ORIGINAL ARTICLE

A randomised study of "wet wraps" versus conventional treatment for atopic eczema

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Aims: To compare two treatments in common usage for children with atopic eczema: "wet wrap" bandages versus conventional topically applied ointments.

Methods: A total of 50 children (age 4-27 months) with moderate to severe eczema were randomised to one or other treatment. Two research nurses supervised the study. The first gave advice and support, and the second, blinded to the treatment modality being used, scored the change in eczema severity over a period of four weeks using the SCORAD eczema severity scale.

Results: Both treatments gave a benefit in overall SCORAD scores (mean change for wet wrap group was 53 to 24; for the conventional group, 41 to 17). There was no significant difference between the two groups in terms of overall improvement at four weeks or in the timescale of improvements. The amount of topical of topical steroid used was similar in both groups. The wet wrap group suffered significantly more skin infections requiring antibiotics. Carers reported that wet wraps were less easy to apply than conventional treatment.

Atopic eczema is a common and disabling condition in infancy and childhood. Treatment is symptomatic, and is often uncomfortable, time consuming, and complicated.¹ In recent years we have used a method of treatment for atopic eczema known as "wet wrapping" with encouraging results. This method involves using tubular retention bandages applied wet as occlusive dressings over conventional emulsifying ointments and topical steroids to eczematous areas. We found no previous studies comparing the efficacy of wet wraps versus (non-wet wrap) conventional treatment. There are personal views²⁻³ and case reports about the use of wet wraps for the acute management of exacerbations of eczema.⁷⁻⁹ The purpose of this randomised, single blinded study was to compare the effectiveness of wet wrapping with conventional eczema treatment when used as maintenance treatment over a four week period. Parents' views on the benefits and ease of application of these different treatment methods were also collected.

METHODS

Participants

The study was conducted in a Secondary Care Paediatric Department at Fairfield General Hospital, Bury in Greater Manchester. Children were referred by general practitioners, health visitors, and paediatric colleagues, and were recruited to the trial according to the following criteria: age 3 months to 5 years; clinical diagnosis of atopic eczema according to the criteria of Hanifin and Rajka;⁴ the child had moderate or severe eczema as determined by assessment made according to the SCORAD index (SCORing Atopic Dermatitis).⁵⁻⁶ On this system a composite score of eczema severity is determined based on the surface area involved, intensity of symptoms, and subjective symptoms such as sleep disturbance and pruritus. The total possible score is 103. Mild eczema is defined as a score less than 15, moderate eczema a score more than 15 and less than 40, and severe eczema as a score greater than 40. To qualify for enrolment children therefore had SCORAD scores >15; perhaps because of this most had previously received some form of treatment for eczema prior to referral (see table 2).

Children were excluded from the study if there was active skin infection at enrolment, if there had been previous allergic reactions to proposed trial treatments, or if eczema was predominantly on the face.

Procedure

At referral a medical examination was performed to confirm the diagnosis of eczema. Provided the child met the inclusion criteria, informed consent was obtained. Each child was randomised to receive wet wraps for four weeks or conventional treatment for four weeks. At enrolment the child and carers were seen by a research nurse ("education nurse") who undertook an education session about atopic eczema including advice about application of ointments, administration of other treatments, application of wet wraps if required, and allergen avoidance.

Interventions

Conventional treatment included regular use of emollients (applied at least three times daily and "whenever skin is dry"), as required use of 1% hydrocortisone ointment (applied twice daily), and if necessary, use of more potent topical steroids. The wet wrap treatment included one week of wet wraps initially applied daily for 24 hours a day over 1% hydrocortisone ointment (and if necessary more potent topical steroids) followed by wet wraps 12 or 24 hours a day depending on progress as assessed by the "education nurse". When wet wraps were used for 12 hours a day, 1% hydrocortisone and emollients were used as required during the non-wet wrap period. Both groups were given information about allergen control, a sedative antihistamine at night as required, and oral antibiotics as required during the study period. The "education nurse" visited regularly during the four weeks to troubleshoot and advise.

Objectives

The objective was to compare the effectiveness of wet wrapping and conventional eczema treatment when used as maintenance treatment over a four week period in children between 3 months and 5 years of age with moderate to

Table 1 Demographics

	Wet wraps n = 23	Conventional n = 22	Total n = 45
Sex: females, n (%)	9 (39%)	9 (41%)	18 (40%)
Age (mth): median (IQR)	8 (4 to 27)	14 (7 to 22)	10 (5 to 26)
Weight* (kg): mean (SD)	10.0 (3.9)	10.7 (3.2)	10.3 (3.6)

*Weight not available for two children in the wet wraps group.

severe eczema. The trial is reported according to the CONSORT format for randomised controlled trials.¹³

Outcomes

Patients were assessed using the SCORAD index after 96 hours, 1 week, 2 weeks, and 4 weeks post-enrolment by a second research nurse ("scoring nurse") who was blinded to the treatment modality in use. A record of the potency and amount of topical steroid used was made at each visit. Side effects were monitored and noted.

At the end of the four week period, carers and the "scoring nurse" made separate overall assessments of efficacy, tolerability, and ease of application of a given treatment scoring on a five point scale, the categories for efficacy being "none" to "very good"; for tolerability "very poor" to "very good"; and for ease of application being "very difficult" to "very easy". The primary outcome was SCORAD index at four weeks post-enrolment.

The Bury & Rochdale Local Research Ethics Committee approved the study.

Statistical methods

Sample size

Sample size was estimated based on the percentage of patients that would show a change from moderate to mild severity at 4 weeks in their SCORAD score. From our own experience we expected 70% to show an improvement at 4 weeks in the wet wrap group compared to 40% in the control group. With a sample size of 49 in each group, the study would have a power of 80% at a 0.05 significance level to detect such a difference. Assuming a 5% loss to follow up, this suggested a total sample size of 103 patients.

Randomisation

Children were randomised to receive wet wraps for four weeks or conventional treatment for four weeks. Two equal numbered sets of unmarked envelopes were prepared containing either the word "wet wrap" or the word "conventional". After informed consent was given, an envelope was chosen at random, opened, and the child allocated to the indicated group. The results of randomisation were explained to the carers/child by the "education nurse".

Figure 1 Participant flow.

Blinding

Children, parents, and the "education nurse" were not blind to allocation. The "scoring nurse", who was blind to allocation, assessed the SCORAD, potency, and amount of topical steroid used and noted side effects. Parents were asked to remove any wet wraps and to bathe the child prior to appointments with the "scoring nurse" so that skin marks from wet wraps would fade and not compromise blindness.

Statistical methods

Comparison of week 4 outcomes between children allocated to wet wraps and children allocated to conventional treatment was made using linear regression. The analyses adjusted for the baseline measure of the outcome since there was a substantial discrepancy in the baseline scores between the groups. The mean amount of topical steroid used over the four weeks was calculated for each child. Comparison between the wet wrap and conventional groups was made using an independent *t* test. The proportions of children who used antihistamines and antibiotics were compared between

Table 2 Treatment history

	Wet wraps n = 23	Conventional n = 22	Total n = 45
Age at symptom onset (mth): median (IQR)	2 (1-4)	2 (2-4)	2 (1-4)
Family history of eczema: n (%)	18 (78%)	18 (82%)	36 (80%)
Family history of atopy: n (%)	21 (91%)	20 (91%)	41 (91%)
Breast fed: n (%)	9 (39%)	7 (32%)	16 (36%)
Previous treatment with wet wraps: n (%)	2 (9%)	3 (14%)	5 (11%)
Previous treatment with emollients: n (%)	22 (96%)	22 (100%)	44 (98%)
Previous treatment with 1% hydrocortisone: n (%)	20 (87%)	21 (96%)	41 (91%)
Previous treatment with other topical steroids: n (%)	6 (26%)	5 (23%)	11 (24%)
Ever treated with antibiotics: n (%)	11 (48%)	12 (54%)	23 (51%)
Ever treated with antihistamines: n (%)	6 (26%)	8 (36%)	14 (31%)
Ever treated with dietary exclusion: n (%)	12 (52%)	9 (41%)	21 (47%)

the groups using Fisher's exact tests and Miettinen 95% confidence intervals. For the nurses and parent questionnaires, positive responses were grouped together and compared against the other responses. χ^2 tests and Miettinen 95% confidence intervals were used to compare between groups.

RESULTS

Participant flow

A total of 50 children were recruited (28 in the wet wraps group and 22 in the conventional group). Outcome data were not available for five children in the wet wraps group, four children withdrew between the baseline and 96 hour visit, and one withdrew between the 96 hours and week 1 visit (see fig 1). This meant that intention to treat analyses were not possible.

Recruitment

This started on 10 July 2000 and finished on the 20 July 2003, by which stage 50 children had been enrolled. Recruitment was slower than expected and for this reason, and also because an interim statistical analysis suggested clinically significant adverse differences between the two groups; recruitment was discontinued at this point. Collection of the final four week data finished on 18 July 2003.

Baseline data and numbers analysed

Demographics, treatment history, and baseline measures for the 23 children with complete outcome data allocated to the wet wraps group and the 22 children allocated to the conventional treatment group are presented in tables 1–3.

The majority of children were under 2 years of age. There was no difference in the age distributions of the two groups.

Outcomes and estimation

Table 2 suggests that both groups had poorly controlled eczema at baseline despite having previously received basic treatments (emollients, 1% hydrocortisone) in most cases, and antibiotics or dietary intervention in around half of the patients.

Figure 2 Change over time of SCORAD.

Table 3 Baseline scores

	Wet wraps n = 23	Conventional n = 22	Total n = 45
SCORAD: mean (SD)	53 (15)	41 (15)	47 (16)
Extent score: mean (SD)	61 (22)	49 (24)	55 (24)
Intensity score: mean (SD)	7 (3)	5 (2)	6 (3)
Subjective score: mean (SD)	17 (7)	13 (5)	15 (7)

In both groups there was an improvement in SCORAD scores. The mean SCORAD score for the wet wrap group improved from a mean of 53 to a mean of 24 (55% reduction); in the conventional group the mean baseline score was 41, improving to 17 (59% reduction) after four weeks.

Change over time of SCORAD

No evidence of a significant difference was found between the two interventions (see fig 2). Children receiving conventional treatment had slightly lower scores at 4 weeks; intervention effect was -3.4 (95% CI -12.2 to 5.5). The results of the other outcome measures—"extent", "intensity" and "subjective"—were similar (see table 4).

Withdrawals

There were five withdrawals from the study due to non-compliance. All withdrawals were in the wet wraps group: 5/28 (18%) versus 0/22 (0%) ($p = 0.057$).

Concomitant treatments

All children used steroids of mild potency, except one allocated to the wet wrap group who received a potent steroid between the 96 hour visit and week 1 visit and was subsequently withdrawn. A record of the amount of topical steroid used was available for 24 children in the wet wrap group and 20 children in the conventional treatment group. Although the mean amount of steroid used over the four weeks was higher in the conventional intervention group, no evidence of a difference in the population was found; mean difference (wet wrap minus conventional) was -0.56 g/day (95% CI -1.9 to 0.8 g/day, $p = 0.404$).

The use of antihistamines was similar in both groups. Three children (13%) in the wet wrap group received antihistamines compared to three children (14%) in the conventional treatment group; the difference was 22% (95% CI -23% to 21% , $p > 0.999$).

There was evidence that more children received antibiotics under wet wrap treatment compared to conventional treatment. Five children (22%) in the wet wraps group received antibiotics compared to none of the children in the conventional treatment group; difference was 22% (95% CI 5% to 42% , $p = 0.05$). No other side effects or problems were reported.

Nurse and carers questionnaire (table 5)

There was general agreement between the "scoring nurse" and carers that both treatments improved eczema control. Wet wraps were considered significantly less easy to use than conventional treatment.

DISCUSSION

Interpretation

This study has shown that over a period of four weeks a considerable improvement in eczema severity can be achieved using either wet wraps or conventional treatment. In the two groups studied there was no difference in the degree of this

Table 4 Outcome measures

Outcome	Wet wraps n = 23 Mean (SD)	Conventional n = 22 Mean (SD)	Effect of allocation* (95% CI)	p value
SCORAD	24.0 (15.3)	17.0 (12.8)	-3.4 (-12.2 to 5.5)	0.445
Extent	25.2 (22.0)	16.9 (17.5)	-5.3 (-17.3 to 6.6)	0.373
Intensity	2.7 (2.5)	1.8 (1.4)	-0.2 (-1.5 to 1.1)	0.726
Subjective	9.1 (5.2)	7.3 (5.4)	-1.3 (-4.6 to 2.1)	0.452

*Effect of intervention from linear regression model, after adjustment for baseline measure.

improvement. There were no demonstrable differences in any of the subgroup scores or in the timescale of improvements. Both groups received intensive education about eczema and support in the application of treatments from an experienced community paediatric nurse. The benefit of education and support in the management of atopic eczema has previously been reported.¹²

The amount of hydrocortisone used over the four weeks was similar for both groups. The absorption of steroids and possible effects on the pituitary-adrenal axis were not examined. There is some concern that wet wrapping may enhance percutaneous absorption of topical steroids.⁷⁻⁹ On the other hand there was an increased use of 1% hydrocortisone in the conventional group, which although it did not reach significance in this study over a six month period, could become so.

Twenty two per cent of children receiving wet wraps required antibiotics for infective exacerbations of their eczema, significantly more than those in the non-wet wrap group. This has been mentioned in a previous report as a cause for failure of long term treatment with wet wraps,⁷ and mentioned as a problem in a questionnaire study about wet wraps.¹¹

In both groups the "scoring nurse" and the child's carers felt that there was a beneficial effect ("better" or "much better") in 60–70% of cases that finished the trial. Carers found conventional care easier to apply; this may explain why the five children who dropped out of the study were all in the wet wrap group. Difficulty maintaining wet wrap treatment long term has been reported.⁷

There were limitations to the study, in particular: some differences between the two groups at baseline, suggesting a possible bias in randomisation; the inability to undertake an intention to treat analysis; the discontinuation of the trial prior to reaching the recruitment numbers suggested by the initial power calculation (in part because of slower than expected recruitment, but also because of the results of an interim analysis); and the possible difficulties with ensuring blindness of the scoring nurse (who felt that skin marks indicating use of wet wraps were not apparent on scoring).

Generalisability

The data presented concern the treatment of moderate to severe eczema in young children over a four week period. Although the inclusion criteria allowed recruitment up to 5 years of age, the oldest child enrolled in the study was 27 months. The results cannot be extrapolated to older children and adults or to the use of wet wraps for the short term treatment of exacerbations of eczema or their prolonged usage. Children in this study only used 1% hydrocortisone under wet wraps, and the results do not apply to wet wraps with more potent steroids.

Overall evidence

There are few published studies about the use of wet wraps for the treatment of eczema. Goodyear and colleagues⁷ reported 30 children with acute erythrodermic eczema treated with wet wraps soaked in weak topical steroid creams with 90–100% improvement of eczema severity. Abeck and colleagues⁸ used chlorhexidine soaked dressings with emollients and found pronounced improvements. Oranje *et al* showed 0.05% fluticasone propionate cream/emollient 1:1 dressings to be highly effective for three children and four adults with severe erythrodermic atopic dermatitis.⁹ Pei and colleagues¹⁰ showed an improvement in eczema severity in children with moderate to severe disease after two weeks of either 0.1% mometasone furoate or 0.05% fluticasone propionate, with a further improvement in those given wet wrap treatment for an additional two weeks over these preparations compared to those continuing with topical treatment alone. Despite this limited evidence, base wet wraps are widely used, and concern has been expressed about the variation in wet wrap regimes and the supervision of children treated in this way.¹¹

Our study adds to the evidence about the use of wet wraps in young children with eczema. Though there may be clinical situations (for example, short term treatment of acute erythrodermic atopic eczema) where wet wraps are a useful option, we found no advantages of wet wraps to conventional treatment when used over a four week period, and some disadvantages, including increased skin infections and parental views that wet wraps are less easy to use.

Table 5 Questionnaire responses

	Wet wraps n = 23	Conventional n = 22	% difference (95% CI)	p value
Nurse response to "What difference has the treatment made to the eczema control?": Better or much better, n (%)	15 (65%)	13 (59%)	6% (-22% to 33%)	0.672
Carer response to "What difference has the treatment made to the eczema control?": Better or much better, n (%)	16 (70%)	14 (64%)	6% (-22% to 33%)	0.758
Carer response to "How easy has the treatment been to use?": Easy or very easy, n (%)	9 (39%)	16 (73%)	-33% (-58% to -4%)	0.036
Carer response to "How easy has the treatment been to tolerate?": Easy or very easy, n (%)	11 (48%)	14 (67%)	-19% (-45% to 11%)	0.239

What is already known on this topic

- Wet wraps are commonly used for the treatment of eczema in childhood
- Wet wraps can be useful for the treatment of acute exacerbations of eczema

What this study adds

- Conventional treatment or wet wraps can both lead to substantial improvement in eczema severity if accompanied by intensive education and support
- Maintenance treatment with wet wraps is harder to use and may be associated with more skin infections than conventional treatment

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Urinary tract infection caused by bacteria other than *Escherichia coli*

Between 65% and 90% of urinary tract infections (UTIs) in children are caused by *Escherichia coli*. Other pathogens include *Klebsiella* species, *Proteus* species, *Pseudomonas aeruginosa*, and *Enterococcus* species. Researchers in Israel (Nir Marcus and colleagues. *The Paediatric Infectious Disease Journal* 2005;24:581–5) have compared *E coli* with non-*E coli* infections.

During 2001 and 2002 at a tertiary paediatric medical centre 158 children had 175 episodes of culture-proved, community acquired UTI. Most urine samples for culture were obtained by catheterisation (110) or suprapubic aspiration (41). The children's mean age was 31 months; 50 episodes were in neonates and 59 in infants over 1 month. Ninety-eight episodes were in girls. Seventy episodes were caused by bacteria other than *E coli*. The non-*E coli* pathogens were *Klebsiella* spp. (22), *Pseudomonas aeruginosa* (17), *Enterococcus* spp. (14), *Proteus* spp. (8), *Enterobacter* spp. (5), coagulase-negative staphylococci (3), and *Acinobacter* spp. (1). Thirty-seven of 105 *E coli* infections and 40 of 70 non-*E coli* infections were in boys. Ten *E coli* infections and 21 non-*E coli* infections followed antibiotic therapy in the previous month. Twenty-three episodes occurred in children given prophylaxis after a previous UTI. Seven of these episodes were due to *E coli* and 16 to non-*E coli* pathogens. Eight children had received prophylaxis with a β -lactam antibiotic and all eight had a non-*E coli* infection. Among children given prophylaxis with trimethoprim-sulphamethoxazole *E coli* infection was no less likely than non-*E coli* infection. An underlying renal abnormality was found significantly more often after non-*E coli* infection (46/70 vs 47/105). Non-*E coli* pathogens were significantly more likely to be resistant to a wide range of antibiotics and 19% of non-*E coli* infections (vs 2% of *E coli* infections) were treated initially with inappropriate intravenous antibiotics. The fever tended to be slightly lower with non-*E coli* infection but the clinical course was similar in the two groups.

Non-*E coli* UTI was common in this series and associated with male sex, recent antibiotic therapy, and underlying renal abnormality. Antibiotic resistance was more frequent than with *E coli* UTI.