

CASE SERIES

Retrospective study of oral lichen planus and allergy to spearmint oil

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ABSTRACT

Oral lichen planus (OLP) is a chronic inflammatory disorder with significant morbidity, associated with symptoms of pain and local discomfort. The concept of contact allergy aggravating or inducing OLP is recognised, and reported allergens include amalgam, metals used in dental restoration and flavourings. To date there has been only one case report of a contact allergy to spearmint oil in a patient with a 3-year history of OLP. We retrospectively reviewed our positive spearmint oil patch test data at the Skin and Cancer Foundation Victoria over a period of 11 years. In total 75 patients of the 1467 tested for allergy to spearmint oil had positive patch tests. The total number of patches tested during this time was 6134. Of the 75 positive reactions, 19 (26%) were classified as relevant, in that the patients had a history of using spearmint oil-containing products. Coexisting OLP and a spearmint allergy were found in 14 of these 19 patients. All patients had erosive OLP and were female. Patients, especially women, with OLP recalcitrant to treatment should be patch tested to flavourings, especially spearmint oil. We believe that spearmint allergy should be considered a cause of OLP, or at least, of oral lichenoid reactions.

Key words: amalgam, cheilitis, chewing gum, cinnamon, contact dermatitis, erosive, flavourings, gingivitis, inflammation, lichenoid reactions, menthol, mouth, mouthwash, mucous membranes, patch test, peppermint, stomatitis, toothpaste.

INTRODUCTION

Oral lichen planus (OLP) is a relatively common inflammatory condition of the oral mucous membranes (MM) with a prevalence of about 0.5–2.2%. It has a female preponderance with a peak incidence at 30–60 years of age.¹ OLP is usually idiopathic but several factors such as hepatitis C, smoking, trauma from periodontal procedures or radiation therapy have been implicated. There are several morphological forms of OLP including atrophic, bullous, erosive, papular, pigmented, plaque-like and reticular forms. Symptoms such as burning, dysphagia, interference with speech and halitosis can greatly affect the patient's quality of life.² In long-standing disease, especially in erosive or atrophic forms, a malignant transformation has been reported; however the exact incidence of this is unclear.³

The origin of OLP remains unknown, but an immune-mediated (T-cell dependent) pathogenesis is proposed.⁴ A contact allergy to mercury compounds has been shown to be important in the pathogenesis of OLP, especially if the OLP is adjacent to amalgam fillings. In cases of positive patch test reactions to mercury compounds, the partial or complete replacement of amalgam fillings has resulted in a significant improvement.⁵ Other authors believe that amalgam should be replaced if it is adjacent to OLP, regardless of whether or not the patch test is positive.⁶ Other allergens associated with OLP include metals used in dental restoration and flavourings.⁷ Histologically it is not always possible to distinguish between OLP and a lichenoid reaction. OLP may be an example of a reaction pattern occurring intra-orally. Other authors believe that allergens cause lichenoid reactions, rather than OLP.⁸

A contact allergy from spearmint oil is rare. There are only a handful of case reports of exposure to spearmint oil from toothpaste causing contact cheilitis.⁹ There is only one report of contact allergy to spearmint associated with OLP.¹⁰ Our experience leads us to believe that the association between spearmint allergy and OLP has been under-recognised. We

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Abbreviations:

MM	mucous membranes
OLP	Oral lichen planus

demonstrate the probable association of spearmint allergy and OLP in 14 patients. The two patients described below are representative of the remainder.

METHODS

A retrospective audit of relevant cases of spearmint allergy was conducted by the treating dermatologists. This study was performed using de-identified patient details as part of a quality assurance activity, which has been approved by the Board of the Skin and Cancer Foundation.

Patients with positive patch tests to spearmint oil were identified from the Patchcams (Occupational Dermatology Research, Melbourne) database at the Skin and Cancer Foundation, Melbourne. This comprised 6134 patients who had undergone patch testing in both the Contact Dermatitis Clinic (January 2000–September 2011) and the Occupational Dermatology Clinic (January 1993–September 2011). A total of 1467 patients had been tested for spearmint allergy since spearmint oil had been included in the cheilitis series in March 1999, as a result of concerns by an oral medicine specialist that it may be associated with allergic reactions. It was subsequently included in the toothpaste, essential oils and fragrances (rare) series. Our patch test sample was prepared by a pharmacist (Clarendon Pharmacy, South Melbourne) who diluted neat spearmint essential oil obtained from the Australian Essential Oil Company, Coraki New South Wales, Australia to 5% in white soft paraffin. This concentration was selected based on previous reports.¹¹ This was kept in a sealed jar in a refrigerator and loaded into a syringe for patch testing as required. Most of our other allergens, including carvone were obtained from Chemotechnique Diagnostics (Malmo, Sweden).

Patches were applied to the upper back using Finn chambers on Scanpore (Epitest OY, Tuusula, Finland) and left on for 48 hours. Reactions were recorded at 48 hours and 96 hours according to the International Contact Dermatitis Research Group guidelines. They were assessed as irritant (irr), equivocal (+/-), weak positive (+), strong positive (++) or extremely positive (+++). Only patients with positive reactions (+ or greater) were used for the analysis. Positive reactions were classified as relevant, of past relevance or unknown relevance. Relevance was determined by the patch test clinic consultant dermatologist at the time of patch testing and at follow-up interviews with the patients.

The patients with OLP had all been referred for patch testing and were subsequently followed up by the same oral medicine specialist. Patch testing was done to investigate the role that allergies played in their OLP on account of their limited response to treatment. The specialist had recorded the severity of their OLP when they were initially assessed, based on the extent of their oral disease and the associated symptoms. All had biopsy-proven OLP diagnosed by an experienced histopathologist. The patients were subsequently reviewed following patch testing, thereby assessing the percentage of the improvement of their OLP, following advice to avoid relevant allergens, particularly spearmint.

RESULTS

The patch tests of 73 of the 1467 patients tested were positive for spearmint. Of the 73 positive reactions, 19 (26%) were classified as relevant, in that they had a history of use of spearmint oil-containing products and an appropriate clinical presentation. Coexisting erosive OLP and spearmint allergy were found in 14 of these 19 patients. These patients were all women and none had cutaneous lichen planus. The results are summarised in Table 1. Ten patients achieved at least 80% improvement following the avoidance of spearmint products. One patient had additionally relevant reactions to dental acrylates and nickel, both present in her dental splint, and a history of improvement with avoidance of all these allergens. The OLP was predominantly distributed on buccal and gingival surfaces and two cases of co-existing cheilitis and one case of desquamative gingivitis were seen.

DISCUSSION

We found that spearmint allergy was associated with OLP in 14 patients, all of whom were female and presented with biopsy-proven erosive OLP characterised by severe pain and resistance to systemic and topical therapies. In our patients the sites involved were the buccal and gingival surfaces, the lingual mucosae and the floor of the mouth. The sites most commonly involved in OLP are the buccal mucosa (100%), the gingivae (40%), tongue (40%), lips (40%) and palate (25%).¹²

A female preponderance has previously been reported in OLP by Axell and colleagues. Allergy to spearmint oil has been reported to manifest as allergic contact cheilitis¹⁵ or a vesicular cutaneous eruption following direct application of spearmint leaf infusion.¹⁴ There has been only one report of OLP and spearmint allergy by Clayton and colleagues¹⁰ occurring in a 78-year-old woman with a 3-year history of this condition in the UK. Her exposure to spearmint was in the form of a Gengigel Mouth Rinse, (Genigel, Ruislip, UK) together with chewing gum. Avoidance resulted in a dramatic improvement of her symptoms.

The two main types of spearmint oil are obtained from the leaves of the perennial herbs *Mentha spicata* L. (native spearmint) and *Mentha cardiaca* L. (Scotch spearmint). Spearmint is a species of mint native to much of Europe and south-west Asia. It is grown all over the world, mainly in the USA and more recently in China and South America. The world market for spearmint oil is approximately 1500 tons per year.¹⁵ It is reputed to have a number of therapeutic attributes, including antiseptic, antispasmodic, carminative, cephalic, emmenagogue, insecticidal, restorative and stimulant properties.

Spearmint oil generally consists of more than 50% carvone and limonene, pinene, phellandrene, dipentene, cineole, linalool and esters of dihydrocumyl alcohol and dihydrocarveol. Australian spearmint oil is said to contain over 70% carvone, dihydrocarvone and limonene.¹⁶ We found that seven of our 14 patients (50%) with allergic reactions to spearmint reacted to carvone. *M. cardiaca* also

Table 1 Details of patients with erosive oral lichen planus and positive reactions to spearmint or related chemicals (bolded)

Patient (age, sex)	Site of lichen planus and associated condition where relevant	Positive patch test reaction (relevant substances in bold)	Past treatment	Exposure to spearmint	Percentage improvement post-avoidance of spearmint; other comments
61, F	Gingival MM	Spearmint , sassafras, epoxy resin, potassium dicyanoaurate	Mometasone furoate cream, miconazole oral gel	Macleans Protect [†] MildMint Toothpaste, Colgate mint flavoured dental floss, Wrigleys Spearmint Chewing Gum, after dinner mints	90% No gold fillings present No relevance to epoxy resin found
47, F	Buccal MM, cheilitis	Spearmint , methyl methacrylate, 2-hydroxyethyl methacrylate, nickel	Nil	Wrigleys Spearmint Gum, mints, Sensodyne Mouthwash, Colgate Sensitive Toothpaste	100% Removal of acrylic dental splint, avoidance of nickel, low nickel diet
50, F	Gingival MM	Spearmint , carvone, mercury	Betamethasone dipropionate 0.05% miconazole oral gel	Colgate Mint toothpaste, Listerine Coolmint Mouthwash, chewable mints	80% 50%
73, F	Buccal MM, gingival MM	Spearmint , carvone, sassafras,	Mometasone furoate cream, miconazole oral gel	Colgate Sensitive Toothpaste	50%
66, F	Lingual MM, floor of mouth	Spearmint , carvone, nutmeg	Mometasone furoate cream, miconazole oral gel	Grant's Extra Fresh Toothpaste	90%
46, F	Buccal MM, gingival MM	Spearmint , carvone, tea tree oil, sassafras, ginger powder, nutmeg, thyme, benzoyl peroxide, abitol	Betamethasone dipropionate 0.05% ointment, Mometasone furoate cream	Mint flavoured toothpaste	50%
71, F	Gingival MM	Spearmint , amalgam, gold sodium thiosulphate, sassafras, methylhydroquinone	Betamethasone dipropionate 0.05% ointment, miconazole oral gel	Dentitex Cavity Protect, Dentitex Sensitive toothpastes (Aldi)	80-90% Amalgam reaction thought not to be relevant
72, F	Gingival MM	Spearmint , carvone, cinnamic aldehyde, zinc chloride, sassafras	Mometasone furoate cream, betamethasone dipropionate 0.05% cream, pimecrolimus cream	Mint flavoured dental floss, Biotene Freshmint Toothpaste	90%
75, F	Buccal MM, gingival MM, desquamative gingivitis	Spearmint , fragrance mix	Mometasone furoate cream, miconazole oral gel	Colgate Total Advanced Fresh Gel Toothpaste	80-90%
70, F	Buccal MM, cheilitis	Spearmint , colophonium	Nil	Colgate Mint Toothpaste, mint flavoured chewing gums.	100% Colophonium present in chewing gum. Lost to follow up
70, F	Palate, uvula, lingual MM	Spearmint , thiuram mix	Hydrocortisone cream, miconazole oral gel	Colgate Mint Toothpaste	100%
53, F	Floor of mouth	Spearmint , carvone, sassafras, eucalyptus, nutmeg	Nil	Macleans Mint Toothpaste, Colgate Mint Toothpaste, Biotene Dry Mouth Gum	100%
63, F	Buccal MM, upper labial MM	Spearmint , carvone, nutmeg, sassafras, amalgam, mercury chloride, mercury ammonium chloride	Mometasone furoate cream, miconazole oral gel	Colgate Total Advanced Freshening Toothpaste, Wrigleys Spearmint chewing gum, Colgate Plax Mouthwash	70-80% Amalgam had been removed previously
71, F	Buccal MM, gingival MM	Spearmint , sassafras	Mometasone furoate cream	Colgate Toothpaste	20-50% at 5 weeks follow up only

†All toothpaste manufactured in Australia. F, female, MM, mucous membranes

has a 2% menthol content. Carvone is found in lower concentrations in caraway, dill, ginger grass and kuromoji oil.¹⁷

Spearmint is most commonly found in toothpaste and other dental hygiene products such as mouthwashes, chewing gum and confectionery, and is sometimes added to shampoos and soap. Toothpaste is a personal care product that is commonly used by consumers, starting at a young age. Otto and colleagues analysed all potential allergens in 80 toothpastes found on the Walgreen's Pharmacies database in the USA. The most common allergen was found to be flavouring, present in 95% of the toothpaste brands listed in the database.¹⁸ This was also validated by a multicentre study of allergic contact cheilitis, where in most cases flavourings such as spearmint, cinnamon, peppermint, carvone and anethole were responsible for toothpaste allergies.¹⁹ Mint flavours such as spearmint, peppermint and menthol are particularly relevant, given that they are commonly used in toothpastes to produce a sensation of freshness.⁹ Interestingly, none of our patients had reactions to peppermint or menthol. Peppermint contains only 1% of the key ingredient found in spearmint; carvone. The main ingredient in peppermint is menthol.

Half of our patients had concomitant reactions to sassafras. Sassafras is a genus of three extant and one extinct species of deciduous trees in the family *Lauraceae* native to eastern North America and eastern Asia. The steam distillation of its dried root bark produces an essential oil used as a fragrance in soap, perfumes and food. Extract of sassafras was the primary ingredient in root beer. Its main components are safrole, 5-menthyl-eugenol and camphor. Today, it is mostly used as an artificial flavour, given the concern of carcinogenicity related to its natural extract.²⁰ The relevance of this reaction is unknown and, given that none of our patients recalled specific exposure to it, it is likely that these reactions represent cross reactions.

Most of our patients achieved improvement with strict spearmint avoidance. Their improvement was scored in terms of surface area involvement and symptom reduction. Several scoring systems for the assessment of OLP have been developed but there has not yet been consensus as to the most appropriate scoring system for OLP and a uniform scoring system has not yet been adopted.²¹

The most difficult aspect was counselling patients to avoid spearmint and identifying a suitable toothpaste for those allergic to it. We contacted several toothpaste manufacturers and it appeared that most brands contain a mixture of mint flavourings. All Colgate toothpastes contain a mixture of spearmint, peppermint and menthol. Spearmint-free toothpastes available on the market include Red Seal Lemon Fresh, Macleans Extreme Clean Fresh, Maclean Protect FreshMint, Sensodyne Gentle Whitening, Sensodyne Total Care Whitening and Sensodyne Original toothpastes (GlaxoSmithKline, Melbourne, Australia). We were unable to identify any spearmint-free mouthwashes or dental flosses.

The mercury, amalgam and gold reactions found were not thought to be relevant. The distribution of the OLP was varied and not just adjacent to dental amalgam or dental gold. Two patients had co-existing cheilitis. One patient

with cheilitis and OLP was found to be allergic to acrylates and nickel, which were both believed to present in her dental splint. She was completely cured after the removal of the splint and spearmint avoidance. The other was also found to be allergic to the spearmint and colophonium found in her mint-flavoured chewing gum. She had a 100% improvement with the avoidance of spearmint. Another patient presented with desquamative gingivitis, as well as OLP (Patient 2).

Sometimes allergic contact stomatitis can present with similar clinical findings to OLP, including with oedema, erythroplakia and ulcerous or hyperkeratotic change. The histology usually tends to be non-specific but may include a band of dermal infiltrate extending more deeply than usually seen in OLP. The infiltrate usually contains plasmacytes and eosinophils.²²

There are a number of limitations to this study. While biopsies indicated the diagnosis of OLP some authors believe that the patients experienced allergic contact stomatitis and that the lichenoid changes seen both clinically and histologically are better termed a lichenoid reaction.²³ We prefer the interpretation that this is, indeed, OLP, but recognise that this is an area of some contention.

As spearmint was not a commercially available patch test allergen, our test preparation was not itself subject to analysis. Oxidation of ingredients has been an issue reported previously with some fragrances, although we have no reason to doubt the stability of the patch test preparation.²⁴

The quantification of improvement following avoidance of spearmint was based on the assessment a single, non-blinded observer. However, no rating scales had been proposed at the time of instituting testing for spearmint allergy in 1999. It is possible that there is some bias in this assessment. However, the association found between OLP and allergy to spearmint still remains, regardless of whether the improvement is substantiated.

CONCLUSION

We found that spearmint allergy was associated with OLP, especially when there was a history of exposure. We believe that patch testing should be performed in all patients with OLP who are unresponsive to treatment. The allergens tested should go beyond the commercially available standard series and include flavourings, particularly spearmint, carvone, peppermint and menthol, given the ubiquitous nature of these products in dental products and chewing gum. OLP is best managed by a multidisciplinary team, with input from oral medicine specialists and dermatologists.

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