

ORIGINAL ARTICLE

Treatment of patients with atopic dermatitis using wet-wrap dressings with diluted steroids and/or emollients. An expert panel's opinion and review of the literature

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Abstract

Background The use of dampened bandages to reduce inflamed eczema (synonyme dermatitis) is an old remedy. In order to evaluate the current indications for so-called wet-wrap treatment (WWT) for atopic dermatitis (AD), and to compare the different currently recognized methods, a group of experts critically reviewed their own expertise on WWT in respect to the existing literature on the subject.

Results WWT is well tolerated in eczema due to the cooling effect on the skin and the rapid improvement in skin inflammation. It has been shown to be an extremely effective treatment for acute erythrodermic dermatitis, therapy-resistant AD and intolerable pruritus. Advantages of WWT include rapid response to therapy, reduction in itch and sleep disturbance, and potential for reduction in usage of topical corticosteroids (TCS). However, disadvantages include high cost, the necessity for special training in usage, potential for increased TCS absorption, increased cutaneous infections and folliculitis, and poor tolerability. Precautions to reduce the risks of long-term treatment should include education, monitoring of weight and height and, if necessary, serum cortisol levels. In adolescents the risk of striae from TCS absorption around puberty is high, and WWT with TCS in this age group should be used as a short-term therapy only and with extreme caution. To reduce risks, dilutions of steroids may be used ranging from 5 to 10%. In the maintenance phase this treatment can be rotated with the use of emollients only. Low potency TCS should be used on the face (with a mask).

Conclusion WWT using diluted steroids is a relatively safe addition to the therapeutic treatment options for children and adults with severe and/or refractory AD. Explanation and education is extremely important in the treatment of AD and WWT should only be employed by practitioners trained in its use. Specialized nursing care is essential, especially when using WWT for prolonged periods.

Introduction

Atopic dermatitis (AD) is an inflammatory, chronically relapsing and pruritic skin disease. There is considerable

discussion about nomenclature (atopic eczema, atopic dermatitis, constitutional eczema, extrinsic and intrinsic atopic dermatitis, atopiform eczema and atopic eczema/dermatitis syndrome) and there is no consensus regarding

the method for evaluation of the severity of the disease (SCORAD, SASSAD EASI, POEMS, etc.) and the role of IgE.^{1,2} Epidemiological work has shown that the incidence of atopic dermatitis is rising in most 'westernized' countries although the majority of AD is mild to moderate in severity. Only around 10% have a modified objective SCORAD (SCORAD index not including subjective symptoms) severity of more than 40, indicating severe AD.³

Topical corticosteroids (TCS) and emollients are the key players in the therapy of AD. Promising drugs such as the calcineurin inhibitors, tacrolimus ointment or pimecrolimus cream have recently become available. In severe childhood AD, photo(chemo)therapy, systemic corticosteroids and immunosuppressive drugs have relative contraindications because of the potential for serious side-effects. These modalities are used only in selective cases. For patients with severe AD, agents such as tacrolimus ointment or pimecrolimus cream are not efficacious enough in most cases. In children and adults where systemic treatment is not appropriate, intermittent treatment with wet wraps (WWT) and (diluted) topical corticosteroids and emollients is an ideal option.

The role of WWT has been a matter of debate over the past 5 years. Wet-wrap dressings have been popular in the UK since 1991.⁴ Earlier use can be dated back to the 1970s in the UK and even earlier in Australia (M Rogers, Children's Hospital, Sydney, personal communications). In order to evaluate the current indications for WWT, a group of experts in paediatric dermatology, with experience of the treatment modality, critically reviewed their own experience and the existing literature on the subject.

Methods

Experts in the field of atopic dermatitis in children discussed the therapeutic position of wet wraps with diluted steroids and/or emollients in meetings in Malta (2003), Rotterdam (2003), Frankfurt (2004) and Budapest (2005). All participants shared their own experiences on WWT methods; the use of water (or just emollients), types of dressings and bandages and other nursing aspects, choice of TCS and their dilution (or not), and any differences in WWT between children and adults. The pros and cons of WWT, indications for its use and precautions to reduce side-effects were considered and compared with the experiences found in the literature.

Water and dressings

Wound healing is a complex process influenced by many intrinsic and extrinsic factors. From sesame oil used by the Babylonians in 2250 BC and honey used by the Egyptians in 2000 BC to the currently available dressings, the evolution of wound products has been tremendous. Some factors influencing wound healing have been elucidated, while

others are still to be discovered. The ancient Babylonians and Egyptians observed that covered moist wounds heal more rapidly than open dry wounds, but it took until 1958 for Odland to first describe that a blister healed faster when left unbroken.⁵ Since then many studies have demonstrated the beneficial effect of a moist environment on wound healing.⁶ In a disease such as AD the skin barrier is impaired and significant amounts of water are lost through the skin.⁷ In AD lesional skin a significant decrease in ceramides 1 and 3 has been found compared with the skin of healthy subjects.⁸ Non-lesional skin of patients with AD also exhibits similar decreases of ceramides, in particular ceramide 1. This may be due to the fact that the epidermal enzyme sphingomyelin deacylase is expressed at high levels in the epidermis of AD patients, leading to an abnormal accumulation of sphingosyl phosphorylcholine but low levels of ceramide.⁹ However, the biological and genetic mechanism behind this high expression remains to be elucidated.

A second reason for dryness of the skin in AD is the diminished water binding in the stratum corneum due to a depletion of hydrophilic molecules such as natural moisturizing factor, probably due to a decrease in fillagrin. Finally, sebaceous secretion is also lower than normal in AD patients. Sebaceous glands in the dry skin of AD are reduced in number and size compared to those in the skin of normal individuals, and the lipids in sebaceous gland secretion are also reduced compared to normal subjects.

The benefit of emollients in AD may be explained by the restoration of the epidermal barrier, which prevents the penetration of allergens, irritants and organisms and breaks the itch-scratch cycle, thereby reducing the release of inflammatory mediators.¹⁰

Wet dressings support the rehydration of the skin and afford cooling of the skin through evaporation. This gradual cooling has an anti-inflammatory effect and reduces itching. The hydration and occlusion provided by the wet wraps also increases the absorption of topical medications.

These dressings also act as a mechanical barrier against scratching, allowing more rapid healing of excoriated lesions and protection against external factors such as allergens and bacteria, although heavily infected eczema may be worsened by the occlusion. The use of wet dressings in AD generally encompasses a layer of wet tubular cotton gauze bandages, of which there are several commercial types available, covered by a corresponding layer of dry bandaging. The literature on the appropriate use of water in this approach is limited. Advice is usually given to put the bandages in lukewarm water, squeeze the water out of the bandages and then apply.¹¹ Nothing is said about the mineral content of the water, which may be an important consideration. Recent studies have shown that barrier recovery measured by the improvement of transepidermal water loss towards normal is inhibited by high extra

cellular Ca^{++} and K^{+} , and accelerated by low extracellular concentrations of these ions.¹² Another study evaluated the efficacy of cool compresses in the treatment of experimentally induced irritant contact dermatitis with both distilled water and a physiological salt solution. It was shown that cool compresses of distilled water or a physiological salt solution improved barrier function and reduced inflammation with no statistical differences between the efficacy of the saline or water compresses.¹³

The temperature of the water used for wet wraps is also an important factor to consider, and the water should be at body temperature. If the water is too cold vasoconstriction is soon followed by secondary vasodilation. If too hot, vasodilation occurs with increased pruritus. Besides the hardness and the temperature of the water, several other mechanisms such as osmolarity and pH may account for the irritancy of water. Occlusion per se also changes the physiology of the skin and may trigger the activation of potentially active substances.¹⁴

Definition of wet-wrap treatment (WWT)

The use of dampened bandages is commonly used throughout the UK, Hamburg (Germany), Munich (Germany), in Rotterdam (Holland) and in several other centres. All these treatments are called wet wraps.

In the 1970s several UK centres used single layer tubular bandages or dampened cotton T-shirts and emollients with or without topical corticosteroids (TCS) to control widespread AD. An initial report in 1991 of two-layer bandaging wet-wrap therapy (WWT) described the use of Tubegauz® impregnated with hydrocortisone cream, with a dry layer on top.⁴ In this 'London' method for inpatients no water at all is used.

Other practitioners in the UK use water-dampened bandages with dry bandages on top. This is also the case in the 'Rotterdam' method, where the skin is re-wetted every 2 h during the day. The skin dries within 30 min and is relatively dry till the next re-wetting action (without applying emollients) 90 min later.^{11,15,16}

The use of dampened bandages to reduce inflammation is an ancient medical remedy and is often used for the treatment of AD. Their use has been described as early as in ancient surgical textbooks. In his description of wound dressing, Liston writes in 1846: 'water dressings had been applied to sores for time immemorial'. In modified applications they continue to be part of approved therapy for acute inflammatory states, ulcers and other skin affections.¹⁷

Details of the four major methods of WWT

Wet wraps (simple) for cooling

A wet wrap originally consisted of a cloth soaked in

water and applied directly to the affected skin, usually in several layers. White lint, linen or cotton cloth was formerly used. Nowadays a variety of single-use gauze pads are available that can be fixed by a gauze bandage to the diseased skin and soaked when required with aqueous liquids. The effect is cooling, anti-inflammatory and itch-reducing.¹⁸ These positive properties of the evaporation of water from the dressing are, however, accompanied by a drying out of the skin, which makes the procedure theoretically, unsuitable for dry skin conditions like AD.

One layer wet wrap with ointment

To avoid the undesired desiccation of the skin, a modified procedure came into use for eczematous conditions, the 'oil wet wrap' ('fett-feuchte Umschläge'). First, an ointment is spread generously onto the skin. Then a bandage, soaked in lukewarm tap water and squeezed out to leave it damp is applied over it. For extensive skin affections damp pyjama cloth can be used instead of bandages. 'The effect is the same as with WWT, without the side-effect of drying out the skin'.¹⁸ However, ointment enhances the risk of folliculitis.

Double-layer wet wrap with ointment or cream and water

While the damp 'pyjama' technique was conceived for in-hospital use, another modification more suitable for application at home was described in the nineties¹⁹ and used in Australia (M Rogers, Children's Hospital, Sydney, personal communications), Dundee, Hamburg, Rotterdam and for out-patients in London (Table 3). A damp tubular bandage is applied over the ointment layer, as in the oil-wet wrap, followed by a second layer of dry tubular bandage. The second bandage layer results in a more gradual evaporation of the water from the wet bandage and therefore in a prolonged effect of moisturization and cooling.^{11,19}

Double layer wrap with ointment alone

In 1991, Goodyear *et al.*⁴ described another technique for the treatment of AD in children, which they termed 'wet-wrap dressings'. The crucial difference with this method is that no water is applied to the bandages. The 'wetness' results from diluted steroid cream, which becomes more fluid when warmed by immersion in hot water. The bandage is soaked in the warm cream and applied to the skin after a bath with oily additive. Finally, a second layer of dry tubular bandage is wrapped around.

All of the authors publishing reports on wet-wrap dressings describe a 'cooling effect on the skin'.^{4,11,15,16}

Wet-wrap treatment in children with atopic dermatitis

The first detailed reports about the use of diluted topical steroids and 'wet-wrap' dressings in patients with AD were centred on the treatment of children.^{4,11} They described a very successful intervention treatment for severe and/or refractory skin disease with a relatively good safety profile. Patients showed a marked improvement of their skin lesions associated with a significant decrease in objective SCORAD scores during a clinical treatment period of 1 week.^{15,16}

In the Erasmus MC–Sophia Children's Hospital (Rotterdam), the treatment is commonly started as whole body application and continued throughout a short hospitalization of 7 days. After patients have been discharged from the hospital, the treatment is continued at home for seven consecutive days on involved areas, and thereafter for only 4 days per week (Table 1). Monitoring for potential side-effects is undertaken throughout the therapy by measuring fasting early-morning serum cortisol and growth parameters. Topical corticosteroids have a well-known potential for systemic and local side-effects. Young children are especially at risk for systemic absorption due to their low body volume to skin surface area ratio compared to adults. If systemic absorption occurs, suppression of the hypothalamus-pituitary-adrenal gland (HPA) axis and growth retardation may result. Evaluation of the adverse effects in the published data reveals that temporary suppression of the HPA axis has been reported as a possible side-effect of using diluted topical steroids and wet-wrap dressings.^{11,15,16} A local side-effect that may occur more easily in childhood than in adulthood is the development of striae, particularly in pubertal children (figs 1, 2 and 3).



fig. 1 Old style wet wraps (on courtesy of Dr M. Rogers).

Using greater dilutions of the topical steroid (1 : 20 and 1 : 10) reduces the risk of systemic bioactivity, while maintaining a good efficacy.^{15,16} Fortunately, growth retardation as a result of wet-wrap treatment has not been described. This finding is supported by McGowan *et al.*, who did not observe any growth retardation in a group of eight children during a median period of 12 weeks of wet-wrap treatment.²⁰ They measured velocity of lower leg length growth using knemometry, and assessed bone and collagen turnover by urinary deoxypyridinoline crosslink excretion corrected for creatinine excretion.

Table 1 Wet-wrap treatment according to Oranje with recent modification (in italics) (1999). (guidelines Erasmus medical center – Sophia Children's Hospital)

1. Choose the appropriate width of the tubular bandages and cut these to size to fit the arms, legs and trunk. Cut a facial mask if necessary. *Instead of bandages, tubifast garments have been used since 2004.*
2. Apply the appropriate dilution of fluticasone propionate 0.05% (FP) cream on the skin. *Diluted steroids in emollients of 1 : 19 (face, body in infants) and 1 : 9 (body) or 1 : 3 (body) are used.*
3. Wet the individual pieces of tubular bandage in lukewarm water. *When garments are used, then the inner garment is wetted using a plant spray.*
4. Apply the first layer of wet tubular bandage. Connect the arm and leg pieces to the trunk. *When garments are used, the inner garment is wetted using a plant spray. Use the facial mask if necessary.*
5. Apply the second layer of dry tubular bandage. Again connect the arm and leg pieces to the trunk. Use the facial mask if necessary. *When garments are used, a second dry garment is pulled over the wet one.*
6. Re-wet the bandages or the inner garments every 2 to 3 h.
7. Repeat the above mentioned procedures daily.
8. After 7 days of treatment the diluted FP cream is only applied on the clinically involved skin for four of seven consecutive days of the week. Emollient is applied on the uninvolved skin. Patients can perform the treatment at home.

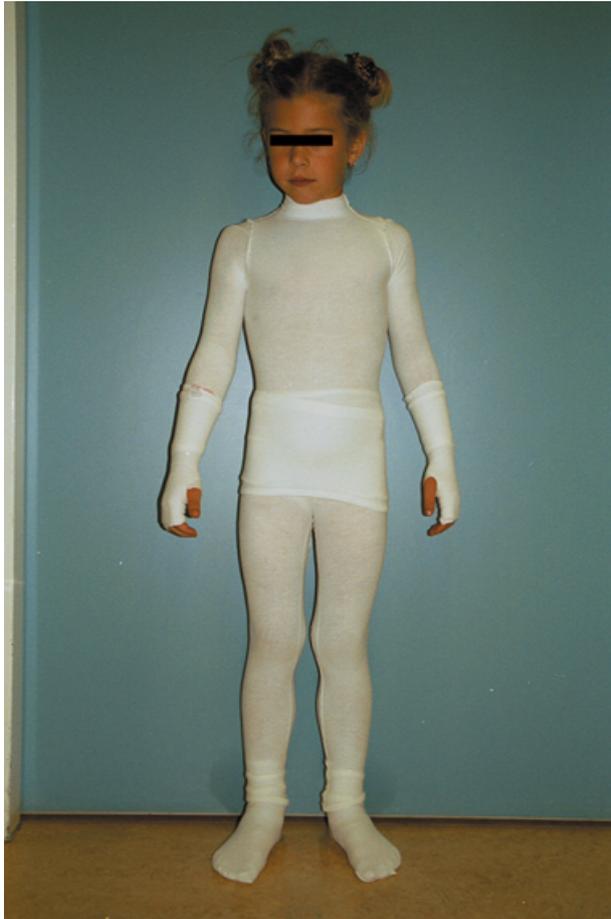


fig. 2 Tubifast pyjama for WWT.

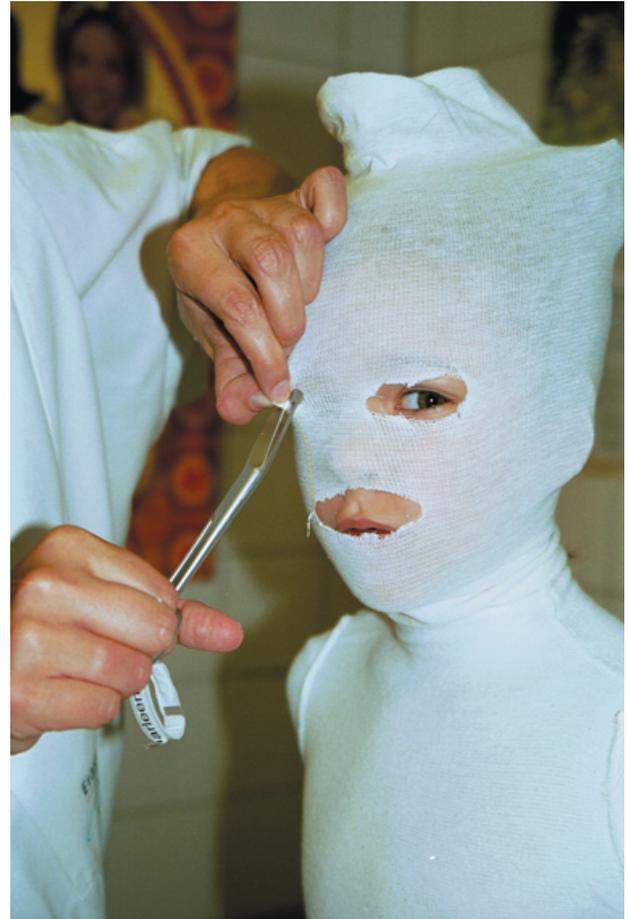


fig. 3 Preparing the mask.

However, this is a small group, and sensitivity to TCS absorption appears to be very variable.

In Rotterdam, diluted fluticasone propionate 0.05% cream (1 : 4, 1 : 10 and 1 : 20) is used once daily.^{15,16} FP cream and mometasone furoate are newer potent topical corticosteroid agents, which have been shown to have an improved benefit/risk ratio with relatively low systemic absorption and may further lower the risk of steroid-induced side-effects. However, there is still a risk of skin atrophy.^{15,16} Currently, the use of 1 : 20 dilutions of FP cream is advocated in children under 2 years of age and dilutions of 1 : 4 and stronger are strongly discouraged. Parameters of systemic bioactivity, such as fasting early-morning serum cortisol levels should be monitored (i.e. checked before the first day of start therapy, after 1, 3, 4, 6 consecutive weeks each and then every 2–3 months).

Oranje and coworkers (unpublished data) observed an initial impressive improvement after 3 to 7 days, but after 4 weeks worsening and stabilizing of AD to mild to moderate severity was observed. We call this the 'broken stick effect' (fig. 4).

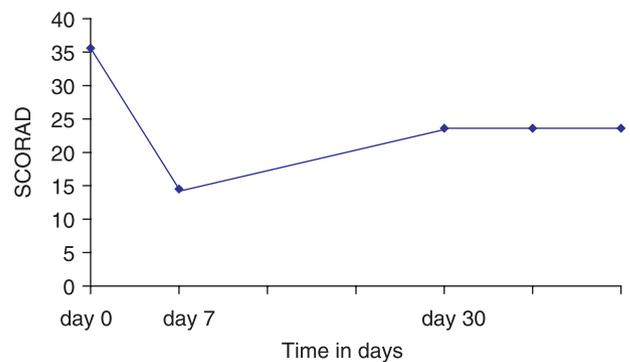


fig. 4 Double-broken stick phenomenon in objective modified SCORAD evaluation. Retrospective study in 48 children with AD treated by wet-wrap dressing with diluted FP in the period 2001–04 (Willems M, Oranje AP 2004, unpublished data).

In Hamburg (department of dermatology) the treatment is as an alternative to hospitalization and is conducted in a daycare clinic for 3 to 5 days. Patients are instructed by trained nurses to perform double layer wet dressings with

Table 2 Wet-wrap dressings for inpatient treatment using Tubegauz® (GOSH, London, UK)

Action	Rationale
<i>Treatment procedure</i>	
Cut appropriate sized pieces of the cotton tubular bandage (Tubigauz®) for the arms, legs and trunk	The technique comprises two layers of bandaging
Soak the individual pieces of Tubigauz® (suit1) in the steroid cream* (not water)	To produce the first 'wet' layer
Put on the first layer of 'wet' Tubigauz®; tie the arm and leg pieces to the trunk	This enables all affected areas on the limbs and trunk to be covered by a dressing impregnated with a weak steroid cream
Then apply the second 'dry' suit over the top of the wet layer securing the arm and leg pieces to the trunk section	This completes the dressing
Keep hands covered. If the child is a thumb-sucker a small hole can be cut in the bandage	To minimize damage from scratching
<i>Treatment regimen</i>	
Dressings are changed twice daily by the nursing staff, usually for 3 days	There is usually a rapid improvement and in most cases > 90% clearance of eczema in this period of time
Apply separate topical preparation to face and neck as prescribed	Areas not covered by the wet dressings
<i>Treatment immediately after the application of wet dressings</i>	
The child is kept in hospital for a further 1–2 days and the residual or recurrent areas of eczema treated with an appropriate topical steroid ointment† (without the use of dressings) once or twice daily, as needed	Treatment during this time is then continued after discharge from hospital at home. It allows for the skin condition to stabilize
The use of a moisturizing agent at other times during the day to all areas of dry skin (2–3 times daily)	To maintain the integrity of the skin barrier
<i>General measures</i>	
Twice daily cool baths with an oily bath emollient	To cleanse and hydrate the skin
Use a soap substitute, such as aqueous cream or emulsifying ointment to wash	Normal soap too drying and can irritate the skin
If there is any suspicion of secondary bacterial infection, oral antibiotics should be prescribed by the doctor‡	Skin infection may be responsible for the exacerbation of eczema
A sedative antihistamine is also helpful in this situation and should be given as prescribed	To help settle the child
Loose cotton pyjamas should be worn over wet dressings	To prevent child becoming cold
<i>Discharge planning</i>	
Educate care-givers on treatment and management at home, support with written instructions	Essential so that the control of eczema is maintained
Liaise with GP and community paediatric nursing team as appropriate	To ensure child and care-giver supported locally
Outpatient follow-up appointment within 2 to 3 weeks	To closely monitor progress and review long-term treatment plan

*Currently for babies under 1 year of age we use 0.5% hydrocortisone cream and for children over 1 year betamethasone valerate 0.01% cream (Betnovate® diluted 1 : 10). Both hydrocortisone and Betnovate® can be diluted with either aqueous or cetamacragol cream.

†Currently for babies below 1 year of age we use 1% hydrocortisone ointment and for children over 1 year betamethasone valerate 0.025% ointment (Betnovate-RD®).

‡If there is overt impetiginization then wet dressings should be delayed until 48–72 h after commencing antibiotics and until appropriate treatment has been confirmed from the skin swab results. If eczema herpeticum is suspected this is an absolute contraindication to the use of wet dressings.

the tubular bandage at home, using diluted steroid creams only on affected areas and emollients on the rest of the skin (B Kunz, personal communication).

At Great Ormond Street Hospital (GOSH), babies under 1 year of age are treated with 0.5% hydrocortisone cream and children over 1 year with betamethasone valerate 0.01% cream (Betnovate® diluted 1 : 10) and using Tubegauz bandages. Either aqueous or cetomacragol cream can be used as the diluent (Tables 2 and 3).⁴

In Dundee WWT comprises the use of emollients and one, dampened layer of Tubifast® dressings with a dry layer on top. Occasionally, in severe cases, potent or moderately potent TCS are used undiluted to affected areas for a max-

imum of 5 days only. Otherwise, and especially in infants, 1% hydrocortisone ointment for 5 to 7 days is applied to affected areas only. WWT is only continued on a long-term basis with emollients alone, usually at night, and TCS are applied during the day without occlusion to affected areas. In a recent Dundee pilot study of 19 infants below 5 years of age with moderate AD, WWT did not prove more effective than conventional therapy with 1% topical hydrocortisone cream and emollients over a 2-week period.²¹

Long-term intermittent treatment with wet-wrap dressings and diluted corticosteroids is feasible but requires close monitoring and adequate guidance of patients and

Table 3 Wet-wrap dressings more suitable for use at home using Tubifast® (Guidelines GOSH, London, UK)

Action	Rationale
<i>Treatment procedure</i>	
Apply the weak topical steroid ointment, beclomethasone dipropionate 0.0025% (Propaderm® 1 in 10) only to the affected areas, including the face	To reduce inflammation
Apply 50 : 50 white soft paraffin/liquid paraffin liberally to the unaffected areas	As a moisturizing agent and to maintain the integrity of the skin barrier
Apply a suit of Tubifast® bandages (one wet layer and one dry layer). Tubifast has a tighter fit than Tubigauz®. The wet layer uses water and needs to be kept damp using a sponge or spray	To reduce itching and prevent damage from scratching, as well as maintaining an appropriate skin temperature
Then apply the second 'dry' suit over the top of the wet layer securing the arm and leg pieces to the trunk section	This completes the dressing
<i>Treatment regimen</i>	
For use in hospital, dressings are changed twice daily for 3 to 5 days	This will produce a significant improvement sufficient for the child to be discharged
Continue nightly wet wraps at home for 6 to 8 weeks, gradually reducing frequency after this period if effective	Stopping wet wraps abruptly can induce a flare of eczema

their parents.¹⁶ Regular measurements of fasting early morning serum cortisol and growth parameters should be monitored (in long-term treatment at least every 6 to 8 weeks). For facial eczema, wearing a mask can lead to psychological resistance or problems and is refused by about 10% of the parents and/or children²² (A Oranje, personal communication). The face is treated with WWT and more diluted steroids (1 : 20, 5% steroid cream) than elsewhere on the skin.^{23–28} Low-potency steroid without WWT for severe facial eczema is also an option. We have now also treated a number of children with pimecrolimus 1% cream or tacrolimus 0.03% ointment for facial lesions without occlusion by a mask (A Oranje, unpublished data). The effectiveness of topical steroids may diminish with time (tachyphylaxis) and, last but not least, the cost and time-consuming nature of the dressings limit their use.

Wet-wrap dressings in adults with refractory atopic dermatitis

Adult patients with refractory AD unresponsive to topical corticosteroids and emollient, photo(chemo)therapy and/or even systemic therapy can be treated with WWT using diluted or undiluted steroids. Treatment can be started during a short hospitalization, in an outpatient treatment centre, or as an outpatient under the supervision of a suitably trained specialist nurse. In a Rotterdam study, after 7 days of inpatient therapy with WWT and diluted FP cream (1 : 4 and 1 : 10), the WWT was continued at home daily (first week). Thereafter for four consecutive days/week (maximum five in severe cases), and for a minimum of 12 h each day, diluted FP cream was used once daily on clinically involved skin only and emollient alone was used on uninvolved skin. For the next 3 days,

only emollient was applied.¹⁶ The Rotterdam group described results of WWT using diluted FP cream (1 : 4 and 1 : 10) in seven women and five men, aged between 18 and 61 years, 3 months (average 29 years and 11 months).¹⁶ Two patients were treated using the wet-wrap dressings including a facial mask and more diluted steroids (1 : 20). The remaining patients did not use a facial mask at their own request or due to absence of facial skin lesions. A marked improvement of skin lesions was noted in all patients. One patient using prednisone orally had cortisol levels below 200 nmol/mL both before and after treatment.

Only two patients developed cortisol levels below 200 nmol/mL at the end of treatment. Both used additional topical corticosteroids on the face and scalp. One patient had been treated with the less diluted and more potent concentration of FP cream (1 : 3) after day 5, and the other one used FP via an inhaler. This patient, who used excessive amounts of cream and also FP via an inhaler, developed prolonged hypothalamus-pituitary-adrenal-cortex (HPA) axis suppression, in combination with several striae on his abdomen.

Bandages for use in wet-wrap treatment

In 1995 a paediatric nursing report described a two-layer technique using tubular stretchy bandages Tubifast®, with a wet layer, and dry layer on top, which is widely used in a variety of different methods.^{4,29} This is borne out in a UK review by the British Society for Paediatric Dermatology (BSPD), which revealed wide variation in the use of emollients, water, TCS potency and dilution, and bandaging techniques. Some respondents considered cream-impregnated cotton bandages to constitute WWT and some used a dry bandage technique. Recently, a number

of new bandages and garments have become available. In the UK and other parts of Europe these are Actifast® (Activa), Comfast® (Shiloh Healthcare), Elastus Tubiquick (Most Active), Zipsocs® and Coverflex® (Hartmann); however, there may be variation in trade names and availability in other countries. Most bandages can only be washed and re-used a few times and they are difficult to apply, requiring a trained nurse and committed parents. Incorrect usage may be ineffective and potentially harmful. There are a variety of teaching videos and booklets available for parents, children and nurses. Medlock Medical now makes Tubifast® garments for WWT for varying age groups. These consist of long-sleeved roll-neck T-shirts and pull-up leggings, both with external seams to avoid irritancy. These are much simpler and easier to use and last up to 20 washes, which greatly offsets their increased cost. Although WWT can be very beneficial for severe AD, reducing itching, improving sleep and allowing healing and therefore decreased TCS usage, it does have disadvantages. These include high cost, difficulty or intolerance of use and increased risk of cutaneous infections and systemic absorption of steroid.²⁹ The use of special silk clothes may be a useful addendum in the treatment of AD; however, these clothes fit less well than garments. Antiseptic activities are thought to enhance their usefulness. Coater® pyjamas are not suitable for children with AD treated with wet wraps. Coaters are made for the prevention of scratching and are especially used for children treated with steroids, emollients and tar ointments. In London (UK), Tubegauz® or Tubifast® is used and only occasionally other dressings such as pyjamas.

Comparative studies with different steroids

Apart from a few comparative studies, which have described the use of different topical treatments (steroid preparations or a steroid preparation vs. a steroid-free preparation) under wet-wrap dressings,^{23,24} no comparative, methodological, evidence-based studies have been performed focusing on the technique itself. In order to define more clearly the most effective wet-wrap technique(s) in atopic dermatitis patients, such RCT studies need to be performed.

Nursing and educational aspects

Explanation and education is of fundamental importance to ensure compliance (adherence) to therapy. This should ideally be carried out by trained specialist dermatology nurses, as is the case in some UK centres or in eczema schools, which have been set up in Germany, France and Holland. It is vitally important that a nurse trained in dermatology (and paediatrics for children) assists the patient in initial demonstration of treatment and follow-up to avoid unnecessary side-effects and to reduce risks.

Routine or indiscriminate use of WWT in mild AD, particularly by staff untrained in dermatology, should be challenged.^{25–28} In the group's experience, the most common reason for failure of WWT is non-compliance with the dressings. This is frequently a result of lack of knowledge and incorrect training by unskilled nurses or medical practitioners. High cost in terms of time and money, side-effects such as infection and folliculitis, child dislike or refusal and non-availability of dressings or creams are other important factors.

Other indications for wet-wrap treatment

Wet-wrap treatment can also be used in conditions other than AD such as:

- Guttate psoriasis with diluted steroids as crisis intervention.
- Erythrodermic psoriasis with emollients only.
- Some cases of pruritic and active urticaria pigmentosa (mastocytosis), with diluted steroids over a period of 3–6 months.
- Lamellar ichthyosis in small babies with emollients only.

Precautions and contraindications

One aspect of potential concern is systemic absorption and hypothalamic-pituitary-adrenal axis (HPA) suppression. Concerns regarding possible systemic and topical toxicity have limited the use of moderate-potency corticosteroids in children.³⁰ Goodyear *et al.* found that even 5 days of topical hydrocortisone cream and WWT in infants resulted in some suppression of the HPA, and proposed caution in the use of TCS under WWT.⁴ The relevance of systemic absorption clearly depends on the amount of topical steroid used, the frequency of treatment, and close monitoring if used at home.

If there is overt impetiginization, then wet dressings should be delayed until 48–72 h after commencing antibiotics and confirmation of appropriate treatment by skin swab results. If eczema herpeticum is suspected this is an absolute contraindication to the use of wet dressings.²⁹

Other problems encountered especially in home use include time-consuming application requiring the co-operation of the child; the frequent occurrence of *Staphylococcal* folliculitis; and the rare complication of *Pseudomonas* infection in the creases. The facial mask sometimes leads to psychological problems. We advise low-potency steroids to be used in the face. Parents also require careful instruction in the early diagnosis of eczema herpeticum.

Conclusions

A consensus on the definition of wet-wrap dressings for the treatment of atopic dermatitis (AD) can only be

based on evidence and this remains to be further established. There are only limited evidence-based data demonstrating that WWT with emollients or corticosteroids are an effective therapy modality in severe AD.³¹ The involved experts all agreed that wet-wrap treatment in all its different variations is effective for the treatment of severe AD. However, randomized controlled studies (RCT) studies to support this statement are currently unavailable.

It has been known for more than 35 years that wet dressings for a period of 1–3 days are highly effective for acute flare-ups of AD. Empirically, the experts concluded that in severe AD WWT with TCS is highly effective, and safer if diluted TCS are used. In the maintenance phase this treatment can be rotated with the use of emollients only. Common side-effects are bacterial folliculitis and chilling. Treatment with antiseptics under wet wraps seems to be promising, but only limited data are available.³² The role of explanation and education is extremely important in the treatment of AD and cannot be overemphasized. Increased time spent with children and parents is in itself beneficial. Specialized nursing care is essential in long-term therapy using wet-wrap dressings. The use of TCS should be limited to short-term therapy, which may be used intermittently when necessary, provided that appropriate growth monitoring, and if necessary serum cortisol monitoring, is undertaken. Localized WWT can be used for severely affected body sites such as limbs, for example. In older children and adults, cream impregnated tubular bandages such as Zipsocks® can also be extremely useful for limbs. During long-term treatment, a step-down approach for TCS usage is essential: first week once daily, second week once daily only to affected areas, and then tapering off to only 4 days per week. WWT masks are better reserved for short-term management and are not always tolerated, and in cases where long-term TCS are necessary for the face, treatment with one of the newer topical immunomodulators may be beneficial.

In summary, whichever method is used, the effect of wet dressings can be very impressive; they can make the child feel more comfortable by rapidly reducing itching and thus improving sleep. Wet-wrap dressings are undoubtedly a valuable tool for the treatment of children with severe generalized AD. The use of a less potent dilution of FP cream or MF cream/ointment has been shown to be effective and diminishes the risk of TCS therapy. However, home use requires adequate training and motivation to ensure good compliance and must be carefully monitored, while maintaining good efficacy. A daycare centre with dermatologically qualified nurses, with appropriate paediatric training, provides an excellent setting for the follow-up of these patients.

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