Occupational Dermatology Pearls and Pandemic Related Occupational Skin Disease

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Learning objectives

- Identify common allergens causing occupational allergic contact dermatitis (OACD)
- Recognize different presentations of OACD
- Learn practical approach to workup and management
- Review OACD in the context of pandemic related occupational skin disease

Occupational Skin Disease (OSD)

OSD accounts for more than 35% of all occupationally related disease

Annual est. cost >$1 billion

- lost productivity, medical care, and disability payments

90% of occupational skin disease can be attributed to contact dermatitis

Significant emotional distress

Decreased quality of life

Clinical classification of occupational dermatoses.

CLINICAL CLASSIFICATION OF OCCUPATIONAL DERMATOSES
Contact dermatitis
• Irritant - chemically induced - photoinduced - mechanical • Allergic
Chemical burn
Contact urticaria
Cancer
• Sunlight/UV-induced • Ionizing radiation-induced • Chemically induced
Follicular disease
• Acne • Folliculitis • Chloracne
Autoimmune connective tissue disease
• Systemic sclerosis (silica; see Ch. 43) • Scleroderma-like (vinyl chloride, organic solvents; see Ch. 43) • Vibration-induced
Pigmentary disorders
• Hypopigmentation (see Ch. 66) • Hyperpigmentation (see Ch. 67)
Foreign body reactions (see Ch. 94)
Infection
• Viral • Bacterial • Fungal • Parasitic

Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

High risk occupations

- Health care workers

- Hairdressers
- Cosmetologists

- Butchers
- Cooks
- Florists

- Machinists
- Mechanics
- Construction workers

High risk exposures

- Wet work including frequent hand washing
- Irritating and sensitizing chemicals
- Mechanical friction and trauma
- PPE use (ex. nitrile and latex gloves, face masks, scrubs, gowns, etc.)

History

- ❑ What exactly does patient do in his/her job?
- ❑ Protective gloves/gear?
- ❑ What materials does patient use?
  Oils? Metals? Epoxies? Acrylates?
- ❑ New product or new procedure in the workplace?
- ❑ Cleansers? Skin protectants (creams) used?
- ❑ Other workers affected?
- ❑ Better on weekends/vacations?
- ❑ Recreational exposures?
- ❑ Check Safety Data Sheets
- ❑ Literature search if necessary

Mathias criteria for diagnosis of Occupational Contact Dermatitis

1) Appearance?

2) Exposure?

3) Distribution ?

4) Temporal relationship?

5) Non occupational sources excluded?

6) Improvement away from work?

7) Patch tests + ?

4/7 needed to establish diagnosis of OCD

Mathias CT; J Am Acad Dermatol 1989; 20: 842

Sample allergen categories

Metals

Fragrances

Rubber Additives

Medicaments

Preservatives

Dyes/Vehicles

Resins/Adhesives

Plants

T.R.U.E. TEST Allergen Information

Each T.R.U.E. TEST patch test unit contains Panel 1.3, 2.3 and 3.3, and includes 35 common allergens and a negative control.

Panel 1.3	Panel 2.3	Panel 3.3
Nickel Sulfate	p-tert-Butylphenol Formaldehyde Resin	Diazolidinyl Urea
Wool Alcohols	Epoxy Resin	Quinoline Mix
Neomycin Sulfate	Carba Mix	Tixocortol-21-Pivalate
Potassium Dichromate	Black Rubber Mix	Gold Sodium Thiosulfate
Caine Mix	Cl+ Me- Isothiazolinone (MCI/MI)	Imidazolidinyl Urea
Fragrance Mix	Quaternium-15	Budesonide
Colophony	Methyldibromo Glutaronitrile	Hydrocortizone-17-Butyrate
Paraben Mix	p-Phenylenediamine	Mercaptobenzothiazole
Negative Control	Formaldehyde	Bacitracin
Balsam of Peru	Mercapto Mix	Parthenolide
Ethylenediamine Dihydrochloride	Thimerosal	Disperse Blue 106
Cobalt-Dichloride	Thiuram Mix	Bronopol

https://www.smartpractice.com/shop/category?cn=Products-T.R.U.E.-TEST&id=508222&m=SPA

North American Contact Dermatitis Group (NACDG) Standard Series- 80 allergens

1.	B-004	Benzocaine
2.	M-003B	2-Mercaptobenzothiazole (MBT)
3.	C-020	COLOPHONIUM
4.	P-006	p-PHENYLENEDIAMINE (PPD)
5.	I-001A	IMIDAZOLIDINYL UREA
6.	C-014	CINNAMAL
7.	A-004	Amerchol L-101
8.	Mx-06	Carba mix
9.	N-001	Neomycin sulfate
10.	Mx-01	Thiuram mix
11.	C-028	Clobetasol-17-propionate
12.	E-005	Ethylenediamine dihydrochloride
13.	E-002	Epoxy resin, Bisphenol A
14.	C-007B	QUATERNIUM-15
15.	B-024	4-tert-Butylphenolformaldehyde resin (PTBP)
16.	Mx-05B	Mercapto mix
17.	D-022	1,3-Diphenylguanidine
18.	P-014B	Potassium dichromate
19.	B-001	Peru balsam
20.	N-002B	Nickel(II)sulfate hexahydrate
21.	D-044C	DIAZOLIDINYL UREA
22.	T-036	TOCOPHEROL
23.	B-032B	Bacitracin
24.	Mx-24	Mixed dialkyl thiourea
25.	D-032	DISPERSE ORANGE 3
26.	Mx-03A	Paraben mix
27.	D-049E	METHYLDIBROMO GLUTARONITRILE
28.	Mx-07	Fragrance mix I
29.	G-003B	GLUTARAL
30.	B-015B	2-BROMO-2-NITROPROPANE-1,3-DIOL
31.	Mx-18	Sesquiterpene lactone mix
32.	T-007	THIMEROSAL
33.	P-022	Propolis
34.	H-014C	BENZOPHENONE-3
35.	C-010B	CHLOROXYLENOL (PCMX)
36.	Mx-16	Ethyleneurea, melamine formaldehyde mix
37.	B-022	2-tert-Butyl-4-methoxyphenol (BHA)
38.	G-005A	Gold(I)sodium thiosulfate dihydrate
39.	E-004	Ethyl acrylate
40.	G-004	GLYCERYL THIOGLYCOLATE
41.	T-010	Toluenesulfonamide formaldehyde resin
42.	M-013	Methyl methacrylate
43.	C-017A	Cobalt(II)chloride hexahydrate
44.	T-031A	Tixocortol-21-pivalate
45.	B-033A	Budesonide
46.	C-019	COCAMIDE DEA
47.	T-016	TRIETHANOLAMINE
48.	Mx-30	Textile dye mix
49.	T-035B	Tea Tree Oil oxidized
50.	Mx-25	Fragrance mix II
51.	D-036	Disperse Yellow 3
52.	B-010B	BENZYL SALICYLATE
53.	D-065	DECYL GLUCOSIDE
54.	M-035B	METHYLISOTHIAZOLINONE
55.	H-010	2-Hydroxyethyl methacrylate
56.	D-047B	DMDM HYDANTOIN
57.	Y-001	Ylang ylang oil
58.	B-008B	BENZYL ALCOHOL
59.	I-003	ISOPROPYL MYRISTATE
60.	H-032A	Hydroperoxides of Limonene
61.	D-057	Desoximetasone
62.	P-013	POLYSORBATE 80
63.	I-008C	IODOPROPYNYL BUTYLCARBAMATE
64.	O-004	2-n-Octyl-4-isothiazolin-3-one
65.	Mx-26	Disperse Blue mix 106 / 124
66.	Mx-29A	Compositae mix II
67.	L-002B	Lidocaine
68.	F-003	Fusidic acid sodium salt
69.	D-005B	Dibucaine hydrochloride
70.	B-007	Benzoylperoxide
71.	I-009	ISOAMYL p-METHOXYCINNAMATE
72.	L-003	HYDROXYISOHEXYL 3-CYCLOHEXENE CARBOXALDEHYDE
73.	O-007A	ETHYLHEXYL SALICYLATE
74.	H-031A	Hydroperoxides of Linalool
75.	A-029	Amidoamine
76.	C-018	COCAMIDOPROPYL BETAINE
77.	F-002B	FORMALDEHYDE
78.	C-009B	METHYLISOTHIAZOLINONE+ METHYLCHLOROISOTHIAZOLINONE
79.	P-019B	PROPYLENE GLYCOL
80.	O-005	OLEAMIDOPROPYL DIMETHYLAMINE

https://www.chemotechnique.se/products/product-search-/?search=&series=Series

North American Contact Dermatitis Group (NACDG) Patch Test Results 2019-2020; *N=4121*

Top 5 Allergens

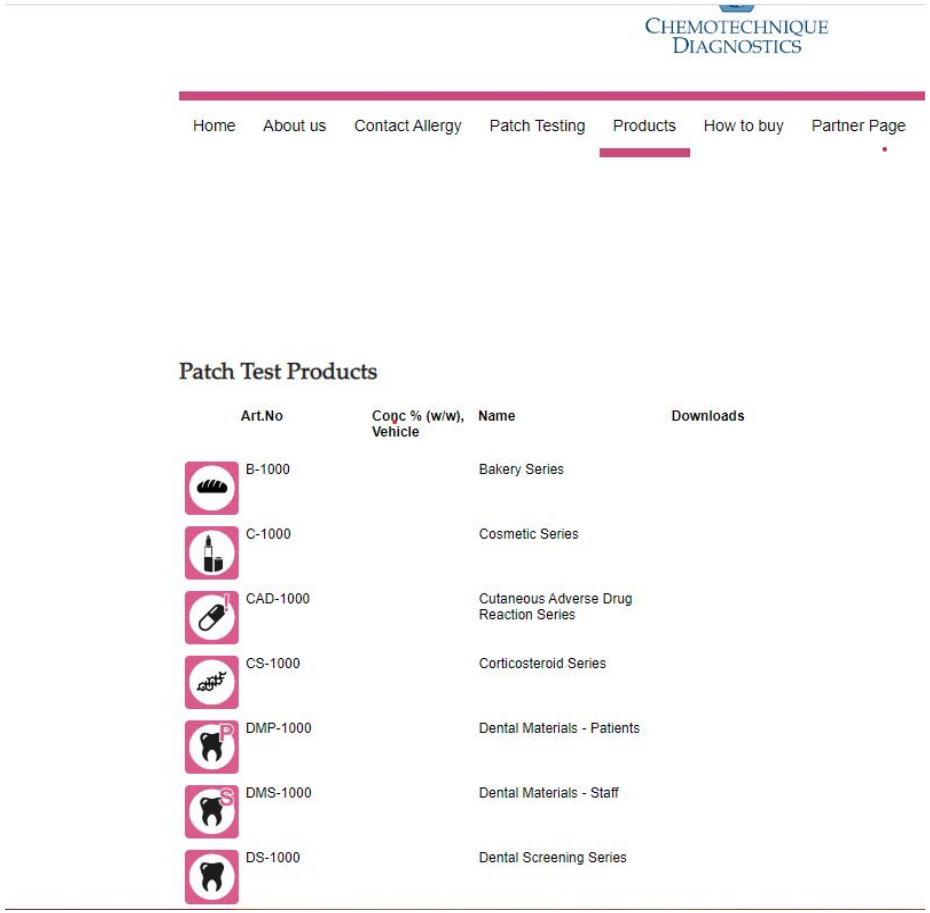
- Nickel sulfate (18.2%)
- Methylisothiazolinone (MI) (13.8%)
- Fragrance mix (FM) I (12.8 %)
- Linalool (11.1%)
- Benzisothiazolinone (10.4%)

Top 6-11 Allergens

- (MCI/MI) (9%)
- Propolis (8.6%)
- Myroxylon Pereirae (balsam of Peru) (7.4%)
- Cobalt (7.3%)
- Formaldehyde (6.8%)
- Neomycin (6.3 %)

DeKoven J, et al. Dermatitis 2023; 34(2)

Sample expanded series options



CHEMOTECHNIQUE DIAGNOSTICS

Home | About us | Contact Allergy | Patch Testing | Products | How to buy | Partner Page

Patch Test Products

Art.No	Conc % (w/w), Vehicle	Name	Downloads
B-1000		Bakery Series	
C-1000		Cosmetic Series	
CAD-1000		Cutaneous Adverse Drug Reaction Series	
CS-1000		Corticosteroid Series	
DMP-1000		Dental Materials - Patients	
DMS-1000		Dental Materials - Staff	
DS-1000		Dental Screening Series	

E-1000	Epoxy Series
ECB-1000	European Comprehensive Baseline Series
F-1000	Fragrance Series
H-1000	Hairdressing Series
I-1000	Isocyanate Series
ICB-1000	International Comprehensive Baseline Series
IMP-1000	Implant Series
IS-1000	International Standard Series
LU-1000	Leg Ulcer Series
MA-1000	(Meth) Acrylate Series - Adhesives, Dental, Printing & Other
ME-1000	Medicament Series
MET-1000	Metal Series
METE-1000	Metal Series Extended
MN-1000	(Meth) Acrylate Series - Nails

https://www.chemotechnique.se/products/product-search-/?search=&series=Series

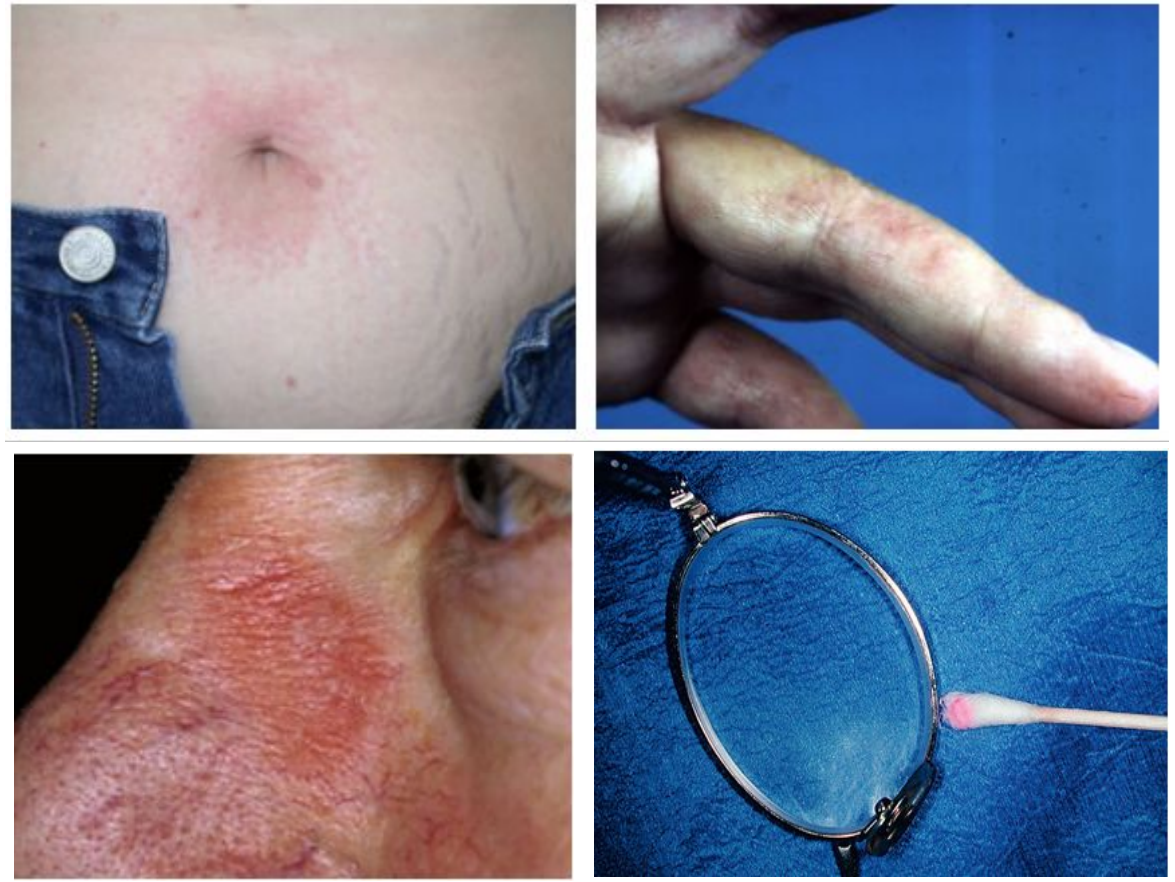
O-1000	Oil & Cooling Fluid Series
PG-1000	Plastic & Glues Series
PL-1000	Plant Series
PP-1000	Photopatch Series
R-1000	Rubber Additives Series
S-1000	European Baseline Series
SH-1000	Shoe Series
SU-1000	Sunscreen Series
TF-1000	Textile Colours & Finish Series

Allergic contact dermatitis

Nickel

- Most common allergen

- Combined with other metals to enhance strength /durability
  - White gold, 14-carat yellow gold, chrome, silver, bronze, brass
- Often co-allergen along with chromium and cobalt- T.R.U.E. and NACDG



https://dermnetnz.org/topics/nickel-allergy
Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

Nickel Testing

- Dimethylglyoximine test kit
  - (Allerderm Ni kit)
  - (Delasco Nickel Spot Test)

T.R.U.E. TEST
THIN-LAYER RAPID USE EPICUTANEOUS PATCH TEST

NICKEL SULFATE

WHERE IS NICKEL FOUND?

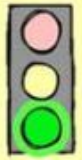
***At work*, you may find nickel in or around:**

- Metal alloys
- Copper-nickel tubing for salt water
- Machine parts
- Chemical catalysts
- Aluminum electrical joint compounds
- Equipment
- Orthodontic and dental appliances
- Welding and cutting
- Nickel plating
- Metal-working fluids and oils
- Batteries
- Dyes
- Insecticides

Prevention / Treatment

- Avoidance
- Coat metal with clear nail polish
- NIK-L-BLOK Barrier Cream (metal ion chelator for nickel and cobalt)
- Avoid placing keys in the front pocket
- Controversial?: Nickel sensitive pts with hand and/or foot dermatitis may benefit from nickel free diet

THE LOW-NICKEL FOOD GUIDE™



Go!
Low Nickel Content


MUSHROOM


CUCUMBER


BELL PEPPERS


CELERY

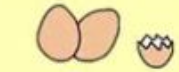

BRUSSELS SPROUTS


BROCCOLI


APPLES, ORANGES, & BANANAS


OLIVE OIL


SALMON


EGGS


SWISS CHEESE


CHICKEN BREAST


WHITE RICE


STEAK


SWEET POTATO


PLAIN BAGEL

Stop!
High Nickel Content


KALE


SOY

PEANUT BUTTER


LIMA BEANS

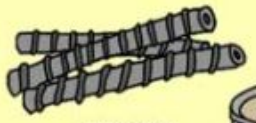
CANNED PORK & BEANS

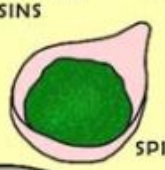
CHOCOLATE


WHEAT GERM


GRANOLA WITH RAISINS


PINTO BEANS


LICORICE


SPIRULINA


OAT RING CEREAL

CANNED REFRIED BEANS

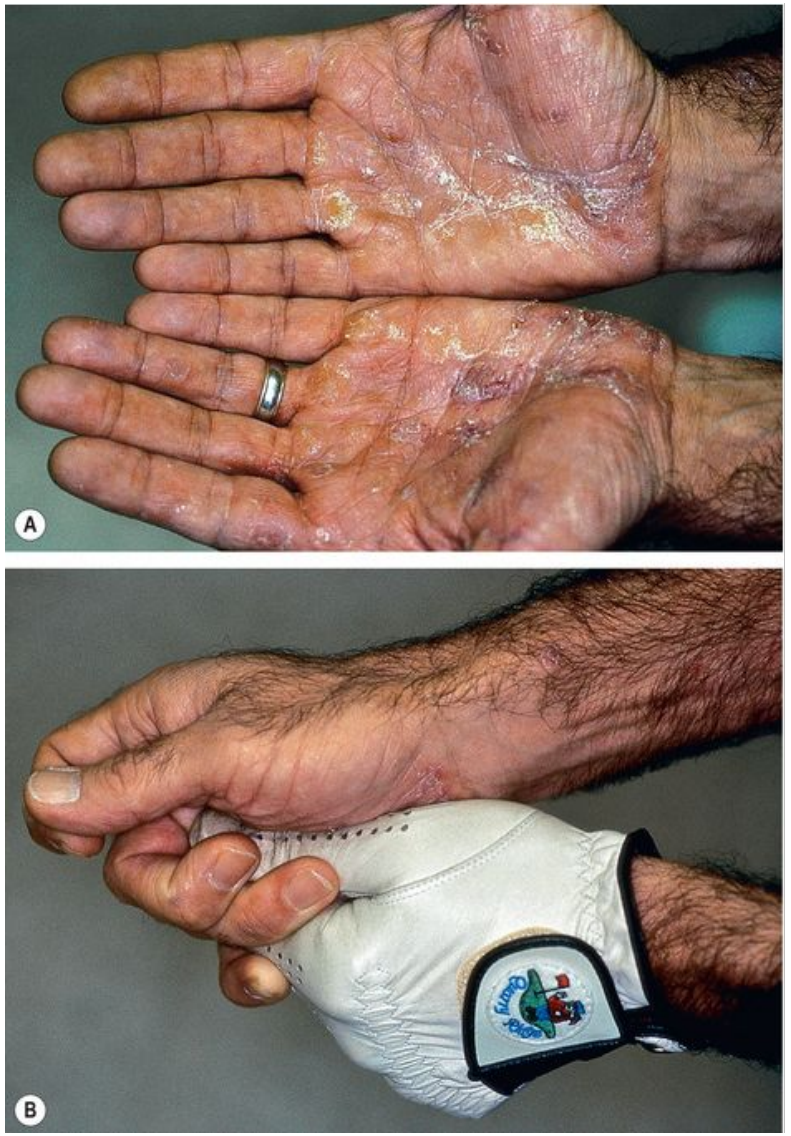

SUNFLOWER SEEDS

https://www.dermatitisacademy.com/nickel-page/low-nickel-diet-guide/

Allergic contact dermatitis- hand dermatitis

Chromium (potassium dichromate)

- Can be irritant / allergen
- Dyes:
  - green felt fabric (pool table)
  - yellow-green pigment (tattoos / cosmetics)
- **Leather (strengthens it)**
- Cement
- Matches
- Chromic gut suture



Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

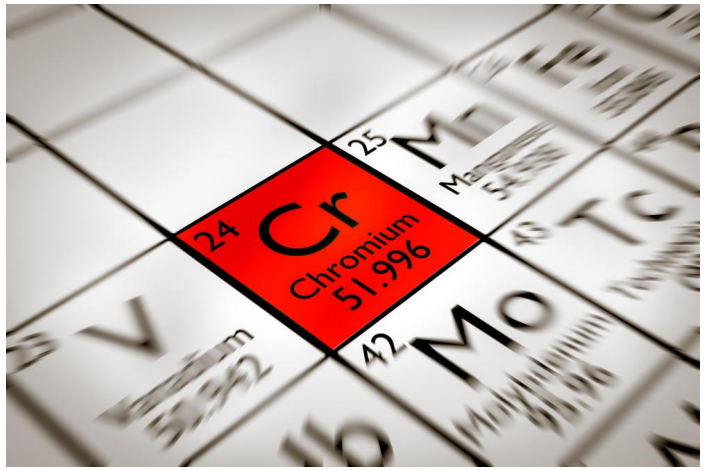
T.R.U.E. TEST®
THIN-LAYER RAPID USE EPICUTANEOUS PATCH TEST

POTASSIUM DICHROMATE

WHERE IS POTASSIUM DICHROMATE (OR CHROMIUM) FOUND?

***At work,* you may find chromates or chromium in:**

- Construction materials such as cement, mortar, concrete, bricks, plaster, drywall
- Leather tanning and product manufacturing
- Primers and chromate-based pigments in paints
- Cutting oils, corrosion inhibitors, oils, fuels and drilling muds
- Liners in high temperature industrial furnaces
- Pyrotechnics
- Printing inks
- Manufacturing, plating and metal working with chrome alloys and stainless steel
- Orthopedic and dental implants, dental prostheses
- Wood preservative manufacturing
- Green dyes used in felt and textiles
- Chrome alloy welding fumes
- Chromic surgical gut sutures



Allergic contact dermatitis- hand dermatitis

T.R.U.E. TEST®
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EPOXY RESIN

- Adhesives
- Paints
- May be added to other plastics

Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

WHERE IS EPOXY RESIN FOUND?

***At work,* you may find epoxy resin in and around:**

- Production of molds, dies and models
- Two-component paints and adhesives
- Electron microscopy embedding media
- Art and sculpture materials
- Manufacture of epoxy composite products such as tennis racquets, skis and circuit boards
- Lightweight equipment and rotor production
- Flooring, floor sealers and coatings
- Protective finishes, coverings and coatings
- Dental restoratives and epoxies

Allergic contact dermatitis- **RUBBER**

Chemicals added in the rubber process are sensitizers:

- Rubber Accelerants: help make liquid rubber solid
  - **Thiuram mix** (tetramethylthiuram disulfide + others)
  - **Carba mix** (carbamates + Diphenylguanidine)
  - **Mercapto mix** and **mercaptobenzothiazole**
- Rubber antioxidants
  - Phenyl-a-napthylamine
  - Hydroquinone (also causes depigmentation)
  - Propyl p-phenylenediamine (tires, heavy duty / **black rubber mix**)
- Additives
  - Dialkyl thioureas
- NOT Latex!

Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

Allergic contact dermatitis- hand dermatitis

Methylisothiazolinone (MI)/

Methychloroisothiazolinone (MCI)

- important allergens that have increased in prevalence over recent years

- extremely common in hand soaps, detergents, wipes, cleaning products

-relative benzisothiazolinone (BI) was allergen #5 on recent NACDG list

Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

Allergic contact dermatitis- hand dermatitis

T.R.U.E. TEST®
THIN-LAYER RAPID USE EPICUTANEOUS PATCH TEST

COLOPHONY

WHERE IS COLOPHONY FOUND?

***At work,* you may find colophony in:**

- Wood and sawdust
- Coated papers
- Cutting fluids
- Paints and stains
- Asphalt products
- Greases and oils
- Polyethylene
- Waterproofings
- Linoleum
- Wood fillers
- Printing inks
- Lacquers and varnishes
- Polishes and waxes
- Corrosion inhibitors
- Solvents
- Neoprene rubber
- Soldering materials
- Drive belts

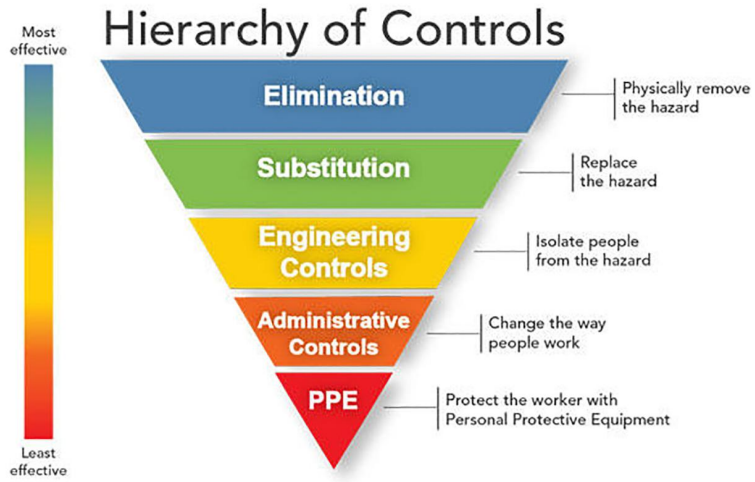
Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

Allergic contact dermatitis- hand dermatitis

- Glutaraldehyde
  - Important allergen for health care workers
  - Used to disinfect and sterilize equipment, surfaces, laundry; embalming fluid; x-ray film development
  - Not on T.R.U.E. test but is on NACDG standard series

Bolognia, Jean, L. et al. Dermatology. Available from: Elsevier eBooks+, (4th Edition). Elsevier - OHCE, 2017.

Management



- Gloves
- Speak to glove specialist
  - Ansell Occupational health care: Barrier glove

    www.ansellpro.com
  - Northern Safety and Industrial: Silver Shield glove

    www.northernsafety.com
- Time off from work: 2-3 weeks

Management

Topical steroids, biologics such as dupilumab. Immunosuppression with systemic steroids, cyclosporine, methotrexate. Antihistamines as needed.

Refer for patch testing

Computerized databases for suitable personal care products

- CAMP (Contact Allergen Management Program)
  www.contactderm.org
- SkinSafeProducts
  www.skinsafeproducts.com

Putting it all together:
occupational derm consult- full body rash

A Mini-epidemic of Suspected Contact Dermatitis to Delta Airlines Uniforms

To the Editor:

In mid-2018, Delta Airlines launched a new uniform line. Soon after rollout, hundreds of Delta flight attendants reported rashes and other symptoms[1]; allergic contact dermatitis to the new uniforms was suspected.

A total of 18 Delta patients were referred between January and October 2019 to 4 patch testing centers and included in the analysis. Table 1 highlights the demographics of these patients. Sixteen patients (88.9%) were female and had an average age of 40 years. The most common morphology was scattered erythematous papules (n = 8, 44.4%). The predominant location of rash was on the torso (n = 16, 88.9%) and face/neck (n = 9, 50.0%). Eight patients (44.4%) also reported nondermatologic complaints associated with the uniform.

Photograph: Delta

Putting it all together:
occupational derm consult: facial rash related to face mask

Do not lose sleep over mask allergic contact dermatitis

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Chestnut Hill and Wellesley, Massachusetts and New York, New York

Key words: allergic contact dermatitis; face mask; N95 respirator; occupational.

Fig 1. Allergic contact dermatitis. Facial erythema and irritation of the nasal bridge after wearing N95 mask.

Fig 2. Self-patch test. Cluster of pruritic papules d oped on day 3 after removal of self-patch–tested r material.

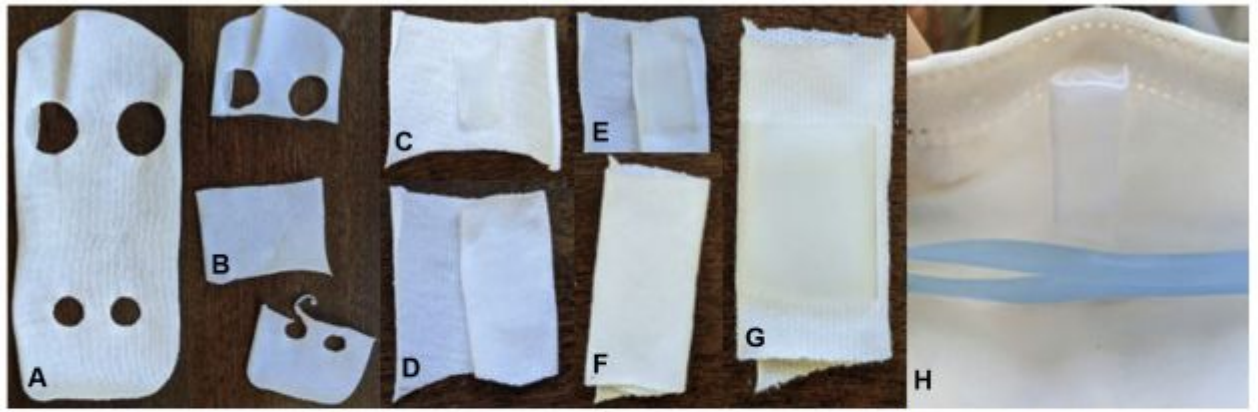

Fig 3. Steps to create the barrier strip. **A,** Intact barrier strip. The solid middle piece of the cloth should be cut out (**B**), and tape is used to fold it like a burrito with the ends untucked (**C** to **F**). Tape is placed in the center (**G**). The barrier is taped into place inside the mask overlying the area of skin inflammation (**H**).

Putting it all together: pandemic related occupational skin disease patterns

TABLE 1 The main materials, potential allergens, sites of skin lesions and symptoms caused by PPE.

PPE		Material	Allergen	Body regions	ASR
Masks	Surgical mask	Soft absorbent sheets, Polypropylene barriers, Melt-blown non-woven fabric	Formaldehyde, 2-bromo-2-nitropropane-1,3-diol, Coco-propylenediamine-guanidinium diacetate, Dibromodicyanobutane Vulcanization promoters, Antioxidants, Nickel, Cobalt	Nasal, Bridge, Ears, Cheeks, Perioral, Chin	Redness, Itching, Dryness
	N95/KN95 respirator	Skin-friendly layer, Structural support filter layer, Hydrophobic coating layer	Formaldehyde, Thiurams, Dithiocarbamates, Mercaptobenzothiazole		Redness, Itching
	Cloth mask	Cotton, Polyester	Formaldehyde, Formaldehyde textile resins, Formaldehyde releasers, Disperse dyes, P-aminobenzene, P-phenylenediamine		Erythema, Scaling
Gloves		Latex, Nitrile rubber, Plastic	Latex, Carba mix, Mercaptobenzothiazole (MBT), Thiuram mix	Hands	Dryness, Rash, Itching
Protective clothing		Polypropylene melt-blown cloth, Polyester fiber	Vinyl, Rubber materials	Limbs, Trunk	Dryness, Pruritus
Protective goggles		Polycarbonate, Optical resin, Polymethyl methacrylate	Not available at present	Nasal bridge	Pressure, Sores, Rash
Face shields		Elastic, Headband, Polycarbonate	Not available at present	Forehead	Abrasions, Itching

Table 1
Reported cases of allergic contact dermatitis due to personal protective equipment and hand hygiene during COVID-19

Authors (Alphabetical), Year Published	Country of Origin	HCWs or Non-HCWs	Number of Patients	Location of Dermatitis	Causative Agent
Aerts et al,[14] 2020	Belgium	HCWs	1	Nose Cheeks	Formaldehyde and 2-bromo-2-nitropropane-1,3-diol (bronopol)
Bothra et al,[15] 2020	India	Both	4	Periauricular	No patch testing—suspected thermoplastic elastomer, rubber, latex
Ferguson et al,[16] 2020	United Kingdom	HCWs	13	Face	Unknown
			30	Hands	Limited patch testing—"rubber accelerators"
Singh et al,[17] 2020	India	HCWs	3	Face	Unknown
Xie et al,[18] 2020	China	Non-HCWs	1	Nasal Bridge Cheeks	Toluene-2,4-diisocyanate, diaminodiphenylmethane, and hexamethylene diisocyanate

Tang H, Wang H, Hamblin MR, Jiang L, Zhou Y, Xu Y, Wen X. Contact dermatitis caused by prevention measures during the COVID-19 pandemic: a narrative review. Front Public Health. 2023 Jul 20;11:1189190. doi: 10.3389/fpubh.2023.1189190. PMID: 37546301; PMCID: PMC10400336.

Abdali S, Yu J. Occupational Dermatoses Related to Personal Protective Equipment Used During the COVID-19 Pandemic. Dermatol Clin. 2021 Oct;39(4):555-568. doi: 10.1016/j.det.2021.05.009. Epub 2021 May 31. PMID: 34556245; PMCID: PMC8165076.