Principles of Topical Dermatologic Therapy

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Topical dermatologic treatments are grouped according to their therapeutic functions and include

- Cleansing agents
- Anti-infective agents
- Anti-inflammatory agents
- Astringents (drying agents that precipitate protein and shrink and contract the skin)
- Drying agents and super-absorbent powders
- Moisturizing agents (emollients, skin hydrators, and softeners)
- Keratolytics (agents that soften, loosen, and facilitate exfoliation of the squamous cells of the epidermis)
- Antipruritics

For certain topical treatments, successful therapy may also depend on

- The vehicle with which an agent is formulated
- The type of dressing used

Vehicles

Topical therapies can be delivered in various vehicles, which include

- Powders
- Liquids
- Combinations of liquid and oil

The vehicle influences a therapy's effectiveness and may itself cause adverse effects (eg, contact or irritant dermatitis). Generally, aqueous and alcohol-based preparations are drying because the liquid evaporates and are used in acute inflammatory conditions. Powders are also drying. Oil-based preparations are moisturizing and are preferred for chronic inflammation. Vehicle selection is guided by location of application, cosmetic effects, and convenience.

Powders

Inert powders may be mixed with active agents (eg, antifungals) to deliver therapy. They are prescribed for lesions in moist or intertriginous areas.

Liquids

Liquid vehicles include

- Baths and soaks
- Foams
- Solutions

Lotions

Gels

Baths and soaks are used when therapy must be applied to large areas, such as with extensive contact dermatitis or atopic dermatitis.
Foams are alcohol- or emollient-based aerosolized preparations. They tend to be rapidly absorbed and may be favored in hair-bearing areas of the body.
Solutions are ingredients dissolved in a solvent, usually ethyl alcohol, propylene glycol, polyethylene glycol, or water. Solutions are convenient to apply (especially to the scalp for disorders such as psoriasis or seborrhea) but tend to be drying. Two common solutions are Burow solution and Domeboro® solution.
Lotions are water-based emulsions. They are easily applied to hairy skin. Lotions cool and dry acute inflammatory and exudative lesions, such as contact dermatitis, tinea pedis, and tinea cruris.
Gels are ingredients suspended in a solvent thickened with polymers. Gels are often more effective for controlled release of topical agents. They are often used in acne, rosacea, and psoriasis of the scalp.

Combination vehicles

Combinations include

Creams

Ointments

Combination vehicles usually contain oil and water but may also contain propylene or polyethylene glycol.
Creams are semi-solid emulsions of oil and water. They are used for moisturizing and cooling and when exudation is present. They vanish when rubbed into skin.
Ointments are oil based (eg, petrolatum) with little if any water. Ointments are optimal lubricants and increase drug penetration because of their occlusive nature; a given concentration of drug is typically more potent in an ointment. They are preferred for lichenified lesions and lesions with thick crusts or heaped-up scales, including psoriasis and lichen simplex chronicus. Ointments are less irritating than creams for erosions or ulcers. They are usually best applied after bathing or dampening the skin with water.

Dressings

Dressings protect open lesions, facilitate healing, increase drug absorption, and protect the patient's clothing.

Nonocclusive dressings

The most common nonocclusive dressings are gauze dressings. They maximally allow air to reach the wound, which is at times preferred in healing, and allow the lesion to dry.
Wet-to-dry dressings are nonocclusive dressings wetted with solution, usually saline, that are used to help cleanse and debride thickened or crusted lesions. The dressings are applied wet and removed after the solution has evaporated (ie, wet-to-dry), with materials from the skin adhering to the dried dressing.

Occlusive dressings

Occlusive dressings increase the absorption and effectiveness of topical therapy. Most common are transparent films such as polyethylene (plastic household wrap) or flexible, transparent, semi-permeable dressings. Hydrocolloid dressings draw out fluid from the skin and form a gel and can be applied with a gauze cover in patients with cutaneous ulceration. Zinc oxide gelatin (Unna paste boot) is an effective occlusive dressing for patients with stasis dermatitis and ulcers. Plastic tape impregnated with flurandrenolide, a corticosteroid, can be used for isolated or recalcitrant lesions. Hydrocolloid dressings draw out fluid from the skin and form a gel and can be applied with a gauze cover in patients with cutaneous ulceration. Occlusive dressings applied over topical corticosteroids to increase absorption are sometimes used to treat psoriasis, atopic dermatitis, skin lesions resulting from systemic lupus erythematosus, and chronic hand dermatitis, among other conditions. Systemic absorption of topical corticosteroids may occur and cause adrenal suppression. Local adverse effects of topical corticosteroids include

Development of miliaria

Skin atrophy

Striae

Bacterial or fungal infections

- Acneiform eruptions

Other occlusive dressings are used to protect and help heal open wounds, such as burns; special silicone dressings are sometimes used for keloids.

Topical Agents

Major categories of topical agents include

- Cleansing
- Moisturizing
- Drying
- Anti-inflammatory
- Antimicrobial
- Keratolytic
- Astringent
- Antipruritic

Cleansing agents

The principal cleansing agents are soaps, detergents, and solvents. Soap is the most popular cleanser, but synthetic detergents are also used. Baby shampoos are usually well tolerated around the eyes and for cleansing wounds and abrasions; they are useful for removing crusts and scales in psoriasis, eczema, and other forms of dermatitis. However, acutely irritated, weeping, or oozing lesions are most comfortably cleansed with water or isotonic saline.
Water is the principal solvent for cleansing. Organic solvents (eg, acetone, petroleum products, propylene glycol) are very drying, can be irritating, and cause irritant or, less commonly, allergic contact dermatitis. Removal of hardened tar and dried paint from the skin may require a petrolatum-based ointment or commercial waterless cleanser.

Moisturizing agents

Moisturizers (emollients) restore water and oils to the skin and help maintain skin hydration. They typically contain glycerin, mineral oil, or petrolatum and are available as lotions, creams, ointments, and bath oils. Stronger moisturizers contain urea 2%, lactic acid 5 to 12%, and glycolic acid 10% (higher concentrations of glycolic acid are used as keratinolytics, eg, for ichthyosis). They are most effective when applied to already moistened skin (ie, after a bath or shower). Cold creams are moisturizing over-the-counter (OTC) emulsions of fats (eg, beeswax) and water.

Drying agents

Excessive moisture in intertriginous areas (eg, between the toes; in the intergluteal cleft, axillae, groin, and inframammary areas) can cause irritation and maceration. Powders dry macerated skin and reduce friction by absorbing moisture. However, some powders tend to clump and can be irritating if they become moist. Cornstarch and talc are most often used. Although talc is more effective, talc may cause granulomas if inhaled and is no longer used in baby powders. Cornstarch may promote fungal growth. Aluminum chloride solutions are another type of drying agent (often useful in hyperhidrosis). Super-absorbent powders (extremely absorbent powders) are occassionally required to dry very moist areas (eg, to treat intertrigo).

Anti-inflammatory agents

Topical anti-inflammatory agents are either corticosteroids or noncorticosteroids.
Corticosteroids are the mainstay of treatment for most noninfectious inflammatory dermatoses. Lotions are useful on intertriginous areas and the face. Gels are useful on the scalp and in management of contact dermatitis. Creams are useful on the face and in intertriginous areas and for management of inflammatory dermatoses. Ointments are useful for dry scaly areas and when increased potency is required. Corticosteroid-impregnated tape is useful to protect an area from excoriation. It also increases corticosteroid absorption and therefore potency.
Topical corticosteroids range in potency from mild (class VII) to superpotent (class I—see Table: Relative Potency of Selected Topical Corticosteroids). Intrinsic differences in potency are attributable to fluorination or chlorination (halogenation) of the compound.

Relative Potency of Selected Topical Corticosteroids

Class*	Drug
I	Betamethasone dipropionate 0.05% ointment
	Clobetasol propionate 0.05% cream or ointment or foam
	Diflorasone diacetate 0.05% ointment
	Halobetasol propionate 0.05% cream or ointment
II	Amcinonide 0.1% ointment
	Betamethasone dipropionate 0.05% cream
	Betamethasone dipropionate 0.05% ointment
	Desoximetasone 0.25% cream, 0.05% gel, 0.25% ointment
	Diflorasone diacetate 0.05% ointment
	Fluocinonide 0.05% cream, gel, ointment, or solution
	Halcinonide 0.1% cream
	Mometasone furoate 0.1% ointment
III	Amcinonide 0.1% cream or lotion
	Betamethasone dipropionate 0.05% cream
	Betamethasone dipropionate 0.05% lotion
	Betamethasone valerate 0.1% ointment
	Desoximetasone 0.05% cream
	Diflorasone diacetate 0.05% cream
	Fluocinonide cream 0.05%
	Fluticasone propionate 0.005% ointment
	Halcinonide 0.1% ointment or solution
	Triamcinolone acetonide 0.1% ointment
IV	Fluocinolone acetonide 0.025% ointment
	Flurandrenolide 0.05% ointment
	Mometasone furoate 0.1% cream or lotion
	Triamcinolone acetonide 0.1% cream or ointment
V	Betamethasone valerate 0.1% cream
	Desonide 0.05% ointment
	Fluocinolone acetonide 0.025% cream
	Flurandrenolide 0.05% cream
	Fluticasone propionate 0.05% cream
	Hydrocortisone butyrate 0.1% cream, ointment, or solution
	Hydrocortisone valerate 0.2% cream or ointment
	Triamcinolone acetonide 0.1% lotion or 0.025% ointment
VI	Alclometasone dipropionate 0.05% cream or ointment
	Betamethasone valerate 0.1% lotion
	Desonide 0.05% cream
	Flumethasone pivalate 0.03% cream
	Fluocinolone acetonide 0.01% cream or solution
	Triamcinolone acetonide 0.1% cream
	Triamcinolone acetonide 0.025% cream or lotion
VII	Hydrocortisone 1% or 2.5% cream, 1% or 2.5% lotion, 1% or 2.5% ointment
	Hydrocortisone acetate (1% or 2.5% cream, 1% or 2.5% lotion, 1% or 2.5% ointment) and pramoxine hydrochloride 1%

*Class I is the most potent, and class VII is the least potent. Potency depends on many factors, including the drug's characteristics and concentration and the base in which it is used.

Topical corticosteroids are generally applied 2 to 3 times a day, but high-potency formulations may require application only once a day or even less frequently. Most dermatoses are treated with mid-potency to high-potency formulations; mild

formulations are better for mild inflammation and for use on the face or intertriginous areas, where systemic absorption and local adverse effects are more likely. All agents can cause local skin atrophy, striae, and acneiform eruptions when used for > 1 month. This effect is particularly problematic on the thinner skin of the face, axillae, or genitals. Corticosteroids also promote fungal growth. Contact dermatitis in reaction to preservatives and additives is also common with prolonged use. Contact dermatitis to the corticosteroid itself may also occur. Perioral dermatitis occurs with mid-potency or high-potency formulations used on the face but is uncommon with mild formulations. High-potency formulations may cause adrenal suppression when used in children, over extensive skin surfaces, or for long periods. Relative contraindications include conditions in which infection plays an underlying role and acneiform disorders.

Noncorticosteroid anti-inflammatory agents include tar preparations. Tar comes in the form of crude coal tar and is indicated for psoriasis. Adverse effects include irritation, folliculitis, staining of clothes and furniture, and photosensitization. Contraindications include infected skin. Several herbal products are commonly used in commercial products, although their effectiveness has not been well established. Among the most popular are chamomile and calendula.

Antimicrobials

Topical antimicrobials include

- Antibiotics
- Antifungals
- Insecticides
- Nonspecific antiseptic agents

Antibiotics have few indications. Topical clindamycin and erythromycin are used as primary or adjunctive treatment for acne vulgaris in patients who do not warrant or tolerate oral antibiotics. Topical metronidazole and occasionally topical sulfacetamide, clindamycin, or erythromycin are used for rosacea. Mupirocin has excellent gram-positive (mainly *Staphylococcus aureus* and streptococci) coverage and can be used to treat impetigo when deep tissues are not affected. Retapamulin and ozenoxacin are newer topical antibiotics used to treat impetigo.

Over-the-counter topical antibiotics such as bacitracin and polymyxin have been replaced by topical petrolatum for postoperative care of a skin biopsy site and to prevent infection in scrapes, minor burns, and excoriations. Topical petrolatum is as effective as these topical antibiotics and does not cause contact dermatitis, which these antibiotics, especially topical neomycin, can cause. Also, the use of topical antibiotics and washing with antiseptic soaps in healing wounds may actually slow healing.

Antifungals are used to treat candidiasis, a wide variety of dermatophytoses, and other fungal infections (see Table: Options for Treatment of Superficial Fungal Infections*).

Insecticides (eg, permethrin, malathion) are used to treat lice (see Table: Treatment Options for Lice) and scabies (see Table: Treatment Options for Scabies).

Nonspecific antiseptic agents include iodine solutions (eg, povidone iodine, clioquinol), gentian violet, silver preparations (eg, silver nitrate, silver sulfadiazine), and zinc pyrithione. Iodine is indicated for presurgical skin preparation. Gentian violet is used when a chemically and physically stable antiseptic/antimicrobial is needed and must be very inexpensive. Silver preparations are effective in treating burns and ulcers and have strong antimicrobial properties; several wound dressings are impregnated with silver. Zinc pyrithione is an antifungal and a common ingredient in shampoos used to treat dandruff due to psoriasis or seborrheic dermatitis. Healing wounds should generally not be treated with topical antiseptics other than silver because they are irritating and tend to kill fragile granulation tissue.

Keratolytics

Keratolytics soften and facilitate exfoliation of epidermal cells. Examples include 3 to 6% salicylic acid and urea. Salicylic acid is used to treat psoriasis, seborrheic dermatitis, acne, and warts. Adverse effects are burning and, if large areas are covered, systemic toxicity. It should rarely be used in children and infants. Urea is used to treat plantar keratodermas and ichthyosis. Adverse effects are irritation and intractable burning. It should not be applied to large surface areas.

Astringents

Astringents are drying agents that precipitate protein and shrink and contract the skin. The most commonly used astringents are aluminum acetate (Burow solution) and aluminum sulfate plus calcium acetate (Domeboro® solution). Usually applied with dressings or as soaks, astringents are used to treat infectious eczema, exudative skin lesions, and weeping pressure ulcers. Witch hazel is a popular over-the-counter astringent.

Antipruritics

Doxepin is a topical antihistamine that is effective in treating itching of atopic dermatitis, lichen simplex chronicus dermatitis, and nummular dermatitis. Topical benzocaine and diphenhydramine (present in certain over-the-counter lotions) are sensitizing and not recommended. Other antipruritics include camphor 0.5 to 3%, menthol 0.1 to 0.2%, pramoxine hydrochloride, and eutectic mixture of local anesthetics (EMLA), which contain equal parts lidocaine and prilocaine in an oil-in-water vehicle. Topical antipruritics are preferred over systemic drugs (eg, oral antihistamines) when smaller surface areas of skin are affected and pruritus is not intractable. Calamine lotion is soothing but not specifically antipruritic.