery or routine procedures who show a positive result for carriage of MRSA following pre-hospital admission screening. In this situation patients will not be able to undergo surgery until the MRSA has been eradicated. In such cases, the Dermol range may offer a useful therapeutic option due to its antimicrobial activity against MRSA as shown previously. Secondly, doctors and nurses working in Occupational Health departments within hospitals often find Dermol Lotion or Cream useful for treating the hands of medical personnel that have become very dry, sore and even fissured as a result of dermatitis from the constant use of soap and/or alcoholic hand rubs and scrubs. In this situation Dermol Lotion or Cream can be used as an antibacterial soap substitute with the added benefit of emollient properties to soothe and rehydrate dry, sore and chapped hands thus enabling the healthcare staff to continue at work.

To summarise, Dermol Lotion can be considered an effective, well tolerated hand wash to control bacterial contamination. It has been shown to be effective even in the presence of resistant bacteria i.e. MRSA and FRSA. With its emollient properties and low irritancy potential, Dermol Lotion provides a useful alternative to soap for routine hand washing, particularly for those with soap or detergent induced hand dermatitis.

References

6. Wrosthorne M. Dermal Laboratories Ltd. Data on File
7. Alleby CF. Dermal Laboratories Ltd. Data on File
8. Rosher PH. Dermal Laboratories Ltd. Data on File
9. Wrosthorne M. Dermal Laboratories Ltd. Data on File
10. Poster presented at the 18th EADV, Berlin, October 2009
When the eczema is itchy...

...it may be time for an emollient with added antimicrobials.