



## Contact stomatitis

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Contact stomatitis is inflammation or pain of the oral mucosa caused by external substances. These substances act either as irritant or allergic contactants. Irritants cause inflammation and activation of immunologic mediators without involvement of memory T-cell function or antigen-specific immunoglobulins. They require no previous exposure and tend to cause their untoward effect on the oral mucosa within minutes to hours. Because of this, patients are more likely to discover the causal contactant themselves. Although irritant contact stomatitis is more common than allergic stomatitis generally, many patients with irritant reactions, such as thermal burns from hot food or ulcerations from poorly fitting dentures, may treat themselves at home or visit their dentist rather than seeking the care of a dermatologist.

In contrast, allergic contact stomatitis requires previous exposure to an allergen. This initial sensitization can occur through contact with the oral mucosa but may also arise by contact with keratinized skin. As a result of the initial exposure, memory T-cells are activated, but no clinical reaction is seen. With subsequent exposures, a type IV hypersensitivity reaction occurs, but is typically delayed at least 48 hours. This delay between antigen presentation and onset of symptoms makes uncovering the responsible substance challenging.

The biologic and physiologic properties of oral epithelium make it more resistant than keratinized skin to irritants and allergens. For example, saliva provides a continuous solution that solubilizes, dilutes, and begins digesting potential contactants and

helps wash them away before they contact oral mucosa [1]. When the mucosa is damaged, saliva promotes healing because of a high concentration of epidermal growth factor. There is less protein in nonkeratinized oral mucosa resulting in fewer targets for allergens. Irritants and allergens that do contact the oral mucosa are removed more quickly because of higher vascularity and faster epithelial renewal rates than in keratinized skin [2]. Despite its specialized characteristics, the oral mucosa is occasionally damaged by contactants.

The differential diagnosis of contact stomatitis is extensive and includes other causes of a sore mouth as follows:

Contact stomatitis (irritant, allergic)

Vesiculobullous diseases

Pemphigus

Pemphigoid

Paraneoplastic pemphigus

Ulcerative diseases

Aphthous ulcers

Behçet's syndrome

Erosive lichen planus

Erythema multiforme

Stevens-Johnson syndrome

Nutritional deficiencies

Iron, vitamins B<sub>12</sub> and B<sub>6</sub>, folate, zinc

Connective tissue diseases

Lupus erythematosus

Scleroderma

Dermatomyositis

Lichen planus

Drug reactions

Infection

Viral (herpes simplex virus,  
varicella-zoster, measles)

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- Fungal (*Candida*)
- Bacterial (syphilis, necrotizing ulcerative gingivostomatitis)
- Oral cancer
  - Squamous cell carcinoma
  - B-cell lymphoma
  - Kaposi's sarcoma
  - Mesenchymal tumors
  - Malignant melanoma
- Psychogenic
  - Fear of cancer
  - Depression, anxiety
- Gastroesophageal reflux
- Menopause
- Diabetes
- Xerostomia
- Inflammatory bowel disease

An organized approach focusing on the patient's history and clinical appearance of lesions is fundamental to making an accurate diagnosis. In addition, selected tests, such as patch testing, blood tests, and biopsy of specific oral mucosal lesions, can assist in differentiating possible diseases (Table 1).

## History

Obtaining a thorough history is particularly important in evaluating patients with suspected contact stomatitis because the symptoms are often more prominent than the physical examination findings. In fact, it is possible to have prominent subjective complaints associated with a normal-appearing mouth. The most common symptoms are pain and burning. Decreased sense of taste and numbness occur less frequently and itching is uncommon.

It is essential to obtain information regarding contact with potential irritants or allergens, such as toothpaste, mouthwash, chewing gum, dentures, denture cleaners, and dental restorations. The site of mouth symptoms, whether it is diffuse or localized to a specific structure, such as the hard palate, buccal mucosa, or tongue, can give valuable clues to diagnosis. For example, complaints of soreness or pain localized to the buccal mucosa may suggest irritant stomatitis caused by frictional trauma from dentures or allergic stomatitis from a metal dental restoration. In contrast, diffuse mouth pain may represent allergy to an oral flavoring, which contacts most structures in the mouth during mastication.

Temporal correlation can occasionally be helpful, such as a patient who notes onset of discomfort shortly after the placement of a dental restoration.

Similarly, a patient may promptly note symptom onset or worsening after chewing certain types of gum. A patient with sensitivity to spearmint, for example, may have chronic exposure caused by widespread use of this flavoring in numerous oral care products, thereby making a temporal association more difficult.

A thorough review of systems including questions about diet, changes in weight, and swallowing is also important to identify the cause of a sore mouth. A poor diet or an underlying disorder resulting in weight loss may be a marker for deficiencies in zinc, vitamin B<sub>12</sub>, folate, and iron. Similarly, odynophagia may indicate a scleroderma syndrome, whereas heartburn may suggest acid reflux that can result in a sore mouth.

## Physical examination

Recognizing differences in location and morphology of oral lesions caused by contact stomatitis can help to narrow the potential causes. Four general types of physical examination findings are seen in contact stomatitis including red lesions and erythema, white lesions and leukoplakia, erosions and ulcerations, and the normal mouth (see Table 1).

Localized or diffuse red maculae and patches are caused by a variety of irritant and allergic substances. Contactants in metal dental restorations and flavorings found in toothpaste, mouthwashes and gum are common offenders [2]. Atypical gingivostomatitis is an uncommon, but dramatic presentation of contact stomatitis related to some gums and toothpaste [3]. Patients present with bright red erythema and edema involving the gingivae, tongue, and commissures of the lips. Histology shows a characteristic plasma cell infiltrate.

White patches or plaques are usually localized and can have a homogeneous, wrinkled, or verrucous appearance (Fig. 1). They can arise because of mechanical trauma from friction of the teeth and ill-fitting or uneven dentures. Histologically, these lesions display mucosal hyperkeratosis and hyperplasia. White lesions may also be caused by inflammatory lichenoid reactions, which clinically and histologically can be similar in appearance to oral lichen planus (Fig. 2). In fact, many patients with lesions diagnosed as oral lichen planus have been found to have clinically relevant contact allergy to metals in their dental fillings [4–6].

Erosions and ulcerations in the mouth present with rough macerated bases and may develop irregular borders. They are often surrounded by a

Table 1  
Recommended work-up for patients with a sore mouth

| Mucosal appearance | Erosions/Ulcer/Bullae   | Erythema   | “Leukoplakia”   | Normal appearance   |
|--------------------|---|--|---|---|
| Bx                 | Routine<br>DIF  | Routine<br>+/- DIF   | Routine   | Usually not performed   |
| Blood              | IIF<br>Hepatitis panel if LP suspected<br>Syphilis serologies   | -/- IIF<br>Hepatitis panel if LP suspected<br>Syphilis serologies  | Performed only if other investigations suggest need<br>Hepatitis panel if LP suspected<br>Syphilis serologies | CBC, basic chemistries<br>Zinc<br>B <sub>12</sub><br>Folate<br>Iron<br>TSH      |
| Patch testing      | Perform metal and dental series if lesions primarily adjacent to restorations   | Perform metal and dental series if lesions primarily adjacent to restorations  | Perform metal and dental series if lesions primarily adjacent to restorations                                 | Perform oral flavorings and metal and dental series if above (–)                |
| Diagnosis          | Aphthae (nonspecific labs)<br>Pemphigus, pemphigoid (characteristic Bx, DIF, IIF)<br>LP (characteristic Bx, DIF)<br>Drug (history, suggestive Bx)<br>Erythema multiforme (Bx)<br>Lupus erythematosus (Bx, DIF)<br>Syphilis (suggestive Bx, serologies)<br>Friction<br>Contact stomatitis<br>(may appear identical to aphthae) | Pemphigus, pemphigoid<br>LP<br>Drug<br>Erythema multiforme<br>Lupus erythematosus<br>Friction<br>Candidiasis, syphilis<br>Contact stomatitis | LP<br>Squamous atypia, SCC<br>Friction<br>Candidiasis, syphilis<br>Contact stomatitis                         | Deficiency state<br>Contact stomatitis<br>Burning mouth syndrome<br>Psychogenic |

*Abbreviations:* Bx, biopsy; CBC, complete blood count; DIF, direct immunofluorescence; IIF, indirect immunofluorescence; LP, lichen planus; SCC, squamous cell carcinoma; TSH, thyroid stimulating hormone.



Fig. 1. Allergic contact stomatitis. White patches on the tongue. Note dental metal, right lower teeth.

red halo (Fig. 3). Erosions can be caused by trauma in the form of friction from the teeth or irregular dental restorations. Burns from hot foods, radiation, and caustic chemicals typically cause erosions. In addition, allergic contact stomatitis can present with erosions and is sometimes indistinguishable from aphthous ulcers based on physical examination alone.

Complaints of a burning or sore mouth with a normal-appearing oral mucosa on examination are the primary features of burning mouth syndrome. Contact stomatitis is thought to be responsible for burning mouth syndrome in some cases. Drage and Rogers [7] showed that 13% of patients with burning or sore mouth had positive patch tests that were thought to be clinically relevant. Oral flavorings were responsible for most reactions in their study. Dental metals and denture materials have also been



Fig. 2. Allergic contact stomatitis. Lichenoid reticulated patch with ulceration of the buccal mucosa adjacent to gold restorations.



Fig. 3. Irritant stomatitis. Ulcerations with surrounding erythematous on the hard palate caused by a pizza burn.

implicated as possible causes of burning mouth syndrome [8,9].

#### Irritant contact stomatitis

Heat, frictional trauma, and chemicals can cause irritant contact stomatitis. Factors that determine the degree of inflammation include the inherent irritation potential of the agent; amount of exposure (concentration, duration, and frequency); ability to penetrate the tissue; and host factors, such as immune status [10]. Thermal burns from hot food and liquid commonly involve the hard palate, tongue, and lips. Occasionally, oral inflammation develops from mechanical trauma because of jagged teeth or poorly fitting dentures [11]. Friction from poor-fitting dentures can be combined with poor hygiene and trapped food to cause irritation in adjacent mucosa.

Acidic and alkaline denture cleaning chemicals are also known to cause irritant lesions and patients should be reminded to rinse dentures thoroughly after soaking them in these cleaners. Medications, such as aspirin and vitamin C, may unintentionally not be swallowed, especially in a neurologically impaired patient, thereby resulting in an irritant oral lesion. Shohl's solution, which continues to be used orally for the treatment of metabolic acidosis, can irritate the mouth and should be diluted with water or juice and rinsed thoroughly following administration. Gasoline and other caustic chemicals ingested either purposefully or accidentally can cause mild to severe erosive and inflammatory lesions in the mouth and esophagus.

Treatment for irritant dermatitis primarily involves removal of the inciting cause. Usually, the discomfort then resolves spontaneously, but severe, painful involvement may require topical anesthetics, such as lidocaine.

## Allergic contact stomatitis

Oral flavorings, preservatives, and dental materials, such as metals, acrylates, resins, and impression compounds, are the most common cause of allergic delayed-type hypersensitivity reactions of the oral mucosa. Oral flavoring and preservatives are ubiquitous in commercially available personal hygiene products and foods, making exposure in developed countries nearly universal. Table 2 details examples of common oral flavoring allergens and lists the products in which these allergens are found. Table 3 lists recommended patch-test antigens for patients suspected to have contact stomatitis.

Fragrance mix contains several antigens including cinnamic aldehyde and eugenol and is a useful screening tool that identifies common flavoring allergies [12]. Another screening allergen helpful in identifying oral flavoring allergies is balsam of Peru. The antigens found in these screening tests are often used in lipsticks, mouthwashes, oral analgesics, and toothpaste.

The most common preservatives that cause allergic contact stomatitis are parabens and propylene glycol. Parabens are found in a variety of foods including salad dressing, spicy sauces, mustard, jellies, jams, fruit juices, syrups, and candies. They are also used in lipsticks and toothpaste. Propylene glycol is found in tobacco formulations, food colors, flavoring agents, and oral pharmaceuticals [1]. Although allergy to preservatives is infrequent, these antigens should be considered and included in patch test series for evaluating contact stomatitis.

The most common and best-documented dental metals to cause oral contact allergy are mercury and gold [13]. Silver-colored amalgam dental fillings typ-

ically contain metallic mercury. Clinically significant mercury allergy more likely is found in patients with symptoms and examination findings localized to the mucosa adjacent to an amalgam dental restoration. Koch and Bahmer [5] found that 78.9% of patients with oral lichenoid lesions adjacent to amalgam fillings were sensitized to inorganic mercury. In contrast, only 12% of patients in this study with lichenoid lesions distant from amalgam and 4.3% of patients with burning mouth syndrome were allergic to mercury. The mercury allergies of patients with lesions adjacent to amalgam were believed to be clinically significant as evidenced by finding that 13 of 15 patients had considerable improvement in their symptoms after removal of their metal fillings [5]. Little et al [14] suggests that mercury salts released from fillings may act directly on oral keratinocytes to induce changes that attract lymphocytes, thereby promoting the development of lichenoid lesions. Specifically, oral keratinocytes cultured in the presence of mercuric chloride acquired subcytotoxic concentrations of mercuric chloride that induced a concentration-related increase in intercellular adhesion molecule 1 and consequent T-cell binding.

Metallic gold is found in gold-colored dental fillings and restorative crowns. Gold is being recognized as a more important cause of contact dermatitis and stomatitis than previously thought [1,6,13,15,16]. Kanerva et al [13] evaluated patch test data of patients with either suspected contact reactions of the oral mucosa, or suspected occupational and non-occupational contact reactions caused by dental products. Of 4508 patients from seven centers patch tested to gold sodium thiosulfate, 7.7% (range 4.1% to 15%) had positive reactions. The authors did not address

Table 2  
Oral flavoring allergens and examples of sources of exposure

| Oral flavoring              | Commercial and medicinal products   |
|-----------------------------|---|
| Balsam of Peru              | Cements and liquids in dentistry<br>Flavoring in toothpaste, cough drops, throat tablets, and lozenges<br>Spicy foods, such as curry; allspice; pickled vegetables;<br>ketchup; tomatoes; barbecue sauce; and soft drinks |
| Cinnamon, Cinnamic aldehyde | Mouthwash and toothpaste<br>Cola, chocolate, ice cream, gums, and candy   |
| Menthol                     | Mouthwash, toothpaste, cough drops, candy, chewing gum, food,<br>cigarettes, liqueurs, and mixed drinks   |
| Peppermint                  | Mouthwash, toothpaste, chewing gum, breath mints, candy, and liquors  |
| Eugenol                     | Antiseptic, periodontal dressings, zinc oxide cement,<br>and impression pastes in dentistry<br>Flavoring for toothpaste and mouthwash<br>Food spices, such as allspice<br>Over-the-counter inhalants and antiseptics      |

(Data from Rietschel RL, Fowler JF. Contact dermatitis, ed 5. Philadelphia: Lippincott Williams and Wilkins; 2001. p. 736–817)

Table 3  
Antigens used in patch testing for contact stomatitis

*Standard series*

|   |   |
|---|---|
| 1. Benzocaine 5% pet  | 36. Diazolidinyl urea 1% Aq                               |
| 2. Mercaptobenzothiazole 1% pet                                 | 37. Phenoxyethanol 1% pet                                 |
| 3. Colophony 20% pet  | 38. Cobalt chloride 1% pet                                |
| 4. P-phenylenediamine 1% pet                                    | 39 Sesquiterpene lactone mix 0.1% pet                     |
| 5. Imidazolidinyl urea 2% Aq                                    | 40. Budesonide 0.1% pet                                   |
| 6. Cinnamic aldehyde 1% pet                                     | 41. Tixocortal 21 pivalate 1% pet                         |
| 7. Lanolin alcohol 30% pet                                      | 42. BHA 2% pet  |
| 8. Carba mix 3% pet   | 43 Glutaraldehyde 0.2% pet                                |
| 9. Neomycin sulfate 20% pet                                     | 44. Glutaraldehyde 1% pet                                 |
| 10. Thiuram mix 1% pet  | 45. BHT 2% pet  |
| 11. Formaldehyde 1% Aq  | 46. Ethyl acrylate 0.1% pet                               |
| 12. Ethylenediamine dihydrochloride 1% pet                      | 47. Glyceryl thioglycolate 1% pet                         |
| 13. Epoxy resin 1% pet  | 48. Toluensulphonamide formaldehyde resin 10% pet         |
| 14. Quaternium-15 2% pet  | 49. Methyl methacrylate 2% pet                            |
| 15. p-tert-Butylphenol formaldehyde resin 1% pet                | 50. Ethyleneurea-melamine-formaldehyde mix 5% pet         |
| 16. Mercapto mix 1% pet   | 51. Triamcinolone acetonide 1% pet                        |
| 17. Black rubber mix 0.6%                                       | 52. 2-Hydroxy-4-methoxyfenzophene 3% pet                  |
| 18. Potassium dichromate 0.25% pet                              | 53. 1H Benzotriazole 1% pet                               |
| 19. Balsam of Peru 25% pet                                      | 54. Hexahydro-1,3,5-tris (2-hydroxyethyl) triazine 1% aq. |
| 20. Nickel sulfate 2.5% pet                                     | 55. Hexylresorcinol 0.25% pet                             |
| 21. Diazolidinyl urea 1% pet                                    | 56. Phenol formaldehyde resin 1% pet                      |
| 22. DMDM hydantoin 1% pet                                       | 57. Clioquinol 5% pet                                     |
| 23. Imidazolidinyl urea 2% pet                                  | 58. Cetyl alcohol 5% pet                                  |
| 24. Bacitracin 20% pet  | 59. Isopropyl myristate 20% pet                           |
| 25. Mixed dialkyl thioureas 1%pet                               | 60. Stearyl alcohol 30% pet                               |
| 26. Methylchloroisothiazolinone/methylisothiazolinone 0.67% Aq  | 61. Triclosan 2% pet                                      |
| 27. Paraben mix 15% pet   | 62. Triethanolamine 2% pet                                |
| 28. Methyl dibromoglutaronitrile/phenoxyethanol 1% pet          | 63. Chloquinaldol 5% pet                                  |
| 29. Fragrance mix 8% pet  | 64. Hexachlorophene 1% pet                                |
| 30. 2-Bromo-2-nitropropane-1,3-diol 0.5% pet                    | 65. Benzalkonium chloride 0.1% aq.                        |
| 31. Thimerosal 0.1% pet   | 66. Tocopherol (vitamin E) 10%                            |
| 33. Methylchloroisothiazolinone/methylisothiazolinone 0.67% pet | 67. Dermatophagoides mix 20%                              |
| 34. Chloroxylenol (PCMX) 1% pet                                 | 68. Gold sodium thiosulfate 0.5%                          |
| 35. DMDM hydantoin 1% Aq  | 69. Natural fragrance mix 2%                              |

*Metal series*

|  |  |
|--|--|
| 1. Ammoniated mercury 1% pet               | 14. Metallic mercury 1% pet              |
| 2. Potassium dichromate 0.5% pet           | 15. Chromium chloride 5% pet             |
| 3. Nickel sulfate 2.5% pet                 | 16. Mercury ammonium chloride 1% pet     |
| 4. Cobalt sulfate 1% pet                   | 17. Tin 2.5% pet                         |
| 5. Gold chloride 0.5% alc.                 | 18. Zinc 2.5% pet                        |
| 6. Copper sulfate 1% aq                    | 19. Cadmium chloride 1% aq               |
| 7. Silver nitrate 1% aq                    | 20. Ferric chloride 1% aq                |
| 8. Palladium chloride 1% pet               | 21. Manganese chloride 2% aq             |
| 9. Gold sodium thiosulfate 1% pet          | 22. Zinc chloride 2% aq                  |
| 10. Ammonium tetrachloroplatinate .25% pet | 23. Molybdenum chloride 1% aq            |
| 11. Aluminum 100% pet                      | 24. Titanium disk                        |
| 12. Potassium dicyanoaurate 0.001% aq      | 25. Beryllium sulfate tetrahydrate 1% aq |
| 13. Mercuric chloride 0.1% pet             | 26. Cobalt chloride 1% pet               |
|  | 27. Amalgam 5%                           |

(continued on next page)

Table 3 (continued)

*Oral flavors and preservatives*

|   |                               |
|---|-------------------------------|
| 1. Anethole 5%                                    | 18. Tartrazine yellow 0.1%    |
| 2. Benzoic acid 5%                                | 19. Theobroma 5%              |
| 3. Dodecyl gallate 0.25%                          | 20. Sorbitan sesquioleate 20% |
| 4. Propyl gallate 1%                              | 21. Sorbic acid 2%            |
| 5. Sodium benzoate 5%                             | 22. BIS GMA 2%                |
| 6. Dipentene (Limonene) 1%                        | 23. Methyl salicylate 2%      |
| 7. Benzyl alcohol 1%                              | 24. Peppermint oil 2%         |
| 8. Octyl gallate 0.25%                            | 25. Spearmint oil 2%          |
| 9. Citric acid 1% Aq                              | 26. Amyl cinnamaldehyde 2%    |
| 10. Benzoyl peroxide 1%                           | 27. Eucalyptus oil 2%         |
| 11. Ammonium persulfate 2.5%                      | 28. Menthol 2%                |
| 12. Propionic acid 3%                             | 29. Eugenol 2%                |
| 13. Ethyleneglycol dimethacrylate (EGDMA) 2%      | 30. Clove oil 2%              |
| 14. Isoeugenol 2%                                 | 31. Vanillin 10%              |
| 15. Glutamic acid 1%                              | 32. Lemon oil 2%              |
| 16. Orange oil 2%                                 | 33. Resorcinol 1%             |
| 17. Triethyleneglycol dimethacrylate (TREGDMA) 2% |                               |

the clinical relevance of the positive reactions in their study. Yiannias et al [6] reported 46 patients with lichenoid lesions and a diagnosis of oral lichen planus. Patch tests showed 17 of these patients had positive reactions to metals, with gold accounting for 82% (14 of 17). Of the 14 patients with reactions to gold, 10 were thought to be clinically relevant based on finding that four patients' symptoms resolved after removal of the gold, whereas the remaining six continued to have lichenoid lesions adjacent to gold-colored fillings. In 2001, gold was chosen as the contact allergen of the year by the American Journal of Contact Dermatitis [17]. Gold will likely be included more frequently in future patch testing series thereby potentially identifying increased numbers of relevant causes of oral contact stomatitis. As with mercury, gold allergy should be considered in a patient with a mucosal lesion adjacent to dental gold.

Nickel is found in denture material and in instruments used in dental procedures. The role of nickel as the most common cause of metal allergy in contact dermatitis is well known. Although many stomatitis patients have a positive patch test to nickel, studies show these results are likely not clinically relevant. For example, Dawn et al [18] evaluated 137 patients with oral disease who underwent patch testing during a 12-month period. Of these, 23 (17%) had a positive reaction to nickel. The prevalence of allergic contact dermatitis from nickel, however, in the general patch test population at the same center in the same year was 22%. They concluded that the positive patch tests in patients with oral complaints were likely a reflection of the background prevalence of allergic contact dermatitis from nickel and that nickel alone

does not play a major role in oral disease. In a prospective trial of 16 patients with long-standing recurrent contact dermatitis to nickel, Speichowicz [19] found that placing dental crowns or bridges containing 66% nickel in the mouth did not result in any oral mucosal or systemic reactions.

Copper, beryllium, chrome, cobalt, platinum, and palladium can be found in varying amounts in dental materials. For example, copper makes up a portion (approximately 10%) of some dental alloys used to make crowns. Beryllium, chrome, and cobalt are used in dental prostheses, such as partial dentures. Platinum and palladium are used in combination with or in place of gold for fillings and crowns [20,21]. As a group, these metals rarely cause relevant contact allergy. This may be because of the inherent lack of allergic sensitizing capability of the metal or to the small amounts usually present in dental materials.

Most dentures are processed by the polymerization of acrylic monomers either by heat curing or by the use of autopolymerizing resins (cold curing). Heat curing requires no additional resins and leaves no residual monomer, whereas cold curing can leave varying amounts of monomer unpolymerized. It is this monomer that is thought to occasionally cause allergic contact stomatitis [22]. Koutis and Freeman [23] reported a patient who had pain and redness at the site of a new denture. Patch tests to an acrylate, 2-hydroxyethyl methacrylate, and the patient's own denture material were positive. After boiling the denture he had reversal of his symptoms. Repeat patch testing to the prosthesis was negative. Common acrylate monomers are methacrylates and urethane-based dimethacrylates [1]. Resins, such as bisphenol

A, used during cold curing are also known to cause oral allergy. In addition to denture manufacture, resin-based cold curing materials are used as sealants, orthodontic adhesives, glazes, repair kits for porcelain-fused-to-metal restorations, and temporary crowns [1]. They are also used by some dentists instead of amalgam as fillings.

Dental impression compounds include such substances as stearin, paraffin wax, beeswax, gutta-percha, and many synthetic and natural resins [1]. Although chemicals in dental impression compounds are uncommon causes of stomatitis, when allergic reactions do occur, resins are the most likely substances of this group to be responsible.

### Evaluation plan

Successful treatment of a sore mouth is dependent on the history and physical examination, but a definitive diagnosis of contact stomatitis generally requires patch testing. Blood tests and tissue biopsy may help confirm the diagnosis or rule out other causes. Often, simplification of oral care and avoidance of common contactants is used as an initial therapeutic trial before proceeding to diagnostic testing.

Contact stomatitis can have multiple physical examination and histologic findings (see Table 1). If lesions are present on physical examination, consideration should be given to proceed directly to obtain a biopsy. Histologically, spongiosis and a mixed cellular infiltrate of lymphocytes, macrophages, and eosinophils characterize allergic contact stomatitis. Chronic lesions can show epidermal hyperplasia. Biopsy with or without direct immunofluorescence testing can be helpful in ruling out other processes, such as immunobullous diseases or neoplasm. If no obvious lesions are present in a patient complaining of a sore mouth, laboratory blood tests are usually pursued first, followed by patch testing. Commercially available patch test kits, such as T.R.U.E test, screen for 23 antigens that commonly cause contact dermatitis. Although this kit screens for several common relevant causes of contact stomatitis, such as balsam of Peru, fragrance mix, paraben mix, and thimerosal, a number of potential causes can be missed. The authors recommend testing to broad standard, metal, and oral flavoring and preservative series (see Table 3) for all patients with mouth complaints in whom contact stomatitis is considered. Additionally, given the potential late reactions that can occur with metal patch testing, readings should be performed on day 7 in addition to the traditional readings performed on days 3 and 5 [5,6].

### Therapy

The mainstay in treatment of contact stomatitis is avoidance of the causative agent. The number of potential irritants and allergens in commercially available products that come in contact with the mouth make this difficult. In general, before initiating patch testing the authors recommend that patients with a sore or painful mouth follow specific guidelines to avoid common contactants. Patients should use toothpaste that is free of flavorings or preservatives, such as plain PEELU (PEELU Products, Fargo, ND) or plain baking soda with instructions to brush gently using a soft bristle toothbrush. Flossing with plain nonflavored dental floss is recommended. Rough or crunchy foods, such as nuts, chips, popcorn, pretzels, or firm fruits like apples, should be avoided and replaced with soft foods.

Patients are given instructions to take frequent sips of water and use only plain petrolatum for lip lubrication. Denture wearers should use only flavor-free cleaning products and adhesives, such as plain Efferdent Denture Cleanser tablets and Fixodent Free or flavor-free OraGrip. In addition, patients are instructed to avoid mouthwash; gum; mints; chocolate; cinnamon-flavored candy or food; carbonated beverages; and extremely salty, spicy, hot, or acidic foods. Smoking cessation is strongly encouraged.

Resolution of symptoms usually occurs quickly after the offending agent is removed. If symptoms fail to improve with simplification of oral care as listed previously, and appropriate blood tests and biopsy specimens have ruled out other diagnoses, contact stomatitis can be confirmed by patch testing. When patch tests reveal a clinically relevant allergen, patients need recommendations guiding avoidance. This also includes instructions on avoiding substances that are known to cross-react. For example, if a patient is allergic to a flavoring agent, such as cinnamic aldehyde, all oral care products used by the patient should be flavor free, as listed previously. Similarly, if a patient is sensitive to balsam of Peru, they should also consider avoiding foods containing the components of balsam of Peru or their cross-reactors as follows:

Products that contain citrus fruits (oranges, lemons, grapefruit, bitter oranges, tangerines, and mandarin oranges), such as marmalade, juices, and bakery goods

Flavoring agents, such as those found in Danish pastries and other bakery goods, candy, and chewing gum

Spices, such as cinnamon, cloves, vanilla, curry, allspice, anise, and ginger  
 Spicy condiments, such as ketchup, chili sauce, barbecue sauce, chutney, and liver paste  
 Pickles and pickled vegetables  
 Wine, beer, gin, and vermouth  
 Perfumed or flavored tea and tobacco, such as mentholated tobacco products  
 Chocolate  
 Ice cream  
 Cola and other spiced soft drinks  
 Chili, pizza, Italian, and Mexican foods with red sauces  
 Caramels  
 Tomatoes and tomato-containing products

In addition, restaurant meals where these ingredients cannot be identified should also be avoided.

In a patient with contact stomatitis, the number of positive metal patch tests is not necessarily predictive of relevance. Positive reactions to two formulations of gold may potentially be irrelevant, whereas a 1+ reaction to a single formulation of mercury may be significant. Indeed, several clinical factors must be considered to determine the relevance of the patch tests. For instance, avoidance therapy regarding dental metals can represent a straightforward management issue if the patient is allergic to two forms of gold, has only one oral lesion immediately adjacent to a solitary gold-colored filling, and the lesion developed within several months of the placement of the dental restoration. In this scenario, the evidence strongly supports relevance of the positive patch test and the patient only needs to have a single restoration replaced with a gold-free substitute. The clinician is faced with a greater challenge, however, in a patient who has a 1+ reaction to a single formulation of mercury; multiple silver-colored restorations; and erosions primarily, but not exclusively, adjacent to the intraoral mercury. In this case, several options should be considered: retest to the mercury formulations making sure that a final reading is done no earlier than day 7; patch test to a sample of the patient's own silver-colored dental restoration; use topical immunomodulators as a diagnostic and therapeutic trial; and discuss with the patient the fact that the reaction may be relevant, but that costly and time-consuming restoration removal may or may not result in significant improvement.

Avoidance of identified antigens is not always possible and topical immunomodulators are regularly used. For example, a patient may unwittingly eat Mexican food without realizing that it was prepared with cinnamon. Similarly, a patient with

a mercury allergy may not have the opportunity for mercury dental restoration removal immediately. Fluocinonide 0.05 gel or tacrolimus 0.1% ointment are useful adjunctive therapies in these situations, particularly because they can be applied with relative ease to broad areas of the oral mucosa. Triamcinolone in a dental paste, such as Orabase, is best reserved for patients with only localized disease. "Miracle Mouthwashes," of which many variants exist, are often used empirically at the outset of a sore mouth evaluation because they usually contain various anti-inflammatory and anti-infective drugs (eg, diphenhydramine, hydrocortisone, nystatin, and tetracycline). These formulations, however, are best avoided in a patient with proved flavoring allergies because the syrup base usually has flavorings.

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