

Basics of Patch Testing for Allergic Contact Dermatitis

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Patch testing is essential for identification of culprit allergens responsible for allergic contact dermatitis. This manuscript reviews how to perform patch testing and how to read and interpret the results.

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Allergic contact dermatitis is a common cause of dermatitis and a frequent diagnostic consideration in dermatology.

Patch testing to a broad array of relevant allergens is the only way to identify the substances causing allergic contact dermatitis. Although the results of patch testing can often be rewarding for the patient and physician, the process of patch testing can be expensive, challenging, time consuming, and frustrating. Often, it raises more questions than answers. Finding the one substance that definitively accounts for the patient's dermatitis is relatively rare. More often, a number of patch-test reactions are noted that might or might not be contributing factors in the patient's dermatitis.

Patch testing is a somewhat imprecise science requiring substantial clinical judgment. What allergens should be considered? How should patch-test reactions be read and interpreted? What should patients be taught about allergen avoidance? This article attempts to clarify some of the questions surrounding patch testing and provide practical guidance for the novice patch tester. Specifically, this article will describe when to perform patch testing, describe the process of patch testing, recommend useful allergen series, and summarize notable allergens.

How to Organize Your Office to Perform Patch Testing

What Is a Good Basic Series for the General Dermatologist?

The standard series (sometimes called the *baseline series*) is the starting point for almost all patch testing. A standard series contains the most common contact allergens en-

countered by most patients. The standard series used at Mayo Clinic currently comprises 72 allergens. Supplemental allergen series (eg, metal series, cosmetic series, dental series) can be added on the basis of the patient's history and exposures.

Components of the standard series and the number of allergens included can vary widely. For example, the British standard series is different from the Belgian standard series. In the United States, standard series include the Food and Drug Administration–approved Thin-Layer Rapid Use Epicutaneous patch test (TRUE test; SmartPractice; Phoenix, AZ), the North American series, the North American Contact Dermatitis Group series, and the American Contact Dermatologic Society core allergen series.

How Do I Obtain and Store Allergens for Patch Testing?

Hundreds of allergens are available from Chemotechnique Diagnostics (Vellinge, Sweden) and AllergEAZE (Calgary, Canada). The Table lists selected allergens and the products commonly associated with them. The TRUE test is a series of allergens and allergen mixes (currently 35) pre-prepared and mounted on adhesive strips.

In general, allergens should be refrigerated. Specific allergens may need to be stored in freezers.

Who Should Be Patch Tested?

Because allergic contact dermatitis occurs at any age, patch testing can be considered at any age. In a study of 31,912 patients who underwent patch testing, positive reactions were observed in 47% of pediatric patients tested, 66.9% of adults (age 19-64 years), and 67.4% of older individuals (age ≥65 years).¹

In general, everyone with recurrent or persistent dermatitis suspected of having a component of allergic contact dermatitis should be patch tested.

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Table Selected Common Allergens Associated With Allergic Contact Dermatitis

Allergen (ACDS 'Allergen of the Year' [Designation] ^a)	Products	Comment
Acrylate [2012]	Sculptured nails, dental products	Used to form plastics and glues Unpolymerized (monomeric) form can penetrate through rubber gloves, whereas the polymerized form is inert (harmless)
Bacitracin [2003]	Over-the-counter and prescription topical antibiotics	Topical antibiotic Rash often takes 3-5 d to develop (late reactor)
Balsam of Peru	Perfumes, cosmetics, candles, cleaning products, essential oils, gum, powders, flavored tobaccos, food products (tomatoes, citrus, chocolate, colas, wine, liquors, cinnamon, vanilla, spices)	Fragrance
Black rubber mix	Shoes, tires, belts, hoses, cables, sports equipment	Rubber
Bronopol	Personal care products (shampoo), cosmetics, food preservative, orthopedic casts, root canal disinfectants, paints, glues, home detergents	Formaldehyde-releasing preservative Antimicrobial, fungicide, germicide Can form nitrosamines, which are carcinogenic (use is decreasing)
Budesonide [2005 ^b]	Corticosteroid screening agent	
Caine mix (benzocaine, tetracaine, dibucaine)	First-aid analgesics, antiseptics, other topical pain relievers	Anesthetics
Carba mix (diphenylguanidine, zinc dibutylthiocarbamate, zinc diethylthiocarbamate)	Rubber products (gloves, shoes, rubber bands, erasers, toys), swimwear, hosing, neoprene, fungicides, pesticides	Rubber product manufacturing
CI-Me isothiazolinone [2013]	Moist personal hygiene wipes, cutting fluids, cooling liquids, latex paints, skin products, hair care products, cosmetics, glues	Contains methylchloroisothiazolinone/methylisothiazolinone Preservative Be suspicious of this allergen in cases of dermatitis affecting the genital area
Cobalt dichloride	Jewelry, tools, pigments, keys, dental and orthopedic implants, bricks, cement, plastics	Metal Co-sensitization with nickel
Cocamidopropyl betaine [2004]	Suds-forming products (shampoos, hand soaps, body washes)	Nonionic surfactant and foaming agent, popular in commercial products because it is less irritating than older surfactants Two chemicals used in its synthesis: amidoamine and dimethylaminopropylamine
Colophony	Personal care products (diapers, feminine pads), cosmetics and personal creams, glues, polishes, waxes, wood products, inks, lacquers, neoprene, polyethylene, oils, colored pencils	Coniferous tree (pine) sap
Diazolidinyl urea	Cleansers, detergents, cosmetics	Antimicrobial preservative
Dimethyl fumarate [2011]	Antimicrobial in sachets used in furniture manufactured in China	Biocide May cause dermatitis of back, buttocks, and parts of upper/lower extremities, depending on exposure
Disperse blue 106 [2000]	Common in polyester lining in women's clothing	Fabric dye
Epoxy resin	Glues, adhesives, flooring, dental epoxies, art, sculpture	Found in curing agents but is not sensitizing when cured Will penetrate rubber but not vinyl gloves

Table Selected Common Allergens Associated With Allergic Contact Dermatitis (Continued)

Allergen (ACDS 'Allergen of the Year' [Designation] ^a)	Products	Comment
Ethylenediamine dihydrochloride	Manufacturing (chelators, curing agents, surfactants, dispersants, binders, carbamates, fuel additives), generic nystatin creams	Manufacturing (drugs, industrial compounds)
Formaldehyde	Fabric finishes, construction materials (plywood, glues, paints, varnishes), polishes, photography materials, personal care products, cosmetics, smoke	Preservative and disinfectant
Fragrance mix [2007]	Included in most skin care products	Look for products that are "fragrance free"
Gold sodium thiosulfate [2001]	Jewelry, electronics, dental restorations, intracoronary stents	Metal Consider in hand, neck dermatitis May be the source of "atopic dermatitis" of the eyelids
Hydrocortisone-17-butyrate [2005 ^b]	Corticosteroid screening agent	
Imidazolidinyl urea	Personal products (cleansers, moisturizers), cosmetics	Preservative
Mercapto mix	Rubber products (shoes, goggles, mats, headphones, tubing, gloves, erasers, wetsuits, sports equipment)	N-Cyclohexyl-2-benzothiazyl sulfenamide, dibenzothiazyl disulfide, 2-(4-morpholinyl mercaptol) benzothiazole Rubber manufacturing
Mercaptobenzothiazole	Pesticides, rubber products, sports equipment	Fungicide, microbicide
Methyldibromo glutaronitrile	Cutting oils, glues, adhesives, skin care and personal hygiene products	Preservative
Mixed dialkyl thioureas [2009]	Clothing, scuba suits, spandex	Rubber chemicals used in production of neoprene and spandex
Neomycin sulfate [2010]	Over-the-counter antibiotic preparations	Common topical antibiotic Rash often takes 3-5 days to develop (late reactor)
Nickel sulfate [2008]	Costume jewelry, coins, keys, tools, buttons, snaps	Metal Commonest allergen Dimethylglyoxime test can detect nickel in products Coat of clear nail polish is an effective barrier
p-tert-Butylphenol formaldehyde resin	Glues, surface coating, adhesives (in shoes, upholstery, leather), electrocardiogram electrodes, fiberglass	Formaldehyde resin
Paraben mix	Hair care products, personal hygiene products (creams, shaving products), cosmetics, antiseptics, lip balms, some foods	Preservative Least common sensitizer of all preservatives
Paraphenylenediamine [2006]	Hair dye, black henna, clothing dye, ink, photographic developers	Black dye
Parthenolide (sesquiterpene lactone)	Plants, garden, floral shops, herbal supplements	Natural product in flowers and fruit of feverfew
Potassium dichromate	Wet cement, chrome, stainless steel, tanned leather products (shoes), pigments and inks, chromic gut surgical sutures, green dyes in felt and textiles, wood preservatives, cosmetics, construction materials	Metal-chromium salt
Propylene glycol	Personal care products, cosmetics	Preservative, humectant, emollient, and spreader Can be an irritant

Table Selected Common Allergens Associated With Allergic Contact Dermatitis (*Continued*)

Allergen (ACDS 'Allergen of the Year' [Designation] ^a)	Products	Comment
Quaternium-15	Insulation, embalming and preserving fluids, glues, inks, toners, paints, waxes, polishes, particleboard, cosmetics, skin care and personal hygiene products, household cleaners, smoke	Preservative (formaldehyde-releasing agent)
Quinoline mix	Topical antifungals, antibacterials, paste bandages	Antimicrobial
Thimerosal [2002]	Topical (eye) medications, antiseptic sprays, fluorescent dyes, cosmetics, vaccines	Preservative and antiseptic Thimerosal-containing vaccinations are safe (including in children), even if patch testing is positive
Thiuram mix (tetramethylthiuram monosulfide, disulfiram, tetramethylthiuram disulfide, dipentamethylenethiuram disulfide)	Rubber products (gloves, shoes, neoprene, rubber bands, erasers, tubing masks, sports equipment), pesticides, fungicides, repellents	Rubber manufacturing
Tixocortol-21-pivalate [2005 ^b]	Corticosteroid screening agent	
Wool alcohols (lanolin)	Lotions, cosmetics, metal-working fluids, waxes, shoe polishes	From fleece of sheep

^aAnnually, the ACDS names an "Allergen of the Year" to draw attention to an important allergen.

^bIn 2005, corticosteroids were named the Allergen of the Year.

Abbreviation: ACDS, American Contact Dermatitis Society.

What Allergen Series Should I Use to Patch Test a Patient?

A standard allergen series should be used. Additionally, it is reasonable to patch-test patients to suspected personal skin care products. If particular exposures are not covered by the standard series, a specialized series may be added. For example, a hairdresser with hand dermatitis should be patch tested to the standard series and to a series containing allergenic chemicals commonly found in a salon. Most dermatologists patch test only to a standard series. Referral to a patch-test center may be needed if more extensive testing is necessary. Patch testing also can be considered for patients with dermatitis or other dermatoses because any dermatosis can be complicated by allergic contact dermatitis.

Who Is a Good Candidate for Patch Testing?

Ideally, patients who undergo patch testing will have normal skin at the test area (usually the back) and are not immunosuppressed. Patients with widespread or generalized dermatitis generally are unsuitable candidates. Suboptimal circumstances for patch testing include patients receiving immunosuppressive medications, undergoing UV light treatment (including frequent tanning), and applying topical corticosteroids to their backs 2 to 3 weeks before testing. These conditions can be associated with false-negative or invalid results.

How Do I Prepare Patients for Patch Testing?

Relevant information for patients² is summarized in the online Appendix (<http://www.skinandallergynews.com/scms-journal/volume-32/september-dermatitis.html>). If patients

prefer to watch instructional videos, they can be referred to the MyPatchLink website.³

Protocol for Patch Testing

How Are Patch Tests Prepared and Applied?

Individual allergens from Chemotechnique and AllergEAZE are sold in prefilled syringes, compounded with either a petrolatum (pet) or alcohol base. Preparation of these materials for patch testing is shown in Figure 1.⁴ The TRUE test has pre-prepared allergens mounted on discs and is ready for application upon package opening. A diagram indicating the locations of applied allergens (Figure 2) should be included in the patient's chart for reference during patch-test readings.

Allergens should be applied to dermatitis-free skin, most commonly on the back. If the back is dermatitic, alternative locations include the abdomen, thighs, or lateral arms. Avoid applying patches over nevi, scars, or tattoos. Typically, patch tests are applied in strips from left to right on the patient's back, beginning with the upper left back. The next chamber is applied closely adjacent to the first chamber but without overlap.

What Type of Schedule Is Needed?

The entire patch-test process generally requires 5 to 7 days, depending on the clinic. Often, testing is performed using a "Monday, Wednesday, Friday" schedule.

- Day 1 (eg, Monday): by definition, this is the day patches are applied (Figure 3A)

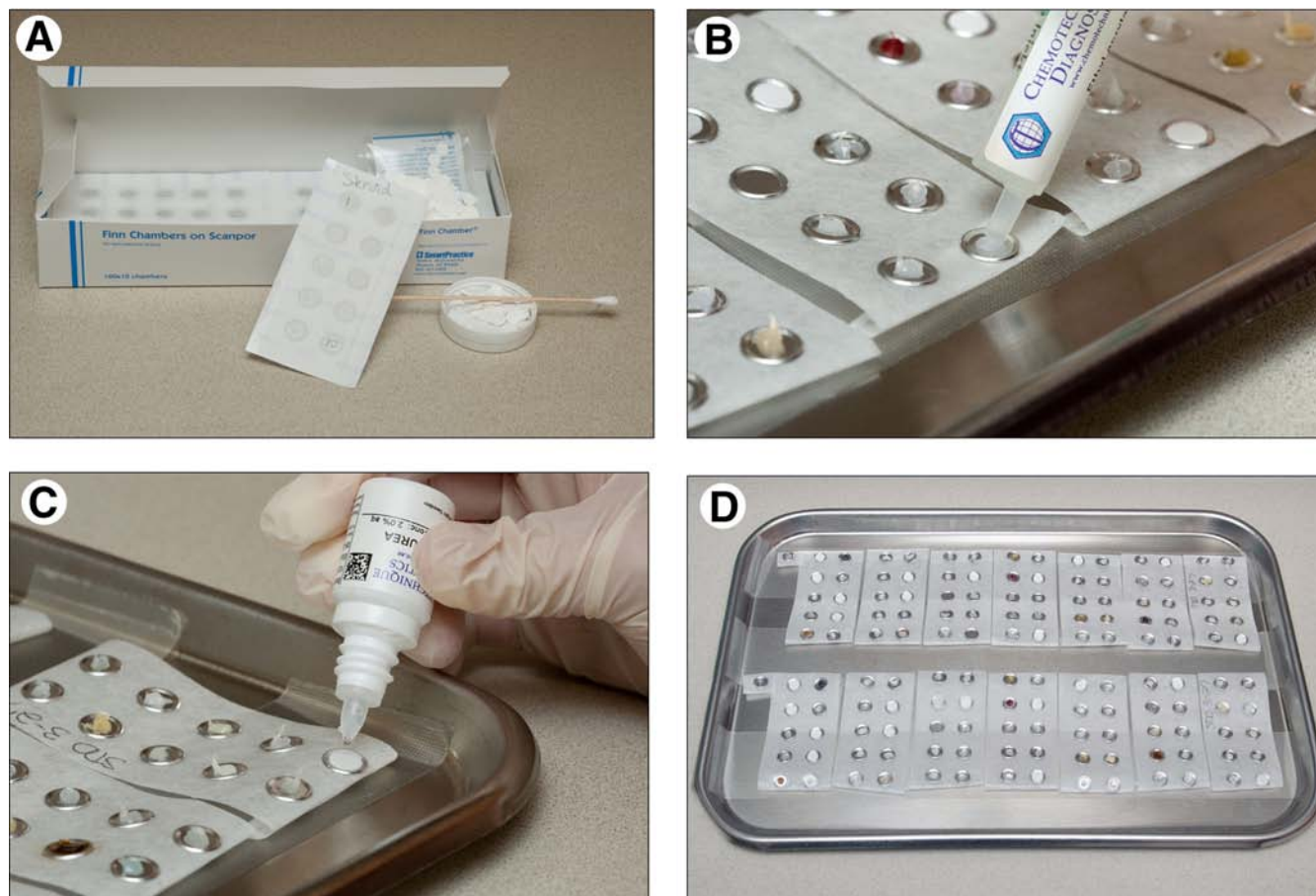


Figure 1 Preparing for patch testing. (A) Aluminum discs (Finn chambers) are premounted on (Scanpor) tape. (B) Allergens prepared in petrolatum are applied directly to the aluminum discs. (C) Allergens prepared in alcohol are applied to paper on the aluminum discs. (D) A tray with the Mayo Clinic standard series of allergens, ready to apply.

- Day 3 (eg, Wednesday): patches are removed and reactions are initially interpreted (Figure 3B). This first reading should occur 15 to 20 minutes after tape removal. (This rest period allows urticarial reactions to settle.)
- Day 5 (eg, Friday): A reading, usually the final one, is performed (Figure 3C).
- Days 7-10 (eg, the following Monday through Wednesday): patients may return for additional readings. Late

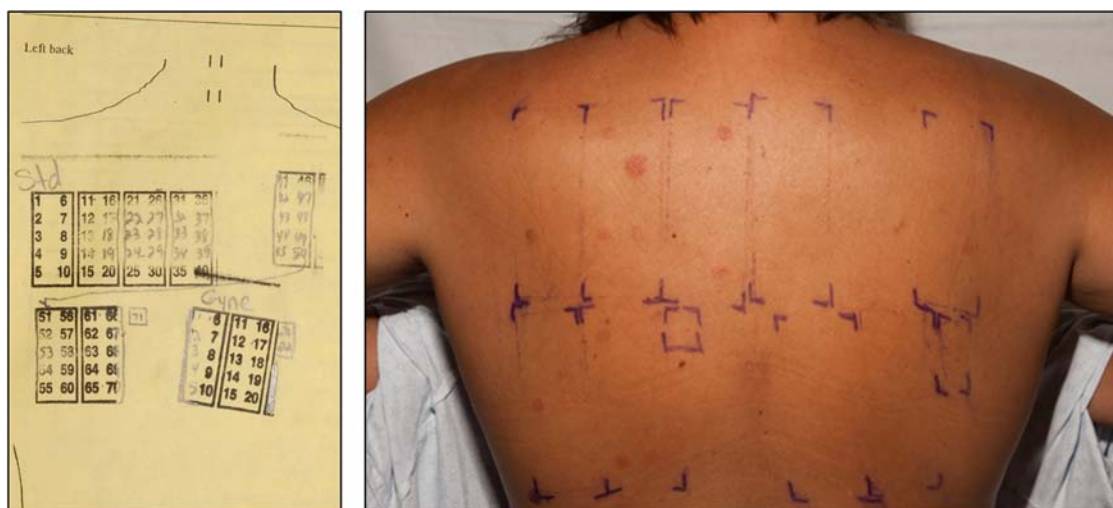
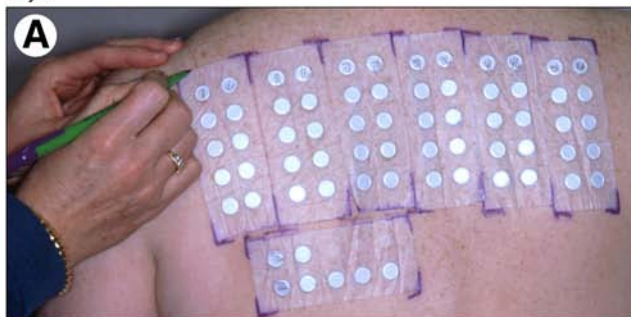


Figure 2 Diagram showing location of applied patch tests to facilitate correct identification of culprit allergens.

Day 1



Day 3



Day 5



Figure 3 Patch-testing protocol. (A) The standard allergen series is applied to a patient's back on day 1. (B) Finn chambers are removed on day 3. After 15 minutes, patch-test reactions are read and graded. No distinct reactions were apparent for this patient. (C) Patch-test readings are repeated on day 5. Multiple reactions for this patient indicated allergy to formaldehyde and formaldehyde releasers.

readings are recommended for metals and topical antibiotics.⁵

There are many variations of this scheduled protocol and much controversy regarding the optimal time to interpret patch tests.

Patch-Test Readings

Reactions can vary from very mild (redness) to severe (vigorous reactions). The degree of reaction should be documented. Grading schemes for patch-test reactions vary. An example is the grading scale for reading patch tests at Mayo Clinic is as follows:

- Negative: normal-appearing skin
- 1+ reaction (very mild): macular erythema (Figure 4A)
- 2+ reaction (mild): weak, nonvesicle, erythema, infiltrated, questionable papules
- 3+ reaction (moderate): strong, edematous, or vesicular (Figure 4B)
- 4+ reaction (severe): extreme, spreading, bullous, ulcerative (Figure 4C)

It is important to note that certain fabric dyes may stain the skin. These stains, however, should not be interpreted as positive reactions (Figure 5).

Patients should not read their own patch tests because of the potential for error in identifying allergens causing the reactions.

Allergens Associated With Strong Reactions

Certain allergens on the standard series are known to give dependably strong reactions on patch testing in allergic patients.⁶ These include mixed dialkyl thioureas 1% pet, tixocortol-21-pivalate 1% pet, ethylenediamine dihydrochloride 1% pet, sesquiterpene lactone mix 0.1% pet, nickel sulfate 2.5% pet, bacitracin 20% pet, thimerosal 0.1% pet, epoxy resin 1% pet, colophony 20% pet, mercaptobenzothiazole 1% pet, and gold sodium thiosulfate 0.5% pet.

Allergens Associated With Weak Reactions

Certain "problematic" allergens may be associated with a disproportionately large number of weak, irritant, and questionable reactions.⁶ In the standard series, these include cocamidopropyl betaine 1% aqueous (aq), benzalkonium chloride 0.1% aq, jasmine absolute 2% pet, iodopropynyl butylcarbamate 0.1% pet, 2-bromo-2-nitropropane-1, 3-diol 0.5% pet, methyl dibromo glutaronitrile 0.4% pet, methyl dibromo glutaronitrile/phenoxyethanol 2% pet and 2.5% pet, dimethylol dihydroxyethyleneurea 4.5% aq, and clobetasol-17-propionate 1% pet.

Interpretation of Patch-Test Reactions

Ultimately, patch testing aims to identify relevant allergic patch-test reactions, with avoidance of the identified allergens facilitating resolution of the dermatitis. To ascertain relevance, all possible allergen exposures in the setting of home, hobbies, and occupation should be reviewed. Overall clinical

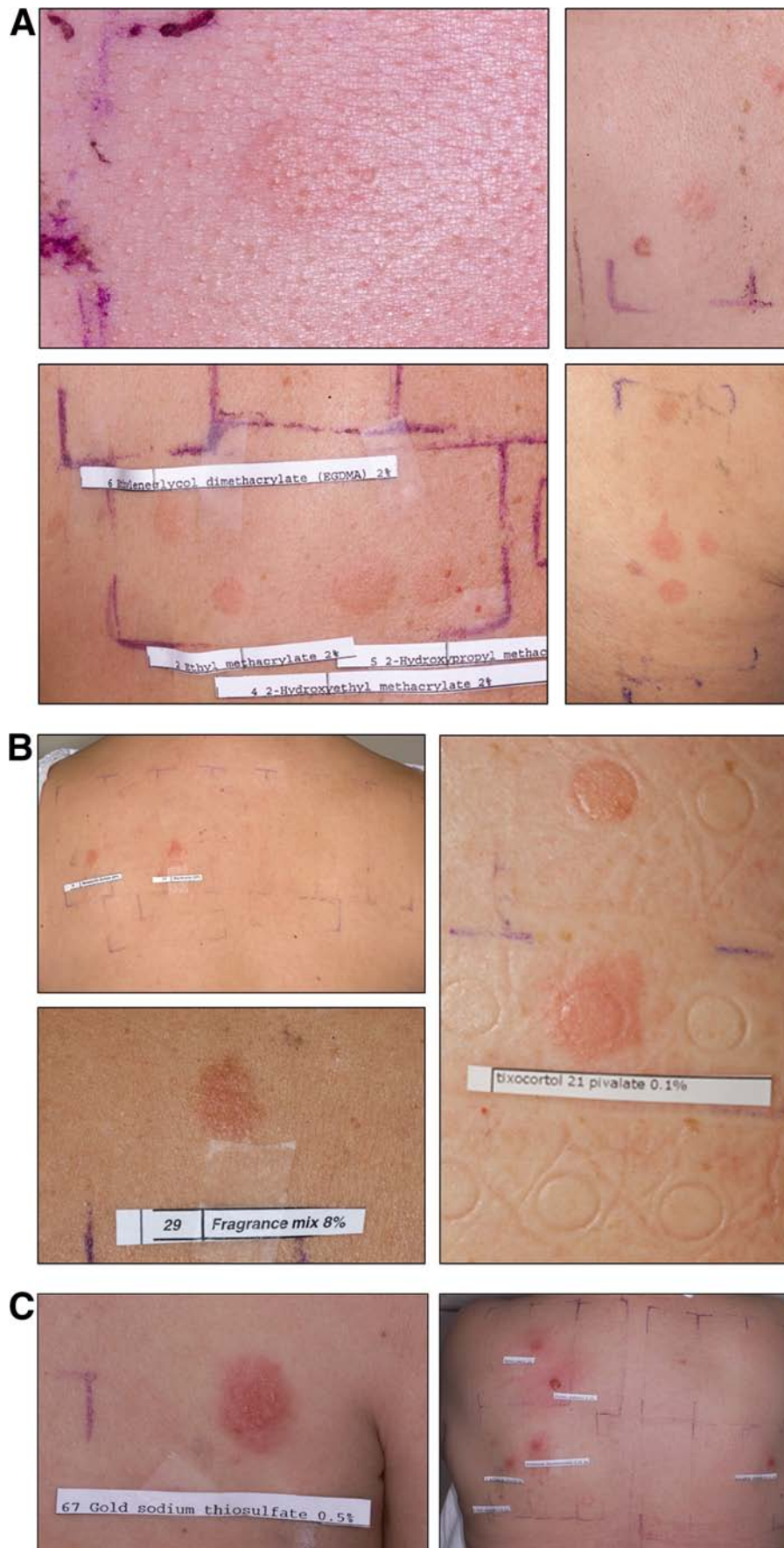


Figure 4 Reading and grading individual patch-test reactions. (A) Very mild reactions. (B) Moderate reactions. (C) Severe reactions.

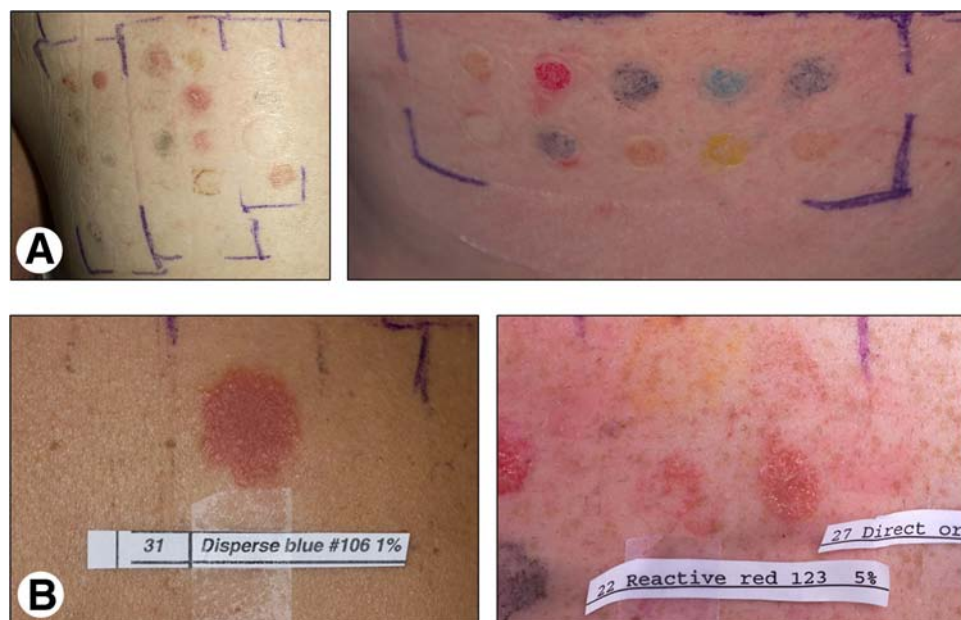


Figure 5 Disperse dyes can color skin. It is important to distinguish between a positive patch-test reaction vs disperse dye coloration. (A) Skin colorations due to the disperse dye. (B) Positive patch-test reaction to disperse dye.

context is necessary (and frequently helpful) in this endeavor.

Conventionally (and for the patient's convenience), interpretation of patch testing occurs around the time of the final day of patch-test reading. However, many patch-test experts have suggested that interpretation of patch-test results should be deferred for weeks or months, the rationale being that true relevance cannot be judged until the patient has avoided the identified allergens and reports whether the contact dermatitis has improved.

A commonly used classification scheme for relevance is from the North American Contact Dermatitis Group;⁷ positive patch-test reactions are designated as having definite, probable, possible, past, or no relevance. *Definite relevance* is defined as a positive patch test with the suspected item, object, or product, or ingredients verified in patient's product, and use of that product is verified. *Probable relevance* is when the antigen could be verified as present in known skin contactants. *Possible relevance* is when the patient was exposed to circumstances in which skin contact with materials known to contain the allergen was likely to occur. *Past relevance* is defined as allergens with previous confirmed relevance but no current exposure. *No relevance* is defined as allergens without relevance to the patient's dermatitis.

Confounding Factors

When determining relevance of positive patch-test reactions, a number of factors must be considered. First, some positive reactions on patch testing may have no apparent relevance to the clinical situation. For example, a positive reaction to gold sodium thiosulfate in a patient who has always tolerated a gold ring is difficult to interpret.

Second, patch tests can be positive in a general population, most of whom do not have eczema (dermatitis). A consider-

able percentage of subjects without any dermatitis can have a positive patch test to nickel. For example, the prevalence of nickel allergy in large populations with eczema was 16.7% in the United States and 17.3% in the European Union. However, baseline (population) levels for positive patch testing to nickel is estimated to be 13.1% in Germany; 27.8% in Thailand; 11% in Denmark; and 8.6% in Odense, Denmark.⁸

Third, determining the relevance of a patient's reactions is no easy task. Patients have thousands of exposures to potentially relevant allergens daily, and determining which allergen is most likely to be a culprit at one visit is difficult. In the experience of one of the authors of this article (MDPD), most reactions are of possible or probable relevance.

Nonetheless, patch testing is worthwhile. Without this tool, identifying the likely culprit implicated in a patient's allergic contact dermatitis would be guesswork and frequently inaccurate. Predicting positive, relevant allergens is difficult because unexpected reactions may occur. For example, a patient suspected she was allergic to hair dye. Patch testing showed marked reactions to paraphenylenediamine (a common component of hair dye) and related chemicals. However, she also had an unexpected and marked reaction to amidoamine, a chemical in her hair care products.

Patient Education

Communicating the results of patch testing, demonstrating their relevance to the patient's dermatitis, and teaching the patient how to avoid the identified allergens are the most important elements of patient education after patch testing.

Allergen Avoidance

Patients can be provided helpful educational brochures (termed *avoidance sheets*) that describe specific allergens

and explain where they might be found. Avoidance sheets are available from companies that supply patch-test materials and from the American Contact Dermatitis Society. Videos discussing select allergens are available from the MyPatchLink website.³ Multiple books are also available for physician reference.⁹⁻¹²

Identification of Safe Products

In addition to knowing which products to avoid, patients also find it helpful to know which products are safe to use. Two resources available in the United States may be tremendously helpful in this regard because they create a customized list of personal care products that are safe to use, given the allergies identified:

- **Contact Allergen Replacement Database:**¹³ Patients are provided a unique identification number so they may update their list of safe-to-use products periodically. Additionally, mobile applications for the iPhone and iPad are available for purchase.
- **Contact Allergen Management Program:**¹⁴ Provided by the American Contact Dermatitis Society and available to its members, it identifies safe products and provides allergen descriptions and educational materials.

For patients with concerns about allergies to non-skin care products, an article by Scheman et al¹⁵ has a list of allergen-containing items and/or allergen-free alternatives (eg, clothing, gloves, shoes, etc).

Commonly Asked Questions

How Do You Differentiate Between Irritant vs Allergic Patch-Test Reactions?

The primary distinguishing factor is the timing. Irritant reactions occur within minutes to hours after application of the chemical, whereas allergic reactions occur over days. Irritant patch-test reactions are usually very prominent initially and then fade with time (“decrecendo”), whereas an allergic patch-test reaction usually increases with time (“crescendo”). However, some chemicals can give rise to both irritant and allergic patch-test reactions in the same patient.

How Do You Interpret Very Weak Patch-Test Reactions?

Up to 50% of reactions may be very weak at the final reading. Certain allergens are particularly problematic in this regard (see above: ‘allergens associated with weak reactions’). Management of weak reactions is controversial. Should they be treated as true-positive reactions or disregarded? Interpretation of these reactions is part of the “art” of patch testing (and depends on clinical judgment). Our practice at Mayo Clinic is to regard very weak reactions as potentially relevant.¹⁶

How Do You Interpret All-Negative Results?

Patch testing may be negative for numerous reasons. Possibly, the culprit allergen was not included in the series, which

necessitates patch testing to a wider range of allergens. The patient may have been immunosuppressed at the time of testing, which could lead to negative results. Of course, the best explanation is that it is also possible that allergic contact dermatitis is not a contributing factor to the patient’s rash. In this situation, it is important to explain the advantages of negative findings to the patient.

How Do I Patch Test Using Patient-Supplied Items?

Cosmetics and personal care products that remain on the skin (eg, moisturizers, makeup, sunscreens, perfumes) can be tested as is, without dilution, and placed on the aluminum discs or other surfaces like other allergens. Clothing, shoes, and, in chosen circumstances, plants may be tested as is. Generally, a representative piece is cut to approximately the size of one of the aluminum discs, applied directly to the back, and secured in place with Scanpor tape. Alternatively, a sample can be taken from the clothes/shoe/plant, soaked in saline or water for 10 minutes and then placed in a similar manner on the back for patch testing.

Generally, patch testing is not advised for materials other than personal care products that stay on the skin (not washed off). Referral to patch-test centers is suggested for unusual materials. Wash-off products (eg, soaps, shampoos) will need to be diluted up to 100-fold (by volume) for patch testing. Household products (eg, detergents and cleansers) may need to be diluted up to 1,000-fold (by volume). Although material safety data sheets can be used to determine the initial dilution of unknown or industrial materials, industrial products generally should not be patch tested by a novice because of the tremendous potential for skin irritant reactions. Patch testing on 5 to 10 control subjects is suggested before patch testing patients to unknown or industrial materials. In most cases, we recommend that the novice patch tester refrain from patch testing to any products other than the commercially available standardized allergen series and personal skin care products that stay on the skin.

Can Patients Test Themselves to Personal Care Products?

Patients can bring their own skin care products for inclusion in patch testing. However, if items are forgotten, patients can perform a “use” test at home. This can be done in various ways. Often, a 1- to 2-cm circle is drawn on the forearm. Patients are instructed to apply the product once or twice a day for a week to this area and determine whether a rash develops.

How Can a Patient With Generalized Dermatitis Be Patch Tested?

Most patients with generalized dermatitis should not undergo patch testing because patch tests placed over an area of dermatitis are uninterpretable. Furthermore, patch testing can aggravate the dermatitis. Patch testing ideally should be deferred until the dermatitis is well controlled, the skin has been normal for several weeks, and the patient is not taking

any immunosuppressant medications. Realistically, this may be difficult to achieve.

In patients with generalized dermatitis, allergic contact dermatitis may be suspected of having a role. For example, the patient may be allergic to a topical corticosteroid being used or to preservatives in the moisturizer used. No clear guidelines exist for patch testing in such a situation. Some recommend controlling the dermatitis by whatever means possible and stopping the treatment a week before patch testing. Some advocate prednisone (1-2 g/kg/d) for 1 to 2 weeks and stopping treatment abruptly, immediately before patch testing but our experience is that false-negative results may occur with this approach. At our center, intensive treatment with topical corticosteroids and wet dressings are used; topical corticosteroids to the back are halted a few days before patch testing. We note, however, that this approach is associated with a risk of a dermatitis flare during patch testing.¹⁷

Can Oral Medications Be Patch Tested?

The literature describing patch testing to oral medications (including the actual crushed tablets in the patch testing materials) is limited. It is possible to obtain appropriate dilutions of oral medications prepared for patch testing from commercial sources. However, given the limited literature regarding interpretation of the results of patch testing to oral medications, we suggest the novice patch tester should defer this type of testing to patch-test centers with appropriate expertise.

Can Diet Have a Role When Allergen Avoidance Is Ineffective?

The role of diet in flares of dermatitis is highly controversial and the evidence is anecdotal.¹⁸ Generally, changes in diet are not recommended for treating allergic contact dermatitis, given the limited literature.

How Is Patch Testing to Possible Photosensitizers Performed?

Photosensitizer patch-test series can be purchased from commercial sources. Two identical sets of allergens are applied side-by-side on the back (or thighs). One set of allergens is exposed to UV-A (approximately 10 J/cm² or 50% of the UV-A minimal erythema dose). The patch-test reactions are then read per routine at 48 and 96 hours. If allergens on both sides (unlighted and lighted) give rise to a reaction, the patient has typical allergic contact dermatitis. If the reaction on day 5 is noted only on the lighted side, then this reaction is a photo-allergic reaction (the allergen was “photo-activated” by exposure to the UV light).

Controversial Allergens

Considerations for Patch Testing to Dust Mites (*Dermatophagoides*)

Allergists often patch test to dust mites (*Dermatophagoides* species) to assess for atopy (ie, the “atopy test”). The assumption is that if patch testing to dust mites results in allergic

patch-test reactions, then dust mites are implicated in flares of atopic dermatitis. However, it has been our experience that most patients undergoing patch testing to any preparation of dust mites have positive reactions, regardless of whether they have atopic dermatitis. Research at our institution paradoxically showed that atopic patients had fewer reactions to the dust mites than patients who were nonatopic.^{19,20} Given these findings, we advise against patch testing to dust mites.

Is Laundry Detergent a Common Culprit Allergen?

When allergic contact dermatitis is suspected, many patients immediately switch to another laundry detergent. Physicians also believe patients may have become allergic to their laundry detergent. However, cases of true allergic contact dermatitis to laundry detergent are extremely rare.²¹ Allergic contact dermatitis to laundry detergent has been described as an urban legend.²²

Role of Patch Testing for Orthopedic Implants

Patch testing is occasionally performed to determine whether a patient might have problems with a future orthopedic implant device or to determine whether a patient with an implanted device has problems that are due to allergy to a device component. This is an unresolved problem with very limited data and no clear answers.²³⁻²⁵ Although the prevalence of contact sensitivity to metal is high, hypersensitivity complications associated with metal implants have been reported to be less than 0.1%. Nevertheless, we believe it is reasonable to suggest that a patient with a history of metal sensitivity undergo patch testing and avoid any culprit metals (eg, testing for nickel sensitivity before placing a nickel-containing implant). Patch testing should include the baseline (standard) series and components of the implant, including metals, plastics, acrylates, and other materials.

Potential allergic complications after implantation of orthopedic metal devices include cutaneous eruptions, chronic joint pain, edema, joint loosening, and joint failure. If a patient already has the implant and is experiencing these problems, the benefits of patch testing are uncertain. However, if patch testing is performed and the results are negative, the patient can be reassured. If patch-test results are positive, then discuss removal. Implant removal must be considered on a case-by-case basis.

Conclusion

Patch testing is a valuable tool that can identify the culprit allergen(s) causing a patient's allergic contact dermatitis. Patch testing to a standard series and specialized series can be done relatively easily in the dermatology office.

Supplemental Material: *Patient Information about Patch Testing* (Adapted from Patient Education: Patch Testing, ©2011 Mayo Foundation for Medical Education and Research.² Used with permission.) is available either online at http://www.skinandallergynews.com/fileadmin/content_images/jso/PDF/Pt_Info_re_Patch_Testing.pdf or by scanning the QR code.



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Appendix

Patient Information About Patch Testing

(Adapted from Patient Education: Patch Testing. ©2011 Mayo Foundation for Medical Education and Research.² Used with permission.)

Patch testing is done to learn what may be causing your allergic contact dermatitis. Allergic contact dermatitis happens when skin comes into contact with a substance that causes an allergic reaction. Some reactions may not be obvious for up to 5 days.

During patch testing, discs with substances to which you may be allergic are put on your back (eg, on a Monday). The discs stay there for about 48 hours (eg, until Wednesday). After the discs are removed, your skin is examined for allergic reactions on the day the discs are removed and several days later (eg, Wednesday and Friday).

Patch testing does not involve scratches or pricks to the skin. It does not identify allergies to food, oral medicines, or inhaled substances.

How Do I Prepare For Patch Testing?

What Medications Can I Use?

If you take cortisone pills or have had a cortisone injection within the past month, tell your health care provider.

You may use any prescribed skin creams as directed until one week before patch testing. At that time, stop applying prescribed creams to your back only. You may continue to use moisturizers until the patch-test strips are applied. Antihistamines may be used during patch testing.

Avoid exposure to the sun or ultraviolet light (such as in a tanning booth) for a week before patch testing.

What Should I Wear?

If you know about the test ahead of time, wear clothes you won't mind getting stained. Sometimes the substance used to mark the test area stains clothing.

What Should I Bring to the Patch Test Appointment?

Your doctor will advise you about what to bring and will tell you which products will be patch tested. Your doctor will consider patch testing to skin care products that may be causing your dermatitis, including those you encounter at work or with a hobby. Products must have labels (bring the material safety data sheet [MSDS], if possible). Bring all substances that you apply to your skin (ie, "personal skin care products") that are not washed off. These include any prescription and nonprescription creams, lotions, ointments, moisturizers, make-up (foundation, eye shadow/liner, mascara, cover-up, lip balm/gloss/stain, lipstick), nail polishes/products/glues, perfume or cologne, and hair dyes. Be sure to bring any eye drops or creams if the eyes or area around the eyes is involved in the rash.

Substances that you apply to your skin and then wash off are patch tested less frequently because they may cause irritation of your skin (not allergy). These products include soap, shampoo, conditioner, personal cleansers, toileting wipes, hand sanitizer, laundry detergent, fabric softener or sheets, and bleach. If you have hand dermatitis, rubber gloves may be a consideration. If you have foot dermatitis, your socks, boots, and shoes may be considered.

How Much Does Patch Testing Cost?

The cost varies based on your insurance and the number of allergens (patches) being applied. Generally, there is a charge per patch and different insurance companies cover different numbers of patch tests. Patch testing can cost several thousand dollars. You should contact your insurance company before undergoing patch testing to get an estimate of the cost and find out whether it is covered by your insurance.

Are There Alternatives to Patch Testing?

Essentially, no better methods are available. Patch testing is the best method for finding skin allergies.

How Is Patch Testing Done?

Patch testing includes a series of appointments, each lasting about 20 minutes.

Day 1

A member of your health care team puts several sticky strips on your back. Each strip has 10 dime-sized aluminum discs. Each disc contains a different substance to which you may be allergic. Tape may be used to hold the strips in place. (Sometimes, the discs are put on another part of the body.)

Day 3

After about 48 hours, you return to have the discs removed. You are checked for reactions such as redness, inflammation, or swelling at the patch-test site. Tell your health care provider if you had any itching or burning when the discs were on you.

Day 5

After about 96 hours, you return for another exam. It may take about 5 days for a skin reaction to appear.

Other Appointments

It could take more than 5 days to react to some substances. You may be asked to return for more skin exams.

Special Instructions

While the discs are in place and during the few days when you are being checked for reactions, follow these guidelines:

- Do not wash or get the patch-test area wet. That could remove the test substances.

- Do not put creams or lotions on the patch-test site.
- Do not let the tape rub on clothing or furniture. This may loosen the discs.
- Do not expose the patch-test area to the sun or ultraviolet light (ie, tanning booths).
- Do not do anything that would cause your skin to stretch or sweat (ie, exercise).
- Do not rub or scratch the patch-test site.
- Do not put tape on any patch-test strip that becomes loose. Make sure the strip stays on the original area. You may need help to do this.

What Do My Results Mean?

Positive Results

If you are allergic to a substance, the test is “positive.” You will be given information about the substance(s) that caused your skin to react. Examine the products you use and try to avoid substances to which you are allergic.

Remember

Even if you have a positive result, it can be hard to figure out exactly what is causing your reaction and whether other things also are involved. It may take time to reduce or eliminate your symptoms. Be patient and continue to work with

your health care provider to find the best ways to manage your condition.

Negative Results

If your skin shows no reaction to patch testing, your results are “negative.” Even if your results are negative, patch testing may help your health care provider diagnose your skin condition by ruling out the tested substances as sources of your symptoms.

Side Effects and Risks

Although patch testing can cause a reaction in the patch-test area, the test has very few risks or side effects. The patches generally take up a fairly large portion of a person’s back and can be uncomfortable for the 2 days that they are in place. Often, some mild itchiness may develop. You may have itching in the patch-test area after testing is completed, but this usually goes away within a few days. Infrequently, a positive patch-test reaction may last for some time. Your doctor can prescribe medications to help if this happens after the final patch-test reading is performed. Testing can rarely cause you to become allergic to new substances.

Rarely, an angry-red itchy back can occur or there can be a flare of your current rash. If a disc causes intense itching, burning, or pain, call your health care provider right away.