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Dr. Stuart Maddin, Chairman of SkinCareGuide, is one of North America's leading dermatologists, and is the author of



numerous dermatologic journal articles, monographs and textbooks. In addition to providing consultative input to a number of pharmaceutical and biotech companies, he is the director of the clinical trials unit at the Department of Dermatology and Skin Science, University of British Columbia. Dr. Maddin has also acted in an advisory capacity to a number of drug regulatory agencies, such as the Health Protection Branch (Ottawa), the AAD-FDA Liaison Committee, and WHO (Geneva). He is the founder of the Dermatology Update symposia, now in its 25th year. As well, he is Past President of the Canadian Dermatology Association and served as Secretary-General of the International Committee of Dermatology — International League of Dermatological Societies.

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A Review of Therapeutic Options for Head Lice

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Introduction

Head lice infestations (*Pediculus humanus capitis*) are most prevalent during childhood in industrialized countries. It is estimated to occur in about 1-3% of children aged 6-12 years.¹ Greater susceptibility is associated with girls, which is likely attributed to close contact play and the sharing of objects.² Infestations are caused by direct physical contact with humans or fomites carrying live lice. Head lice infestations do not pose health risks, nor are they indicative of poor hygiene. Instead, active infestations signal the onset of a potentially widespread nuisance in schools and homes, and may subject affected individuals and their family members to stigmatization within their community. Diagnostic accuracy, decontamination, and topical therapy are required for containment and eradication.

Facts on Head Lice

- Adult lice are 2-4 mm long (about the size of a sesame seed). These wingless insects cannot jump or fly. Hence, hair-to-hair contact represents the primary mode of transmission.
 - Lice can crawl rapidly (about 6-30 cm per minute).
 - They can adapt their colour to their surroundings, making detection by visual inspection difficult.
 - Lice survive by sucking blood from their host every 3-6 hours and they cannot miss several consecutive meals.²
 - After mating, an adult female louse can lay 5-6 eggs daily for 30 days.³
- Eggs (nits) are laid on the hair shaft closest to the scalp.
 - Nits are very small and oval-shaped, and they range in colour from white to tan or silver to grey.
 - Nits are located near the scalp owing to the warmer temperature and close proximity to their eventual food supply.
- Nymphs (hatched immature lice) require 9-12 days to reach adulthood.

Symptoms

- Most infestations are asymptomatic, but persistent itching occurring near the back of the head and/or around the ears is commonly the first noticeable symptom. Sleeplessness, red marks, excoriations, and rash can also occur.
- Pruritis may be experienced 2-6 weeks after the first infestation; itching may occur sooner (1-2 days) in future infestations due to prior sensitization to antigens present in lice saliva during the initial exposure.

Diagnosis

Early detection of head lice is important for reducing its communicable potential. Diagnostic accuracy can be challenging and requires experience and expertise, as lice can readily evade detection by their rapid mobility and minimal visibility. Additionally, nits can resemble dandruff, scabs, hair spray droplets, or other debris.⁴

- An active infestation is defined by the presence of 10 or more live lice.⁵
- The discovery of nits alone without live lice does not indicate infestation; about 10-30% of nits do not hatch.⁶
- Overdiagnosis by healthcare professionals is common, whereby extinct or inactive infestations are determined to be active infestations and pharmacologic intervention is unnecessarily initiated.⁵
- Once an active infestation has been confirmed, alert and screen everyone in the household and close contacts.

Methods of Detection

Although visual inspection is easier to perform, wet combing with conditioner (WCWC) remains the most reliable method of detection.^{1,6}

*WCWC Method for Head Lice Detection*⁶

1. Apply a liberal amount of conditioner (white is best) to dry hair, soaking strands from scalp to ends.
2. Remove tangles with a regular bright light-coloured comb.
3. Start behind the ears and comb each section of hair.
4. Place the lice comb (a special fine-tooth comb) against the scalp and pull to the end of the hair.
5. Check the comb for lice after each pull.
6. Wipe the comb with a tissue each time and look for lice.
7. Place the tissue in a plastic bag.

8. Check all the hair over the entire head.
9. Repeat combing every section of hair at least 5 times.
10. When finished, tie the plastic bag with the soiled tissues and discard in the garbage.
11. If live lice are detected, all traces of conditioner must be washed from the hair prior to treatment.

Manual Removal

- Manual removal of lice and nits is recommended for children <2 years of age.
- Manual removal and daily lice combing serve as useful adjunctive measures. These nonpharmacologic approaches aid in reducing pediculicidal resistance, which is a concern in topical insecticidal use.

Environmental Decontamination

Because lice can survive away from a human host for 3-4 days, implementing fomite control strategies can eliminate potential sources of transmission and minimize reinfestation.

- Personal items used or worn by an infested person during the 3 days before treatment should be machine laundered in hot water (e.g., linens, blankets, pillows, stuffed toys, and clothing), then placed in a dryer using a hot setting for 20 minutes.
- Objects that cannot be washed should be stored in a tightly-wrapped plastic bag for 2 weeks or in a freezer for 24 hours.
- Soak combs (including lice comb) and hairbrushes in very hot water for 20 minutes or in rubbing alcohol for 1 hour.
- Vacuum carpets, furniture, and mattresses that the infested person came into contact with.
 - Extensive cleaning is unnecessary as the survivability of head lice away from the scalp is limited.
- Insecticidal sprays have not been shown to be effective.
- Children should be permitted to return to school after appropriate treatment; strict no-nit policies are unnecessary.^{4,5,7}

Topical Treatment

Topical treatment (Table 1) is recommended only when live lice are found. To prevent reinfestation, it is advisable to treat all infested family members and close contacts immediately and on the same day.⁶

Key Points of Topical Treatment

- Permethrins (synergized pyrethrins) are considered first-line therapies and most preparations are available OTC.
- Available pediculicides are not 100% ovicidal. Consequently, for all topical therapies, two treatments (7-10 days apart) are necessary to eradicate the nymphs that are hatched from nits not killed by the first treatment.
- Depending on the pediculicide, specific application to either wet or dry hair is required.
- Adequate saturation and treatment duration are essential for penetration of lice and nits by the active agent.
- The medication should be applied not only to the scalp and along the hair shaft, but also to the back of the ears and neck.
- Patients should not wash their hair for 1-2 days after the treatment is rinsed off.
- The presence of live lice after treatment does not indicate failure, as it can take up to 24 hours for the parasites to die.
- The most common side-effects from topical therapies include itchiness, mild skin irritation, and redness.
 - Post-treatment itching is not an indication of reinfestation.
- Many proposed alternative or natural treatments, such as tea tree oil, petroleum jelly, peanut butter, and mayonnaise have not been clinically proven to be effective.

Topical Treatment (continued)

Topical Agent	Details of Use
<i>Permethrin</i>	<ul style="list-style-type: none"> Wash hair with shampoos that are free of conditioner and silicone; towel dry until hair is almost dry Apply product to hair, scalp, behind ears, and neck; leave for 10 minutes, rinse with cool water over a sink (not in the shower or bath) Comb wet hair with nit comb to remove dying lice and nits Approved for use in persons >2 years of age Compatible with pregnancy and breastfeeding; low risk of toxicity Does not cause allergic reactions; may cause itching or mild burning sensation of the scalp
<i>Pyrethrin + Piperonyl Butoxide</i>	<ul style="list-style-type: none"> Apply to completely DRY hair Leave on for 10 minutes, then add water to form lather Rinse with cool water over a sink; do not use conditioner Approved for use in persons >2 years of age Probably compatible with pregnancy and breastfeeding; low risk of toxicity Do not use if there is a known allergy/sensitivity to chrysanthemum or ragweed
<i>Lindane</i>	<ul style="list-style-type: none"> Second-line treatment Apply to DRY hair and leave for 5 minutes (avoid skin contact beyond the scalp), rinse with cool water over a sink (not in the shower or bath) Neurotoxic at high doses or with repeated exposure Contraindicated in neonates, young children (<2 years of age), pregnancy, breastfeeding, or in patients with a history of seizures Resistance has been observed; may cause scalp irritation
<i>Isopropyl Myristate + Cyclomethicone</i>	<ul style="list-style-type: none"> Nonpediculicidal OTC treatment approved by Health Canada in 2006 Second-line to permethrin; may be tried first if a noninsecticide is favoured Dehydrates and kills lice by dissolving the exoskeleton Apply to DRY hair and leave on for 10 minutes, then rinse with warm water Indicated for individuals >4 years of age Potential for local irritation

Table 1. Topical treatments for active head lice infestations^{4,6,8}

Treatment Failure

The most common reasons for treatment failure include:

- Misdiagnosis
- Improper use (e.g., not saturating hair from scalp to ends or not leaving the product on long enough)
- Not repeating the treatment after 7-10 days or reapplication too soon after initial application
- Pediculicidal resistance
- Inadequate manual removal of nits
- Repeat exposure to lice (reinfestation)

Improper management of an active infestation poses considerable costs to a family as:⁸

- the child may not be permitted to attend school and may be ostracized and stigmatized.
- the parent may be required to take time off from work or pay for alternate care.
- the family must commit time and financial resources for eradication and prevention of reinfestation.

Conclusion

Although head lice infestation is not as prevalent in Canada as in developing countries, it remains a common communicable problem that carries substantial costs, both financial and social, for affected individuals. Given their favourable safety and efficacy profiles, permethrins and synergized pyrethrins remain first-line treatments for *Pediculosis capitis*.^{3,4,6,7} Diagnostic accuracy and appropriate management, as well as education aimed at reducing transmission, are central for eradication and minimizing the suffering and treatment-related costs for those impacted.

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Non-Pharmacologic Management of Atopic Dermatitis

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Background

Atopic dermatitis (AD) or eczema is a chronic, relapsing skin condition that can lead to xerosis, pruritus, and patches of dermatitis. Coping with the physical and emotional aspects of AD can significantly impact the quality of life. It is most common in childhood, as many patients seem to outgrow the condition by adulthood. The etiology of AD is complex and not fully understood, but contributing factors include a dysfunctional skin barrier that allows moisture to escape and irritants to enter, as well as inflammatory mediators. There is increasing interest in exploring the feasibility and efficacy of using non-drug alternatives as adjuncts to conventional pharmacologic approaches. Lifestyle modifications that can aid AD management will also be reviewed.

Diagnostic Features

- Chronic or chronically relapsing dermatitis
- Typical morphology and distribution (e.g., flexural erythema, excoriations, lichenification, xerosis)
 - Facial and extensor involvement in infants and children; flexural dermatitis and lichenification in adults
- Early age of onset – AD affects up to 20% of children¹
- Intensive itching that can cause disruptive sleep or difficulties in concentration
 - Breaks in the skin from scratching can lead to secondary infection
- Personal or family history of atopy (i.e., asthma, allergic rhinitis, AD)
- Hyperreactivity to environmental triggers

Defects in the Skin Barrier

There is growing data to support the longstanding theory that AD may be caused by a genetic defect in the epidermis, permitting environmental irritants, microbes, and allergens to penetrate, which in turn elicit inflammatory responses.²

- The filaggrin gene contributes to the formation and function of the skin.
- Deviations in the gene coding for filaggrin can cause skin barrier defects that contribute to AD.
- Defects in skin barrier development prevent adequate levels of antimicrobial peptides to form in the epidermis. Consequently, bacterial and viral infections may occur in affected lesions.

Treatment Options

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| <ul style="list-style-type: none"> • Avoidance of triggers • Emollients/moisturizers <ul style="list-style-type: none"> • Standard adjunct for prevention and maintenance • Topical corticosteroids <ul style="list-style-type: none"> • The cornerstone of AD therapy • Potential for tachyphylaxis, skin atrophy, and systemic side-effects, especially in long-term use • Topical calcineurin inhibitors (TCIs) <ul style="list-style-type: none"> • Useful when conventional therapies fail or are unsuitable • In 2006, an FDA boxed warning was issued for TCIs over concerns of immunosuppression and the potential risk of malignancy following long-term or continuous use | <ul style="list-style-type: none"> • Antimicrobials for infection <ul style="list-style-type: none"> • Topical or oral antibiotics may be prescribed to treat infected lesions • Overuse or prolonged treatment increase the risk for developing antibiotic resistance • Oral antivirals can be used for cases of eczema herpeticum (eczema infected with herpes virus) • Oral antihistamines for pruritus <ul style="list-style-type: none"> • Often tried for intractable itch, but little evidence exists to support their antipruritic effect • Systemic corticosteroids, systemic immunosuppressants and phototherapy <ul style="list-style-type: none"> • Reserved for severe disease |
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Moisturizing and Bathing

Moisturizers

- Daily moisturization is essential for managing AD, both during and between flare-ups.
- A randomized controlled study demonstrated that moisturizers can improve the barrier function of skin; however, the effects are determined by individual product composition.³
- Basic essential components of moisturizers include emollients and humectants.
 - Emollients provide a protective film by filling-in spaces between cells and restoring lost lipids to prevent transepidermal water loss (TEWL).
 - Commonly used emollients include animal oils, butyl stearate, cocoa butter, lanolin, lipids, mineral oil, petrolatum, and shea butter.
 - Petrolatum is the gold standard emollient; its non-sensitizing and highly occlusive properties are effective against TEWL.
 - Ceramides are lipid molecules that are important components of skin structure; they improve the skin barrier by limiting TEWL and preventing the entry of irritants.
 - AD patients have significantly fewer ceramides in their stratum corneum.
 - Lipids can be replaced topically with a ceramide-dominant emollient.
 - A new class of emollients, now available in the US, aims to replenish certain molecules that are deficient in the skin of AD patients. These nonsteroidal moisturizers are very expensive, but study findings indicate their efficacy and safety for mild to moderate AD.⁴

- Humectants aid in the absorption and retention of moisture, and soften thickened skin.
 - Commonly used humectants include glycerin, hyaluronic acid, lactic acid, propylene glycol, panthenol, silicones, and urea.
 - Glycerin's high affinity to attract moisture to the skin makes it the most widely used.
 - Panthenol (vitamin B5) functions as a humectant, emollient, and moisturizer. Studies examining adjuvant care with panthenol showed improved hydration and reduced dryness, itching, and inflammation.⁵

Choosing a Moisturizer

- Generally, the greasier the better. Bland ointments, such as petrolatum, are non-irritating and provide an excellent barrier, but they can be perceived by patients as being too thick.
- Less greasy creams and lotions may be more irritating.
- Some acids (e.g., salicylic acid and lactic acid) and humectants (e.g., urea) can be poorly tolerated by eczematous skin. Avoid their use in infants and small children due to the risk of systemic absorption.

Bathing

- Bathing first, and then applying a moisturizer while the skin is still damp, will help trap moisture in the skin. Medicated treatments should be applied to any dermatitis and moisturizers to unaffected skin.
- Bathing more than once daily is not always practical. Although, during flare-ups, several short baths followed by daytime applications of a moisturizer can be helpful.
- Baths (or showers) should be taken with warm (not hot) water and limited in duration.

Advancements in the Use of Natural Anti-inflammatories

Increasingly, patients prefer to supplement medical treatments with over-the-counter skin care products that incorporate natural ingredients. Plant-derived extracts are one of the largest categories of additives found in moisturizers. A few notable compounds have emerged following scientific evaluation, which supports their therapeutic benefits for alleviating symptoms associated with AD and other inflammatory skin conditions.⁶

Aloe Vera

- Applications include its use as an anti-inflammatory, analgesic, antipruritic, antioxidant, and wound healing agent.

Chamomile (*Matricaria recutita*)

- Topical use can relieve skin irritation. The active components (α -bisabolol, α -bisabolol oxide A and B, matricin) inhibit enzymes that mediate inflammation and suppress histamine release.

- Its anti-inflammatory effect is approximately 60% of that elicited by hydrocortisone 0.25%.⁷

Colloidal Oatmeal

- It has multiple active components that include enzymes, flavonoids, lipids, proteins, polyphenols (avenanthramides), polysaccharides, and vitamins.
- Avenanthramides are potent phytochemicals that inhibit the release of proinflammatory cytokines, resulting in reduced contact hypersensitivity and inflammation.⁸
- It also has antioxidant, anti-irritant, antihistaminic, and immunomodulatory effects.
- Colloidal oatmeal is one of few natural ingredients approved as a skin protectant by the US FDA.

Feverfew (*Tanacetum parthenium*)

- Its broad spectrum of clinical applications is attributable to its potent anti-inflammatory, antioxidant and anti-irritant properties.

Advancements in the Use of Natural Anti-inflammatories (continued)

- Parthenolides are compounds in feverfew that can produce skin sensitivities. Development of a purified extract that is free of parthenolides has been shown to have strong anti-inflammatory activity through inhibition of proinflammatory cytokine release.⁹

Licorice Extracts (Glycyrrhiza glabra, Glycyrrhiza inflata)

- *Glycyrrhiza glabra* (contains glabridin) reduces irritation, inflammation, and melanin production.

- *Glycyrrhiza inflata* (contains licochalcone A) decreases irritation and inflammation.
- Twice daily application of a licochalcone A-containing lotion for 8 weeks by patients with mild to moderate red facial skin produced statistically significant improvements in erythema scores.¹⁰

Avoidance of Triggers

Avoidance of triggers is a key AD management strategy. Each patient and his or her physician need to identify and eliminate relevant triggers.

Food

- While AD patients are more prone to food allergies (type 1 hypersensitivity), it is unclear if certain foods can cause a flare-up, which is more of a type 4 hypersensitivity reaction.
- If there appears to be a food trigger, parents or patients should keep a diary to track foods eaten and flare-ups. Food elimination diets should be physician supervised.
- If type 1 allergic symptoms develop in response to a particular food, avoid ingestion until testing can be undertaken. If a food source is unclear, it may be useful to involve an allergist.

Aeroallergens

- Certain aeroallergens (e.g., dust mites or seasonal allergens) can trigger AD flares.^{11,12}
- Confirmatory testing may be useful in refractory patients. If results are positive, deploy dust mite prevention strategies (e.g., frequently laundering mattress covers and avoid stuffed toys, feather pillows, duvets, and carpets).

Humidity/Sweating

- Sweating can aggravate itching and humid conditions that increase perspiration can induce flares. Frequently cooling off, changing clothes, and adjusting activities in humid weather can help.
- Heat and sweating can promote nighttime scratching. Recommend one layer each of sleepwear and covering. The bedroom should also be kept cool (but not cold).

Low Humidity/Dry Weather

- Due to the dry weather, most patients have worse flares in the winter. Moisturizing several times per day is crucial. Use of a cool mist humidifier in the bedroom can be helpful.

Infection

- AD patients are commonly colonized with *Staphylococcus aureus* (*S. aureus*) and have problems with *S. aureus* killing mechanisms.¹³ This frequently presents as a worsening of AD that is not responsive to therapy. Infected areas can appear as wet, oozing, or crusted lesions that require topical or oral antibiotics.
- *S. aureus* may drive AD flares through superantigen mechanisms, even in the absence of an actual clinical infection.¹⁴ Therefore, patients who have frequent flare-ups may need strategies to reduce *S. aureus* colonization and inflammation.

Environmental Irritants

- AD patients can be especially sensitive to dry grass, perfumes or fragrances in skin care products, and certain fabrics (wool and synthetics).
- Wearing cotton clothing can be helpful. Some evidence suggests that specially treated silk or silver-coated fabrics may also be beneficial.^{15,16}

Chlorine

- Swimming can be a good sport for AD patients, because sweating is not a concern. However, to avoid irritation, they should rinse off thoroughly afterwards and apply a moisturizer.
- There is a lack of data to confirm if salt water or chlorinated pools are better for AD patients.

Normal Routines

School

- Children with severe eczema may engage in school-avoidance behaviours that are caused by fatigue due to nocturnal pruritus, or anxiety from being teased. These issues must be addressed promptly to re-establish a normal school routine.

Sunscreen

- Many sunscreen products contain irritating ingredients. If regular sunscreens are unsuitable, suggest using sensitive skin formulations or physical sunblocks (e.g., titanium dioxide or zinc oxide).
- A comprehensive sun protection strategy combines regular sunscreen use, avoidance of peak sun exposure times, and wearing hats and protective clothing.

Normal Routines (continued)

Sleep

- Sleep disturbance from pruritus can be a major problem for many patients and their families, particularly if parents sleep with their AD-afflicted child and help to scratch or restrain their child's hand to prevent scratching.¹⁷ Both practices should be discouraged and may indicate a need to increase antipruritic therapy and the use of emollients.
- Poor sleep can lead to patient and/or parental difficulties in concentration, irritability, and fatigue.

Additional Tips

- Keep nails short to minimize tissue damage from scratching.
- Keep moisturizing creams in the refrigerator, as the cold sensation is soothing to itchy skin.
- For topical medical therapy, ointments are usually better tolerated than creams or lotions.
- Ask families if sleep routines are satisfactory and if sleep is disturbed. Many families do not volunteer this information to physicians.
- Patients should be steered toward good sources of information (e.g., <http://www.eczemahelp.ca>).

Conclusion

Successful AD management is best undertaken with a step-wise approach that considers multiple factors including disease severity, therapeutic side-effects, patient preferences, itch intensity, and sleep quality. As well, psychosocial impacts from AD cannot be overlooked. The regimented use of moisturizers can improve the skin barrier and significantly reduce xerosis and itch. As such, it can serve as useful adjunctive care for maintenance and flares. The new research realm directed at the epidermal barrier and the important immune factors carries the hope that innovative therapeutic approaches will lead to reduced infections and improved management of AD patients.

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