

Wet Wrap Therapy in Moderate to Severe Atopic Dermatitis



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KEYWORDS

- Wet wrap therapy • Wet wrap • Wet dressings • Occlusive dressings
- Occlusion therapy • Atopic dermatitis • Atopic eczema

KEY POINTS

- Atopic dermatitis (AD) remains a complex, common, chronic, and relapsing skin disorder, and a global public health problem.
- National and international guidelines address AD care in a stepwise fashion. Wet wrap therapy (WWT) is a therapeutic intervention for moderate to severe AD.
- WWT plays an important role as an acute therapeutic intervention for management of moderate to severe AD used with undiluted topical corticosteroids of appropriate potency.
- WWT should not be used for mild AD or as a chronic or maintenance therapy.
- WWT should be considered as a treatment option ahead of the systemic therapies for patients failing conventional topical therapy.

INTRODUCTION

Atopic dermatitis (AD) remains a complex, common, chronic, and relapsing skin disorder of infants and children but can affect patients of any age. In the United States, prevalence in school-aged children has been found to be up to 18%.¹ In addition, recent data from the National Health Interview Survey show that up to 10% of adults in the United States report having eczema and the prevalence is higher in those with concomitant allergies or asthma.² In other industrialized countries, prevalence greater than 20% has been reported.³ Of note, in a large cohort of subjects with mild to moderate AD, it was not until age 20 that 50% had at least 1 lifetime 6-month period free of symptoms and treatment.⁴ More than half of these patients will develop asthma and allergies suggesting an atopic march in a significant number of patients with AD.⁵

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AD occurs in genetically predisposed individuals with a defective skin barrier and abnormal immune responses to irritants, allergens, and microbial organisms.⁶ AD is characterized by abnormal skin barrier function associated with abnormalities in cornified envelope genes, reduced ceramide levels, increased levels of endogenous proteolytic enzymes, and enhanced transepidermal water loss (TEWL).⁷ Skin barrier may also be damaged by exposure to exogenous proteases from *Staphylococcus aureus*.⁸ Skin barrier abnormalities contribute to increased allergen absorption and microbial colonization. Exposing the immune system of the skin to allergen compared with systemic or airway sensitization results in a higher allergic antibody response and could predispose susceptible children to developing asthma and allergic rhinitis later in life.⁹ Patients with AD typically have severe pruritus and disrupted sleep that affects their quality of life, as well as that of family members.¹⁰ When AD remains in poor control, patients and caregivers can experience multiple medical and psychosocial issues. Associated with this, AD imposes a significant economic burden on the patient, family, and society.¹¹

ROLE OF MULTIDISCIPLINARY CARE

A multidisciplinary care model that incorporates a stepwise approach to the management of moderate to severe AD has been used by the authors for almost 3 decades.^{12,13} In this approach, the importance of teaching patients or caregivers skills to self-monitor and manage disease with the help of an individualized plan is a key component.¹⁴ In the authors' center, the multidisciplinary team is composed of pediatric allergist-immunologists with extensive experience in basic and clinical research in AD, pediatric nurse specialists, behavioral clinicians, fellows-in-training, physician assistants, nurse educators, child-life specialists, art therapists, social workers, dietitians, and rehabilitation therapists. Dermatologists are available for consultation if the diagnosis of AD is in question or alternative therapies, such as phototherapy, are being considered. The philosophy of care is based on a personalized approach with comprehensive evaluation and treatment tailored to the needs and goals of the patient and caregiver.

In this treatment model, all members of the multidisciplinary team teach the same key concepts and reinforce the messages being delivered to the patients and caregivers regardless of which educational strategy is incorporated. Educational strategies include one-on-one communication, direct demonstration with reinforcement, group discussions, classroom teaching, written materials, and AD Home Care Plan or AD Action Plan. AD Home Care Plans or AD Action Plans are integral to the management of the AD patient^{15–17} (**Box 1**). Development of a skin care regimen that is agreed on by the clinician, patient, and caregivers requires open communication. Patients or caregivers, especially given the degree of sleep disruption associated with AD,¹⁸ may forget or confuse skin care recommendations given to them without a written plan. This plan should be reviewed and modified at follow-up visits.

STEPWISE MANAGEMENT OF ATOPIC DERMATITIS

National and international AD guidelines outline basic treatment of AD to establish the foundation of AD management.^{9,19,20} These guidelines recommend 3 basic components of optimal skin care. First and foremost, the regular use of moisturizers²¹ or emollients in conjunction with skin hydration is essential to address the skin barrier defect. Second, identification and avoidance of specific and nonspecific triggers is critical in reducing symptoms. Third, depending on the severity of AD, topical therapeutic agents may be initiated in a stepwise fashion. Topical corticosteroids are often the standard of care to which other treatments are compared.

Box 1**National Jewish Atopic Dermatitis Program step-care "AD action" plan***Maintenance or daily care*

1. Take at least 1 bath or shower per day; use warm water, for 10 to 15 minutes.
2. Use a gentle cleansing bar or wash in the sensitive skin formulation as needed.
3. Pat away excess water and immediately (within 3 minutes) apply moisturizer, sealer, or maintenance medication if directed. Fragrance-free moisturizers are available in 1 pound jars include Aquaphor Ointment (Beiersdorf, Wilton, CT), Eucerin Crème (Beiersdorf, Wilton, CT), Vanicream (Pharmaceutical Specialties, Rochester, MN), CeraVe Cream (Valeant, Bridgewater, NJ), or Cetaphil Cream (Galderma, Fort Worth, TX). Vaseline is a good occlusive preparation to seal in the water; however, it contains no water so it only works effectively after a bathing. Use moisturizers liberally throughout the day. Moisturizers and sealers should not be applied over any topical medication.
4. Avoid skin irritants and proven allergens.

Mild to moderate AD

1. Bathe as above for 10 to 15 minutes, in comfortably warm water, 2 times a day, in the morning and before bedtime.
2. Use a gentle cleansing bar or wash in the sensitive skin formulation as needed.
3. Use moisturizers, as above, on healed and unaffected skin, twice daily, especially after baths, and on total body at midday.
4. Apply to affected areas of face, groin, and underarms twice daily especially after baths _____ (low potency topical corticosteroid), or _____ (topical calcineurin inhibitors), or other topical preparation as directed _____ (topical barrier repair cream; eg, Atopiclair 3 times daily).
5. Apply to other affected areas of the body twice daily, especially after baths, _____ (low to mid potency topical corticosteroid), or _____ (topical calcineurin inhibitors), or other topical preparation as directed _____.
6. Add other medications as directed: _____ (eg, oral sedating antihistamines, topical or oral antimicrobial therapy).
7. Pay close attention to things that seem to irritate the skin or make condition worse.

Moderate to severe AD

1. Bathe as above for 10 to 15 minutes, in comfortably warm water, 2 times a day, in the morning and before bedtime, or a third time midday if WWT is applied 3 times. Put no additives in bath water.
2. Use a gentle cleansing bar or wash in the sensitive skin formulation as needed. An antibacterial cleanser may be considered.
3. Use moisturizers as above on healed and unaffected skin, twice daily, especially after baths, and on total body at midday.
4. Apply to affected areas of face, groin, and underarms twice daily, especially after baths _____ (low potency topical corticosteroid), or _____ (topical calcineurin inhibitors), or other topical preparation as directed _____ (topical barrier repair cream, eg, Atopiclair 3 times daily).
5. Apply to other affected areas of the body twice daily, especially after baths, _____ (mid to high potency topical corticosteroid), or _____ (topical calcineurin inhibitors), or other topical preparation as directed _____.
6. Use wet wraps on involved areas selectively as directed per policy and procedure. Wet wraps are left in place a minimum of 2 hours. If left in place, need to be rewet every 2 to 3 hours. In

general, wet wraps are removed after 4 hours. If patient falls asleep with wet wraps in place, they may be left on overnight. Stop rewetting during the night. Apply moisturizer total body after wet wraps are removed.

7. Add other medications as directed: _____ (eg, oral sedating antihistamines, topical or oral antimicrobial therapy).
8. Pay close attention to things that irritate skin or make condition worse.
9. Step down to moderate plan above as the skin heals.

Reduce skin irritation

1. Wash all new clothes before wearing them. This removes formaldehyde and other irritating chemicals.
2. Add a second rinse cycle to ensure removal of detergent. Residual laundry detergent, particularly perfume or dye, may be irritating when it remains in the clothing. Changing to a liquid and fragrance-free, dye-free detergent may be helpful.
3. Wear garments that allow air to pass freely to skin. Open weave, loose-fitting, cotton-blend clothing may be most comfortable.
4. Work and sleep in comfortable surroundings with a fairly constant temperature and humidity level.
5. Keep fingernails very short and smooth to help prevent damage due to scratching.
6. Carry a small tube of moisturizer or sunscreen at all times. Daycare, school, or work should have a separate supply of moisturizer.
7. After swimming in chlorinated pool or using hot tub, shower or bathe using a gentle cleanser to remove chemicals, then apply moisturizer.

Courtesy of Noreen Nicol, PhD, RN, FNP, Mark Boguniewicz, MD, and Donald Leung MD, PhD, Atopic Dermatitis Program, National Jewish Health, Denver, CO. This may be modified and used for patient care citing National Jewish Health Atopic Dermatitis Program as source. (Nicol and Boguniewicz, 2008); with permission.

In severe cases that cannot be controlled with topical treatment, guidelines suggest systemic treatment options.^{9,20,22} These include cyclosporine A and ultraviolet light therapy. Systemic corticosteroids are known to be effective in short-term treatment of AD but evidence is limited to support their use due to long-term side effects and rebound flaring. Systemic steroids are discouraged for continuous or chronic intermittent use in AD but may be considered for transitional therapy to nonsteroidal therapies, including phototherapy, and in acute, severe, rapidly progressive, or debilitating cases in adults or children. Use of other immunosuppressives, including cyclosporine A, methotrexate, azathioprine, or mycophenolate mofetil, is problematic because such therapy is off-label for AD in most countries and can be associated with serious side effects. A different approach in the patients with difficult to manage moderate to severe AD is acute intervention with wet wrap therapy (WWT). **Fig. 1** is a flowchart highlighting AD diagnosis and management developed by the Joint Task Force on Practice Parameters, representing the American Academy of Allergy, Asthma & Immunology; the American College of Allergy, Asthma & Immunology; and the Joint Council of Allergy, Asthma and Immunology.⁹

ROLE OF WET WRAP THERAPY IN ATOPIC DERMATITIS

Overview of Wet Wrap Treatment

Dampened bandages or water dressings are an ancient remedy described by the Babylonians and Egyptians. Their use is described in historical surgical and nursing

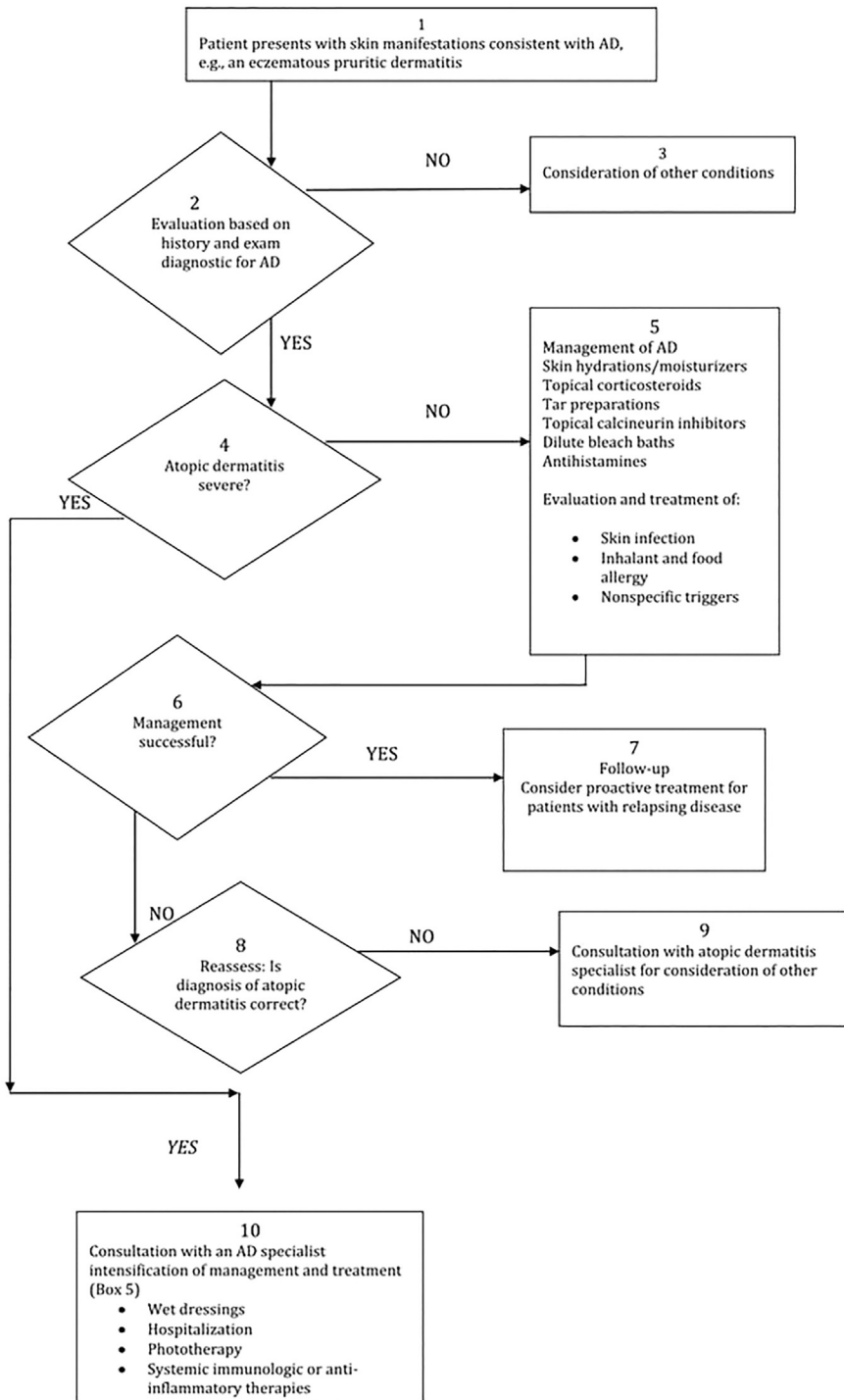


Fig. 1. Diagnosis and management of AD. (From Schneider L, Tilles S, Lio P, et al. Atopic dermatitis: a practice parameter update 2012. *J Allergy Clin Immunol* 2013;131(2):297; with permission.)

textbooks to reduce inflammation. The use of dampened bandages is still commonly used throughout the world and these treatments are often referred to as wet dressings.

Dampened bandages or moist dressings are used in for a variety of acute inflammatory states, ulcers, and other skin disorders. The simple wet dressing is used for cooling, antiinflammatory, and itch-reducing properties; it was often a cloth or dressing soaked in cool water and applied directly to the affected skin for everything from bug bites and wounds to a variety of skin disorders. Single or multiple layers of wet dressings were also used historically over a variety of topical preparations to assist in absorption. They also act as a protective barrier from the trauma associated with scratching in pruritic skin disorders.

Definition of Wet Wrap Therapy

WWT is generally defined as a treatment modality using layers of bandages, cotton clothing, or gauze over or together with topical medication. Specialized nursing care and education is important to ensure proper use of WWT. Nicol¹³ published a detailed description of WWT in AD in 1987. This article described the technique using illustrative photos. The investigator also clarified the concept of simplifying wet wraps by using wet clothing in place of bandages to make this treatment simpler, less time intensive, and less expensive. This article is cited in the *Annotated Bibliography of the Dermatologic Nursing Literature* done at Oxford as the first nursing paper in the literature on the wet wrap technique specifically in AD.²³

Over the past 3 decades, the term WWT has been used as a treatment for severe and/or refractory AD. Current reviews on the efficacy and safety of occlusive therapy, including WWT, state that this therapy is advocated as a relatively safe and effective treatment modality in moderate to severe AD when used appropriately and may be underused.^{24–26}

Mechanism of Wet Wrap Therapy

WWT is well tolerated in eczema treatment due to the cooling, antiinflammatory, and antipruritic properties on the skin. Itch is reduced by cooling through vasoconstriction. WWT increases skin hydration and decreases TEWL. WWT protects the skin as a barrier against external irritants and allergens. Additional work has pointed to a beneficial effect of WWT on the skin barrier that persists even after discontinuation of this treatment modality.²⁷

Reported side effects and contraindications of WWT vary greatly depending on study methodology; WWT technique, including topicals used; and time devoted to WWT oversight and patient education (**Table 1**). The biggest barrier is the time that it takes to properly teach the patient and family to avoid discomfort and poor acceptance. WWT can be a time-consuming treatment depending on methodology of application. Other complications reported in varying degrees include potential local and systemic corticosteroid side effects, allergic sensitization, skin maceration, and possible increased infectious complications, including folliculitis, impetigo, and herpes. Occlusion alone results in increased density of bacteria of both normal and lesional eczematous skin.²⁸ Paradoxically, WWT can promote skin dryness if sufficient emollients are not used after wet wraps are removed.

Methodology of Wet Wrap Therapy

There are 2 primary methods of WWT used in the treatment of AD:

1. Double-layer wet wrap (inner wet layer and outer dry layer) over ointment or cream applied directly to skin

Table 1
Reported complications, besides temporary systemic bioactivity, during an intervention treatment with wet-wrap dressings and (diluted) topical corticosteroids for a maximum period of 14 days

Adverse Event	Occurrence
Discomfort, including chills and poor acceptance	Frequent
Folliculitis	Common
Refractory skin lesions on the areas not covered by bandages	Common
Impetigo	Rare
Cutaneous <i>Pseudomonas aeruginosa</i> infection	Rare
Herpetic infections	Rare

From Devillers AC, Oranje AP. Efficacy and safety of 'wet-wrap' dressings as an intervention treatment in children with severe and/or refractory atopic dermatitis: a critical review of the literature. *Br J Dermatol* 2006;154(4):579–85; with permission.

2. Double layer wrap (1 layer impregnated with diluted steroids, rather than water, and 1 outer dry layer) applied directly to the involved skin.

In both methods, the use of an outer layer results in decreased evaporation of water from inner layer and, therefore, in prolonged moisturization and cooling.²⁹

The first method has been standardized for years at the authors' AD treatment program.^{12,16,30} Step care for AD as done in the National Jewish AD Program is outlined in **Box 1**.¹⁵ This step care is the basis for the recommended AD therapies and protocol for daily provider orders, as well as patient discharge orders and instructions. As used by the authors, WWT is reserved for patients with moderate to severe AD as an acute intervention.

The typical standard for this method of care includes a 10 to 15 minute bath in warm water, immediately followed by application of a topical medication (appropriate full-strength topical steroid because topical calcineurin inhibitors in the United States carry a warning not to use with occlusive dressings) to eczematous lesions and moisturizers to clear areas. Based on clinical severity as assessed with a validated outcomes tool (eg, SCORing atopic dermatitis [SCORAD]) by the attending team, patients are prescribed 2 to 3 supervised baths per day; topical and/or oral medications; moisturizer applications, usually 2 to 3 times per day; and WWT applied up to 3 times a day, tapering all therapy with improvement. WWT is done using children's normal cotton-blend clothing and detailed in **Box 2**. This is followed by applying the water-dampened wet cotton pajamas, socks, or gauze dressings covered by a dry second outer layer (**Fig. 2**). The area requiring skilled nursing technique is the face. When the face has moderate to severe AD, a low potency topical steroid is applied and wrapped with 2 layers of wet gauze followed by 2 layers of dry gauze held in place by a tubular bandage retainer. Wet wraps are left in place for approximately 2 hours. At bedtime, they may be left on overnight and, in fact, this may be beneficial in preventing trauma from patient scratching at night. Moisturizer should be applied to total body after wet wraps are removed. Significant healing of severely excoriated eczema lesions is seen after 3 to 4 days of WWT (**Fig. 3**).

In the second method, Goodyear and colleagues³¹ demonstrated efficacy of wet-wraps in a study of erythrodermic children with AD using diluted topical corticosteroids. The difference between this WWT method and the method prescribed by the investigators is that no water is applied to the bandages. The wetness results from Tubegauz impregnated with diluted topical steroids applied directly as the first layer

Box 2**Wet wrap therapy procedure**

WWT will be used to relieve inflammation, itching, and burning of AD. Wet wraps facilitate the removal of scale and increase penetration of topical medications in the stratum corneum. Skin protection provided by the wraps allows healing to take place. WWT should only be used during flares of AD under the supervision of a health care provider. They should not be used as routine maintenance therapy.

Supplies:

1. Topical medications and moisturizers
2. Tap water at comfortably warm temperature
3. Basin for dampening of dressings
4. Clean dressings of approximate size to cover involved area:
 - a. Face: 2 to 3 layers of wet Kerlix gauze held in place with Surginet.
 - b. Arms, legs, hands, and feet: 2 to 3 layers of wet Kerlix gauze held in place with Ace bandages or tube socks, or cotton gloves, or wet tube socks followed by dry tube socks. Tube socks may be used for wraps for hands and feet, and larger ones work as leg or arm covers.
 - c. Total body: combination of above, or wet pajamas or long underwear and turtleneck shirts covered by dry pajamas or sweatsuit. Pajamas with feet work well for the outer layer.
5. Blankets to prevent chilling.
6. Nonsterile gloves if desired.

Procedure:

1. Be certain that the patient's room is warm and insure privacy. Gather supplies appropriate to the individual.
2. If wraps are to be applied to a large portion of the body, work with 2 people if possible. It is necessary to work rapidly to prevent chilling.
3. Explain the procedure to the patient and parent.
4. Fill the basin with warm tap water.
5. The patient will have had a 15 to 20 minute soaking bath, in warm water without additional additives, before this procedure. Pat skin dry with a towel.
6. Apply the appropriate topical medications to affected areas and moisturizer to nonaffected areas immediately after pat drying the skin. Use clean plastic spoons or tongue depressor to avoid contamination of products in jars. This allows large areas to be covered quickly and prevent caregivers from unnecessary exposure to topical medications.
7. Soak the dressings in very warm water because they cool quickly in this process. Squeeze out excess water. Dressings should be wet, not dripping.
8. Cover an area with wet dressing chosen for the area and the patient. Immediately after wrapping, cover with appropriate dry material such as an Ace bandage, socks, or pajamas. Start at the feet and move upward. Use wet, long underwear or wet pajamas covered by dry pajamas or sweatsuit with total body involvement in place of wet gauze.
9. Take steps to avoid chilling. Blanket can be put in a dryer to warm up and cover patient but do not overheat the patient. Wraps can be removed after 2 to 4 hours or can be rewet. A warm blanket and snuggling help pass the time.
10. If patient is known or suspected to have an infection of the involved areas, place dressings in appropriate bag, and dispose according to infection control procedure.
11. After all dressings are removed, moisturizers may be applied to the entire body.

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Fig. 2. (A) Supplies for WWT. (B) Topical steroids applied to affected lesions. (C) Wet socks to eczema of extremities. (D) Wet pajamas to eczema of trunk. (E) Dry layer applied over wet layer. (F) Wet Kerlix bandage (Molnlycke Healthcare, Norcross, GA) applied to facial eczema. (G) Face wrap held in place by burn netting. (H) Completed wrap (with patient's doll also wrapped!).

and covered by an outer dry layer. It is worth noting that, outside the United States, WWT is often done using a variety of expensive dressings. Some tubular bandages, such as Tubifast (Molnlycke Healthcare, Norcross, GA), are available only by prescription. The ability to wash and reuse these expensive bandages appears to range from none to up to 20. Disadvantages reported with these tubular bandages include high cost, difficulty applying, intolerance of use, increased risk of cutaneous infections, and systemic

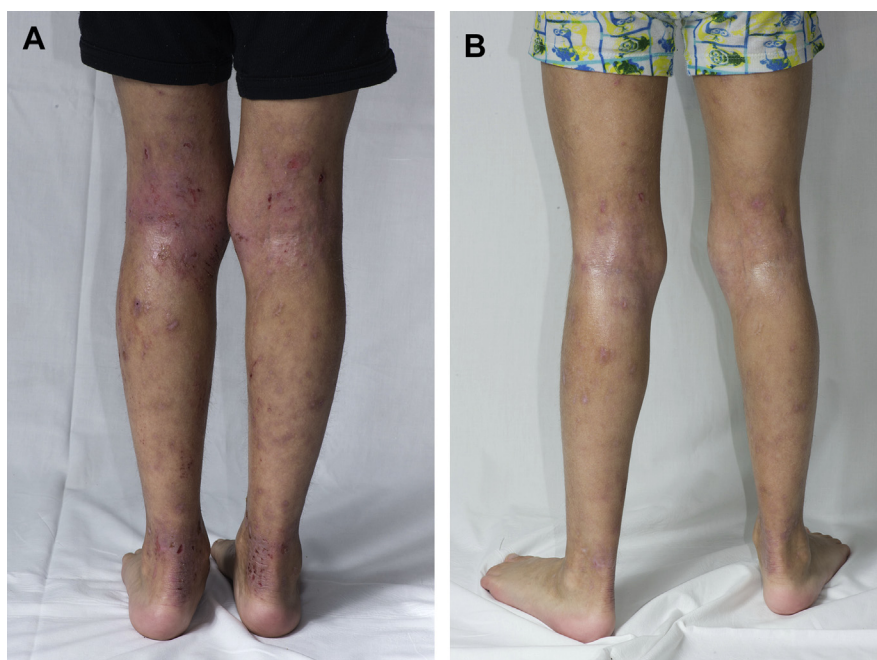


Fig. 3. (A) Severe excoriated eczema lesions on lower extremities before WWT. (B) Significant healing of severe eczema of lower extremities after 3 to 4 days of WWT.

absorption of steroid.²⁹ Of note, some investigators advocate use of WWT as part of a maintenance skin care regimen versus using as an acute intervention.³²

Wide variations in WWT methodology exist from center to center and country to country. These include lack of clarity regarding use of water (or not), use with nonsteroidal topical preparations (eg, topical calcineurin inhibitors), use with only emollients, or use of only a wrap without topical medication or moisturizer. When topical corticosteroids are used in WWT, it is often unclear if they were used full-strength, as a pharmacy-diluted solution, or in some self-compounded manner. There is also lack of clarity regarding the types of dressings and bandages used, what they were soaked in, how they were applied, how long they were applied, and skin care before and after application of the WWT.

In 2006, Devillers and Oranje²⁶ published a critical review of the literature related to the efficacy and safety of wet-wrap dressings as interventions in children with severe and/or refractory AD. The study did an inventory of methodologies to evaluate the currently available use of WWT. These investigators summarized 9 possible differences in the methodology of WWT in AD literature: topical product, type of bandages, application technique of topical product, application frequency, rewetting of the first layer of bandages, bandages left in situ, area treated, duration of treatment, and location of treatment. These 9 differences remain as critical variables in WWT today. The investigators suggest 2 additional variables: skin care immediately before application and immediately after removal of WWT. Important details in the skin care before WWT application include noting whether and how the patient is instructed to hydrate the skin and specifying whether a local soak, shower, or bath is used. When bathing is recommended, clarify length of bathing and whether a bath additive is used (eg, oils,

bleach, or other). The aftercare detail should include if or what topical is to be applied (eg, specific moisturizer or other).

Devillers and Oranje²⁶ concluded that large prospective studies evaluating the efficacy and safety profile of WWT are lacking. Their conclusions with a grade C of strength of recommendation included:

1. WWT using cream or ointment and a double layer of cotton bandages, with a moist first layer and a dry second layer, is an efficacious short-term intervention treatment in children with severe and/or refractory AD.
2. The use of wet-wrap dressings with diluted topical corticosteroids is a more efficacious short-term intervention treatment in children with severe and/or refractory AD than wet-wrap dressings with emollients only.
3. The use of wet-wrap dressings with diluted topical corticosteroids for up to 14 days is a safe intervention treatment in children with severe and/or refractory AD, with temporary systemic bioactivity of the corticosteroids as the only reported serious side-effect.
4. Lowering the absolute amount of applied topical corticosteroid to once daily application and further dilution of the product can reduce the risk of systemic bioactivity.

Evaluating Studies Using Wet Wrap Therapy

Several variables and unresolved issues are apparent when one examines the published reviews and clinical studies that incorporate WWT in the treatment of AD. Clinical studies on the efficacy of WWT published between 1991 and 2015 are listed in **Table 2**. Of the 18 studies examined,^{30–47} only 12 studies used a validated AD severity outcomes tool and only 6 were randomized controlled trials. The total number of subjects included in these studies was small. All WWT studies demonstrated efficacy of this treatment or no worsening in the WWT treatment arms. One of the 18 WWT studies had a follow-up assessment after stopping WWT as part of the study.³⁰

The largest study to date in moderate to severe AD subjects treated with WWT under direct nursing supervision and using a validated outcomes tool was done at the authors' institution.³⁰ This was a retrospective observational cohort study in a multidisciplinary AD treatment program. The study population consisted of 72 children with AD, mean age 4.6 years (SD = 3.12) ranging from 6 months to 12.8 years. Significant differences between SCORAD index means at admission 49.68 (SD = 17.72) and discharge 14.83 (SD = 7.45) demonstrate significant clinical improvement as a result of participation in this treatment program using WWT ($P \leq .0001$). The average number of days of receiving WWT was 7.5 (range 2–16 days); WWT was discontinued on all subjects before discharge. Of note, none of the subjects required systemic immunosuppressive therapy during this treatment program. Only 4 of the 72 subjects experienced mild folliculitis while using WWT. The AD Quickscore (ADQ)⁴⁸ is a parent administered questionnaire that correlated with SCORAD while the subjects were in the AD treatment program and 1 month after discharge. The results also suggest that these subjects were able to maintain improvement of their AD despite stopping WWT before discharge³⁰ (**Fig. 4**). This study demonstrates the benefit of an intensive multidisciplinary AD treatment program consisting of supervised skin care incorporating WWT in improving AD severity. Subjects treated in this unique outpatient AD program had moderate to severe AD and were failing outpatient therapy. This study showed that these subjects could be managed without systemic immunosuppressive therapy and were able to transition off of WWT before discharge from the program.

Table 2
Clinical studies on the efficacy of wet-wrap treatment

Investigators, Year	Study Design	Subjects	Validated AD Severity Yes/No, Measure Result
Abeck et al, ³³ 1999	Prospective observational	N = 6 3 children (3–12 y) and 3 adults	Yes, SCORAD Improved SCORAD index in WWT
Beattie & Lewis-Jones, ³⁴ 2004	Prospective randomized controlled trial	N = 19 Children (4 mo–3 y)	Yes, SASSAS No difference between groups; all improved Mild population: only HC 1% required
Dabade et al, ³⁵ 2012	Retrospective observational inpatient comparison	N = 218 Children (2 mo–17 y)	No, IGA: no objective score >90% improvement in WWT
Devillers et al, ³⁶ 2002	Retrospective observational inpatient side-to-side comparison	N = 26 14 children (6 mo–10 y) and 12 adults	Yes, SCORAD Improved modified objective SCORAD index in WWT
Foelster-Holst et al, ³⁷ 2006	Prospective randomized controlled trial, left or right study	N = 24 Adults (18–63 y) and children (6–16 y)	Yes, SCORAD Improved SCORAD index both treatment arms significantly better in WWT
Goodyear et al, ³¹ 1991	Prospective observational	N = 30 Children (9 m–16 y)	No, IGA >90% clear in WWT
Hindley et al, ³⁸ 2006	Prospective randomized controlled trial	N = 50 Children (4–27 mo)	Yes, SCORAD Improved SCORAD index in all treatment arms; moderate to severe wraps varied 12–24 h vs none; 4-wk trial
Hon et al, ³⁹ 2007	Prospective observational case studies	N = 6 Children (3–15 y)	Yes, SCORAD Improved SCORAD index in WWT
Leloup et al, ³² 2015	Prospective open-label	N = 17 Children (<18 y)	Yes, SCORAD and subject questionnaire Improved SCORAD “satisfied & tolerated”

Janmohamed et al, ⁴⁰ 2014	Prospective, randomized controlled trial, double-blind, placebo-controlled trial	N = 39 Children (6 mo–10 y)	Yes, SCORAD Improved SCORAD WWT with diluted corticosteroids more than WWT with emollients
Mallon et al, ⁴¹ 1994	Prospective observational	N = 21 Children (4 mo–10 y)	No, IGA and parental questionnaire “All responded well”
Nicol et al, ³⁰ 2014	Retrospective observational-nurse supervised	N = 72 Children (6 mo–12.8 y)	Yes, SCORAD Improved SCORAD index in WWT; lasting benefit 1 mo after discontinuing WWT intervention
Oranje & de Waard-van der Spek, ⁴² 1999	Prospective observational	N = 7 3 children (6 mo–4 y) and 4 adults	Yes, SCORAD Improved modified objective SCORAD index with WWT
Pei et al, ⁴³ 2001	Prospective randomized controlled trial	N = 40 Children (1–15 y)	No, CSS and parental questionnaire Improved CSS and parental questionnaire in both groups using different topical steroid and WWT
Schnopp et al, ⁴⁴ 2002	Randomized controlled trial; inpatient comparison side-to-side	N = 20 Children (2–17 y)	Yes, SCORAD Improved Regional SCORAD index and TEWL in steroid-containing WWT vs vehicle WWT
Tang & Chan, ⁴⁵ 1999	Prospective observational	N = 12 Children (3–12 y)	No, CSS and self-assessment WWT effective
Tang, ⁴⁶ 2000	Prospective observational	N = 10 Children (4–15 y)	No, IGA and parental assessment WWT “good”
Wolkerstorfer et al, ⁴⁷ 2000	Prospective observational; comparison of 3 arms	N = 31 Children (5 mo–13 y)	Yes, SCORAD Improved modified objective SCORAD index with WWT

Abbreviations: CSS, clinical severity scoring; IGA, investigator’s global assessment; SASSAD, six area, six sign atopic dermatitis.

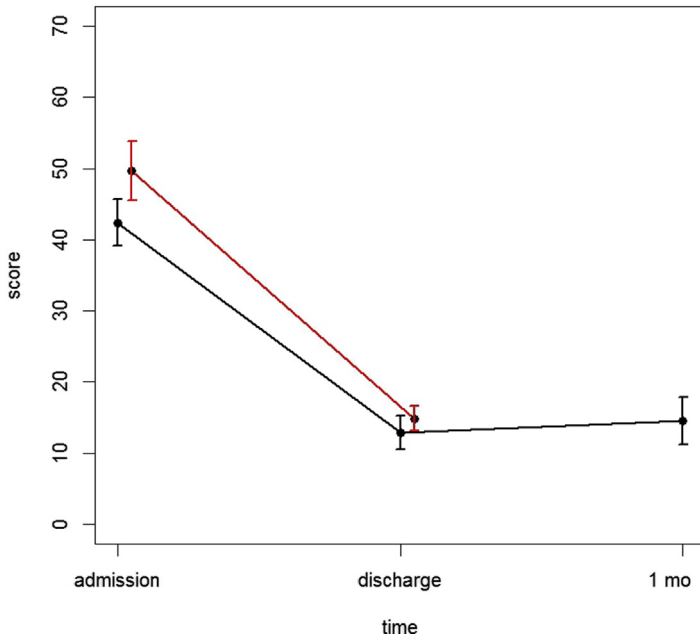


Fig. 4. Sustained improvement in severity of AD (SCORAD) 1 month after discontinuing WWT as measured by ADQ. Mean ADQ (*lower line*) versus SCORAD (*top line*), with 95% confidence limits. (From Nicol NH, Boguniewicz M, Strand M, et al. Wet wrap therapy in children with moderate to severe atopic dermatitis in a multidisciplinary treatment program. *J Allergy Clin Immunol Pract* 2014;2(4):405; with permission.)

Importantly, WWT was used as an acute treatment intervention, not part of a maintenance regimen.

SUMMARY

National and international AD guidelines address AD care in a stepwise fashion. The literature, as well as the authors' experience, suggests that WWT plays an important role as an acute therapeutic intervention for management of moderate to severe AD used with undiluted topical corticosteroids of appropriate potency. Simplifying WWT by using clothing in place of bandages makes this treatment simpler, less time intensive, and less expensive. Education of patients and caregivers is critical to the success of WWT. WWT methodology needs to become more standardized. Future WWT studies need to carefully describe all components of WWT procedures. Incorporation of the SCORAD index or other validated outcomes tools would help with interpretation of future studies using WWT. WWT should be considered as a treatment option ahead of systemic immunosuppressive therapies for patients failing conventional topical therapy.

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