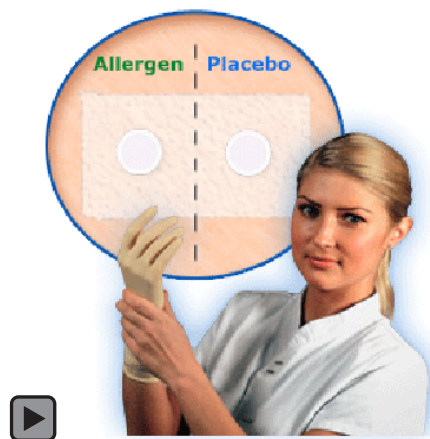


Adverse Reactions to Latex Products: Preventive and Therapeutic Strategies

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Abstract

Evidence-based infection control/exposure control practices are evolutionary in nature. Elements of historical note were first recorded with the suggestions of Lister¹ for guidelines on aseptic procedures. Others, like Semmelweis², promoted the practice of hand washing by medical students and physicians prior to leaving autopsy suites and before entering the labor and delivery areas of hospitals. Halstead³ is credited with being the first to use surgical gloves in a clinical setting. While the use of latex surgical gloves became routine by the end of World War I, it wasn't until the adoption of universal precautions by the Centers for Disease Control⁴ in 1987 that the use of gloves was officially expanded to cover virtually all aspects of patient care. The ubiquitous use of latex gloves and other latex products in healthcare has resulted in a parallel increase in latex-associated adverse reactions. To provide for a safe environment for both oral healthcare providers and patients alike, clinicians must understand the basis for latex-related adverse reactions, recognize associated signs and symptoms, and initiate appropriate preventive and therapeutic strategies. The recommendations for preventing/minimizing latex allergy in the oral healthcare setting are based on current knowledge and a common sense approach to the problem. Evolving manufacturing technology and improvements in measurement methods (for latex proteins) may lead to changes in these recommendations in the future.

Keywords: Latex gloves, adverse reactions, latex allergies, allergy prevention

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Etiology and Epidemiology of Latex Allergies

Latex is a product of the Brazilian *Hevea braziliensis* rubber tree harvested mainly in Malaysia, Indonesia, and Thailand.⁵⁻⁸ A milky sap flows in lactifers under the surface of the bark, which is collected by making diagonal cuts in the bark of the tree. Once collected, ammonia is added to the sap to prevent autoagglutination and bacterial contamination of the latex.^{5,7,9}



There are two types of ammonia-latex concentrates. High ammonia-latex concentrate contains 0.7% ammonia by weight, and low ammonia-latex concentrate contains 0.2-0.3% ammonia by weight. While the higher ammonia concentration is more effective in stabilizing the latex, it also increases skin irritation.¹⁰ For glove production, lower concentrations of ammonia are used, but this requires the addition of antioxidant preservatives.^{7,10}

Latex contains cis-1,4-polyisoprene (the major component of natural rubber), proteins, lipids, carbohydrates, and numerous inorganic constituents such as potassium, manganese, copper, zinc, and iron.¹¹ Over 250 proteins have been identified in latex and, depending on the source, the overall protein content varies from 1-1.8%. These proteins are involved in numerous processes of biosynthesis and defensive, structural, and housekeeping functions.⁹ For example the rubber elongation factor protein (Hev b 1) facilitates the activity of prenyltransferase to polymerize the basic isoprene molecule to molecular weights that can exceed 100,000 Daltons, while the β -1,3-glucanase protein (Hev

b 2) defends against fungal pathogens. While about 30-60 latex proteins are believed to be responsible for virtually all of the immediate hypersensitivity reactions (Gell and Coombs Type I), only 13 of these proteins have been classified and labeled by the International Nomenclature Committee of Allergens.¹¹⁻¹⁶

Gloves are produced by one of two processes: coagulant dipping or straight dipping.⁸ In coagulant dipping a destabilizing chemical is deposited on the formers that are used for dipping, while in straight dipping no destabilizing agent is used. After dipping, the latex product on the former is washed (leached) to remove residual chemicals and proteins. In order to enhance elasticity, strength, and stability it is then subjected to the process of vulcanization (heating in the presence of sulfur). To reduce the time and temperature required for vulcanization, numerous "accelerators" and "promoters" (thiurams, mercaptobenzothiazoles, and carbamates) are added. After vulcanization, a post-cure leaching is accomplished to further remove residual chemicals and proteins. The residual chemicals are primarily responsible for allergic contact dermatitis associated with latex glove use (Gell and Coombs Type IV).^{7,9,10,17-19}

If the gloves are destined to be free of donning powder, another washing followed by chlorination and further washing is undertaken to reduce the inherent tackiness of latex.⁸ Alternatively, donning powder is added by dipping the gloves into a slurry prior to removal from the formers. Donning powder (typically cornstarch) is recognized as a major contributing factor for the development of latex sensitivity.^{8,14,15,18,20-28} Free extractable proteins not removed during the glove manufacturing process may be adsorbed by the cornstarch. During the donning, use and removal of these gloves, the cornstarch/protein complexes come in direct contact with skin and mucosal surfaces or become suspended in the air (aeroallergens) for up to six hours.¹² Following direct contact, mucosal surfaces appear to absorb latex proteins much more readily than intact skin surfaces, and exposure to aeroallergens is considered the predominant method of inducing latex sensitization in healthcare workers.^{20,21,27,29} While an allergy to cornstarch is rare, evidence

exists that it may act as an immunoadjuvant further increasing the risk of latex-induced allergic reactions.^{7,20,30}

Recognizing the problems associated with free residual latex proteins, several governmental agencies and the latex industry have undertaken steps to begin to address the issue of free residual latex proteins.^{8,9,22,26-29,31,33} While resisting calls for an outright ban on donning powder, the Food and Drug Administration (FDA) has proposed guidelines establishing the maximum allowable extractable proteins in latex gloves at < 1200 µg/glove and the maximum allowable amount of donning powder at < 120mg/glove.³¹ The Centers for Disease Control (CDC) and others recommend powder-free gloves be utilized whenever possible.^{9,22,26,28,29,32,33} Improvements in the manufacturing of latex gloves includes the use of enzymatic processes to breakdown raw latex proteins; increased centrifugation of the raw latex liquid to separate out more latex proteins; refined leaching protocols; and chemical deproteinization during the leaching process.⁸ In addition the use of oat starch in lieu of cornstarch as a donning powder appears to be associated with reduced aeroallergen formation.²⁷

Finally, increasing numbers of latex-free alternatives are becoming available. However, residual chemicals associated with the manufacturing of non-latex gloves may also induce delayed hypersensitivity reactions; many lack the preferred tactile feel and quality of latex gloves and many are not biodegradable, thus, creating a potential disposal problem.⁸

The true prevalence of latex sensitivity is unknown with estimates for the general population, rubber industry workers, and healthcare workers ranging from 5-10%, 1-11%, and 0.5-17%, respectively.⁹ However, currently available test reagents react to only a limited number of the potential latex antigens and variations in study design preclude comparative interpretation.^{9,13,14,34} Furthermore, the limited sensitivity and specificity of commercially available testing reagents may contribute to an overestimation of the true prevalence of latex allergy³⁵; a concept supported by the reality that a positive latex sensitivity test often does not manifest as a clinical allergy.^{9,36}

Clinical Manifestations

Adverse reactions following exposure to latex products may be categorized as irritant contact dermatitis, allergic contact dermatitis, or immediate hypersensitivity reactions (urticaria, angioedema, allergic rhinitis, asthma, or anaphylaxis).^{5,7,10,18,37}

Irritant Contact Dermatitis

The most common reaction to latex products, specifically to latex gloves, is irritant contact dermatitis (ICD). ICD is a nonimmunologically mediated dermatitis characterized by dry, itchy, irritated areas of the skin, usually of the hands. This reaction may result from abrasion and maceration from wearing gloves constantly, repeated hand washing and drying, incomplete hand drying, the use of cleaners and sanitizers, exposure to powders added to gloves, and exposure to other workplace products and chemicals.^{5,7,10,38} These signs and symptoms are similar to allergic contact dermatitis and can be ruled out by allergy testing. Eighty percent of the cases of hand dermatitis are a result of this non-allergic type of reaction.^{38,39} The problem for the practitioner is the skin damage associated with ICD increases the potential for allergic sensitization.^{9,22,33,34,38,40,41}

Allergic Contact Dermatitis

Allergic contact dermatitis is a delayed hypersensitivity reaction (Gell and Coombs Type IV) caused primarily by the accelerators, promoters, and antioxidants that are added to natural rubber latex during harvesting, processing, or manufacturing.^{7,9,10,17,19,26,34,38} Many of these processing chemicals are also utilized in the manufacturing of nitrile and neoprene gloves.¹⁹ It is a T cell-mediated immune response. Allergic contact dermatitis is characterized by a rash, redness, and itching, which usually begins 24 to 48 hours after contact with offending products and may progress to oozing skin blisters and spread to areas of skin untouched by latex.^{13,19,42} (Figure 1). The reaction is similar to those caused by nickel and poison ivy. A skin rash may be the first sign a person has become allergic to latex and more serious reactions could occur with continued exposure. Since the clinical signs and symptoms of allergic contact dermatitis are similar to irritant contact dermatitis, it is necessary to



Figure 1. Allergic contact dermatitis characterized by rash, redness, and itching, which began about 24 hours after treatment under a rubber dam. **A.** Anterior view. **B.** Right side view.



Figure 2. Acute urticaria characterized by pruritic, red wheals that range from 1.5 to 3.0 cm in diameter, which began about an hour after exposure to latex gloves. **A.** Anterior view. **B.** Left side view.

confirm the allergic nature of the reaction in order to avoid further sensitization. Allergic contact dermatitis can develop upon re-exposure to an antigen many years after initial exposure.⁷

Immediate Allergic Reactions

The risk of progression from skin rash to more serious reactions is unknown, but at least some patients initially develop allergic contact dermatitis; then urticaria; then allergic rhinitis, sneezing, scratchy throat, conjunctivitis, angioedema, wheezing, asthma (coughing, difficulty breathing); and, rarely, anaphylaxis. Immediate allergic reactions are all IgE mediated and the hallmark symptoms are swelling, redness, and itching.²⁶

Urticaria

Urticaria is the most common presentation of a type I hypersensitivity reaction to latex (Figure 2). It likely reflects an IgE-mediated immediate hypersensitivity reaction in response to contact with latex proteins, although not all cases are associated with detectable latex-specific IgE antibodies. Urticaria may represent a transitional stage in the progression from contact dermatitis to immediate hypersensitivity. Reactions that occur within 60 minutes are highly suggestive of IgE-mediated allergy, while delayed or persistent urticaria is suggestive of delayed hypersensitivity.³²

Angioedema

Angioedema may be a feature of urticaria. It is characterized by episodes of localized, well-circumscribed, nonpitting swelling commonly affecting the lips (Figure 3), face, limbs, trunk, abdominal viscera, and larynx. When edema affects the larynx, upper airway obstruction can be severe and life threatening. Involvement of the gastrointestinal tract is associated with severe pain.

Allergic Rhinitis and Asthma

Nasal congestion, sneezing, watering eyes, and an itching sensation of the oro-pharyngeal mucosa are clinical symptoms of a type I hypersensitive reaction known as allergic rhinoconjunctivitis.²⁴ It is generally accepted the deposit of aeroallergens (in this case latex allergens) on the mucosal surfaces of the eyes and upper respiratory tract initiate the



Figure 3. Angioedema characterized by localized, well-circumscribed, non-pitted swelling affecting the lips. **A.** Anterior view. **B.** Right side view.



Figure 4. Anaphylactic reactions to latex allergens in the oral healthcare setting characterized by angioedema of the lips and oropharynx associated with stridor, wheezing, hypotension, and tachycardia. **A.** Anterior view. **B.** Intraoral view.

IgE-mediated allergic response. If sufficient aeroallergen penetrates below the level of the glottis, the allergic response progresses to include asthma.²⁴ An estimated 2.5% of healthcare workers are susceptible to asthma induced by exposure to latex aeroallergens.²³

Anaphylaxis

Anaphylaxis is the most severe acute reaction characterized by a combination of respiratory, cardiovascular, and cutaneous signs and symptoms. It is the result of the interaction of an antigen with IgE antibodies found on tissue mast cells and peripheral blood basophiles. The massive release of histamine and other mediators initially results in weakness, dizziness, and cutaneous symptoms such as flushing and urticaria. The reaction progresses rapidly to include laryngeal edema (resulting in stridor), bronchospasm (resulting in wheezing), hypotension, tachycardia, and vascular collapse as a result of decreased systemic vascular resistance⁴³ (Figure 4). The most common causes of anaphylaxis are foods, drugs, insect stings, and latex. While anaphylaxis is seldom the first sign of latex allergy, latex exposure is estimated to account for up to 16% of anaphylactic reactions that occur during surgery.⁴⁴ In dentistry, anaphylactic reactions to latex allergens have been reported to occur with exposure to gloves, dental rubber dams, and indirect exposure to latex glove use in the facility.⁷ Anesthetics and drapes can mask the early signs of allergic reactions, and hypotension may be the first indication of distress.⁴⁴ Rapid detection of signs and symptoms with immediate intervention is necessary to prevent serious complications and death from this severe immediate hypersensitive reaction.^{10,45}

Diagnosis

The contemporary diagnostic algorithm for latex allergy entails obtaining a thorough clinical history, performing skin puncture testing with a standardized latex reagent, testing for latex-specific IgE antibody employing a standardized assay method and, if necessary, performing a provocative in vivo latex challenge.^{13,42} Unfortunately, to date there is no FDA standardized reagent licensed to perform skin puncture testing in the United States.^{9,13,17,28,34,42}

Medical History

Obtaining a complete medical history is the first step in diagnosing latex allergy, which should be suspected in anyone who relates a history of rhinitis, conjunctivitis, urticaria, angioedema, coughing, shortness of breath, or wheezing following exposure to latex.^{12,13,34} A physician should evaluate any individual who experiences these symptoms, since further exposure could result in a life-threatening anaphylactic reaction. It is extremely important to question all patients about the possibilities of latex allergy, and since 1991 the FDA has supported these recommendations. Certain patient populations are at higher risk for latex allergies than the general population.

Persons with a History of Multiple Surgeries and Atopy

Persons who have undergone multiple surgical procedures are at increased risk for latex sensitivity, especially if these procedures involved extensive or chronic mucosal contact with latex products.^{41,44} Thus, high-risk groups include patients with neural tube defects (spina bifida, myelomeningocele), spinal cord trauma, urogenital malformations, and neurogenic bladder.^{44,46} In the United States persons with spina bifida have such a high risk for latex allergy (18-73%) as to warrant complete avoidance.^{10,47,48} It is interesting to note in Venezuela, where spina bifida patients experience less exposure to medical latex products, the rate of latex allergy is much lower at 4.3%.⁴⁹ Atopy is the term applied to characterize persons predisposed to multiple allergies such as those with a familial history of hay fever, asthma, dry skin, or eczema. Atopic individuals are at an increased risk of developing an allergy to latex or any other allergen for that matter.^{9,13,15,30,34,41,44,46,50}

Persons with Occupational Exposure to Latex

It is widely assumed healthcare workers have an increased risk of developing severe latex allergy compared to the general population.^{5,17,47,48} However, the results of many studies investigating the issue have either been mixed or critically disputed, leading some to question the premise that healthcare workers are at an increased risk.⁵² Regardless



of the outcome of this debate, contemporary improvements in latex glove production (lower protein and powder levels) combined with refined glove hygiene practices (restrictions on latex glove use in occupational settings and the use of powder-free latex gloves) should greatly alleviate the burden of concern in all occupational scenarios.^{22,23,24,27,29,53,54}

Latex Industry Workers

Although workers in the rubber industry have not been studied for latex allergy to the same extent as healthcare workers, several studies have indicated a higher prevalence in this population (11%).⁷ The job types that were most frequently associated with a higher prevalence of latex allergy in the rubber industry involved the curing and inspection processes. These processes were associated with higher dust levels, chemical-curing fumes confined to small areas, and a synergistic effect between occupational exposure and cigarette smoking.



Persons with Food Allergies

Many latex proteins serve to protect the plant from a variety of environmental threats such as infections by fungi, bacteria, and viruses; wounding; and chemical insult.⁵⁵ Collectively called pathogenesis-related (PR) proteins, these proteins have been conserved in numerous plant species, thus, underlying the potential for cross allergenicity.⁵⁶ For example, the β -1,3-glucanase protein of latex shares epitope similarity to the β -1,3-glucanase proteins found in avocados, bananas, chestnuts, figs, and kiwis. Other latex PR proteins may share epitope similarity with analogous proteins in turnips, tomatoes, potatoes, birch trees, grasses, and weeds.^{9,55} It is estimated a patient with a history of fruit allergy has 11% risk of concurrent latex allergy.⁵⁶

Physical Examination

Signs associated with latex allergy can involve the skin, respiratory tract, gastrointestinal system, and the cardiovascular system. Physical findings include itching, dermatitis, eczema, vesicles, hives, angioedema, watering eyes, chronic sinusitis, sneezing, coughing, wheezing, asthma, dizziness, and/or a decrease in blood

pressure. While all of these findings may be associated with other environmental allergens, their temporal association with any form of latex exposure (entering a facility where ambient latex aeroallergen may be in the air, blowing up a latex balloon, rubber dam placement, etc.) is highly suggestive of a latex allergy.

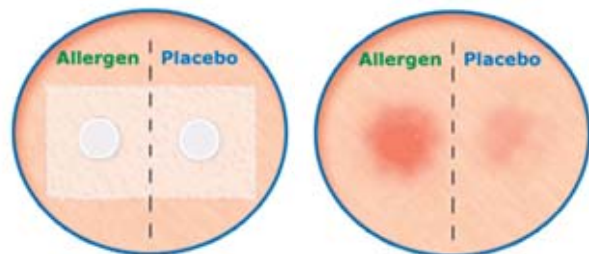
Diagnostic Tests

There are several tests used to identify and diagnose patients with allergies.^{13,34,42} Any patient with a suspected latex allergy should be referred to an allergist or dermatologist for further evaluation.

Patch Testing

In most cases of allergic contact dermatitis the allergen is a chemical that couples with skin proteins, yielding a hapten-protein conjugate. This conjugate then reacts with sensitized cutaneous T lymphocytes to liberate lymphokines, which produce localized cell-mediated inflammation. Patch testing is diagnostic of a type IV hypersensitivity reaction and helps to differentiate an allergic contact dermatitis from an irritant contact dermatitis. The most frequently used individualized technique is called the Finn Chamber, in which small amounts of the suspected allergen are placed in individual aluminum wells that are patched with tape to the patient's back, forearms, or upper back.³⁸ After 48 hours, the patches are removed and the underlying skin is examined for swelling, redness, or blistering, which characterize a positive test. If the test is negative, the site is reexamined again at 72 and 96 hours because weak reactions may appear later. Trained personnel must interpret results, since occasional irritant reactions can confound the results.

A further refinement of the technique, the thin layer rapid use epicutaneous (TRUE) test (Allerderm, Petaluma, CA, USA), has been licensed by the FDA and is available commercially. The



TRUE test consists of a pre-prepared testing strip containing 24 of the most common contact allergens.⁹ It includes four rubber screening mixes and mercaptobenzothiazole. The consistency, ease of use, and cost effectiveness of the TRUE test has made it the most common method of patch testing in use today.^{17,57}

Skin Puncture Test (SPT)

The skin puncture test (SPT) is a reliable, cost-effective, and sensitive testing method, which provides reliable results for diagnosing allergy to natural rubber latex.^{9,14,15,38} In the United States the latex extract reagent must essentially be created in house. Outside the United States, there are two commercially available latex test reagents (Bencard Reagent [Bencard Allergy Laboratories, Missosauga, Ontario, Canada] and Stallergenes reagent [Stallergenes SA, Antony, France]).⁴² It is anticipated a commercially available reagent will soon be approved for us in the United States.^{13,42}

For the SPT, a minute quantity of allergen, sufficient to react with IgE antibodies fixed to cutaneous mast cells, is introduced into the epidermis at a single point. A negative diluent control and a positive control of histamine or a nonspecific mast cell mediator-releasing agent is typically included. The skin of the back, volar aspect of the forearm, or upper arm can be used. After 15 minutes, wheal formation at the test reagent puncture site is compared to that of the positive control. A wheal formation equal to or larger than half the control signifies a positive response.¹⁹ The skin prick test is an indicator of IgE sensitization and should be performed at medical centers with a staff experienced and equipped to manage severe allergic reactions.^{7,58}

Radioallergosorbent Test (RAST)

The radioallergosorbent test (RAST) is a quantitative measurement of allergen-specific IgE antibodies found in the serum of sensitized patients. The FDA has licensed numerous assay techniques from three United States manufacturers: Alastat (Diagnostic Products Corporation, Los Angeles, CA, USA), Pharmacia CAP (Sweden Diagnostics, Kalamazoo, MI, USA), and HyTECH (Hycor Biomedical Incorporated, Garden Grove, CA, USA). Studies have demonstrated diagnostic sensitivities and specificities ranging from 73.3-91.6% and 67.5-

97.2%, respectively. As a consequence, overall efficiency ratings for RAST range from 75.9-89.1%.¹³

Use Test

The Use Test is probably the most commonly employed example of in vivo provocative testing and is performed to test patients who present with a negative serological history of natural rubber latex allergy but have a history that suggests possible latex sensitivity.^{13,42} Its value is limited by the varying allergen contents of gloves from different manufacturers and different lots. While numerous methodologies exist, all involve applying test gloves to the hands followed by observation, over time, for the development of rash, erythema, and pruritis.⁴² A non-latex glove is generally concurrently used to serve as a control. One described method of the Use Test begins with a 15 to 30-minute contact to a latex finger cot. If there is no reaction, the entire glove is placed on the hand for the same amount of time. If there is no reaction, the glove is worn for 60 minutes. If there is still no reaction after 60 minutes of constant contact, the patient is instructed to wear a glove for two hours a day for three consecutive days. The test is negative if no reaction occurs to the placement of either the glove or the finger cot.⁵⁹

Preventive Strategies

Infection may be transmitted in the oral healthcare setting via direct contact with blood, saliva, and other secretions; via direct contact with contaminated instruments, equipment, and environmental surfaces; and via airborne contaminants, such as droplet spatter and aerosols of infectious body fluids. Pathogenic microorganisms that are present in blood, saliva, and other infected body fluids can contaminate the hands of oral healthcare providers. These microorganisms can pass through dermal defects infecting the healthcare provider or they can contaminate sterile instruments, dental equipment, environmental surfaces, and may infect patients. Consequently, work practice and engineering controls are essential elements of today's standard requirements for a practical infection control/exposure control program.

To prevent cross-contamination, oral healthcare workers must perform proper hand hygiene (work

practice controls) and wear gloves (engineering controls) during the treatment of all patients and when cleaning and disinfecting instruments, dental units, and environmental surfaces.^{60,61} In dentistry and medicine sterile surgical gloves are used for barriers during surgery. Non-sterile examination gloves are used for routine examinations, restorative procedures, and preventive care, while thicker, less permeable gloves are used during cleaning procedures. Most available glove types contain latex proteins in variable amounts, as well as processing chemicals that are responsible for precipitating type IV or type I allergic reactions and are the primary source of exposure to natural rubber latex in the healthcare setting.

As mentioned earlier, the proteins responsible for latex allergies have been shown to fasten to the powder (cornstarch) used as a donning lubricant in some gloves. While cornstarch is an extremely rare sensitizing agent, when powdered gloves are used, more latex proteins reach the host. During donning, use, and removal, the water-soluble cornstarch/latex protein particles become airborne. These aerosols can be inhaled and absorbed systemically, causing conjunctivitis, rhinitis, and asthma. It has been reported work areas, where only powder-free gloves are used, show low or undetectable levels of allergy-causing latex proteins.^{9,23,25,26,32} The use of powder-free gloves is highly encouraged.

The amount of latex exposure to produce sensitization or symptoms of an allergic reaction is unknown. However, reductions in exposure to latex products have been reported to be associated with decreased sensitization and symptoms; studies of other allergy-causing substances provide evidence the higher the overall exposure in a population, the greater the likelihood that more individuals become sensitized.^{21,26,32,40,53} (Table 1) contains some of the products used in dentistry that contain latex and a list of alternative products. Practitioners should routinely check with their suppliers to stay current on the availability of latex-free substitutes. The cost of latex alternatives and non-latex gloves has been analyzed, and it was found to be less expensive when compared to the disability and liability costs associated with exposure to latex products.⁶

Table 1. Dental Products that frequently contain latex and alternatives.⁶²

Latex product	Alternatives
Gloves	Vinyl, Neoprene, Nitrile, Thermoplastic elastomer, Styrene-based copolymer, Methyl methacrylate, Polyurethane (numerous manufacturers)
Bite blocks	Silicone bite block (Patterson Dental, St. Paul, MN, USA)
Prophy Polishing Cups	Non-latex prophy cups (Dentamerica, City of Industry, CA, USA; Dentsply, York, PA, USA)
Dental Rubber Dams	Non-latex dental dam (Hygenic, Akron, OH, USA)
Orthodontic elastics	Ligature wires, 3M Unitek chain, 3M Unitek AlastiK ligatures (3M Unitek, Monrovia, CA, USA)
Adhesive tape	Plastic, Silk, 3M – Micropore (3M, St. Paul, MN, USA), Hurt-Free (Johnson & Johnson, New Brunswick, NJ, USA)
Anesthetic carpules	Glass ampules (AstraZeneca Pharmaceuticals LP, Wilmington DE, USA)
Bite wing tabs	Paper loops
Impression Materials containing latex (check MSDS)	Alginate (numerous manufacturers), Blu-mousse (Parkell Inc. Farmingdale, NY, USA), Impregum (Premier ESPE, St. Paul, MN, USA)
Masks	Non-latex cone-shaped and tie-on (numerous manufacturers)
Gutta percha	No good alternative; make certain that gutta percha does not protrude through apex

Allergic reactions to latex products in the healthcare setting can be minimized or prevented by following the recommendations of the National Institute for Occupational Safety²⁹ (Table 2).

Treatment Strategies

Once an individual becomes allergic to latex, special precautions are needed to prevent exposure at home, at work, and during medical and dental care. Although certain medications may reduce symptoms of the allergy (Table 3),

complete latex avoidance is the most effective approach to this problem. Patients with a history of type I hypersensitivity to latex should wear a Medic Alert bracelet and carry epinephrine for emergency use.³⁴ Pretreatment with antihistamines, corticosteroids, and bronchodilators do not predictably prevent latex or other IgE-mediated anaphylactic reactions.²⁸ Strategies for the management of emerging adverse reactions to latex are presented in Table 3.^{63,64}

Table 2. Strategies for the prevention of adverse reactions to latex products.²⁹

- I. General strategies
 - A. Whenever possible, use non-latex gloves and other non-latex products
 - B. If latex gloves are preferred, use reduced-protein, powder-free gloves
 - C. Do not use oil-based hand creams or lotions unless they have been shown to reduce latex-related problems
 - D. After removing latex gloves, perform adequate hand hygiene
 - E. Use good housekeeping practices to minimize latex-contaminated dust in the workplace
 1. Identify areas contaminated with latex dust for frequent cleaning
 2. Change ventilation filters frequently in latex-contaminated areas
- II. Strategies for oral healthcare workers with allergic contact dermatitis
 - A. A trial of reduced-protein, powder-free, additive free or latex-free gloves may resolve dermatitis
- III. Strategies for oral healthcare workers suspected of allergy to latex
 - A. Avoid direct contact with latex gloves and other latex products until evaluated by a physician
- IV. Strategies for oral healthcare workers with evidence of immediate hypersensitivity reaction to latex
 - A. Avoid all contact with latex gloves and other latex products
 - B. Avoid areas where latex aeroallergens may be inhaled
 - C. Follow physicians' instructions for dealing with allergic reactions
- V. Strategies for the prevention of adverse reaction to latex products in patients
 - A. Identify patients who may be allergic to or are at high risk for latex allergy
 - B. Patients allergic to latex must be treated in a latex-free environment
 1. Latex-free treatment room
 - a) Patients should be scheduled for first appointment in the day
 - b) Latex-free gloves and other latex-free devices
 - c) Latex-free procedure tray
 - d) Latex-free emergency kit
- VI. Periodically review and update prevention strategies

Table 3. Strategies for the treatment of allergic reactions to latex products.^{63,64}

- I. Allergic contact dermatitis
 - A. Stop exposure to latex
 - B. High-potency topical corticosteroid are the most effective drugs available
 - 1. Fluocinonide (Lidex), 0.05% ointment
- II. Allergic rhinitis
 - A. Stop exposure to latex
 - B. Topical intranasal corticosteroids are the most effective drugs available
 - 1. Fluticasone propionate (Flonase), 1-2 sprays in each nostrils
- III. Acute urticaria
 - A. Stop exposure to latex
 - B. Oral H₁-receptor antagonists are the most effective drugs available
 - 1. Cetirizine (Zyrtec), 5 or 10 mg once
- IV. Asthmatic reactions
 - A. Stop exposure to latex
 - B. Place patient in a sitting position
 - C. Provide immediate oxygen at 2-4 L/min by nasal cannula
 - D. Short-acting inhaled beta₂-adrenergic agonist
 - 1. Albuterol (Proventil), 90µg/puff, 2-4 puffs
 - E. If wheezing persists, activate EMS
- V. Anaphylaxis
 - A. Stop exposure to latex
 - B. Place patient in supine position and elevate legs
 - C. Maintain the airway and administer 100% oxygen
 - D. Epinephrine is the drug of choice
 - 1. Adult: epinephrine (EpiPen), 0.3 mg, IM (anterolateral thigh), may be repeated in 20 minutes if necessary
 - 2. Child: epinephrine (EpiPen Jr), 0.15 mg, IM (anterolateral thigh), may be repeated in 20 minutes if necessary
 - E. Activate the EMS
 - F. CPR, if indicated

Conclusion

Latex allergy in the oral healthcare setting can result in potentially serious health problems for workers and patients alike. Such health problems can be minimized or prevented. Type I hypersensitivity reactions most commonly occur from exposure to latex proteins. Type IV hypersensitivity reactions are usually associated with accelerators, promoters, and antioxidants used in the manufacturing process of natural rubber latex products. Proven management protocols are now available to safely treat the latex allergic patient and to reduce the risk of future latex sensitization for both the patient and healthcare worker. Patients who are latex sensitive should be treated as the first patient of the day, utilizing latex-free materials, and extreme care should be used to avoid cross-contamination



of surfaces and the environment in general. Reductions in exposure to latex products have been reported to be associated with decreased sensitization and symptoms, consequently, a reasonable reduction of latex products in the healthcare setting should be considered for the protection of both the healthcare worker and the patient.

References

1. Newsom SWB. Pioneers in infections control – Joseph Lister. *J Hosp Infect* 2003;55:246-253.
2. Trampuz A, Widmer AF. Hand hygiene: A frequently missed lifesaving opportunity during patient care. *Mayo Clin Proc* 2004;79:109-116.
3. Ownby DR. A history of latex allergy. *J Allergy Clin Immunol* 2002;110(2 Suppl):S27-S32.
4. Centers for Disease Control and Prevention. Recommendations for prevention of HIV transmission in health care setting. *MMWR* 1987;36(suppl):35-185.
5. Melton A. Managing latex allergy in patients and health care workers. *Cleve Clin J Med* 1997; 64:76-82.
6. Phillips V, Goodrich M, TJ S. Health Care Worker Disability Due to Latex Allergy and Asthma: A Cost Analysis. *Am J Public Health* 1999;89:1024-1028.
7. Woods J, Lambert S, TAE P-M, et al. Natural Rubber Latex Allergy: Spectrum, Diagnostic Approach, and Therapy. *J Emerg Med* 1996;15:71-85.
8. Yip E, Cacioli P. The manufacture of gloves from natural rubber latex. *J Allergy Clin Immunol* 2002;110(2 Suppl):S3-14.
9. Ahmed DD, Sobczak SC, Yunginger JW. Occupational allergies caused by latex. *Immunology Allergy Clin North Am* 2003;23:205-19.
10. Spina A, Levine H. Latex allergy: A review for the dental professional. *Oral Surg Oral Med Oral Pathol Oral Rad Endod* 1999;87:5-11.
11. Sussman GL, Beezhold DH, Kurup VP. Allergens and natural rubber proteins. *J Allergy Clin Immunol* 2002;110(2 Suppl):S33-9.
12. Haeberle HA, Lupic D, Midoro-Horiuti T, et al. Role of cross-allergies to latex in clinical routine of anesthesia. *J Clin Anesth* 2003;15:495-504.
13. Hamilton RG. Diagnosis of natural rubber latex allergy. *Methods* 2002;23:22-31.
14. Tomazic-Jezic VJ, Lucas AD. Protein and allergen assays for natural rubber latex products. *J Allergy Clin Immunol* 2002;110(2 Suppl):S40-6.
15. Weissman DN, Lewis DM. Allergic and latex-specific sensitization: Route, frequency, and amount of exposure that are required to initiate IgE production. *J Allergy Clin Immunol* 2002;110(2 Suppl): S57-63.
16. International Nomenclature Committee of Allergens. <http://www.allergen.org> (accessed 29 March, 2005).

17. Farrell AL, Warshaw EM, Zhao Y, et al. Prevalence and methodology of evaluation for latex allergy among allergists in the United States: results of a cross-sectional survey. *Am J Contact Dermat* 2002;13:183-9.
18. Hamann CP, Turjanmaa K, Rietschel R, et al. Natural rubber latex hypersensitivity. Incidence and prevalence of type I allergy in the dental professional. *J Am Dent Assoc* 1998;129:43-54.
19. Hamann CP, Rodgers PA, Sullivan KM. Allergic contact dermatitis in dental professionals. Effective diagnosis and treatment. *J Am Dent Assoc* 2003;134:185-94.
20. Barbara J, Santais MC, Levy DA, et al. Immuno-adjvant properties of glove cornstarch powder in latex-induced hypersensitivity. *Clin Exp Allergy* 2003;33:106-112.
21. Baur X, Chen Z, Allmers H. Can a threshold limit value for natural rubber latex airborne allergens be defined? *J Allergy Clin Immunol* 1998;101(1 Part 1):24-7.
22. Charous BL, Blanco C, Tarlo S, et al. Natural rubber latex allergy after 12 years: recommendations and perspectives. *J Allergy Clin Immunol* 2002;109:31-4.
23. Charous BL, Schueneman PJ, Swanson MC. Passive dispersion of latex aeroallergen in a healthcare facility. *Ann Allergy Asthma Immunol* 2000;85:285-90.
24. Fish JE. Occupational asthma and rhinoconjunctivitis induced by natural rubber latex exposure. *J Allergy Clin Immunol* 2002;110(2 Suppl):S75-81.
25. Hunt LW, Kelkar P, Reed CE, et al. Management of occupational allergy to natural rubber latex in a medical center: The importance of quantitative latex allergen measurement and objective follow-up. *J Allergy Clin Immunol* 2002;110(2 Suppl):S96-106.
26. Pershall KE. Contact and chemical sensitivities in the hospital environment. *Otolaryngol Clin North Am*. 2003;36:1021-34.
27. Swanson MC, Ramalingam M. Starch and natural rubber allergen interaction in the production of latex gloves: a hand held aerosol. *J Allergy Clin Immunol* 2002;110(2 Suppl):S15-20.
28. Yunginger JW. Latex-associated anaphylaxis. *Immunol Allergy Clin North Am* 2001;21:669-77.
29. Centers for Disease Control. National Institute for Occupational Safety and Health. NIOSH Alert: preventing allergic reactions to natural rubber latex in the workplace. Cincinnati, OH: US Department of Health and Human Services, Public Health Service. CDC, National Institute for Occupational Safety and Health, 1997.
30. Fisher AA. Contact urticaria and anaphylactoid reactions to corn starch surgical glove powder. *Contact Dermatitis* 1987;16:224-5.
31. Federal Register: Proposed rules. Vol 64, No 146, July 30, 1999.
32. Charous BL, Tarlo SM, Charous MA, et al. Natural rubber latex allergy in the occupational setting. *Methods* 2002;27:15-21.
33. Saary MJ, Kanani A, Alghadeer H, et al. Changes in rates of natural rubber latex sensitivity among dental school students and staff members after changes in latex gloves. *J Allergy Clin Immunol* 2002;109:131-5.
34. Zak HN, Kaste LM, Schwarzenberger K, et al. Health-care workers and latex allergy. *Arch Environ Health* 2000;55:336-46.
35. Yeang HY. Prevalence of latex allergy may be vastly overestimated when determined by in vitro assays. *Ann Allergy Asthma Immunol* 2000;84:628-32.
36. Schmid K, Cristoph BH, Niklas D, et al. Latex sensitization in dental students using powder-free gloves low in latex protein: a cross sectional study. *Contact Dermatitis* 2002;47:103-8.
37. Safadi G, Safadi T, Terezhalmay G, et al. Latex Hypersensitivity: It's prevalence among dental professionals. *J Am Dent Assoc* 1996;127:83-88.
38. Antezana M, Parker F. Occupational contact dermatitis. *Immunol Allergy Clin North Am* 2003;23: 269-90.
39. Del Savio B. Is allergic contact dermatitis being overlooked? *Arch Fam Med* 1994;3:537-43.
40. Nettis E, Assennato G, Ferrannini A, et al. Type I allergy to natural rubber latex and type IV allergy to rubber chemical in healthcare workers with glove-related skin problems. *Clin Exp Allergy* 2002;32:441-7.

41. Ruëff F, Kientz A, Schöpf P, et al. Frequency of natural rubber latex allergy in adults is increased after multiple operative procedures. *Allergy* 2001;56:889-94.
42. Hamilton RG, Peterson EL, Ownby DR. Clinical and laboratory-based methods in the diagnosis of natural rubber latex allergy. *J Allergy Clin Immunol* 2002;110(2 Suppl):S47-56.
43. Neugut AI, Ghatak AT, Miller RL. Anaphylaxis in the United States. An investigation into its epidemiology. *Arch Intern Med* 2001;161:15-21.
44. Lieberman P. Anaphylactic reactions during surgical and medical procedures. *J Allergy Clin Immunol* 2002;110(2 Suppl):S64-9.
45. Pumphrey RSH, Duddridge M, Norton J. Fatal latex allergy. *J Allergy Clin Immunology* 2001;107:558.
46. Wagner B, Buck D, Hafner C, et al. Hev b 7 Haea brasiliensis protein associated with latex allergy in children with spina bifida. *J Allergy Clin Immunol* 2001;108:621-7.
47. Shaer C, Meeropol E. Latex information. Spina Bifida Association. Updated Summer 2005. http://www.sbaa.org/site/PageServer?pagename=sbaa_latex (accessed February 7, 2006).
48. Szepefalusi Z, Seidl R, Bernert G, et al. Latex sensitization in spina bifida appears disease-associated. *J Pediatr* 1999;134:344-348.
49. Capriles-Hulett A, Sanchez-Borges M, Von-Scanzoni C, et al. Very low frequency of latex and fruit allergy in patients with spina bifida from Venezuela: influence of socioeconomic factors. *Ann Allergy Asthma Immunol* 1995;75:62-4.
50. Condemi JJ. Allergic reactions to natural rubber latex at home, to rubber products, and to cross-reacting foods. *J Allergy Clin Immunol* 2002;110(2 Suppl):S107-10.
51. Chowdhury MMU, Statham BN. Natural rubber latex allergy in a health-care population in Wales. *Br J Dermatol* 2003;148:737-40.
52. Garabrant DH, Schweitzer S. Epidemiology of latex sensitization and allergies in health care workers. *J Allergy Clin Immunol* 2002;110:S82-95.
53. Bernstein DI. Management of natural rubber latex allergy. *J Allergy Clin Immunol* 2002;110(2 Suppl):S111-6.
54. Turjanmaa K, Kanto M, Kautiainen H, et al. Long-term outcome of 160 adult patients with natural rubber latex allergy. *J Allergy Clin Immunol* 2002;110(2 Suppl):S70-4.
55. Breiteneder H, Ebner C. Molecular and biochemical classification of plant-derived food allergens. *J Allergy Clin Immunol* 2000;106:27-36.
56. Sicherer SH. Clinical implications of cross-reactive food allergens. *J Allergy Clin Immunol* 2001;108:881-90.
57. Farrell AL, Warshaw EM, Zhao Y, et al. Prevalence and methodology of patch testing by allergists in the United States: results of a cross-sectional survey. *Am J Contact Dermatitis* 2002;13:157-63.
58. Sussman G, Beezhold D. Allergy to Latex Rubber. *Annals of Internal Medicine* 1995;122:43-46.
59. Nettis E, Colanardi MC, Ferrannini A. Type I latex allergy in health care workers with latex-induced contact urticaria syndrome: a follow-up study. *Allergy* 2004;59:718-23.
60. Centers for Disease Control and Prevention. Guidelines for hand hygiene infection in health-care settings. *MMWR* 2002;51(No. RR-16).
61. Centers for Disease Control and Prevention. Guidelines for infection control in dental health-care settings-2003. *MMWR* 2003;52(No. RR-17).
62. American Latex Allergy Association. Dental Products. http://www.latexallergyresources.org/Product_lists/dental_products.cfm (accessed 30 March, 2005).
63. Abramowicz M, ed. Treatment guidelines. *Drugs for allergic disorders. The Medical Letter on Drugs and Therapeutics.* 2003;1:93-100.
64. Abramowicz M, ed. Treatment guidelines. *Drugs for asthma. The Medical Letter on Drugs and Therapeutics.* 2002;1:7-12.

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