Allergy or irritant? Making sense of contact dermatitis.

Lissa Judd
Dermatologist and Occupational Medicine Specialist
......a bit of background stuff first, and then some examples
Dermatitis

- Contact irritant dermatitis
- Contact allergic dermatitis
- Photocontact dermatitis
- Endogenous dermatitis (atopic, discoid, etc.)
- Mixtures of the above
Irritant contact dermatitis

- Damage > repair
- Cumulative
- Dose dependent
Irritants

- Over or under hydration
- Soaps and detergents
- Abrasives
- Solvents
- Acids / alkalis
- Etc

- Occlusion enhances irritancy and impairs repair
If skin is immersed in water the stratum corneum absorbs up to 12 x its dry weight in water.

If lipids have been removed, the influx is even greater. Water may penetrate to the nucleated cells, where it is damaging.
Types of contact irritant dermatitis

- *Subjective irritancy*  stinging which occurs within minutes of contact, in the absence of visible changes
- *Acute irritant contact dermatitis* (a chemical burn)
- *Chronic irritant contact dermatitis* (the cumulative effect of repetitive exposures)
Where there is repeated exposure, previous damage may render the skin more susceptible to damage from the next exposure

- potency of the irritant
- duration of application
- frequency of exposure
- occlusion
- temperature
- atopy
- anatomical site

- may all influence irritancy
Diagnosis of irritant contact dermatitis

- Is there a history of **exposure** to irritants?

- Is there a **temporal association** between the exposure and the dermatitis?

- Is the dermatitis **localised** to the site of primary contact?

- Is there **any better explanation** for the dermatitis?
But can you tell by looking at it?

Generally no

Interdigital is wet work
Individuals at risk for contact irritant dermatitis

- Hand dermatitis before age 15
- Persistent body eczema in adulthood
- Persistent dry itchy skin
- If have all 3 risk factors then 80% will get hand dermatitis in dry jobs, and 90% in wet jobs.
In the high risk individual, the choice of occupation may be irrelevant as far as the development of dermatitis goes.

But, contact with irritants may influence the severity of the dermatitis.
Most of those with irritant dermatitis can continue in their work with slight modification of duties, or exposures, and with treatment.

However, atopics have a poor prognosis if they develop a superimposed contact dermatitis (irritant or allergic), and tend not to improve upon leaving their occupation.
i.e, the high risk atopic:

- Has a high risk of hand dermatitis in any job
- The dermatitis will be worse in an “irritant” job.
- Ceasing work may not improve their dermatitis.

These facts should be considered, before denying someone work on the basis of atopy, or recommending that they cease work on account of a dermatitis problem.
Occupations at risk of irritant dermatitis

Food industry

Horticulture
Occupations at risk of irritant dermatitis

Meat/fish processing  construction
Occupations at risk of irritant dermatitis

Animal welfare

Farmers
Occupations at risk of irritant dermatitis

Automotive mechanics  

Hairdressers
Occupations at risk of irritant dermatitis

Beauty therapy

Medical profession
Some occupations have a very low risk of irritant dermatitis

The legal profession

Entertainers
Some occupations have a very low risk of irritant dermatitis

The clergy

Police
Some occupations have a very low risk of irritant dermatitis

Skydivers

Drivers
Some occupations have a very low risk of irritant dermatitis

Senior management
Allergic contact dermatitis

Involves the immune system

Type IV (T cell mediated) Hypersensitivity
Test with a patch test.

Reaction appears 2-7 days after exposure

Not dose dependent
Allergic contact dermatitis may follow years of trouble free exposure to a chemical

Once sensitised, even tiny exposures are enough to cause dermatitis

Dermatitis may occur at sites of secondary contact
So, what’s photo-contact allergic dermatitis...?

- Chemical A is converted to chemical B by the action of ultraviolet light,

and it’s chemical B that the person is allergic to.
Suspect allergy when there is exposure to potential allergens and there is ...

- A sudden onset of severe dermatitis
- Dermatitis which resolves when not at work, or when not doing that particular task
- A refractory hand/facial dermatitis
Patch testing for contact allergy

Commercial allergens and test tape

Tapes applied to the back
The patch test

• Usually one uses a standard series of allergens – the nature of which varies from country to country eg there is a European Standard Series, and an American Standard Series ( and Finnish, British, Polish, Swedish etc )

• Additional allergens can be added, based on the patient’s history of exposure.

• You can also add the patients own products
• The **European standard** (the commonest one used by dermatologists here who prepare their own tests) contains **28 allergens**.

• The **TRUE test** contains **29 allergens** – there are several that are in the European series that aren’t in the TRUE test and vice versa

• About 15-20% of those with a contact allergy are allergic to something which is NOT in the standard series.
• The object of the exercise is to have a standard series that isn't too big, and which captures about 80% of the relevant positive contact allergies in your area.

• The **British and North American series**, with **41** and **50 allergens**, respectively, are too big for that purpose, in my opinion.
• The **TRUE test** is used because it is convenient (you don’t have to spend 30 minutes preparing a routine screen of allergens).

• Many people who use TRUE test use no additional allergens (if they had the time to go mucking about sorting out which allergens to test, and squirting out little itsy bitsy bits of gloop and liquid onto little chambers and filter paper discs, they’d do the whole lot that way).
• The tapes are placed on the back on Day 0 and left for 2 days. In adults it's not uncommon to test 50 – 80 substances.

• The tapes have to be kept dry.

• Day 2 the position of the tapes are marked on the skin and they are removed. The skin is checked for reactions.
• The test sites are checked again in a further 2 days, and a final reading on day 7 or 8 is preferable.

• Patch test reactions are graded +/-, +, ++, or +++ according to the ICDRG criteria.
• Photopatch tests are similar, except 2 sets (duplicates) of allergens are applied.

• One determines the minimal erythema dose to UVA by photo-testing on day 1.

• On day 2 one of the sets of allergens is exposed to 50% of the MED
Pitfalls in patch testing

• If you don’t test it, you won’t get a reaction to it. Deciding what to test is important.

• Irritant reactions are more common in children.

• Just because there is a reaction, doesn’t mean it is relevant to the current dermatitis.
.....Some cases
• Acute irritant dermatitis

• Due to calcium oxalate in a plant
Someone with hand dermatitis – irritant, allergic, endogenous?

• Or all three

• Or does it matter anyway?
Someone with hand dermatitis – irritant, allergic, endogenous?

- If the problem ONLY occurred because of irritant exposures, then you can label it an irritant contact dermatitis.
Irritant contact dermatitis

- No past history of dermatitis or flexural eczema as a child but nothing for many years
- Dermatitis confined to the hands
- Began 6 months ago shortly after starting work as a caregiver or hairdresser or had a baby
- [and you can exclude contact allergy]
Endogenous dermatitis

- History of eczema since childhood

- Hands worst, but eczema other sites too

- Might be aggravated by irritant exposures, so still enquire after these
Contact allergic dermatitis

- No past history of dermatitis/ or flexural eczema as a child but nothing for many years
- Localised to the hands/ or a few patches elsewhere
- Poor response to potent Rx
- Patch test has relevant positive reactions
Someone with hand dermatitis – irritant, allergic, endogenous?

- Clinically these may all look the same.
- Diagnosis is made through history and patch testing.
- Contact allergic dermatitis won't improve unless the allergen is avoided.
• In some cases of allergic dermatitis the causative agent is pretty obvious
Braces

Belt buckle
Linear patches of dermatitis: A plant is the likely cause
Cant guess here its due to a plant

Or here
• Recent onset, face only.

• No response to hydrocortisone; partial and temporary response to prednisone.

• Work = strips bark off logs
• Patch test confirms reaction to colophony – made from pine resin.

• Resolved when ceased work

• Recurred years later when his wife bought a Givenchy perfume. Cross reaction to oak moss absolute
facial dermatitis, coming and going for several months, with no response to hydrocortisone

Reaction to PPD – hair dye allergen
• Dermatitis in this distribution could be due to a hair product, a face product, something transferred by the fingertips including nail lacquer allergy, or it might even be due to the gold jewellery she wears.
Footwear contact dermatitis

Airborne contact dermatitis
Epoxy dermatitis

Shampoo preservative
It’s not uncommon to have multiple allergies

• Gave up work as a printer because of irritant hand dermatitis.

• Then worked at a hardware store, in the wood department, and found that his hands flared with handling wood or bags of cement.
• Flared up badly when he cleaned his wife’s car
Found to be allergic to:

coconut diethanolamide (in the wheel cleaner he used)

collophony (pine resin)

chromate (in cement)

octylisothiazolinone (preservative)

nitrobutylmorpholine and N-isopropyl N phenyl 4 phenylenediamine (rubber chemicals)
• History of otitis externa, getting worse with treatment instead of better.

• Allergies to tixocortol, neomycin, chlorocresol, parabens mix, neomycin
Steroid allergy

• Mr O has had a rash coming and going for many years.

• He has seen lots of doctors, including 3 other dermatologists.

• He has had lots of treatments and investigations.

• Treatment makes him worse rather than better.

• He is a desperate man!
The patient had kept a list of every occurrence of rash and every treatment.

- 2001 itchy spot right wrist. Saw doctor, given cream
- Rash spread fast after cream. Went to see Dermatologist A who tried various creams
- Rash worsening. Dermatologist A referred him to dermatologist B who gave him a “cortisone injection”
- Much worse
• 2002 Dermatologist A consulted again about itchy spot on left leg. Given various creams including hydrocortisone and diprosone
• Rash worse. Big annular patches behind the knees (very commendable drawings appended)
• Rash slowly faded.
• Similar sort of carry on in 2003. Eventually saw a different GP who gave him a kenacort injection
• Rash flared up.
• Miscellaneous steroid creams given, without any benefit.
• Dentist gave him dexamethasone tablet in September 2003 with “violent skin reaction” - large areas bright red. Resolved in 2 days
• Dermatologist C gives him Locoid in 2006. It is soothing, but within 8 days the rash has trebled in size.
• In August 2006 Dermatologist C tries prednisone tablets
• More rash appears. He feels very hot.
• Prednisone finally discontinued 15 Sept.
• Went to a naturopath who diagnosed mercury poisoning
• End of Sept. rash subsiding
• And so on with more GP’s, steroid creams, and systemic steroids for the next 5 years.
Working diagnosis............reacts adversely to doctors
<table>
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<tr>
<th>Drug</th>
<th>48hrs</th>
<th>96hrs</th>
</tr>
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<tbody>
<tr>
<td>hydrocortisone 17 butyrate 0.1%</td>
<td>o</td>
<td>++</td>
</tr>
<tr>
<td>hydrocortisone 1%</td>
<td>o</td>
<td>+</td>
</tr>
<tr>
<td>betamethasone 17 valerate 0.12%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>clobetasol 17 propionate 0.25%</td>
<td>o</td>
<td>+</td>
</tr>
<tr>
<td>prednisolone 1%</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>triamcinalone acetonide 0.1%</td>
<td>o</td>
<td>++</td>
</tr>
<tr>
<td>amcinonide 0.1%</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>tixocortol 21 pivalate</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Steroid allergies can manifest in a variety of ways, in part because of the conflicting effects of the allergy and the anti-inflammatory properties of the steroid.

Reactions can be eczematous, toxicoderma like, morbilliform, or migrating annular erythemas. This patient seemed to manifest all these, at different times.
Flares following systemic administration of steroid can likewise be eczematous, morbilliform, or toxicoderma like. They can be localised to previously affected sites, or generalised.
Patch test reactions might not appear until day 7.
The prevalence of steroid allergies is probably 3 or 4% of patch test patients.
The original classification of steroids

Group A  hydrocortisone, tixocortol, prednisone....
Group B  triamcinalone and budesonide
Group C  betamethasone, dexamethasone,........
Group D  HC 17 butyrate, clobetasone 17 butyrate....
Group A  hydrocortisone, tixocortol, prednisone....
Group B  triamcinalone and **budesonide**
Group C  betamethasone sodium phosphate, dexamethasone,........
Group D1  clobetasone 17 butyrate, betamethasone 17 valerate....
Group D2  hydrocortisone 17 butyrate, methylprednisolone aceponate
• How well is contact allergic dermatitis in adults diagnosed?

  – Badly
A survey of dermatologists in the USA in 2002 found that 83% did patch testing

26% only did one reading

74% used TRUE test

17% don’t patch test at all

Failing to do a reading at day 4 will miss 20-30% of relevant positive reactions. Another reading at day 7 or 8 picks up about another 10% of positive reactions

10 of the 30 most common allergens aren’t in the TRUE test. Many probably didn’t test additional allergens (missing about 20% of relevant positives)
Contact allergy in children

- It's not that long ago that contact allergic dermatitis in children was thought to be rare.
- ....not so.
- It's as common as in adults.
• There is no similar data for children, but a recent show of hands amongst NZ dermatologists, indicated that patch testing children was done rarely.

• [ it may have increased in prevalence following my talk on the subject ]
A meta-analysis of data, reported in 2011
Bonitsis NG et al Contact Dermatitis 2011 64 245-257

• Haptens likely to be positive in >10% of the paediatric population:
  • Nickel
  • Ammonium persulfate

• Haptens likely to be positive in 5-10% of the paediatric population
  • Gold
  • Thiomersal
  • Paratoluenediamine
  • Palladium
  • Cobalt
  • Mercuric chloride
Nickel allergy

• First Denmark in 1990 and then the European Union Nickel Directive in 1994, restricted the amount of nickel in consumer products in contact with the skin.

• There are no such regulations in NZ
# Nickel allergy

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>1985</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>17%</td>
</tr>
<tr>
<td>Poland</td>
<td>2007</td>
<td>30% of 7 year olds</td>
</tr>
<tr>
<td>Sweden</td>
<td>2007</td>
<td>13.3% girls, 2.5% boys</td>
</tr>
<tr>
<td>USA</td>
<td>2004</td>
<td>28%</td>
</tr>
</tbody>
</table>


The prevalence of nickel allergy in Denmark dropped from 27% in 1985 to 17% in 2007.
Nickel allergy

• The risk of sensitisation increases with the number of piercings.

• Often fairly cheap jewellery is used in children

• Domes in jeans don’t seem to be much of a problem any more, but belt buckles are
Nickel allergy

- The first report of Nickel allergy due to contact with cell phones was in 2000.

- In a 2008 Danish study 8 of 41 cell phones tested released free nickel (from metal frames around the display screen, menu buttons, decorative logos etc).

- In 2009 The EU Nickel Directive expanded its policy to include cell phones.
A survey of 3846 7 yr olds, and 5474 16 yr olds in Poland

Czarnobilska E et al Contact Dermatitis 2009 60 264-269

<table>
<thead>
<tr>
<th></th>
<th>7 yr olds</th>
<th>16 yr olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear metal jewellery</td>
<td>10%</td>
<td>50%</td>
</tr>
<tr>
<td>...everyday</td>
<td>1%</td>
<td>21%</td>
</tr>
<tr>
<td>Have pierced ears etc</td>
<td>27%</td>
<td>53%</td>
</tr>
</tbody>
</table>
• 13 yr old F

• 9 month history of eczema

• No history of atopic conditions

• Earlobes, below the ears, waist, back of the neck, eyelids, legs

• Eczema was severe, and had not responded to steroid creams including dermol, nor prednisone
• NiSO$_4$ +++/+++ 

• Avoided metal belt buckles, jewellery significant improvement

• Then weepy eczema and areas of ulceration, chest and back

• Low nickel diet, and eczema resolved
Remember this meta-analysis, 2011?
Bonitsis NG et al Contact Dermatitis 2011 64 245-257

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  - Nickel
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- Haptens likely to be positive in 5-10% of the paediatric population
  - Gold
  - Thiomersal
  - Paratoluenediamine
  - Palladium
  - Cobalt
  - Mercury
Remember this meta-analysis, 2011?
Bonitsis NG et al Contact Dermatitis 2011 64 245-257

• Haptens likely to be positive in >1% of the paediatric population
  • Fragrance mix I
  • Bacitracin
  • Potassium dichromate
  • Lanolin
  • Neomycin
  • Balsam of Peru
  • Cocamidopropyl betaine
  • Paraphenylenediamine
  • Disperse Blue 124
A survey of 3846 7 yr olds, and 5474 16 yr olds in Poland
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<table>
<thead>
<tr>
<th></th>
<th>7 yr olds</th>
<th>16 yr olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had a temporary tattoo</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>Ever used hair dye</td>
<td>0</td>
<td>29%</td>
</tr>
</tbody>
</table>
• A British study of 500 children found that 3% had relevant positive reactions to hair dye.

• The most common source of PPD allergy in the 5-10 yr age group was henna tattoos and in the 10-16 yr age group it was hair dye
  (Clayton T et al BJD 2006 154 114-117)
• In 1992 the Japan Soap and Detergent Association surveyed young people in Tokyo and found that 13% of female high school students had used hair dye.

• In 2001 it was 41%

• PPD was actually banned for a while, by Germany, France, and Sweden.

• Current EU legislation allows PPD up to 6% concentration.
Hair dye allergy

• Severe reactions can occur, and are usually facial rather than on the scalp.

• It is not uncommon for there to be severe facial swelling, confused with angioedema or cellulitis

• Sometimes the dermatitis may become generalised.

• Sometimes significant temporary hair shedding occurs.
• 16 year old girl

• Past history of a “dreadful dermatitis” following an eyelash tint.

• Also PHx of reaction to a henna tattoo

• Presented following severe facial dermatitis. Had colored her hair
Remember this meta-analysis, 2011?  
Bonitsis NG et al Contact Dermatitis 2011 64 245-257

- Haptens likely to be positive in >1% of the paediatric population
  - Fragrance mix I
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<tr>
<th></th>
<th>7 yr olds</th>
<th>16 yr olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily perfume/cosmetic</td>
<td>28%</td>
<td>63%</td>
</tr>
</tbody>
</table>
Allergies to cosmetics and medicaments

- Positive reactions vary from study to study – but include tree oil, bacitracin, perfume, emulsifiers, chlorhexidine.

- A French study of 641 children tested with 7 medicaments, and their emollients, found 7% had positive reactions – of these 47% reacted to their emollient
15 year old girl
Relevant reactions:
• Kathon +/-
• Benzoyl peroxide +/-
15 year old girl
Octocrylene 0/++
16 year old boy
Fragrance mix ++/+++
9 year old girl
Cocamidopropyl betaine 0/+
Who to test?

- Children with localised dermatitis which is severe, and/or difficult to control.
- Children with chronic or recurrent widespread dermatitis, which is difficult to control.
- Children who get worse with treatment, instead of better.
What happens if you refer to the public hospital in Wellington for a patch test

• No patch testing service available
What about in private?

- Although patch testing has not been audited in NZ the situation is probably not too different to North America.

- Because patch testing involves up to 2 hours of work, they are not cheap.

- There are only a few dermatologists in the country offering comprehensive patch testing services:
  - Anne Davis in Christchurch
  - Louise Reiche in Palmerston North
  - Marius Rademaker in Hamilton
  - Deborah Grieg in Auckland
  - Lissa Judd in Wellington
• The referral rate for contact dermatitis should be 1 per 700 population served.

• [ We should be patch testing about 600 in the Wellington region per year. ]

• [ We should be patch testing about 300 children per year ]
What to do if you suspect contact allergic dermatitis

• Refer for patch testing

• Try avoiding the allergen you suspect

• Do the patch test yourself

• You may be thwarted by a lack of facilities

• This hardly ever works, because either you guessed wrong, or there is more than one allergen

• Not ideal
You could use a TRUE test.

You can order a routine screen and/or supplementary allergens from www.anwyl.com/medical.

We can advise on how to grade the results, or you can look this up on:

www.dermnetnz.org/procedures/patch-tests.html

The most difficult part is deciding what to test, and determining the relevance of positive results.