Shoe Dermatitis: Causes, Prevention, and Management

Here's an update for the podiatric physician.

By Robert G. Smith, DPM, MSc, RPh

Introduction

At least seven pairs of shoes are purchased by American families annually. Podiatric physicians have come to realize that there is a variety of footwear styles: casual, formal, work, and athletic shoes made all over the world from leather, rubber, and other synthetic materials. For this reason, it is impossible to identify precisely all of their constituents. A vast variety of potentially sensitizing chemicals are used during shoe manufacturing and finishing. A medical condition referred to as “shoe dermatitis” is a form of contact dermatitis caused by the contact of the foot with parts of the shoe due to these chemicals.1-3 Despite a warm and humid environment inside shoes, shoe dermatitis is relatively uncommon. Shoe dermatitis is a diagnostic and therapeutic challenge and is a common type of contact dermatitis affecting children and adults regardless of race. For this reason, it is imperative that the foot and ankle physician become familiar with recognizing signs and symptoms of shoe dermatitis so that patients can be accurately diagnosed and appropriately treated to avoid secondary infections and disability.

This review will first present causative factors for the etiology of shoe contact dermatitis supported by clinical based evidence as found in the literature.2,3 Secondly, a description of the signs and symptoms of shoe dermatitis will be presented in a narrative fashion.2,3 Finally, both treatment options and preventative measures to avoid shoe dermatitis will be offered to the podiatric clinician.

Causes of Shoe “Contact” Dermatitis

Allergic contact dermatitis is caused by the body’s reaction to something that directly contacts the shoe and the foot. Causative factors for the etiology of shoe contact dermatitis supported by clinical based evidence as found in the literature.

Welcome to Podiatry Management’s CME Instructional program. Our journal has been approved as a sponsor of Continuing Medical Education by the Council on Podiatric Medical Education.

You may enroll: 1) on a per issue basis (at $20.00 per topic) or 2) per year, for the special introductory rate of $139 (you save $61). You may submit the answer sheet, along with the other information requested, via mail, fax, or phone. In the near future, you may be able to submit via the Internet.

If you correctly answer seventy (70%) of the questions correctly, you will receive a certificate attesting to your earned credits. You will also receive a record of any incorrectly answered questions. If you score less than 70%, you can retake the test at no additional cost. A list of states currently honoring CPME approved credits is listed on pg. 200. Other than those entities currently accepting CPME-approved credit, Podiatry Management cannot guarantee that these CPME credits will be acceptable by any state licensing agency, hospital, managed care organization or other entity. PM will, however, use its best efforts to ensure the widest acceptance of this program possible.

This instructional CME program is designed to supplement, NOT replace, existing CME seminars. The goal of this program is to advance the knowledge of practicing podiatrists. We will endeavor to publish high quality manuscripts by noted authors and researchers. If you have any questions or comments about this program, you can write or call us at: Podiatry Management, P.O. Box 490, East Islip, NY 11730, (631) 563-1604 or e-mail us at bblock@podiatrym.com.

Following this article, an answer sheet and full set of instructions are provided (p. 200).—Editor

Continued on page 190
skin. Many different substances, called “allergens”, can cause allergic contact dermatitis. Cronin reports that historically in the 1930s and 1940s, leather and dyes caused most of the presenting cases of shoe contact dermatitis.4

By the 1950s and 1960s, rubber allergens became the most common identifiable cause of foot dermatitis.5,6 Today, shoe dermatitis may occur if a person is sensitive to the rubber or elastic compounds in shoes, form inserts, or elastic glues used to bind shoe components. The other identifiable causes of shoe dermatitis are cements, dichromates used in tanning, dyes, anti-mildew agents, formaldehyde, and nickel eyelets or nickel arch supports.

The allergen is usually a rubber accelerator or antioxidant used in the manufacture of rubber rather than rubber or latex. Rubber continues to be blamed as a common cause of shoe dermatitis, especially when the antioxidant monobenzyl hydroquinone is present.3,5 This antioxidant may also cause hypopigmentation of the skin.3

The paraphenylenediamine group of rubber additives are an important cause of industrial dermatitis. Shoe dermatitis is usually caused by the rubber adhesive used to glue the parts together. Moreover, adhesives, both rubber and non-rubber, can cause problems so much so that even leather shoes may contain products that cause shoe dermatitis.

Chromates

Chromates are compounds that contain chromium and are commonly responsible for allergic contact dermatitis from contact with cement, leather, some matches, paints and anti-rust compounds. Chromates are used to tan leather for shoes and clothing. Chromium is gradually liberated from leather collagen by the action of hydroxyl acids in sweat, especially when shoes are worn without stockings.3

Athletic running shoes, as well as swim fins, contain rubber accelerators, antioxidants, and other rubber additives that are common causes of foot dermatitis.5 These compounds include: thioureas, thiurams, carbonates, N-isopropyl-N-phenyl-p-

TABLE 1
The Most Common Allergens in Shoe Dermatitis Found in the Literature

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Patient #</th>
<th>Method</th>
<th>Common Allergens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saha et al.</td>
<td>1993</td>
<td>50</td>
<td>Patch test</td>
<td>Potassium dichromate, colophony</td>
</tr>
<tr>
<td>Freeman</td>
<td>1997</td>
<td>55</td>
<td>Interview</td>
<td>Rubber, chromate, para-tert-Butylphenol formaldehyde</td>
</tr>
<tr>
<td>Shackelford and Belsito</td>
<td>2002</td>
<td>704, 70*</td>
<td>Patch test</td>
<td>Rubber components, chromated leather adhesives</td>
</tr>
<tr>
<td>Rani et al.</td>
<td>2003</td>
<td>119</td>
<td>Patch test</td>
<td>para-tert-Butylphenol formaldehyde, cobalt chloride,</td>
</tr>
<tr>
<td>Lazzarini et al.</td>
<td>2004</td>
<td>1027, 53*</td>
<td>Patch test</td>
<td>chromate, rubber chemicals, dyes</td>
</tr>
<tr>
<td>Holden and Gawkroder</td>
<td>2005</td>
<td>3337, 230*</td>
<td>Patch test</td>
<td>Chromate, rubber chemicals, paraphenylenediamine</td>
</tr>
<tr>
<td>Nardelli et al.</td>
<td>2005</td>
<td>8543, 474*</td>
<td>Patch test</td>
<td>Potassium dichromate, cobalt chloride, paraphenylenediamine, rubber components para-tert-Butylphenol formaldehyde, colophony</td>
</tr>
<tr>
<td>Chowdhuri and Ghosh</td>
<td>2007</td>
<td>640, 155*</td>
<td>Patch test</td>
<td>Potassium dichromate, cobalt chloride</td>
</tr>
<tr>
<td>Warshaw et al.</td>
<td>2007</td>
<td>10,061, 109*</td>
<td>Patch test</td>
<td>para-tert-Butylphenol formaldehyde, Potassium dichromate, carba mix</td>
</tr>
<tr>
<td>Bajaj et al</td>
<td>2007</td>
<td>1000, 310*</td>
<td>Patch test</td>
<td>Potassium dichromate, mercaptobenzthiazole, mercapto mix</td>
</tr>
</tbody>
</table>

* Accounts for the number of patients with contact dermatitis from footwear.
Shoe Dermatitis...

phenylenediamine, and mercapto-benzothiazole. As with other footwear, the dye found in the in-soles of certain running shoes has caused contact dermatitis in runners.

Review of the Literature

A review of the medical literature reveals a number of case reports, retrospective observations, random control trials, and practice guidelines that identify the potential antigens responsible for shoe dermatitis. Shoe contact dermatitis resulting from shoe linings was first noted in 1877 and has appeared as a recent case report in which the cause was attributed to para-tertiary-butylphenol formaldehyde. The most common allergens responsible for causing shoe dermatitis as found in the literature are presented graphically as Table 1.

Saha, et al. conducted a study to determine the prevalence and clinical patterns of footwear dermatitis. Fifty patients with suspected shoe dermatitis and thirty control subjects were patch-tested with 22 allergens. While seventy percent of patients showed sensitivity to these footwear allergens, both potassium dichromate and colophony were identified as the most common sensitizers. The validity of this observational design study is strengthened by the investigators’ use of matched controls to avoid observer bias. These investigators stress that there should be footwear screening to detect responsible allergens and call upon both manufacturers and research institutions to assist with such screenings in order to provide non-allergic footwear to the public.

Observational results reported by Freeman in 55 patients with chronic foot dermatitis revealed “rubber” as the most the common allergen, followed by chromate, p-tertiary-butylphenol-formaldehyde resin and colophony responsible for causing chronic footwear dermatitis. In this study, the incidence of shoe dermatitis was almost equal in both genders. A hallmark observation identified by Freeman was that during a differential diagnosis, all parts of the foot were affected except the inter-digital areas and hyperhidrosis was found in all subjects.

At the center of this report is the foremost intention of the investigator to analyze interventional data from subjects retrospectively. Freeman’s patient improvement (the resolution of symptoms of 87.5%) was attributed to successfully finding suitable footwear secondary to patch testing that identified the principle causative antigen. However, the relatively small representative sample size in this study does impact the magnitude of precision as it relates to likelihood estimates when used and applied to generalize populations. Therefore, the effectiveness of the intervention of empowering patients with allergen awareness may not be fully appreciated because of bias.

Shackelford and Belsito demonstrated that rubber components were the most common allergens contributing to the etiology of allergic appearing dermatitis. The continued and increased frequency with which rubber components act as causative allergens in shoe dermatitis is a reflection of their continued use, further accentuated by Belsito.

Shackelford and Belsito used a five-year retrospective investigational method on 704 patients who were patch-tested. Ten percent of these patients demonstrated a clinical presentation suggestive of allergic contact dermatitis. Because this was a retrospective design, verifying the existence of risk factors or outcome conditions to the same degree as seen in prospective study design is difficult. It is possible that this investigation may have both elements of recall and or selection bias.

Most athletic shoes increase the probability of perspiration because of the combination of the impermeable nature of their construction. Rubber allergens will penetrate the skin at a greater rate because of this increase in perspiration and will result in increased skin exposure and sensitization of these materials.

A prospective investigation conducted by Rani, et al. included 119 patients (21 males and 98 females) suspected of having contact dermatitis due to shoe allergens. Both shoe series and European Standard series patches were applied on the upper back of each subject and removed after forty-eight hours. Seventy-three percent (n=87) reacted positively to a variety of allergens. These authors determined quantifiably that glues and para-tertiary-butylphenol formaldehyde resin were the leading causes of shoe dermatitis. Glues (33.6%) were the leading cause of shoe dermatitis, followed by leather allergens (26.4%), rubber allergens (7.6%), and dyes (7.6%).

Rani, et al. determined that the maximum incidence of shoe dermatitis observed in this study was in the 20-50 year age group. This finding validates Saha, et al.’s results because a similar pattern of prevalence was observed in this investigation. Rani, et al. acknowledge that their observed prevalence of footwear dermatitis may be influenced by differences in geographic location, social disparity, and climate.

Another investigation was conducted by Lazzarini, et al. on fifty-three patients with eczematous dermatitis. Patch testing was performed using the Brazilian series. Thirty-seven (70%) had at least one positive patch test reaction. The compounds causing positive reactions were rubber-vulcanizing agents, followed by either metals or topical medications. This prospective study detailed both inclusion and exclusion criteria for their study subjects. Also, the presence of dermatitis on the dorsal region of the foot in the majority of the patients with a positive test result was statistically significant. The use of statistical data enriches this investigation by demonstrating that their results are not due to random chance.

Holden and Gawkrodger reported their experience of ten years of patch-testing on 230 patients to identify which allergens are important in determining the cause of shoe dermatitis. Forty-four subjects of the group showed relative allergic positive reactions to the allergens in the British Contact Dermatitis Society’s standard series. Only 13 patients had relevant positive results to one or more allergens from the shoe series.

The current shoe series consists of 17 allergens, including two from the rubber series. One percent of the
Shoe Dermatitis...

230 cases were positive for five allergens. Chromate was identified as the top allergen during this investigation. These authors conclude from their observation that nickel is rarely a relevant allergen for foot dermatitis, unless an obvious source of metal buckles is present.

Nardelli, et al. report the results of a thirteen-year retrospective study that was conducted to identify the relationship between the causative allergens in shoes and localization of foot dermatitis. This study determined that 474 patients presenting with foot dermatitis had a positive reaction to one or more substances related to footwear. The most common allergens in decreasing order of frequency in this study were potassium dichromate and cobalt chloride, followed by p-phenylenediamine, rubber components, colophony, and p-tert-butylphenol formaldehyde.

Potassium dichromate and cobalt chloride were most often found in relation to dermatitis of the whole foot. Rubber chemicals were associated with dermatitis of the soles of the feet.

Chowdhuri and Ghosh conducted an epidemiologic-allergological investigation of 640 patients identifying 155 cases of footwear dermatitis. After a detailed history and clinical examination of a total of 640 patients, patch testing was performed. Patch test units were comprised of ointment forms, liquid forms, strips, discs, and chambers. Those patients with feet dermatitis only were tested for footwear allergens with controls.

Statistical analysis of data obtained from history, clinical features, and allegrological findings by correlation and follow up was performed. Post-patch test counseling was employed and the results were clinic-allergologically correlated. Fortunately, this later prospective investigation’s results allows for validation of Freeman’s earlier observations on the benefit of patient allergy awareness. Chowdhuri and Ghosh identified potassium dichromate and cobalt chloride as the commonest allergens causing footwear dermatitis.

Warshaw, et al. retrospectively analyzed data from 10,061 patients between 2001 to 2004. These investigators set forth four goals as objectives for this study: to determine the frequency of allergens associated with a shoe source in North American Contact Dermatitis Group patients with footwear allergic contact dermatitis, compare their results to allergen frequencies from other published studies, quantify the number of shoe-related reactions that were not identified on the North American Contact Dermatitis Group standard series, and identify relevant allergens not included on the North American Contact Dermatitis Group standard series, based on data from other studies.

It was determined that in 109 North American Contact Dermatitis Group patients with allergic contact dermatitis of the foot and allergens the most common allergen was from a shoe source p-tertiary butylphenol formaldehyde resin, an adhesive, which accounted for 24.7% of positive patch test results, followed by potassium dichromate (17.5%) and carba mix (11.7%).

North American Contact Dermatitis Group patients were statistically more likely to have positive patch test reactions to p-tertiary butylphenol formaldehyde resin and statistically less likely to have a positive patch test reaction to potassium dichromate than patients represented in pooled data studies. A determined final conclusion from their analysis was in North American Contact Dermatitis Group patients.

The most common individual shoe allergen was p-tertiary butylphenol formaldehyde resin, and as a group, rubber chemicals were most common, a finding consistent with those of other investigations.

The most common individual shoe allergen was p-tertiary butylphenol formaldehyde resin, and as a group, rubber chemicals were most common, a finding consistent with those of other investigations. This investigation is superior to the other investigations because of its through comparative analysis of results to previously published literature findings.

Bajaj, et al. reported their experience with patch-testing of 1,000 patients. Patients with suspected allergic contact dermatitis were involved in this retrospective analysis. The Indian Standard Series was used for patch-testing. The age range of this cohort was eight to 87 years, with a median age of 35.9 years. Suspected footwear dermatitis was the commonest clinical pattern found in 310 patients. Among these 310 patients, 190 (61.3%) showed positivity to one or more allergens.

Chemicals such as potassium dichromate (34.2%), mercaptobenzothiazole (30%), and mercapto mix (28%) were the leading allergens in patients with footwear dermatitis. Interestingly, there were no statistically significant differences in sensitization rates between males or females. These authors suggest that wearing thick absorbent socks and using other non-chromate chemicals for tanning and curing leather can minimize chromium exposure from leather footwear.

Case Studies

As a point of completeness, case studies describing shoe dermatitis as they appear in the medical literature are presented. Oztas, et al. report shoe dermatitis from para-tertiary butylphenol formaldehyde in a 38 year old woman. Onder, et al. further present four cases of footwear dermatitis emphasizing that rubber is still the most common shoe allergen reported.

Verma, et al. describe a case report of a 29-year-old male with purpuric contact dermatitis from footwear. This report notes that there exist variations in individual allergen sensitivity with shoe dermatitis because of differences in chemical composition of footwear or individual susceptibility.

Interestingly, Hartmann and Hunzelmam offer a case report of a

Continued on page 193
Shoe Dermatitis...

47-year-old man with a vesicular dermatitis on both soles from cinnamon as an odour-neutralizing agent in shoe insoles.21 Patch-testing revealed a positive reaction to cinnamaldehyde and cinnamic alcohol, despite a social history described by the patient of often eating food flavored with cinnamon.22

Most recently, a case report describing allergic contact dermatitis to Crocs™ has been cited in the literature.26 Castanedo-Tardan, et al. present the case of a 14-year-old boy with a two-year history of pruritic erythematous plaques on both the dorsal and plantar surface of his feet.26 Patch-testing was performed to the North American Contact Dermatitis Standard series and to a punch plug of the patient’s Crocs26 with positive results.26

Discontinuation of the Crocs26 and the use of sneakers resulted in clearance of his foot dermatitis.26 These authors assert the importance of testing shoe components and the need to obtain the individual ingredients from the shoe product manufacturer to enable clinicians to identify potential allergens.26

Corazza, et al. describe a case presentation of a 72-year-old man with the rarely reported contact sensitization to an amputation prosthesis.27 This man presented with an erythematous-edematous scaly dermatitis involving his left foot stump extending to the leg with extension to his right foot and leg.27 A cutaneous biopsy from his left leg was performed revealing histological findings consistent with chronic eczematous dermatitis.27

This patient wore an orthopedic shoe with its mobile plastic prosthesis device covered with leather.27 Patch-testing revealed positive results to para-tertiary-butylphenolformaldehyde resin, cobalt chloride, nickel sulfate, and potassium dichromate.27 The patient’s dermatitis healed with oral antihistamines, systemic and topical steroids, replacing the old prosthesis with chromate-free and para-tertiary-butylphenolformaldehyde resin-free shoes and wearing extra pairs of socks.27

The last case report centers on a 64-year-old woman with the presentation of unilateral contact dermatitis caused by footwear.28 Clinical examination revealed linear erythema on the dorsum of her right foot with two flaccid blisters on the side of her right foot.28 History revealed the patient noticed the lesions and believed they were related to her shoes that had been dyed two months earlier.28 Patch testing was performed with positive results to rubber and dyed leather.28 It was concluded that she had experienced shoe dermatitis after the lesions resolved when the patient stopped using the shoes.28 An important fact acknowledged by these authors is that the atypical presentation of this condition delayed this patient’s diagnosis.28

The podiatric clinician is encouraged to determine if these literature citations are relevant and valid to their specific patient populations. First, the number of subjects is crucial to determine whether accurate statistics can be generated from the collected data. Krejcie and Morgan have suggested that a good rule of thumb is that 400 subjects will provide reliable statistics that can be applied to general populations.29

Indeed, seven of the ten reviewed investigations have greater than 400 subjects. On the other hand, when examining the sub-populations of subjects with foot dermatitis, only one investigation allows for the sample sizes to be precisely visualized by explaining in detail entry and exclusion criteria, ensuring a homogenous study sample population. The methods of all these investigations are described in detail and were designed to answer the investigators’ research question.

All the studies do clearly state and define their primary outcome and how it was measured. Only one investigation addresses confounding variables regarding the presentation of shoe dermatitis. Finally, a few of these investigations specifically state statistical significance, but it must be remembered that statistical significance only minimizes the possibility that the results could have occurred by chance alone. It implies nothing about the actual importance or clinical significance of these results. The findings of all the investigations do offer needed clinical information regarding the most common allergens responsible for causing shoe dermatitis.

Shoe dermatitis usually shows as redness, swelling and water blisters.

Shoe dermatitis usually shows as redness, swelling and water blisters. The size of these blisters range from tiny to large. Also, these blisters may break and form crusts and scales. Untreated, the skin may darken and become leathery and cracked. Allergic contact dermatitis can be difficult to distinguish from other rashes, especially after it has been present for a while. The dermatitis can occur on the weight-bearing parts, heels, sides of the foot, and other pressure and friction areas.32

The most common site first involved with shoe dermatitis is the dorsal surface of the big toe and on the insteps (Figures 1a b). Later, it extends by spreading to the other toes and dorsal aspect of the foot.4 Skin lesions may be acute, presenting as red, blistering, oozing, and usually symmetrical.33

The clinical symptoms of shoe contact dermatitis can range from mild, itchy rash to severe itching with swelling and small blisters.7 On the other hand, chronic lesions are

www.podiatrymanagement.com

OCTOBER 2008 • PODIATRY MANAGEMENT 193
Shoe Dermatitis...

Dry, lichenified, and in severe cases, open sores may present and can result in secondary bacterial infections.15

Finally, an important diagnostic parameter used by physicians is the presence of normal skin not in contact with shoes between eczematous areas. The design of the footwear determines to a large extent the appearance of shoe dermatitis.12 The podiatric physician may keep this observation in mind when referred a patient for medical evaluation. If untreated, a secondary infection may result, which presents as swelling, tenderness and pus formation.

Diagnosis of Shoe Dermatitis

The physician and patient will discuss the materials that touch the person’s skin at work and home, and try to identify the allergen. Given that history and physical examination alone are not sufficient to confirm the diagnosis of allergic contact dermatitis, Freeman recommends that all patients with foot dermatitis which does not respond to treatment should be patch tested to exclude shoe allergy.29

A foot and ankle physician may detect the skin sensitizer responsible for shoe dermatitis by performing a “patch test.”24 First described by Josef Jadassohn in 1895, patch testing is a safe and quick way to diagnose contact allergies and remains the gold standard for diagnosing allergic contact dermatitis.20,31 A small amount of the suspected allergen is applied to the skin for a fixed time.2,5

Commercial patches are available that contain common allergens that are known to cause contact dermatitis.2,4 Two methods for patch-testing exist. The first is the 24-component, thin layer, rapid-use, epicutaneous test screening tool.22 The second method is comprehensive patch testing, which involves creating customized patch-tests based on the history of the patient.22

Patch-testing can also be done using pieces of the shoe soaked in water and applied under occlusion to the medial forearm or back for 48 hours. Finally, patch testing of solid objects may be performed by trimming off a small sample between 0.5 – 1 cm2 and applying the sample to the skin. The ability to select specific allergens gives more power as a diagnostic tool because of the ability to have a higher rate of identifying the relevant allergen, which would have been missed by using a limited screening tool.2,4

Patch testing is not the test of choice for diagnosis of Type-I allergy.26 After these patches are removed, the treating physician can check for a positive reaction over a few days.24 A positive significant allergen will produce a reaction with pruritus, erythema, edema, and even vesiculation. If indeed, the patient tests positive for shoe contact dermatitis, the physician must document this allergy within the patient’s chart and ensure and provide patient instructions to stop wearing the shoes causing this reaction.2,5

Management and Prevention of Shoe Dermatitis

Patient empowerment through education to assist in avoidance of the affecting antigen is the primary goal as well as the cornerstone of shoe dermatitis management.

Unfortunately, patient avoidance of these antigens is often difficult to implement, which ultimately results in a presentation of shoe dermatitis. Once a diagnosis of shoe dermatitis has been confirmed, treatment management goals include alleviation of pruritus and treating the inflammation. The podiatric physician should emphasize basic good skin care with the use of soap-free hydrating cleansers and emollients to patients as an important adjunct to the treatment of shoe dermatitis.22

Treatment should begin with a non-pharmacological approach and incorporate prescription medications, when necessary. In order to treat shoe dermatitis, the physician must achieve an understanding of the mechanism and pathophysiology of allergic contact dermatitis. First, contact dermatitis results from exposure to exogenous agents. Then Zellar and Warshaw’s classification system for contact dermatitis can be used to identify if the reaction is one of two types: non-immunologic and immunologic.30

Shoe dermatitis has been identified as allergic contact dermatitis which is a delayed, cell-mediated, immunologic reaction requiring prior sensitization to the offending antigen.30

Allergens are processed by antigen-presenting cells known as Langerhans cells with receptors specific for the antigen which recognize the antigen, bind to it, and become activated.30 Subsequent contact between the antigen and the skin triggers...
Shoe Dermatitis...

gers an inflammatory cascade that manifests clinically within 24 to 72 hours.2,32 Skin affected by allergic contact dermatitis will demonstrate inflammation corresponding to the degree of potency and immune reaction from the allergen.2,32 Summaries of both non-pharmacological and pharmacological approaches will be offered with an emphasis on mechanism of actions, potential adverse effects, and patient consideration.2,3,12-37

First, moist compresses may be used to enhance the drying of well-localized, acute, weeping lesions. Cool moist soaks applied for five to ten minutes, followed by air-drying, may significantly reduce drainage from the affected foot. Secondly, even though the exact mechanism is unknown, an absorbent cloth moistened with isotonic physiologic saline, aluminum sulfate-calcium acetate astringent solution, silver nitrate or tap water applied for 20-30 minutes, several times a day, can be utilized to reduce inflammation and provide relief from the irritating symptoms of shoe dermatitis.2,32

Finally, inflamed lower extremity skin that is dry, hot, and indurated may benefit from a thin layer of white petrolatum followed by a cold compress.2,32

Moisturizing emollients have been prescribed to treat shoe dermatitis, providing both occlusion and humectance.2,32 The occlusion property of emollients provides a sealant layer on the surface of the skin to reduce water loss.2,32 On the other hand, the humectance property is one of increasing the “water-holding capacity” of the stratum corneum and therefore increasing skin hydration.2,32 Lipids known as ceramides have been added to moisturizing emollients to improve the skin barrier in inflamed skin by enhancing the structural lipid bilayer of the stratum corneum.2,32

Finally, urea, glycerin, pyrrolidone carboxylic acid, alpha-hydroxy acids, as in lactic acid and glycolic acid are examples of low molecular weight humectants that have been added to emollients.2,32

The prescribing and application of topical corticosteroids is a medical standard of care in the treatment of shoe dermatitis.2,3 Corticosteroids are known to interfere with inflammatory response. The major therapeutic role of corticosteroids in treating allergic contact dermatitis is their ability to inhibit T-cell activation and leukocyte migration.2,32

A recently published literature account using contact hypersensitivity mouse models has suggested that corticosteroid therapeutic effects and cell targets for immune suppression in contact allergies, may also involve both macrophages and neutrophils.2,32

Topical glucocorticoids (corticosteroids) are adrenocorticosteroid derivatives incorporated into a vehicle formulated to be applied to the skin and external mucous membranes.2,3 Corticosteroids tend to penetrate human skin slowly, leading to a reservoir effect.2,32,33

The absorption of the drug into the skin is a function of the nature of the drug, the behavior of the vehicle, and the status of the skin. Drug absorption is increased with an increase of water content of the stratum corneum.2,3

The differences in rate of absorption of different topical drugs, or the same drug in a different vehicle, rely on three variables: the concentration of drug in the vehicle, the partition coefficient of the drug between the stratum corneum and the vehicle, and the diffusion coefficient of the drug in the stratum corneum.3

The diffusion coefficient is the extent to which the matrix of the barrier restricts the mobility of the drug.1 Increases in molecular size of the drug will increase the frictional resistance and decrease the diffusion coefficient.3

Topically applied corticosteroids diffuse across cell membranes to interact with cytoplasmic receptors located in both dermal and intradermal cells. The primary therapeutic effects of topical corticosteroids are due to their non-specific anti-inflammatory activity. Glucocorticoids enhance or repress the transcription of genes contained in almost every cell involved in the immune and inflammatory responses through interaction of cell receptors located in the cell membrane and its cytoplasm.3,36

The anti-inflammatory action of steroids is mediated by its action of cortisol, as it induces production of lipocortins through the glucocorticoid receptor mechanism to inhibit the activity of phospholipase A2.2,3 This action impairs production of postagladins and leukotrienes, the mediators of inflammation, through the action of cyclooxygenase on arachidonic acid.1,36

A variety of topical corticosteroids are available in various potency and vehicles. The relative potency of a product depends on several factors including the characteristics and concentration of the drug and vehicle used.2,3 Vasconstriction assays are used to measure the relative potency of available commercial products.2,3 The podiatrist should be familiar with the classifications of relative potencies of available products as they are presented in Table 2.

Once the selection of a topical corticosteroid agent is considered, the clinician must decide on the most appropriate delivery system; thus the choice of vehicle in a topical formulation is of great importance.2,3

The ideal vehicle has the following characteristics: easy to apply and remove, acceptable cosmetically without odor and non-greasy, non-irritating, compatible with the active ingredient, and readily releasing the active drug.1 Topical corticosteroids are available in vehicles such as gels, lotions, solutions, creams, and ointments.2,36

An advantage of using creams or oil-in-water emulsions is that they are absorbable and are vehicles that may be drying.2,3 Water-miscible creams may be more appropriate for moist or weeping lesions.2,3 Ointment bases are compounded as either water-insoluble bases like petrolatum or water-soluble bases like polyethylene glycol, or they can be emulsified with water.2,3

Continued on page 196
Shoe Dermatitis...

An ointment is a water-in-oil emulsion. It is noted as being the most effective hydrating agent. It is considered more potent and effective due to its occlusive, nature-enhancing corticosteroid penetration.\(^2,3\) Ointments are the most effective vehicle for treating thick, fissured, lichenified and dry, scaly eruptions.\(^2,3\)

Lotions are formulated as a powder in a water suspension and are considered less lipophilic suspending agents.\(^2,3\) Lotions are used to treat superficial dermatoses, especially if there is slight oozing. Gels are semi-solid polymers containing pockets of liquids that tend to allow for greater penetration when compared to lotions. Gels are most useful when applied to hairy areas or other areas where it is considered cosmetically unacceptable to have residue of a vehicle remain on the skin.\(^2,3\)

Both gels and ointment formulations are considered more potent than creams and lotions, because ointments and gels restrict water loss and preserve hydration of the stratum corneum.\(^2,3\)

Although topical corticosteroids are generally well-tolerated for short term use, the sophisticated method of delivering topical corticosteroids is not void of producing adverse effects. Long-term widespread use can result in adverse effects grouped into four categories: cutaneous changes, cutaneous infections and infestations, eye effects, and systemic effects.\(^2,3\)

Systemic adverse effects include hypothalamic-pituitary-axis suppression, hyperglycemia, and avascular necrosis.\(^2,3,32\) Therefore, alternative therapeutic interventions for treating shoe dermatitis must be considered.

Topical immune modulators have been investigated as a treatment option for inflammatory skin disorders.\(^2,3\) Both tacrolimus ointment and pimecrolimus cream act by inhibiting the protein calcineurin, which subsequently prevents the dephosphorylation of the nuclear factor of activated T-cells, a transcription factor. This causes signal transduction pathways in T-cells to be blocked and inflammatory cytokine production is inhibited.\(^2,3,32\)

Experimentally, both tacrolimus and pimecrolimus have demonstrated efficacy in treating allergic contact dermatitis induced by nickel.\(^2,3\) Tacrolimus and pimecrolimus should be limited to short-term use. Adverse reactions associated with tacrolimus included pruritis, a sensation of burning skin, and alopecia. Adverse effects associated with pimecrolimus use include a sensation of burning skin, headache, and risk of infection. These agents should be considered when conventional therapies have failed. Both these agents do carry a black box warning emphasizing their potential for cancer risks.\(^2,3,32\)

Systemic therapy may be reserved for severe and chronic allergic contact shoe dermatitis. Systemic treatments may include the use of the following oral agents: H1-antihistamines, systemic corticosteroid, azathioprine, methotrexate, and mycophenolate mofetil.\(^2,3\)

Oral antihistamines have an effect on severe pruritis by competing with free histamine for binding at H1-receptor sites. The most common antihistamines used to treat allergic dermatitis include cetirizine, hydroxyzine, diphenhydramine, chlorpheniramine, and loratadine. Adverse effects of antihistamines include dry mouth and drowsiness.

Systemic corticosteroid therapy has demonstrated high efficacy in the treatment of acute allergic dermatitis by dramatically improving

---

**TABLE 2**

<table>
<thead>
<tr>
<th>Potency</th>
<th>Generic Names</th>
<th>Strengths (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest</td>
<td>Dexamethasone sodium</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Hydrocortisone acetate</td>
<td>0.5, 1</td>
</tr>
<tr>
<td></td>
<td>Methylprednisolone</td>
<td>0.25-1</td>
</tr>
<tr>
<td>Mild</td>
<td>Aclometasone dipropionate</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Desonide</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Dexamethasone sodium</td>
<td>0.1</td>
</tr>
<tr>
<td>Medium</td>
<td>Betamethasone benzonate</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>Cloclortolone pivalate</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Desoximetasone</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Hydrocortisone butyrate</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Hydrocortisone valerate</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Triamcinolone acetaonide</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Fluocinolone acetonide</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>Flurandrenolide</td>
<td>0.05, 0.25</td>
</tr>
<tr>
<td></td>
<td>Fluticasone propionate</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Mometasone furoate</td>
<td>0.1</td>
</tr>
<tr>
<td>High</td>
<td>Aminiconide</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Betamethasone dipropionate</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Betamethasone dipropionate (augmented)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Betamethasone valerate</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Diflorasone diacetate</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Desoximetasone</td>
<td>0.05, 0.25</td>
</tr>
<tr>
<td></td>
<td>Fluocinolone acetonide</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Fluricinolone</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Haloniconide</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Hydrocortisone 17-butyrate</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Triamcinolone acetonide</td>
<td>0.5</td>
</tr>
<tr>
<td>Very High</td>
<td>Betamethasone dipropionate (augmented)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Clobetasol propionate</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Diflorasone diacetate</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Halobetasol propionate</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Shoe Dermatitis...

Skin inflammation; however, they also cause the same adverse effects as topical corticosteroids. In the attempt to avoid adverse effects from repeated doses of corticosteroids in patients with chronic dermatitis, steroid-sparing systemic immunosuppressant therapy was investigated.2,3

The selection of these agents depends on the clinical presentation of the patient as well as the patient’s general health and presenting contraindications. Azathioprine is a cell cycle-specific antimitabolite that affects natural killer cell function, T-cell signaling, prostaglandin production and neutrophil activity. Azathioprine has been studied in allergic contact dermatitis induced by parthenium revealing resolution of disease.2,3

Methotrexate exerts cytotoxic activity through a cell cycle, S-phase-specific antimitabolite, which causes inhibition of neutrophil chemotaxis and inhibition of TNF-alpha, IL-1, IL-6, and IL-8. Mycophenolate mofetil selectively and non-competitively inhibits the enzyme inosine 5'-monophosphate dehydrogenase, preferentially blocking the type II isofrom, in the de novo purine synthesis pathway. Both methotrexate and mycophenolate mofetil have been recognized as effective treatment options for immune-mediated skin disease.2,3

The foremost part of a treatment plan for shoe dermatitis is avoidance of the sensitizer (allergen) once known.2,3

Offer an educational initiative

TABLE 3
Management and Prevention of Shoe Dermatitis

<table>
<thead>
<tr>
<th>Non-pharmacological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moist compressions or cool moist soaks</td>
</tr>
<tr>
<td>Moisturizing emollients or humectants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pharmacological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topical corticosteroids</td>
</tr>
<tr>
<td>Topical immune modulators</td>
</tr>
<tr>
<td>Systemic corticosteroids</td>
</tr>
<tr>
<td>Oral antihistamines</td>
</tr>
<tr>
<td>Steroid-sparing systemic immunosuppressant therapy</td>
</tr>
</tbody>
</table>

The foremost part of treatment plan for shoe dermatitis is avoidance of the sensitizer (allergen) once known.

An insight may be gleaned from a recent report by Borghesan and Bellotti describing successful treatment of a contact allergic dermatitis in a fifty year old construction worker with “barrier socks.” These authors describe both an improvement in their patient’s quality of life as well as a comparative reduction in costs incurred when comparing their observations with traditional topical therapy.

Finally, Srinivas, et al. offer a method to reduce the allergenic hexavalent chromium in leather.3 These authors acknowledge their perspective that chromium is the most common allergen in leather footwear.3,9 Further, they recount that hexavalent chromium penetrates the skin and causes an allergic reaction; however, as the reduced trivalent chromium form, it is less allergenic.3 These investigators prepared a 5% vitamin C solution to be used as a soaking solution for a piece of leather overnight.

After soaking this piece of leather, as well as a control piece of leather soaked in distilled water, these samples were stuck to the inner surface of the heels of two volunteers’ shoes and to the inner surface of the sandal strap of a third volunteer. The pieces of leather were left in place for one week.3 The results of this observational case control study proved that freshly prepared vitamin C solution was capable of making leather hypo-allergic by converting the hexavalent chromium to trivalent chromium.3

Continued on page 198

Continuing Medical Education
References


23. Hansen MB, Menne T, Johansen JD. Cr(III) reactivity and foot dermatitis in Cr(VI) positive patients. Contact Dermatitis 2006; 54(3): 140-144.


Dr. Smith completed his post-graduate training with the College of Medicine at the University of Wales, Cardiff, Wales, UK in wound care and tissue repair. He is a member of the American Professional Wound Care Association and a consultant to National Board of Podiatric Medical Examiners. He is a contributing editor and reviewer to JAPMA in the area of podiatric clinical pharmacology and has authored 50 refereed journal articles in the disciplines of pharmacy, podiatry, and wound care. He currently practices in Ormond Beach, FL.
1) According to this review, what substance is not among the most common allergens responsible for causing shoe dermatitis?
   A) Potassium dichromate
   B) Para-tert-Butylphenol formaldehyde
   C) Thiamine
   D) Rubber components

2) Cronin reports that historically in the 1930s and 1940s _____ and _____ caused most of the presenting cases of shoe contact dermatitis.
   A) Rubber and elastic
   B) Leather and dyes
   C) Rubber and leather
   D) Dyes and Rubber

3) What was a hallmark observation identified by Freeman’s observations during a differential diagnosis?
   A) No subjects had hyperhidrosis.
   B) 50% of subjects had hyperhidrosis.
   C) 33% of subjects had hyperhidrosis.
   D) 100% of subjects had hyperhidrosis.

4) A safe and quick way to diagnose contact allergies, which remains the gold standard for diagnosing allergic contact dermatitis is _____?
   A) antibiotics
   B) radiology
   C) patch test
   D) family history

5) Treatment of shoe “contact” dermatitis should begin with a _____.
   A) non-pharmacological approach
   B) contact isolation
   C) broad spectrum antibiotics
   D) systemic corticosteroids

6) Which of the following corticosteroid(s) have the lowest relative potency?
   A) Dexamethasone sodium 0.10%
   B) Hydrocortisone acetate 0.5%, 1%
   C) Methylprednisolone 0.25%-1%
   D) All of the above products have low potency.

7) In shoe dermatitis, allergens are processed by antigen-presenting cells, known as ________.
   A) Keratinocytes
   B) Fibroblasts
   C) Langerhans cells
   D) Platelets

8) According to this review, what may determine, to a large extent, the appearance of shoe dermatitis?
   A) The patient’s age
   B) The patient’s social history
   C) The design of the footwear
   D) The patient’s physiology

9) Patch-testing is not the test of choice for diagnosis of ________.
    A) Type II allergy
    B) Type I allergy
    C) Type III allergy
    D) Type IV allergy

10) Topical corticosteroids’ primary therapeutic effects are due to their ________.
    A) Moisturizing emollient activity
    B) Anti-infective properties
    C) Water-holding capacity
    D) Non-specific anti-inflammatory activity

11) Chowdhuri and Ghosh identified _____ and _____ in their investigation as the most common allergens causing footwear dermatitis.
    A) Potassium dichromate and cobalt chloride
    B) Rubber components and colophony
    C) Potassium dichromate and leather
    D) Cobalt and leather

12) Two topical immune modulators investigated as treatment options for inflammatory skin disorders are ________ and ________.
    A) Humectants and emollients
    B) Azathioprine and mycophenolate
    C) Tacrolimus ointment and pimecrolimus
    D) Methotrexate and hydroxyzine

13) Shoe “contact” dermatitis skin lesions may be acute, presenting as red, blistering, oozing and ________.
    A) Always contagious
    B) Usually symmetrical
    C) Never itch
    D) Always interdigital

14) Castanedo-Tardan, et al. present the case of a 14-year-old boy with a two-year history of pruritic erythematous plaques on both the dorsal and ventral surface of his feet from ________.
    A) Contact sensitization to the amputation prosthesis
    B) Dyed leather shoes
    C) Crocs™ with positive patch test results
    D) Positive reaction to cinnamic aldehyde and cinnamic alcohol

Continued on page 200
15) Borghesan and Bellotti describe successful treatment of a contact allergic with ________.
   A) Systemic emollients
   B) Systemic corticosteroids
   C) Collagenase products
   D) Barrier socks

16) All of the following are common antihistamines used to treat allergic dermatitis except _____.
   A) Diphenhydramine
   B) Fluocinolone acetonide
   C) Loratadine
   D) Hydroxyzine

17) Srinivas, et al. offer a method to reduce the allergenic hexavalent chromium in leather by using a 5% solution of ________.
   A) Thiamine
   B) Pyridoxine
   C) Ascorbic acid
   D) Folic acid

18) The patch test was first described by __________ in 1895.
   A) Josef Jadassohn
   B) Shanmuga Sundaram
   C) A.K. Bajaj
   D) Abir Saraswat

19) Chromates are compounds that contain ________ and are commonly responsible for allergic contact dermatitis.
   A) Silver
   B) Mercury
   C) Chromium
   D) Lead

20) Long-term widespread use of topical corticosteroids can produce which of the following adverse effects:
   A) Hypothalamic-pituitary axis suppression.
   B) Hyperglycemia.
   C) Avascular necrosis.
   D) All the above are adverse effects.

See answer sheet on page 201.

PM's CPME Program

Welcome to the innovative Continuing Education Program brought to you by Podiatry Management Magazine. Our journal has been approved as a sponsor of Continuing Medical Education by the Council on Podiatric Medical Education.

Now it's even easier and more convenient to enroll in PM's CE program!

You can now enroll at any time during the year and submit eligible exams at any time during your enrollment period.

PM enrollees are entitled to submit ten exams published during their consecutive, twelve–month enrollment period. Your enrollment period begins with the month payment is received. For example, if your payment is received on September 1, 2006, your enrollment is valid through August 31, 2007.

If you're not enrolled, you may also submit any exam(s) published in PM magazine within the past twelve months. CME articles and examination questions from past issues of Podiatry Management can be found on the Internet at http://www.podiatrym.com/cme. Each lesson is approved for 1.5 hours continuing education contact hours. Please read the testing, grading and payment instructions to decide which method of participation is best for you.

Please call (631) 563-1604 if you have any questions. A personal operator will be happy to assist you.

Each of the 10 lessons will count as 1.5 credits; thus a maximum of 15 CME credits may be earned during any 12-month period. You may select any 10 in a 24-month period.

The Podiatry Management Magazine CME program is approved by the Council on Podiatric Education in all states where credits in instructional media are accepted. This article is approved for 1.5 Continuing Education Contact Hours (or 0.15 CEU's) for each examination successfully completed.

Home Study CME credits now accepted in Pennsylvania
Enrollment/Testing Information and Answer Sheet

Note: If you are mailing your answer sheet, you must complete all info. on the front and back of this page and mail with your credit card information to: Podiatry Management, P.O. Box 490, East Islip, NY 11730.

TESTING, GRADING AND PAYMENT INSTRUCTIONS
(1) Each participant achieving a passing grade of 70% or higher on any examination will receive an official computer form stating the number of CE credits earned. This form should be safeguarded and may be used as documentation of credits earned.
(2) Participants receiving a failing grade on any exam will be notified and permitted to take one re-examination at no extra cost.
(3) All answers should be recorded on the answer form below. For each question, decide which choice is the best answer, and circle the letter representing your choice.
(4) Complete all other information on the front and back of this page.
(5) Choose one out of the 3 options for test grading: mail-in, fax, or phone. To select the type of service that best suits your needs, please read the following section, “Test Grading Options”.

TEST GRADING OPTIONS
Mail-In Grading
To receive your CME certificate, complete all information and mail with your credit card information to:
Podiatry Management
P.O. Box 490, East Islip, NY 11730
There is no charge for the mail-in service if you have already enrolled in the annual exam CPME program, and we receive this exam during your current enrollment period. If you are not enrolled, please send $20.00 per exam, or $139 to cover all 10 exams (thus saving $61 over the cost of 10 individual exam fees).
Facsimile Grading
To receive your CPME certificate, complete all information and fax 24 hours a day to 1-631-563-1907. Your CPME certificate will be dated and mailed within 48 hours. This service is available for $2.50 per exam if you are currently enrolled in the annual 10-exam CPME program (and this exam falls within your enrollment period), and can be charged to your Visa, MasterCard, or American Express.
If you are not enrolled in the annual 10-exam CPME program, the fee is $20 per exam.
Phone-In Grading
You may also complete your exam by using the toll-free service. Call 1-800-232-4422 from 10 a.m. to 5 p.m. EST, Monday through Friday. Your CPME certificate will be dated the same day you call and mailed within 48 hours. There is a $2.50 charge for this service if you are currently enrolled in the annual 10-exam CPME program (and this exam falls within your enrollment period), and this fee can be charged to your Visa, Mastercard, American Express, or Discover. If you are not currently enrolled, the fee is $20 per exam. When you call, please have ready:
1. Program number (Month and Year)
2. The answers to the test
3. Your social security number
4. Credit card information

In the event you require additional CPME information, please contact PMS, Inc., at 1-631-563-1604.

ENROLLMENT FORM & ANSWER SHEET

<table>
<thead>
<tr>
<th>Name</th>
<th>Soc. Sec. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please Print:</td>
<td>FIRST MI LAST</td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>State Zip</td>
</tr>
<tr>
<td>Charge to:</td>
<td>Visa MasterCard American Express</td>
</tr>
<tr>
<td>Card # Exp. Date</td>
<td></td>
</tr>
</tbody>
</table>

Note: Credit card is the only method of payment. Checks are no longer accepted.

Signature Soc. Sec.# Daytime Phone

State License(s) Is this a new address? Yes No

Check one: I am currently enrolled. (If faxing or phoning in your answer form please note that $2.50 will be charged to your credit card.)
I am not enrolled. Enclosed is my credit card information. Please charge my credit card $20.00 for each exam submitted. (plus $2.50 for each exam if submitting by fax or phone).
I am not enrolled and I wish to enroll for 10 courses at $139.00 (thus saving me $61 over the cost of 10 individual exam fees). I understand there will be an additional fee of $2.50 for any exam I wish to submit via fax or phone.

Over, please
EXAM #8/08
Therapeutic Hosiery: An Essential Component of Footwear for the Pathologic Foot (Richie)

Circle:
1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D

LESSON EVALUATION
Please indicate the date you completed this exam __________________

How much time did it take you to complete the lesson?
_____ hours _____ minutes

How well did this lesson achieve its educational objectives?
_____ Very well _____ Well
_____ Somewhat _____ Not at all

What overall grade would you assign this lesson?
A B C D

Degree ______________________________

Additional comments and suggestions for future exams:
__________________________________________________
__________________________________________________
__________________________________________________
__________________________________________________
__________________________________________________

EXAM #9/08
Shoe Dermatitis: Causes, Prevention, and Management (Smith)

Circle:
1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D

LESSON EVALUATION
Please indicate the date you completed this exam __________________

How much time did it take you to complete the lesson?
_____ hours _____ minutes

How well did this lesson achieve its educational objectives?
_____ Very well _____ Well
_____ Somewhat _____ Not at all

What overall grade would you assign this lesson?
A B C D

Degree ______________________________

Additional comments and suggestions for future exams:
__________________________________________________
__________________________________________________
__________________________________________________
__________________________________________________
__________________________________________________
__________________________________________________