

Irritant contact dermatitis during COVID-19: Preventing the virus while keeping the itch at bay

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Abstract

Hand hygiene practices have been bolstered during the COVID-19 pandemic to curb the spread of SARS-CoV-2. Unfortunately, such prevention strategies come with a risk of excessive physical damage to the skin and exposure to dermatological irritants, including soap, alcohol, and surfactants. Irritant contact dermatitis frequency has increased not only among those typically susceptible to it, such as healthcare workers, but also among the general populace. This report briefly discusses some of the most common implicated irritants, as well as guidelines and measures for mitigating dermatitis, which include dermatological treatments ranging from moisturisers to pharmacotherapy. Hand hygiene practices may not change, but by following good preventative guidelines and appropriate pharmacotherapeutic interventions, irritant contact dermatitis can be controlled.

Keywords: coronavirus disease 2019, irritant contact dermatitis, moisturisers, severe acute respiratory syndrome coronavirus 2, topical calcineurin inhibitors, topical corticosteroids

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Introduction

In an effort to curb the spread of the severe acute respiratory coronavirus 2 (SARS-CoV-2), various preventative strategies have been promulgated, including hand hygiene.¹ Regular and thorough cleansing of hands using soap and water (for at least 20 seconds), and application of alcohol-based sanitisers (greater than 60% alcohol), are a mainstay of preventing coronavirus disease 2019 (COVID-19).^{2,3} Although these measures reduce viral transmission, dermatological complications such as contact dermatitis have also been noted from these rigorous cleaning routines.³⁻⁸

Contact dermatitis observed during COVID-19

Contact dermatitis and its prevalence in healthcare workers

Contact dermatitis, which may be allergic or irritant, is an inflammatory dermatological condition caused by direct cutaneous exposure to harmful environmental agents.^{8,11} Allergic contact dermatitis is a delayed-type IV hypersensitivity reaction brought on by an allergen, leading to an adaptive immune response where subsequent exposure culminates in T-lymphocyte-mediated erythema, pruritis, and scaling.^{8,11} Irritant contact dermatitis, on the other hand, occurs due to physical and functional perturbations of the stratum corneum brought on by damage to keratinocytes, leading to innate immune response-mediated erythema, scaling, fissures, and algesia.^{8,11}

Irritant contact dermatitis is a common occurrence in occupational settings that involve physical labour, chemical irritants

or wetwork.¹¹ Wetwork comprises regular i) exposure to a wet environment (> 2 hours per day), ii) handwashing (> 20 times per day), iii) hand disinfectant use (> 20 times per day), and/or iv) protective glove use (> 2 hours per day or 20 glove changes per day).¹¹ Healthcare workers are particularly prone to irritant contact dermatitis^{4,10,12-16} due to their wetwork,^{3,10,12,14} as proper hand hygiene is well-known to reduce transmission of infectious organisms.¹⁷ Irritant contact dermatitis during COVID-19 has increased in settings that previously were not considered risk factors,^{4,11,18,19} most likely due to the greater focus on hand hygiene to prevent SARS-CoV-2 transmission.^{4,10,12,18-21}

Hand hygiene products

Hand hygiene can be achieved in several different ways, and there are a wide variety of commercially available disinfectants. Depending on their characteristics, chemical constituency and frequency of use, antiviral efficacy^{3,18,19} and frequency of dermatotoxicity vary between agents.^{3,18,19,22} Numerous types of allergens and/or irritants may be present in these preparations, including alcohols, antiseptics, fragrances, parabens, preservatives, and surfactants.¹⁰ As these disinfectants generally react with epidermal keratin and lipids, penetration into deeper layers of the skin is possible, which may aggravate detriments.⁸ Several commonly used disinfectants are discussed below.

Soap, a fatty acid salt, is an effective cleansing agent that is able to disrupt viral lipid membranes and intracellular lipids.^{3,23} Hands are cleaned by physical removal of particles and anti-lipid properties.³ However, this practice also damages the corneum stratum of the skin through disruption of intracellular lipids and proteins, thus causing irritation and sensitivity.^{1,3,23} Frequent hand hygiene using

soap and water appears to be more damaging to the skin and is prone to causing irritation more than other disinfectants.^{1,14,18}

Alcohol-based hand sanitisers cause antiviral activity via membrane denaturation, protein coagulation, perturbation of cellular metabolism, and viral lysis.³ Current guidelines recommend that these products contain at least 60% alcohol or 70% isopropanol,³ as well as moisturisers to diminish damage to skin.^{3,8} Alcohol-based hand sanitisers have been shown to cause less skin irritation than soap,^{14,18,24} surfactants,²² or detergents,²⁵ and have lower percutaneous penetration.⁸

Synthetic detergents containing chemical surfactants function similarly to soap by disrupting lipid-enveloped viruses.³ Surfactants, such as dodecylbenzene sulfonic acid, benzalkonium chloride, dodecyl dimethyl ammonium chloride,^{3,8,22} and sodium lauryl sulfate²⁶ are considered skin irritants, though their ability to sensitise the skin may differ.⁸ As surfactants can irritate the skin and reduce hydration,^{3,22} moisturisers can be included to protect the skin from toxicity.³ Antiseptic handwashes are soaps or synthetic detergents comprising additional antimicrobial agents, such as ethanol, chloroxylenol, or chlorhexidine digluconate, which may lead to variable antiviral activity.³ Detergents are known to disrupt the skin barrier,²⁵ but their effect is dependent on their constituency.³

Treatment of irritant contact dermatitis

General information on moisturisers

The most reasonable approach to treating irritant contact dermatitis is to remove the irritant,¹¹ which under current COVID-19 guidelines, is not feasible. Luckily, there are general approaches, such as applying moisturisers, before resorting to pharmacotherapeutic interventions.²⁷ Various formulations of moisturisers help reduce erythema, irritation, and dehydration. They are either included in hand hygiene products or are used after the washing of hands.^{13,15,22,24} The ideal moisturiser should reduce trans-epidermal water loss (thus preventing dryness), restore membrane functionality, have quick absorption properties, and lack any allergenic, sensitising, or comedogenic characteristics.^{28,29} Moisturisers should also be cost-effective and be cosmetically acceptable, and lack fragrances which may act as irritants.^{28,29}

Importantly, the term “moisturiser” is often used interchangeably with emollients and humectants, with the latter two being specific components of moisturisers.^{30,31} As such, the scientific literature may be inconsistent,^{28,31} and report on a mixture of emollients, humectants, and other compounds.³² Efficacy studies on moisturisers are varied and often suffer from comparative limitations, such as a lack of standardisation of formulations, irritants, and quality control.^{30,31,33} Although moisturisers appear to offer protection against irritants, this depends on, among others, the type of irritant (as pathogenic mechanisms may differ) and constituency of the product.³¹ For example, a meta-analysis highlighted the protective function of moisturisers against

sodium lauryl sulfate, sodium hydroxide, and lactic acid, but not against toluene.³¹ Additionally, although moisturisers reduce the risk of contact dermatitis,^{12,13} many individuals appear to not apply protection after washing their hands, thus further aggravating the dermatological consequences of cleaning agents.¹² Educational strategies may be beneficial to reduce such occurrences.^{15,23,34} Immediate use of moisturisers have a greater protective effect than delayed use,¹³ thus further stressing the importance of a clear understanding of their role.

Humectants in moisturisers

Humectants, such as glycerin,^{11,26,28} hyaluronic acid,²⁸ lactic acid,²⁶ propylene glycol,¹ and urea,^{1,26} attract water to the stratum corneum from the environment and deeper skin layers, thus hydrating the skin.^{1,11,28,30} This is due to their hydrophilic¹¹ and hygroscopic properties.²⁸ The efficacy of humectants differs between products, where glycerin is the most effective due to its corneocyte maturation properties.²⁸ Urea-containing humectants are also popular, and they reduce the irritant properties of sodium lauryl sulfate by decreasing its long-term dehydration effects.²⁶ Humectants are typically combined with occlusive emollients to prevent excessive loss of absorbed water from the dermis^{28,29} and thereby reduce subsequent dryness.²⁹ Urea- and glycerin-containing products may cause mild dermatological side effects, such as erythema, pruritis, and stinging.³²

Emollients in moisturisers

Emollients, such as lanolin, mineral oils, paraffin waxes and petrolatum²⁹ prevent water loss and act as anti-irritants.^{1,11} Emollients regulate barrier function²⁶ and improve membrane fluidity²⁸ to help protect the skin from irritant contact dermatitis,^{26,30} for example, by reducing epidermal water loss²⁶ and decreasing irritant penetration of the skin.³⁰ Emollients may further create a semi-occlusive layer^{30,35} if the oil content is sufficiently high, thus adding to their hydrophobic properties.^{29,35} Depending on the formulation, emollients may reduce lipophilic or hydrophilic irritant permeation depending on whether or not they are rich in water- or lipid-soluble compounds, respectively.³⁰ Emollients reduce the irritation induced by propanol-based hand rubs³⁶ and soap, though the level of protection differs based on the formulation.³³ The addition of emollients to skincare regimens helps prevent possible irritant contact dermatitis, and may typically be sufficient to treat mild cases without resorting to corticosteroids.³⁰ As with any preparations, emollients should not be used excessively, as they may predispose individuals to certain allergic contact dermatitis caused by fibres or sharp dust particles.³⁰ Emollients may cause mild dermatological reactions, though no serious adverse events.³²

Other additives in moisturisers

Moisturisers may contain a range of other additives to offer further protection. These may include anti-inflammatory (e.g. glycyrrhetic acid and palmitoyl-ethanolamine), antipruritic (e.g. methanol), anti-mitotic (e.g. mineral oils) and/or wound healing agents (e.g. hyaluronic acid).³⁵

Table I: Examples of topical corticosteroids ranked by potency³⁷⁻³⁹

Potency category	Examples
Class I (super-potent)	Betamethasone dipropionate (0.05%) gel or ointment Clobetasol propionate (0.05%), regardless of vehicle Diflorasone diacetate (0.05%) ointment Fluocinonide (0.1%) cream Halobetasol propionate (0.05%) cream or ointment
Class II (high-potency)	Amcinonide (0.1%) ointment Augmented betamethasone dipropionate (0.05%) cream or lotion Betamethasone dipropionate (0.05%) ointment Desoximetasone cream, gel or ointment Diflorasone diacetate (0.05%) cream Fluocinonide (0.05%) cream, gel or ointment Halcinonide (0.1%) cream, ointment or solution
Class III (upper mid-potency)	Amcinonide (0.1%) cream Betamethasone dipropionate (0.05%) cream Fluticasone propionate (0.005%) ointment Triamcinolone acetonide (0.5%) cream or ointment
Class IV (mid-potency)	Desoximetasone (0.05%) cream Fluocinolone acetonide (0.025%) cream or ointment
Class V (lower mid-potency)	Hydrocortisone butyrate (0.1%) cream Triamcinolone acetonide (0.025%) cream, lotion or ointment
Class VI (low-potency)	Alclometasone dipropionate (0.05%) cream or ointment Desonide (0.05%), regardless of vehicle Fluocinolone (0.01%) cream Hydrocortisone butyrate (0.1%) cream
Class VII (least-potent)	Hydrocortisone (1% and 2.5%) cream, lotion or ointment Dexamethasone sodium phosphate (0.1%) cream Methylprednisolone acetate (0.25%) cream

Topical corticosteroids

Topical corticosteroids are well known dermatological treatments for hyperproliferative, immunological and inflammatory conditions,³⁷ such as irritant contact dermatitis.^{11,27,30,38} Corticosteroids are classified into seven potency categories, ranging from I (super-potent) to VII (least-potent) (Table I).³⁷⁻³⁹ To prevent excessive side effects and systemic absorption, the selection of corticosteroids is dependent on the area affected.^{37,38} Low-to-medium potency corticosteroids are applied to large areas of the skin, while high-potency corticosteroids are more appropriate for areas with thicker epidermis (such as the palms and soles).^{37,38} The area also dictates the most appropriate vehicle: ointments provide more occlusion and higher potency, and are thus ideal for hyperkeratotic areas, while gels are less occlusive, and are thus ideal for hair-bearing areas as they are less likely to cause folliculitis.³⁷

Mechanistically, corticosteroids provide anti-inflammatory, anti-mitotic, and immunosuppressive effects.³⁷ By producing lipocortin, corticosteroids reduce phospholipase A2 availability and its subsequent prostaglandin and leukotriene synthesis, with dermal vasoconstrictive properties reducing the distribution of inflammatory mediators to the affected area.³⁷ At a nuclear level, topical corticosteroids modulate anti-inflammatory and pro-inflammatory transcription factors,^{37,40} thus reducing the inflammatory process.⁴⁰ Such nuclear modulation perturbs

immune cell maturation, differentiation and proliferation,³⁷ leading to, among others, reduced T-cell activation and leukocyte migration.³⁸ Lipocortin production may further mediate anti-mitotic effects in the epidermis, impacting cellular proliferation and collagen production.³⁷

Short-term use is generally well tolerated,³⁸ though long-term use may lead to a greater risk of hirsutism, folliculitis,³⁸ and anti-regenerative effects of the skin barrier^{11,27} leading to cutaneous atrophy.³⁸ By reducing lipid restoration in the stratum corneum, topical corticosteroids may, in the long-term, trigger new dermatological complications for patients.¹¹ The strength of a corticosteroid affects its dermatological consequences; thus less potent corticosteroids may be preferred to limit adverse effects,³⁰ while higher potency corticosteroids may be preferred for acute flare-ups.⁴¹ Short courses of topical corticosteroids may be considered in individuals prone to developing dermatitis.^{1,41} Treatment should not exceed two to four weeks, regardless of the potency used, given the risks of adverse effects.³⁷ Administration of high-potency corticosteroids should be gradually reduced to avoid precipitation of adverse effects.³⁷ Patients may have preconceived fears of corticosteroids, affecting their willingness to make use of them,⁴² thus proper education from healthcare providers is needed to ensure that accurate dosing, precautions, and monitoring is in place for patients.³⁷

Topical calcineurin inhibitors

Topical calcineurin inhibitors, such as tacrolimus and pimecrolimus, reduce inflammation and are devoid of anti-regenerative effects (as opposed to corticosteroids),^{27,43} thus can be recommended for longer use.²⁷ Efficacy has been shown for inflammatory dermatological conditions, such as atopic dermatitis^{44,45} and irritant contact dermatitis,^{43,46} though concerns have been raised about whether or not they are effective for treating pathologies of the palms of hands.⁴⁴ This may be due to the thickness of the skin in this area.⁴⁴

Calcineurin inhibitors modulate immune suppression by inhibiting calcineurin and reducing its downstream dephosphorylation of the nuclear factor of the activated T-cells transcription factor.^{38,47} As such, the T-cell signal transduction cascade is perturbed with subsequent lower cytokine release,³⁸ as well as basophil, eosinophil, Langerhans cell, mast cell and neutrophil dysfunction.⁴⁴ To mediate its calcineurin inhibition, both tacrolimus and pimecrolimus must complex with macrophilin-12, with tacrolimus being more potent.³⁸ The greater lipophilicity of pimecrolimus reduces its penetration from the corneal layer to the epidermal layer,⁴⁴ thus offering more skin selectivity.³⁸ Topical calcineurin inhibitors are well-tolerated,⁴⁴ though are well-known to cause burning sensations when applied to inflamed skin^{11,38,44} that resolve within a week of starting therapy.⁴⁴

Conclusion and recommendations

Hand hygiene during the COVID-19 pandemic is a rational measure to curb viral transmission. However, the frequency and practice should not become pathogenic. Education regarding hand hygiene, irritant contact dermatitis, and its treatment should be available to help sensitise individuals to the topic,³⁰ and minimise the need for unnecessary pharmacotherapy. Topical corticosteroids and calcineurin inhibitors may be advisable in certain circumstances where irritant contact dermatitis is severe or cannot be controlled by other preventative means.³⁸ Should topical corticosteroids be justified, a lower potency corticosteroid may be more appropriate for short-term use³⁰ and higher potency corticosteroids for flare-ups.⁴¹

Thorough washing of hands using lukewarm water and soap, as per the guidelines, should be done, preferably with fragrance- and preservative-free soap.⁴⁸ Care should be taken to not be too physically abrasive during washing,¹ with drying by light patting.⁴⁸ Thereafter, hands should be allowed to dry properly prior to the application of hypoallergenic^{1,19,49} and fragrant-free moisturisers.^{1,10} Hands should be washed and moisturised when taking off gloves to avoid excessive irritation.¹ Alcohol-based hand sanitisers may be appropriate alternatives to soap when visible dirt is not present^{23,48} as they are less irritant.⁴⁸ Alcohol-based hand sanitiser should also not be applied to wet hands to avoid excessive permeation of irritants into the skin,¹⁹ and hands should be dry prior to the application of moisturisers^{19,49} to limit trapping sanitiser between web spaces.¹⁹

Unfortunately, patients have failed to approach the healthcare sector for various non-COVID-19 related diseases,^{6,7} due to, among others, lockdown regulations and a fear of contracting SARS-CoV-2.^{6,7} Such lack of treatment may complicate therapy or lead to increased disease severity,^{6,7} thus complicating further dermatotoxicity. Should patients not be able to visit a healthcare facility, or fear doing so, dermatological consultations should be offered with accompanying photographs and reinforcement of dermatological treatment plans via telemedicine.⁴⁹ Hand hygiene will continue to be an important facet of COVID-19 prevention strategies, however, the risks involved with developing irritant contact dermatitis should be mitigated by clear guidelines and proper dermatological education.

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Conflict of interest

The author has no conflict of interest to disclose.

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