

Dental Allergic Contact Dermatitis: An Interesting Case Series and Review of the Literature

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When patients have persistent oral complaints, it is important to consider allergic contact dermatitis to dental components. We present 3 cases seen at the Ottawa Hospital Patch Test Clinic between 2007 and 2009 with persistent oral lesions. Mercury, methacrylate, and beryllium were found to be the responsible allergens after patch testing. Of note, our case is the fourth reported dental contact dermatitis case to beryllium. Subsequently, a literature review and an examination of reported cases and management strategies were done. There is debate over the necessity of changing dental work after a positive patch-test result. We conclude that it is necessary to do your best to uncover all of the materials used in dental work. Often, material safety sheets do not include all allergens present in products. We advocate that if a positive reaction is found and deemed relevant, then appropriate replacement of the offending agent should be recommended.

MANY PEOPLE with oral complaints are referred for patch testing. Kanerva et al¹ reported that the most common positive reactions seen in patients patch tested with the dental screening series were to the metals. Fifteen percent of the patients were positive to nickel, 13% to ammoniated mercury, 10% to mercury, and 8% to gold. One retrospective analysis reported on 331 patients with oral complaints. The most common complaint was burning mouth followed by lichenoid reactions, cheilitis, stomatitis, and gingivitis. There were relevant reactions in 65% of the cases.²

CASE 1

A 62-year-old woman who does clerical work at the credit union was referred for patch testing for a possible allergic contact dermatitis to her metal fillings. Two years ago, she had a new metal filling put in place on her right upper molar. Shortly thereafter, she developed erosions on her right upper buccal mucosa, exactly at the site where her metal filling came into contact with the adjacent mucosa. The lesions are always limited to the buccal mucosa and never involved the other areas of the mouth. Examination revealed a lacelike white erosive lichenoid plaque (Fig. 1).

The patient underwent patch testing in February 2009. She was tested to the North American Contact Dermatitis Group standard

screening series, the dental series, and the metal series (Chemotechnique Diagnostics AB, Malmö, Sweden). The allergens were applied with Finn Chambers (Epitest Ltd Oy, Tuusula, Finland) on Scanpor tape (Norgesplaster A/S, Vennesla, Norway). The patches were held in place for 48 hours. Readings were done at 48 and 96 hours after original placement as was previously described by Pratt et al.³ The interpretation of the patch-test results was standardized as previously described by Marks et al.⁴ The final reading revealed a 2+ reaction to mercury 0.5% petrolatum (pet), mercury chloride 0.1% pet, and zinc chloride 2.0% pet, as well as a 3+ reaction to mercury ammonium chloride 1.0% pet (Fig. 2). The patient also had a 1+ reaction to fragrance mix II 14.0% pet and a 1+ reaction to lanolin alcohol 30.0% pet.

Case reports have found a clinical significance between oral disease and allergic contact dermatitis to mercurial compounds.⁵⁻⁸ Most patch-test-positive reactions to mercury are relevant, and sensitization frequently occurs from dental materials.⁹ An older theory hypothesizes that contact between metals with different electrical potentials in the oral cavity gives rise to electrochemical reactions that causes an increase in release of metal ions causing hypersensitivity. Currently, the pathogenesis is attributed to release of metal ions because of corrosion of the amalgam that causes sensitization.¹⁰

It is generally recommended that patients who have oral lichen planus and positive patch-test reactions to mercury have their amalgams replaced.^{11,12} Pang and Freeman¹² reported a case series of 41 patients with oral lichen planus, with 19 patients having positive reactions to mercurial compounds on patch testing. Sixteen of the 19 patients had their fillings removed, and 13 patients reported significant clinical improvement.¹² Another case series of 84 patients revealed 33 patients with positive reactions. Thirty patients replaced their amalgam fillings, and 28 (87%) improved within 3 months.¹³ In addition, removal of mercury-containing

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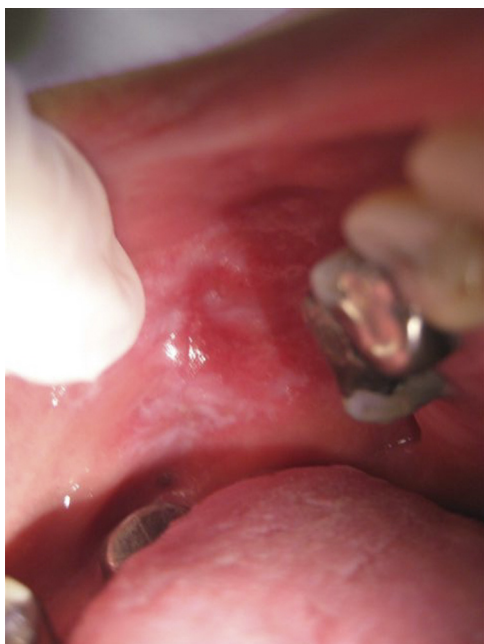


Figure 1. Lichenoid allergic contact dermatitis reaction.

fillings in a female patient with lichenoid dermatitis adjacent to her amalgam resulted in a 40% reduction in her saliva mercury levels.⁵ Removal has the most impact if the oral lichenoid lesions are directly adjacent to the dental amalgam.¹⁴ However, it is not clear if patients with oral lichen planus but negative patch tests should have dental work removed. Wong and Freeman¹³ reported that 7 symptomatic patients with negative patch tests to mercury had their fillings replaced, and only 1 patient had improvement. Conversely, Ibbotson et al¹⁵ reported that 3 of 4 symptomatic patients with negative patch tests but oral lichenoid lesions adjacent to fillings improved after amalgam replacement. Dunsche et al¹⁶ recommend removal of amalgam adjacent to symptomatic oral lichen planus regardless of patch-test results. In some cases



Figure 3. Patient two's allergic contact dermatitis reaction.

where patch testing is negative but removal results in improvement, it is possible that irritant, nonallergic mechanisms play a pathogenic role in amalgam-related oral disease.¹⁷ Also, ill-fitting amalgams causing a Koebner phenomenon and poor oral hygiene may play a role.¹⁷

It is important to note that authors have found a delay in the appearance of positive reactions to mercurial compounds, and thus some allergic contact dermatitis may be missed. Koch and Bahmer¹¹ found that 5 of 15 patients with oral lichen planus adjacent to mercury fillings had positive patch-test reactions at day 10 or 17. This probably represents primary sensitization to mercury from the patch testing.

Patient 1 is an interesting and rare presentation of a true allergic contact dermatitis to mercury. She meets criteria for the reaction given her positive delayed patch-test results to mercury and mercuric compounds and active lesions at the site adjacent to her metal fillings. Her fillings are in fact decaying, thus leading to further exposure to their components. We recommended that



Figure 2. Patient one's positive patch tests.

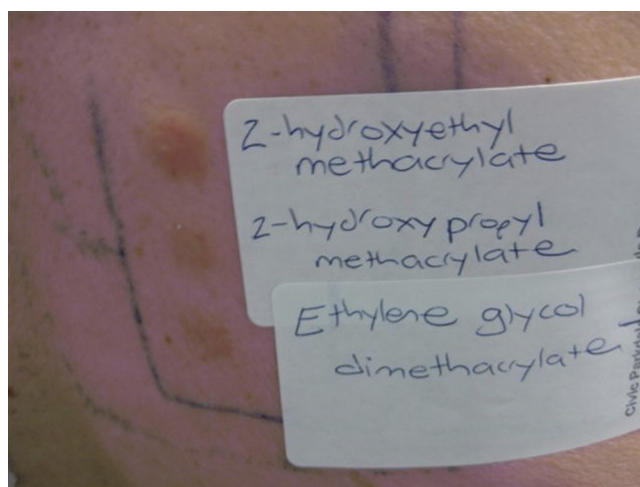


Figure 4. Patient two's positive patch tests.

our patient have these fillings removed, which she did with successful resolution of her eruption. Alternatives to mercury include gold, porcelain, composite resins, and glass ionomers.

CASE 2

A 62-year-old woman who works as a financial officer in the government presented with a persistent swollen upper lip since April 2008. In 2003, the patient had porcelain veneers on her front 4 teeth that were cemented in place with Variolink II (Ivoclar Vivadent, Liechtenstein), an acrylic-based dental adhesive, and had an upper right central incisor tooth root canal with a rubber-based material called gutta-percha. Of note, this is an inelastic natural latex produced from the sap of the *Palaquium* tree. It is chemically a polyterpene or a polymer of isoprene. It is not completely inert as once thought, but allergenicity is extremely rare. Gutta-percha is used along with a cement and a sealer.

At the beginning of April 2008, the patient had sculptured acrylic nails applied once for a 6-week period. She had previously used acrylic artificial nails 3 times over the course of 3 months approximately 3 years ago. Since that time, she remembers her lips and gums swelling intermittently. However, she noticed a drastic increase in her gingival and lip reaction 5 days after reapplication of the sculptured nails in 2008. She has noticed only 1 reaction on her fingernails or fingers consisting of blisters. Her reaction initially increased in size and was fluctuant. It has since become fixed. On examination, the patient had indurated red swollen inflamed gingiva above her front 4 teeth in the midline and also on the hard palate that abuts these teeth (Fig. 3). A biopsy revealed nonspecific inflammation and no evidence of granulomas.

The patient underwent patch testing on February 2009. She was tested to the North American Contact Dermatitis Group standard screening series, the dental and nail acrylates, and the flavors (Chemotechnique Diagnostics AB) as described above. Readings were done at 48 and 120 hours and interpreted according to the previously standardized method.⁴ The final reading revealed a 2+ reaction to 2-hydroxypropyl methacrylate 2.0% pet, a 2+ reaction to ethyleneglycol dimethacrylate 2.0% pet, and a 3+ reaction to 2-hydroxyethyl methacrylate (2-HEMA) 2.0% pet (Fig. 4).

The Material Safety Data Sheet (MSDS) was obtained for the Variolink II cement. It is composed of 10% to 14% *bis*-GMA, 5% to 7% triethyleneglycol dimethacrylate (TEGDMA), 7% to 5% urethane dimethacrylate, and less than 1% benzoylperoxide.

The patient was tested again to the components of the Variolink II cement listed above and *bis*-GMA 2.0% pet and was negative. The Variolink cement product was also diluted down to 1%. A reaction could not be reproduced. The MSDS that the patient provided for the Variolink II did note that a diluent was used in the base that contained other "acrylates."

There are varying case reports in the literature attributing reactions in the mouth to allergic contact dermatitis to acrylates.^{19,20} Acrylic that is fully polymerized is nonsensitizing, but

acrylic monomers are capable of sensitization.²¹ Polymerization occurs either by chemical reaction at room temperature, heat curing, or by light curing with blue or visible light. Dental composite resins are composed of an epoxy group polymerized with acrylic monomers with the help of catalysts. All of these components can be responsible for allergic contact dermatitis. Studies revealed that TEGDMA and 2-hydroxyethyl methacrylate (2-HEMA) are released from resins found in saliva immediately after placement on teeth and are present afterward in the dentin and pulp.²² Ratanasathien et al²³ ranked the toxicity of several dental amalgams by incubating each acrylate with cultures of Balb/c3T3 mouse fibroblasts. Toxicity was assessed using the MTT assay to quantify the number of cells that lost their enzymatic activity. The authors found that *bis*-GMA was the most toxic followed by urethane dimethacrylate, TEGDMA, and 2-HEMA.²³

Various routes of sensitization to acrylates exist including dental work, artificial sculptured nails, cosmetics industry, printing industry, and adhesives. Acrylic monomers that are used when applying artificial nails are an important source of sensitization to acrylates. There are case reports in the literature of patients developing reactions in the mouth secondary to their dental acrylates after being sensitized to acrylates from sculptured nails.²⁴⁻²⁶

A 10-year retrospective study found that the most common positive patch-test results were to 2-HEMA, ethyleneglycol dimethacrylate, and TEGDMA.²⁷ Another series named 2-HEMA, 2-hydroxypropyl methacrylate, EGDMA, and ethyl methacrylate as producing the most positive reactions.²⁴

Patient 2 was likely sensitized and acquired an allergy to acrylic monomers after her nails were applied. The acrylates in the mouth were presumably not fully polymerized, and thus her teeth were sites of exposure. We suspect that the acrylates present in the diluent that were not listed as major ingredients on the MSDS sheets are the source of the acrylates causing her reaction.

It is a widely held opinion that MSDS is unreliable in providing accurate information regarding the specific acrylates that are



Figure 5. Patient three's allergic contact dermatitis reaction.



Figure 6. Patient three's positive patch tests.

present in various products.^{25,28} In fact, producers of acrylates do not have to list all components of their products on the label.²⁹ In 1 study, the MSDS contained roughly half of the methacrylates that were actually present in a product when analyzed with chromatography.³⁰

We recommended that she remove her dental work but has not yet raised the funds to follow through. In the mean time, she has been treated symptomatically with topical and intralesional corticosteroids.

CASE 3

A 35-year-old woman who works as an early childhood educator presented with a very inflamed gingiva involving the upper 2 front teeth with marked recession of her gums (Fig. 5). Fourteen years earlier, she had a bicycle accident and injured these teeth. Subsequently, she had a root canal done and currently has a crown and caps as well as a dental implant. She has no medical history, and her only medications are ethinyl estradiol and levonorgestrel.

The patient underwent patch testing in December 2007. She was tested to the North American Contact Dermatitis Group standard screening series, the dental series, the flavors and bakery goods series, and some additional metals, such as beryllium and titanium oxide 10.0% pet (Chemotechnique Diagnostics AB) as described above. Readings were done at 48 and 96 hours and interpreted according to the previously standardized method.³⁸ The final reading revealed a 3+ reaction to beryllium (Fig. 6), 1+ reaction to nickel sulfate hexahydrate 2.5% pet, and 1+ reaction to myroxylon pereirae resin (balsam of Peru) 25.0% pet.

Beryllium is used in dental prostheses to improve the behavior of other metal alloys. Five classes of cutaneous beryllium disease have been proposed: allergic contact dermatitis, irritant contact dermatitis, chemical ulcers, ulcerating granulomas, and allergic dermal granulomas.³¹ Cutis first described patients with hypersensitivity reactions to beryllium in 1951.³² So far, there are only

3 reported cases in the literature linking beryllium allergic contact dermatitis to oral disease.^{33,34}

Patient 3 was not aware of the composition on her crowns. Unfortunately, original dental records could not be accessed despite best efforts to do so. Since they were done 10 years ago, they possibly used Rexillium (Pentron Alloys, San Diego, CA) which contains beryllium. We suspect that the patient has beryllium in her 2 front teeth. It is our recommendation to replace them, because the probability is high that beryllium is present, and her degree of inflammation and recession are significant. The patient, however, did not want to remove the implants. She understands that she will therefore remain with her eruption. She uses topical corticosteroids and is more content that she knows the cause of her eruption.

Before proceeding with patch testing, we do not ask patients in our clinic whether they are willing to have their dental work removed if it is the cause of the problem. This is due to several factors including that patients can always change their answer about removal, removal does not predict cure 100% of the time, and there is a cost difference to consider depending on whether the allergen is deemed relevant and what the dental procedure entails. We go ahead with patch testing to ensure patients receive all of the possible information, and then they are able to make an informed decision about their own care. For patients who choose not to have work removed, we can only recommend symptomatic management with topical corticosteroids and calcineurin inhibitors. We do make sure that patients know ahead of the patch testing that if we recommend that the dental work should be removed and they fail to do so, the options for treatment are limited, and there is no alternative cure.

CONCLUSIONS

When patients have dental complaints, it is important to consider the possibility of allergic contact dermatitis. It is necessary to do your best to uncover all of the materials used in dental work. Even though removal of the offending material will not always result in improvement of symptoms, if a positive reaction is found and is relevant, then appropriate replacement of the offending agent should be recommended.

REFERENCES

1. Kanerva L, Rantanen T, Aalto-Korte K, et al. A multicentre study of patch test reactions with dental screening series. *Am J Contact Dermatitis* 2001; 12:83–87.
2. Togerson RR, Davis MDP, Bruce AJ, et al. Contact allergy in oral disease. *JAAD* 2007;57:315–321.
3. Pratt MD, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group patch test results, 2001–2002 study period. *Dermatitis* 2004;15: 176–183.
4. Marks JG, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group standard tray patch test results (1992–1994). *Am J Contact Dermatitis* 1995;6:160–165.

5. Pigatto PG, Guzzi G, Persichini P. Nummular lichenoid dermatitis from mercury dental amalgam. *Contact Dermatitis* 2002;46:355–356.
6. Mobacken H, Hersle K, Sloberg K, et al. Oral lichen planus: hypersensitivity to dental restoration material. *Contact Dermatitis* 1984;10:11–15.
7. Laine J, Kalimo K, Happonen RP. Contact allergy to dental restorative materials in patients with oral lichenoid lesions. *Contact Dermatitis* 1997;36:141–146.
8. Ditrichova D, Kapralova S, Tichy M, et al. Oral lichenoid lesions and allergy to dental materials. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub* 2007;151:333–339.
9. Khamaysi Z, Bergman R, Weltfreund S. Positive patch test reactions to allergens of the dental series and the relation to the clinical presentations. *Contact Dermatitis* 2006;55:216–218.
10. Smart ER, Macleod RI, Lawrence CM. Resolution of lichen planus following removal of amalgam restorations in patients with proven allergy to mercury salts: a pilot study. *Br Dent J* 1995;178:108–112.
11. Koch P, Bahmer F. Oral lesions and symptoms related to metals used in dental restorations: a clinical, allergological, and histological study. *JAAD* 1999;41:422–430.
12. Pang BK, Freeman S. Oral lichenoid lesions caused by allergy to mercury in amalgam fillings. *Contact Dermatitis* 1995;33:423–427.
13. Wong L, Freeman S. Oral lichenoid lesions and mercury in amalgam fillings. *Contact Dermatitis* 2003;48:74–79.
14. Laine J, Kalimo K, Happonen R-P. Contact allergy to dental restorative materials in patients with oral lichenoid lesions. *Contact Dermatitis* 1997;36:141–146.
15. Ibbotson SH, Speight EL, Macleod RI, et al. The relevance and effect of amalgam replacement in subjects with oral lichenoid reactions. *Br J Dermatol* 1996;134:420–423.
16. Dunsche A, Kastel I, Terheyden H, et al. Oral lichenoid reactions associated with amalgam. *Br J Dermatol* 2003;148:70–76.
17. Holmstrup P. Oral mucosa and skin reactions related to amalgam. *Adv Dent Res* 1992;6:120–124.
18. Laeijendecker R, Dekker SK, Buger PM, et al. Oral lichen planus and allergy to dental amalgam restorations. *Arch Dermatol* 2004;140:1434–1438.
19. Kanzaki T, Kabasawa Y, Jino T, et al. Contact stomatitis due to methyl methacrylate monomer. *Contact Dermatitis* 1989;20:146–148.
20. Koutis D, Freeman S. Allergic contact stomatitis caused by acrylic monomer in a denture. *Australas J Dermatol* 2001;42:203–206.
21. Austin AT, Basker RM. Residual monomer levels in denture bases: the effects of varying short curing cycles. *Br Dent J* 1982;153:424–426.
22. Hume WR, Gerzina TM. Bioavailability of components of resin-based materials which are applied to teeth. *Crit Rev Oral Biol Med* 1996;7:172–179.
23. Ratanasathien S, Wataha JC, Hanks CT, et al. Cytotoxic interactive effects of dentin bonding components on mouse fibroblasts. *J Dent Res* 1995;74:1602–1606.
24. Lazarov A. Sensitization to acrylates is a common adverse reaction to artificial fingermails. *J Eur Acad Dermatol Venereol* 2007;21:169–174.
25. Jung P, Jarisch R, Hemmer W. Hypersensitivity from dental acrylates in a patient previously sensitized to artificial nails. *Contact Dermatitis* 2005;53:119–120.
26. Giroux L, Pratt MD. Contact dermatitis to incontinency pads in a (meth)acrylate allergic patient. *Am J Contact Dermatitis* 2002;13:143–145.
27. Goon ATJ, Isaksson M, Zimerson E, et al. Contact allergy to (meth)acrylates in the dental series in Southern Sweden: simultaneous positive patch test reaction patterns and possible screening allergens. *Contact Dermatitis* 2006;55:219–226.
28. Henriks-Eckerman ML, Kanerva L. Product analysis of acrylic resins compared to information given in Material Safety Data Sheets. *Contact Dermatitis* 1997;36:164–165.
29. Rubel DM, Watchorn RB. Allergic contact dermatitis in dentistry. *Austral J Dermatol* 2000;41:63–71.
30. Henriks-Eckerman ML, Suuronen K, Jolanki R, et al. Methacrylates in dental restorative materials. *Contact Dermatitis* 2004;50:233–237.
31. Epstein WL. Cutaneous effects of beryllium. In: Rossman MD, Preuss OP, Powers MB, eds. *Beryllium: Biomedical and Environmental Aspects*. Baltimore, MD: Williams & Wilkins; 1987:113–117.
32. Curtis GH. Cutaneous hypersensitivity due to beryllium. *Arch Dermatol* 1951;64:470.
33. Haberman AL, Pratt M, Storrs FJ. Contact dermatitis from beryllium in dental alloys. *Contact Dermatitis* 1993;28:157–162.
34. Vilpana J, Romaguera C, Grimalt F. Occupational and non-occupational allergic contact dermatitis from beryllium. *Contact Dermatitis* 1992;26:295–298.