Oral Tissue Irritants in Toothpaste: A Case Report

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In this case, an adolescent patient presented with multiple, asymptomatic ulcerated lesions- resembling aphthous ulcerations- located in the oral cavity. The etiology of these lesions appeared to be associated with soft tissue irritants found in the patient's toothpaste. This report highlights the need to rule out known oral irritants in dentifrices for patients who present with oral ulcerations.
Keywords. *Allergy, tootpaste, children*

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INTRODUCTION

The presentation of oral ulcerations in patients can mimic a variety of disease entities. A thorough investigation of the etiology of the ulcer will lead to an accurate diagnosis for the patient with oral irritation/inflammatory mucosal lesions. When treating these patients, the dentist should consider recurrent aphthous ulcers (RAU), herpes simplex virus (HSV-1), Coxsackie and Enteric Cytopathic Human Orphan (ECHO) viruses, fungal and bacterial infections, traumatic ulcers, contact stomatitis or allergies, medication induced ulcers, head and neck chemotherapeutic and radiation induced mucositis and systemic conditions in the differential diagnosis. "Canker sores" (recurrent aphthous ulcers, RAU), are the most common among oral ulcerative conditions experienced by patients.[1-5]

Recurrent aphthous ulcerations affect approximately 20% of the population and are brought on by stress, trauma, hormones and/or hypersensitivity. The lesions are usually painful and found on the non-keritinized mucosa (lips, buccal mucosa, floor of the mouth, soft palate). There are three types of recurrent aphthous ulcers: minor (Mikuliicz aphthae), major (Sutton's disease or peradenitis mucosa necrotica recurrens), and herpetiform. Both minor and major forms of aphthae have round or oval ulcers with a pseudomembranous grayish or yellowish center and an erythematous (red) border. In minor aphthae, the most common type, ulcers measure up to approximately 4mm in diameter and heal within 7-10 days without scarring.[4,5] Major aphthae are larger, more painful and slower to heal leaving behind scars. Herpetiform aphthous ulcers present as tiny multiple lesions that heal in approximately a week without scarring.[4,5] More research is needed to determine the exact etiology of RAU; an autoimmune link has been proposed. Etiologic factors associated with RAU include trauma and irritation of the affected oral tissues; therefore, the clinical patient history is important within the patient workup.[1-5]

The dentist considering a review of the patient's systems along with clinical examination data should also consider the possibility of an allergic or hypersensitivity reaction to dental materials.[6,7] Toothpastes, widely used by consumers, are composed of abrasives, detergents, binding agents, humectants, preservatives, coloring agents, antiseptics, fluoride salts, and flavorings which have been demonstrated to cause contact stomatitis in sensitive individuals.[8,9] Contact stomatitis may manifest as either an acute or chronic condition affecting oral tissues (lips, gingiva, tongue, and perioral skin) and resulting in a variety of clinical features including erythema, swelling, desquamation, peeling, epithelial sloughing, ulceration, glossitis, and cheilitis. The acute form is characterized by a burning sensation with variable mucosal symptoms (mild redness to dramatically erythematous lesions, edema may or may not be present). Itching, stinging, tingling and edema may be present. Occasionally, ulcerations that resemble aphthae occur. In chronic cases of contact stomatitis, erythematous or white and hyperkeratoid lesions form as a result of the causative agent being in contact with the tissues. Widespread erythema with desquamation of the epithelium has been seen with some allergens.[10,11]

The literature has demonstrated that the ingredients in many popular tartar control and whitening dentifrices are also associated with oral mucosal sensitivity. Triclosan, a compound with a broad spectrum antibacterial and anti-plaque effect; and Sodium lauryl sulfate (SLS), used in toothpaste as a detergent and surfactant, are often cited among the offending ingredients.[1,6-13]

CASE REPORT

An 11 year-old, Hispanic female presented to Howard University College of Dentistry, Department of Pediatric Dentistry Children's Clinic for a 6-month recall evaluation. She was also a patient of record in the Department of Orthodontics where she was receiving comprehensive orthodontic care.

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Figure 1a. Ulcerated lesions noted in the mandibular anterior vestibule

Figure 1b. Lesions present in the maxillary anterior vestibule

Figure 1c. Lesions noted on the floor of the mouth and on the sublingual/ventral surface of the tongue

A review of her medical history was non-contributory, revealing no contraindications to care. There were a few reported bouts with oral ulcerations in the past. However, the lesions were small, not painful, and no more than two lesions occurred at one time. The patient denied a previous history of painful oral lesions.

The extra-oral examination was within normal limits, including no lymphadenopathy. Inspection of the intra-oral hard tissue found no caries, with brackets and bands present for orthodontic care. Plaque deposits were present under the orthodontic brackets. There was no report of fever/temperature. Target lesions between one centimeter to three centimeters (1cm to 3cm) in diameter were noted in the mandibular anterior vestibule (Fig. 1A), the maxillary anterior vestibule (Fig. 1B) and in the floor of the mouth and sublingual/ventral tongue (Fig. 1C). The patient reported that the lesions were asymptomatic and had been present for about 3 days. The father was contacted regarding the type of toothpaste being used by the family. He was advised to discontinue the use of any toothpaste with triclosan or whitening agents and to choose toothpaste which contained fluoride. The patient returned to the orthodontic department one week later for evaluation and occlusion management. During that visit, the clinician evaluated the oral soft tissues and reported that the oral ulcerations had resolved. (Figs. 2A, 2B, and 2C)

One year following the initial diagnosis of triclosan-induced contact stomatitis, the patient has not had a recurrence of oral ulcers.

DISCUSSION

The patient with oral ulcerations can be challenging to treat. The puzzle lies in determining the correct diagnosis and then finding the precise etiology of the condition to certify the condition is treated properly and the number of recurrences diminished. In this case, the patient presented to the office with multiple, asymptomatic ulcerated lesions located on non-keratinized mucosa. A diagnosis of aphthous stomatitis was considered however, without a report of pain this condition was ruled out. Because of the history of utilization of a dentifrice containing triclosan, the known association between triclosan and oral ulcers and the distribution of the lesions in areas where toothpaste typically pools, the working diagnosis was triclosan-induced contact stomatitis.

A dentifrice-induced intra-oral tissue reaction was considered the most likely cause of the patient's erythematous oral mucosal ulcerations. Upon questioning, it was determined that the tartar-control toothpaste used by the family may have contributed to the patient's condition. Typically, in order to definitively arrive at a diagnosis of allergic reaction or an irritation reaction to a particular entity, it is necessary to perform a challenge or patch test procedure.[14] It is however, very difficult to conduct a patch test for a toothpaste allergy. Research has demonstrated that allergens found in toothpaste are also irritants which can confound the test, resulting in a high number of false positive results.[8] Furthermore, Zirwas and Otto [8] reported success in the resolution of cheilitis when toothpaste with certain fragrances and flavorings was avoided by their affected patients. In order to determine if this was a case of contact or dentifrice stomatitis, the decision was made to remove the suspected offending substance (tartar-control toothpaste) from contact with the oral tissues. Since switching to a fluoride containing toothpaste, the patient has had no more recurrences. In this case, neither allergy nor any other diagnostic testing was performed because of the resolution of the lesions in response to the discontinuation of the dentifrice. It should be noted that it is still possible that these lesions were caused by another entity besides irritants in the toothpaste such as an infectious condition, manifestation of a systemic disease, or autoimmune conditions to name a few.

Panagakos *et al*,[15] reported that a particular triclosan containing dentifrice demonstrated protection against plaque and gingivitis, caries, malodor, stain removal and against the progression of periodontal disease. Their review reported upon the research of a number

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Figure 2a. Resolution of the oral ulcerations in the mandibular anterior vestibule

Figure 2c. Resolution of the oral ulcerations on the floor of the mouth and on the sublingual/ventral surface of the tongue

Figure 2b. Resolution of the oral ulcerations in the maxillary anterior vestibule

of studies which confirmed the efficacy of tartar control dentifrices. DeLattre[16] stated that although the efficacy of tartar control dentifrices has been well established and demonstrated success in the reduction of calculus and periodontal problems for many patients, there is a segment of the population for whom tartar control products may provoke an assortment of adverse oral manifestations. Abdollahi *et al*,[1] and Rees[17] reported that dentifrice hypersensitivity reactions appear to be more common since the advent of tartar-control toothpastes. Kowitz *et al*,[7] evaluated 92 dental students and dental hygiene students in a double-blind randomized study evaluating reactions to four different tooth pastes; 1) control – low flavor without tartar control, 2) medium flavoring with medium tartar-control agent (pyrophosphate), 3) high flavoring with tartar-control agent (pyrophosphate) , 4) medium flavoring without tartar-control. Toothpastes #2 and #3 resulted in statistically significant increased rates of mucosa reactions (e.g. ulceration, sloughing, erythema, etc.) compared to the toothpastes without tartar control agents, toothpastes #1 and #4.

Skaare *et al*, (1997) [10] evaluated four toothpastes in 19 healthy dental students with a double-blind study with regard to determining different irritation potentials between different additives (sodium lauryl sulfate (SLS) and triclosan). They noted that there were a large number of case reports and documentation of cutaneous irritation and allergic reactions to triclosan–containing formulations in surgical soaps. An occlusion test system evaluating the irritation to human skin was utilized. Four different toothpastes were evaluated; 1) a non-ionic detergent toothpaste, 2) a toothpaste containing SLS/polyethylene glycol, 3) triclosan/co-polymer/SLS/propylene glycol (the same ingredient in the toothpaste utilized in the case reported), and 4) triclosan/zinc citrate/SLS/polyethylene glycol. The #3 toothpaste was the greatest irritant causing skin erythema in 16 of the 19 subjects. Toothpaste #4 caused no reactions; toothpaste #2 provoked three reactions of which two were severe, and toothpaste #1 caused only one reaction. The investigators concluded that although the study was carried out on skin and therefore, not directly applicable to the oral cavity, however, these and the results of previous studies tend to indicate that a triclosan containing toothpaste without propylene glycol and SLS may be preferred by susceptible persons.

Skaare *et al*,[18] compared the efficacy of three mouth rinses in controlling recurrent aphthous ulcers. They reported that the mouth rinses containing triclosan were the most efficacious. They concluded that the positive effects of the triclosan containing mouth rinses were probably due to the medication's anti-inflammatory properties. Skaare *et al*, (1997)[10] reported a protective role of Zinc and an irritant effect of propylene glycol in triclosan containing formulations. They investigated the actions of propylene glycol and zinc with regard to mucosal reactions secondary to triclosan containing formulations with a double-blind study of 15 dental students. They noted that formulations containing SLS and SLS and propylene glycol precipitated more erythematous reactions compared to formulations containing SLS, Zinc, and triclosan.

From the above studies, it appears that the combination of triclosan, SLS, co-polymer, and propylene glycol has the potential to cause inflammatory reactions. Certainly, it has been established that triclosan containing dentifrices appear to have a number of positive attributes with regard to decreased plaque and calculus and that triclosan appears to have an anti-inflammatory effect as well. However, it also appears to be well-established that the particular formulation in a commercial dentifrice has the capacity to initiate an oral mucosal inflammatory reaction in susceptible individuals, as was suggested in the case reported.

In conclusion, although tartar control toothpastes demonstrate efficacy with regard to the control of plaque and calculus, it is important for Dentists to consider that tartar control toothpastes have the potential to cause inflammatory oral mucosal reactions resembling aphthous ulcerations. Furthermore, with regard to investigating the diagnosis and treatment of oral mucosal lesions, it is important to take a good history which includes the particular brand of the dentifrice and consider removing the potential irritant to aid in determining the etiology of the inflammatory condition.

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