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Beyond the standard: targeted reapplication in palmoplantar scabies of infants

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Abstract

Infantile scabies can be challenging to treat because of behavioural and anatomical factors that reduce the efficacy of topical therapies. In this small prospective cohort study, there were 22 neonates and infants with persistent palmoplantar scabies. Patients were treated exclusively with permethrin 5% cream. All patients initially failed the standard regimen consisting of one full-body application, followed by a second application after 7 days. In 1 group, 11 infants received an intensified regimen with 3 additional nights of targeted application to the hands and feet (intervention group), while in a second group, 11 continued with the standard regimen only (control group). Complete resolution was observed in all 11 patients in the intervention group, compared with none in the control group. Frequent infant behaviours, including spontaneous kicking, leg movements and habitual fist clenching, probably reduced drug contact time on the palms and soles. These findings indicate that standard topical regimens may be insufficient in this population and that targeted reapplication, combined with caregiver education, can optimize treatment outcomes in infants.

Scabies is a contagious parasitic skin infestation caused by *Sarcoptes scabiei* var. *hominis*, affecting over 200 million people worldwide.[1] A rising incidence has been observed in several regions, including a fivefold increase in incidence in Bologna since 2013.[2] Children, immunocompromised individuals and people living in densely populated settings are particularly vulnerable. In infants, lesions commonly affect the head, palms, soles and ankles, and may present as pustular and polymorphous eruptions.[3] Infants require tailored diagnostic and therapeutic approaches because of their distinct clinical presentation and increased susceptibility.[4,5]

Permethrin 5% cream is widely used as first-line therapy for scabies due to its safety profile in neonates over 2 months of age;[5] however, treatment failure has been increasingly reported not only in adults but also in young children.[6,7] While contributing factors include incorrect application, resistance and reinfestation, infant-specific behavioural and anatomical characteristics may further reduce treatment effectiveness.

A key under-recognized factor is palmoplantar occlusion in infants: constant fist clenching and repetitive movements of the feet, such as rubbing, kicking or alternating flexion and extension, may lead to premature removal of the cream. Additionally, friction with clothing can absorb the medication, reducing its contact time with the skin and ultimately its therapeutic efficacy. These behaviours may create a niche where *S. scabiei* can persist despite an initial correct application. Given this issue, we hypothesized that additional targeted treatment of the palms and soles may improve outcomes in this age group.

Report

We conducted a prospective observational study at the paediatric dermatology unit of Sant'Orsola-Malpighi Hospital, Bologna, Italy, between October and December 2024. All infants presented to our unit with suspected scabies who had experienced treatment failure within 45 days of an initial permethrin prescription were consecutively screened for eligibility. Eligible patients were identified at the first follow-up visit after treatment failure and invited to participate. If the parents/carers agreed, they were then allocated sequentially into two groups (Figure 1).

The diagnosis was established according to the 2020 International Alliance for the Control of Scabies criteria.[6] Each infant underwent a standard clinical examination by two dermatologists. Lesions were examined with handheld dermoscopy to identify the typical 'delta-wing jet with contrail' sign.[1] In doubtful cases, skin scrapings were taken from lesions and examined under light microscopy using an oil-drop preparation to confirm the presence of mites, eggs or scybala. Only infants with a confirmed diagnosis (clinical plus dermoscopic or microscopic confirmation) were included.

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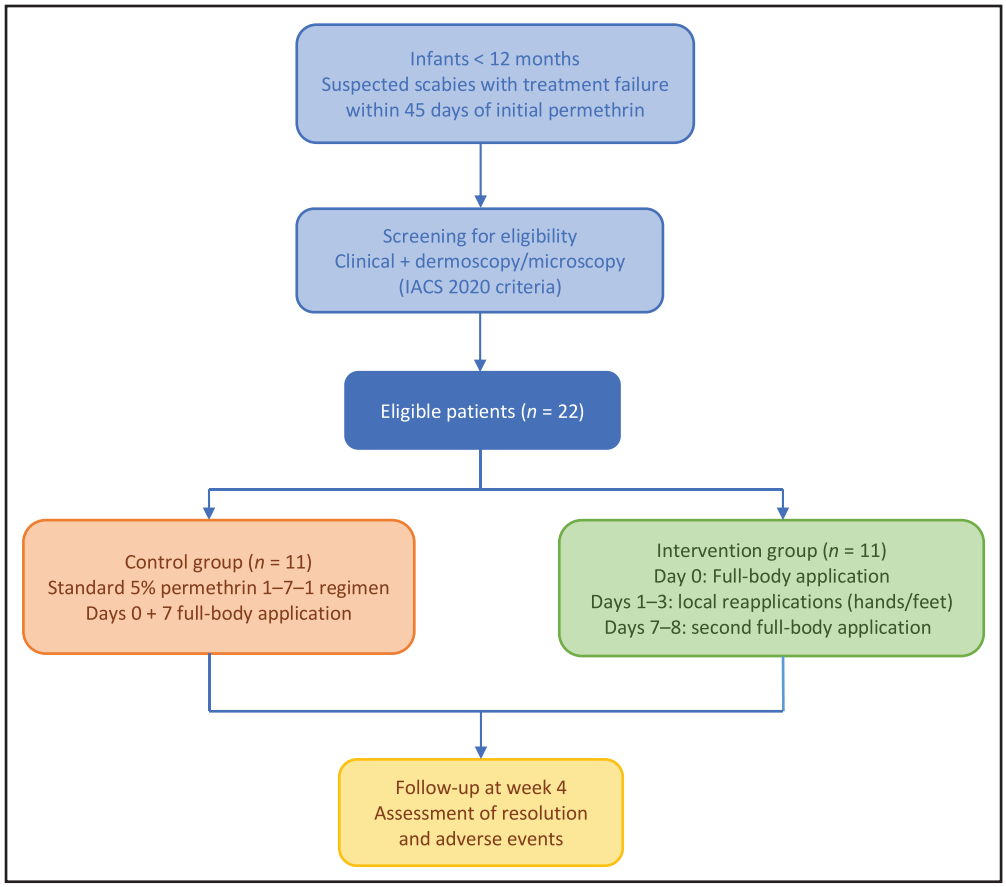

Figure 1 Study flowchart. IACS, International Alliance for the Control of Scabies.

All patients had initially received standard 5% permethrin treatment using a 1–7–1 regimen (applications on day 0 and day 7, each for 8–12 h), including palms and soles, according to European guidelines.[7] Inclusion criteria were age < 12 months, persistent palmoplantar infestation (defined as the presence of active palmoplantar lesions and dermoscopic evidence of mites) at week 2 after standard treatment and exclusive use of permethrin 5% cream. Exclusion criteria included immunosuppression, unconfirmed infestation, prior systemic scabicides and comorbid skin diseases.

We recorded demographic data, number of household members, ethnicity and source of contagion (Table 1). A structured questionnaire was used to assess behavioural

Table 1 Comparison of demographic, clinical and behavioural characteristics between 22 infants treated with the standard protocol and those treated with the modified protocol

Variable	Standard protocol (*N* = 11)	Modified protocol (*N* = 11)	*P*-value
Age (months), median (range)	7 (3–10)	6 (3–11)	0.86
Sex (male/female)	5 (45)/6 (54)	6 (54)/5 (45)	> 0.99
Ethnicity			
White	7 (64)	5 (45)	0.65
North African	4 (36)	4 (36)	–
South Asian	0 (0)	2 (18)	–
Household members, median (range)	5 (3–7)	5 (3–7)	0.93
Source of contagion			
Family (parent/sibling/extended)	10 (91)	9 (82)	> 0.99
Daycare	1 (9)	2 (18)	–
Caregiver instruction adherence			
Adequate	9 (82)	9 (82)	> 0.99
Partial/inadequate	2 (18)	2 (18)	–
Behavioural factors			
Fist clenching	11 (100)	10 (91)	> 0.99
Leg movements	9 (82)	7 (64)	0.64
Resolution at 4 weeks	0 (0)	11 (100)	< 0.001

Data are presented as *n* (%) unless otherwise stated. No statistically significant differences were observed between the two groups in terms of age, sex, ethnicity, household size, source of contagion or caregiver adherence to instructions.

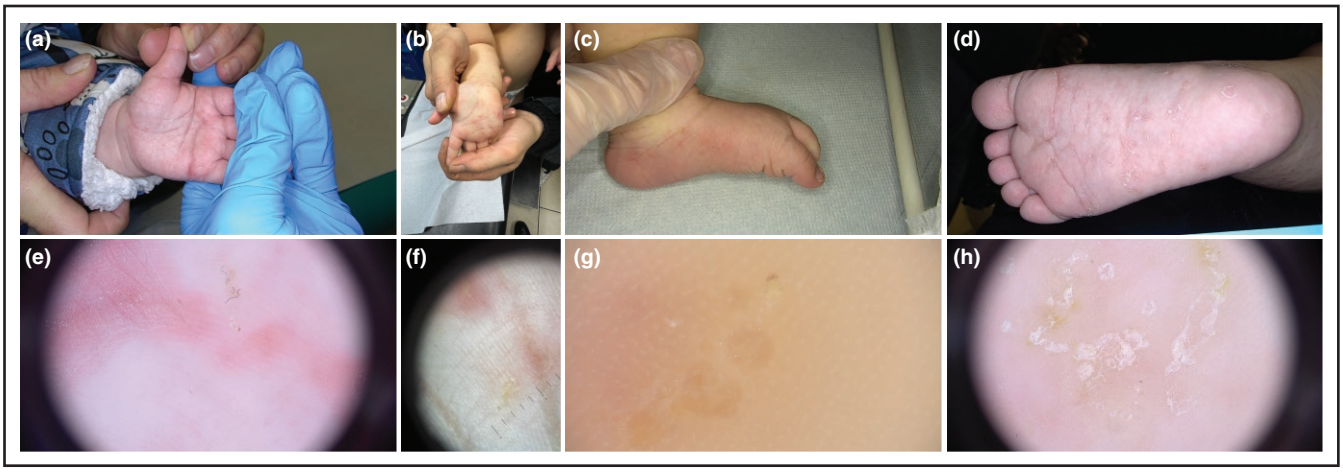

Figure 2 Macroscopic and dermoscopic findings in palmoplantar regions. Images of neonates and infants with persistent palmoplantar scabies at follow-up, 2 weeks after the first standard treatment. (a–d) Macroscopic views showing erythematous papules, burrows and desquamation on the palms and soles. (e–h) Corresponding dermoscopic images highlighting typical scabies features, including burrows and jet sign (magnification × 10).

factors: sock wearing, fist clenching and frequent leg movements. Follow-up was scheduled at week 4.

Patients were sequentially assigned to 1 of 2 groups ($n = 11$ in each group). The intervention group received permethrin treatment as follows: a full-body application (from the neck down, including under fingernails and toenails) on day 0; additional localized reapplications to the hands and feet (including interdigital spaces and wrists/ankles) on days 1, 2 and 3; and a second full-body application on day 7 or 8 (Figure 2). All applications were left on the skin for 8–12 h before rinsing.[7] All caregivers received written documents explaining the treatment modalities.

Assuming a persistence rate of 50% in the control group and < 10% in the intervention group, a sample size of 22 patients was calculated to provide 80% power with a statistical significance level of 0.05. Statistical analyses were performed using IBM SPSS version 26 (IBM Corp., Armonk, NY, USA). Visual representations were produced in Python (Python Software Foundation, Wilmington, DE, USA) using Matplotlib and Seaborn.

In total, 22 infants (median age 6 months; range 3–11 months; 50% male) were included. Ethnicities were 10 (45%) White, 7 (32%) North African and 5 (23%) South Asian. The average household size was five (range 3–8). The source of contagion was familial in 18 (82%) patients and daycare-related in 4 (18%). At 4 weeks, all 11 (100%) patients in the intervention group achieved complete resolution, whereas no patients in the control group recovered, all exhibiting persistent palmar and plantar infestation (Table 1). Behavioural patterns were frequent, such as spontaneous kicking in 20 (91%) compared with 18 (82%), fist clenching in 22 (100%) compared with 20 (91%) and frequent leg movements in 18 (82%) compared with 14 (64%). No systemic adverse events were reported, but two infants (9%) in the intervention group had mild local irritation that resolved spontaneously.

This study highlights how palmoplantar localization may represent a treatment-resistant reservoir in infantile scabies. Despite appropriate application, all patients initially showed persistent lesions in these regions. The infant palmoplantar skin is structurally and functionally different from that of older children and adults. It has a thinner stratum corneum, higher hydration and a more alkaline pH, which may increase permethrin absorption but reduce its retention time.[8] Additionally, sweat gland density and vascularization are higher in these areas, which may dilute the topical agent or alter its local bioavailability. Behavioural habits exacerbate these challenges. Fist clenching potentially shields mites and limits drug permanence. Spontaneous kicking and repeated leg movement probably displace the cream before adequate penetration occurs. These mechanisms may explain the consistent failure of standard regimens in our cohort. Importantly, the reinforced protocol, which included three nights of targeted application to hands and feet, resulted in complete resolution in all patients and strongly suggests that region-specific retreatment may overcome localized resistance mechanisms (poor treatment response).

Recent literature has shown recognition of these anatomical and behavioural factors as determinants of treatment failure. For example, Riebenbauer *et al.*[5] found that an intensified regimen with additional days of targeted palmoplantar application led to a cure rate of over 70%, outperforming standard protocols in infants and young children, supporting our observation that intensive, site-specific therapy on the hands and feet can be crucial for achieving resolution in paediatric scabies, rather than attributing failures solely to pharmacological resistance. Simonart and Lam Hoai[9] further contextualized the current spread of drug-resistant scabies and recommended reinforced and site-intensive regimens, emphasizing the need for adjusted dosages and repeated applications for 'protected' zones, especially in the paediatric population. Finally, Baffa *et al.*[10] explored alternative topical agents with old-fashioned sulfur ointments, obtaining high clearance rates precisely through prolonged and region-targeted application, suggesting that therapeutic success in children may depend more on protocol adjustment and site-specific retreatment than merely on the choice of agent. Other reports have emphasized whole-body coverage in paediatric scabies; however, few have proposed targeted therapeutic intensification in anatomically protected zones.[6,7] Our findings suggest

that treatment failure may not stem from drug resistance or pseudoresistance but from anatomical and behavioural barriers to effective delivery. Notably, both groups had comparable adherence to caregiver instruction, suggesting that behavioural factors were inherent to the infants themselves and not related to application quality.

In conclusion, in neonates and infants, palmoplantar regions may serve as treatment-resistant niches because of a combination of skin physiology and behavioural patterns. Standard permethrin treatment may be insufficient in these areas. A modified approach, involving three additional days of localized application to the hands and feet, achieved full clearance in all treated patients. Caregiver education is also essential. Parents should be advised to ensure complete application to palms and soles and to gently open infants' fists during and after treatment, and to use socks to reduce possible cream displacement. These simple measures, combined with a targeted protocol, may significantly improve outcomes and reduce recurrence. Larger multicentre studies are needed to confirm these findings and to establish optimized regimens for infantile scabies, potentially integrating adjunctive strategies such as oral ivermectin or occlusive dressings in selected patients.

Learning points

- Standard scabicide cream protocols may be insufficient in neonates and infants with palmoplantar involvement.
- Habits such as fist clenching and spontaneous kicking may cause reduced cream–skin contact, reducing scabicide efficacy.
- Palmoplantar areas may act as pharmacological sanctuaries if not specifically targeted during therapy.
- A reinforced treatment protocol with additional applications to the hands and feet resulted in complete resolution.
- Educating caregivers on application technique is essential to maximize therapeutic outcomes.
- Targeted reapplication strategies should be considered in neonates and infants with localized treatment failure.

Author contributions

Martina Mussi (Investigation [Equal], Writing – original draft [Equal], Writing – review & editing [Equal]), Corrado Zengarini (DataCuration [Equal], Investigation [Equal], Methodology [Equal], Writing – original draft [Equal], Writing – review & editing [Equal]), Alessandra Gelmetti (Validation [Equal]), Gionathan Orioni (DataCuration [Equal]), Marco Adriano Chessa (Validation [Equal]), Riccardo Balestri (Validation [Equal], Writing – review & editing [Equal]), Michelangelo La Placa (Conceptualization [Equal], Validation [Equal], Visualization [Equal]), Bianca Maria Piraccini (Visualization [Equal]) and Iria Neri (Conceptualization [Equal], Methodology [Equal], ProjectAdministration [Equal], Supervision [Equal], Validation [Equal], Writing – review & editing [Equal]).

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Conflicts of interest

The authors declare no conflicts of interest.

Data availability

The data underlying this article will be shared upon reasonable request to the corresponding author.

Ethics statement

The study was approved by SCAB-net – Bologna Ethical Committee 2 March 2025.

Patient consent

The patients in this manuscript have given written informed consent to the publication of their case details.

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