

ETIOLOGICAL FACTORS AND THERAPY OF DENTURE STOMATITIS

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Abstract: Denture stomatitis is a common inflammatory condition that affects denture wearers. In otherwise healthy individuals it usually manifests itself as an erythematous, edematous mucosa underlying and confined to the area covered by a complete upper denture. It is sometimes found under upper partial dentures, but only rarely beneath mandibular dentures. Etiopathogenesis of inflammation is multifactorial and complex. Infection by yeast of the genus *Candida*, mainly *Candida albicans*, and long-term wearing of dentures are the most important etiological factors. Factors that may contribute to the development of inflammatory reactions are some general factors, such as smoking, use of different drugs, and systemic diseases such as diabetes mellitus. Iatrogenic factors, such as trauma caused by ill-fitting dentures, poor hygiene, and inadequate occlusal dimensions, facilitate the onset of pathological processes in the oral cavity, the most common of which is denture stomatitis. This article presents multifactorial etiology of denture stomatitis and the usual therapy carried out during treatment.

Keywords: denture stomatitis, dentures, *Candida albicans*

1. INTRODUCTION

Denture stomatitis is a common inflammatory condition that affects denture wearers. In otherwise healthy individuals it usually manifests itself as an erythematous, edematous mucosa underlying and confined to the area covered by a complete upper denture. It is sometimes found under upper partial dentures, but only rarely beneath mandibular dentures. Symptoms are rare: a mild burning sensation is reported, depending on the type of the food, and very rarely dysphagia.

Iatrogenic factors, such as trauma caused by ill-fitting dentures, poor hygiene, and inadequate occlusal dimensions, facilitate the onset of pathological processes in the oral cavity, the most common of which is denture stomatitis (DS). [1,2] Other factors also contribute to the onset of disease, such as a change in the resin polymerization (although the criteria for the liquid-to-powder proportions recommended by the manufacturer and polymerization cycles are followed); these areas are sites of disease onset because of the pores that remain within the resin due to compression and roughness of the surface, which favors the adherence and colonization of microorganisms. [3,4] Dağıstan et al. [5] described DS as an inflammatory process that primarily involves the palatal mucosa (PM) when it is fully or partially covered by dentures, affecting 60-100% of acrylic denture users. Barbeau et al. [6] noted that the etiology of DS is multifactorial and includes advanced age, decline in the defense mechanisms of the immune system, systemic diseases, smoking, the use of dentures while sleeping, poor oral hygiene resulting in the accumulation of plaque on the denture, poorly fitting dentures, and functional factors related to the occlusion. Pattanaik et al. [7] reported that DS may be triggered by an allergy to residual resin monomers and is always associated with yeast from the genus *Candida*, particularly *Candida albicans*, which is a dimorphic fungus that has two major forms: a yeast form (commensal) and a hyphal form (pathogenic). *C. albicans* is frequently found in patients who wear full or partial dentures, immunocompromised patients, patients who have undergone antibiotic therapy, and patients who take medications that induce xerostomia. [8]

Newton in 1962 was the first to propose a classification of denture stomatitis. Based on Newton's original method, Budtz-Jørgensen and Bertram in 1970 and Bergendal and Isacson in 1983 proposed other classifications of denture stomatitis. [9] According to the clinical aspects of the lesions, Newton classified denture stomatitis into three types – punctiform hyperemia (class I), diffuse hyperemia (class II) and granular hyperemia (class III).

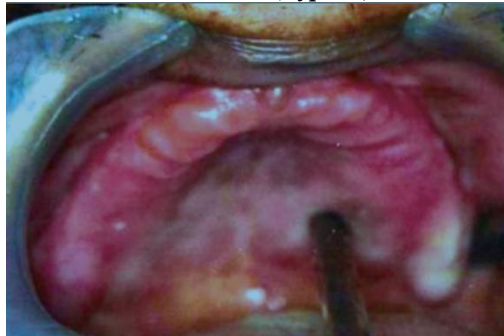
Newton's type I – a localized simple inflammation, described as 'pinpoint hyperemia', which manifests as discrete focal areas of inflammation of the palate. (Fig. 1)

Fig. 1 Pinpoint hyperemia or localized simple inflammation (Type I)



Newton's type II – generalized erythema involving the whole area covered by the denture. (Fig. 2)

Fig. 2 Diffuse erythema associated with scattered petechiae is distributed over the mucosa covered by the base of the denture (Type II)



Newton's type III – papillary hyperplasia of the palate. (Fig. 3)

Fig. 3 Granular surface or inflammatory papillary hyperplasia of the plate (Type III)



The prevalence of denture stomatitis among complete denture wearers has been shown to be from 25% to 65% depending of the type of sample population chosen by various researchers. [10,11] It is therefore a very common condition in the denture wearing population.

2. ETIOLOGICAL FACTORS

Studies have pronounced different factors causing denture stomatitis such as traumatic occlusion, poor oral and denture hygiene, microbial factors, age of the denture, allergy to the denture base materials, residual monomer, thermal stoppage below the denture, smoking, various types of irradiation, dryness of mouth, systemic conditions, diabetes mellitus and immunodeficiency, nutritional deficiencies, and medications. [12]

Poor denture hygiene. Lack of denture cleanliness is considered to be one of the factors involved in the etiology of denture stomatitis. Various factors stimulating yeast proliferation, such as poor oral hygiene, high carbohydrate

intake, reduced salivary flow, composition of saliva, design of the prosthesis and continuous denture wearing can also enhance the pathogenicity of denture plaque. [13]

Trauma. Denture stomatitis is multifactorial in nature, with trauma being a major independent cause. The trauma may originate from ill-fitting or continuously worn dentures, or dentures that do not have correct vertical and horizontal arch relations. [14] According to Nyquist, trauma caused by dentures accounted for the majority of cases of denture stomatitis. Cawson concluded that the trauma and candidal infection are significant causes of denture stomatitis. The latest study pointed out that trauma alone does not induce pictures of generalized denture stomatitis but, rather, it could be the cause of localized forms. Instead, in the generalized forms the principal pathogenic role is played by *Candida albicans*. In this case, trauma could act as co-factor that favours the adhesion and the penetration of the yeast, sustains phlogosis of the palate and increases the permeability of the epithelium to toxins and soluble agents produced by *Candida* yeast. [15]

Denture lining materials. Denture-lining materials, which include tissue conditioners and soft denture liners, are widely used as adjuncts in the prosthodontic treatment and management of traumatized oral mucosa and are most commonly used in association with the mandibular denture. Recently, materials which are available are either silicone elastomers, plasticized higher methacrylate polymers, hydrophilic polymethacrylates or fluoropolymers. Even though these materials exhibit excellent tissue tolerance, one of the problems is the colonization of *Candida* species on and within the material. Fungal growth is known to destroy the surface properties of the liner and this may lead to irritation of the oral tissues. This is due to a combination of increased surface roughness and high concentrations of exotoxins and metabolic products produced by the fungal colonies. [16]

Microorganisms. The importance of oral microorganisms in the etiology of denture-related stomatitis is well understood as the series of studies by Cawson, and Budtz-Jorgensen established that oral fungi, particularly *Candida* species, are essential for the development of denture stomatitis. The mechanisms by which *Candida* species are believed to induce the inflammatory response that is characteristic of denture stomatitis include the release of yeast antigens, toxins and irritants from the denture plaque. Severe forms of denture-related stomatitis were associated with heavy smoking. The effects of tobacco on this increased susceptibility to oral *Candida* infections are probably a result of a combination of factors, including a suppression of the activity of oral leucocytes mediated by smoking, changes in oral mucosal surface due to denture friction associated with tobacco smoking and immunosuppression. [17]

Surface texture and permeability of denture base material. The tissue surface of the dentures usually shows micropits and microporosities. Micro-organisms harbouring in these areas are difficult to remove mechanically or by chemical cleansing. According to several *in vitro* studies, the microbial contamination of denture acrylic resin occurs very quickly, and yeasts seem to adhere well to denture base materials. Surface roughness may facilitate microbial retention and infection. Dentures with a fine texture and absence of porosity did not allow attachment of plaque by penetration of surface defects or by mechanical fixation to surface irregularities. Van Reenen showed *in vitro* that *C. albicans* penetrated the commonly used acrylic resin, *Candida* which was confirmed with the use of a fluorescent dye and *C. albicans*. Penetration of the unpolished surface, which is in contact with the mucosa, was greater than that of the polished surface. [18,19]

Saliva. The role of the saliva in the colonization of *C. albicans* is still controversial. Some studies have shown that it reduces the adhesion of *C. albicans*. In fact, the saliva possesses defensive molecules as lysozyme, lactoferrine, calprotectin, IgA that decrease the adhesion of *Candida* to the oral surfaces. The decrease or the complete absence of saliva in individuals with xerostomia induces the change and the imbalance of the normal microbial communities favouring the proliferation of bacteria as *Staphylococcus aureus* that inhibits the normal adaptation of the commensals. [20]

Denture age. Denture age is thought to be a predisposing factor for the development of denture stomatitis, mainly due to the poor possible fitting of the denture, roughness of its surface, impossibility of adequate cleaning and accumulation of plaque and microbial pathogens. [21]

Systemic conditions. A variety of systemic conditions may also predispose the individuals to candida associated denture stomatitis. Malnutrition, as it occurs in high carbohydrate diets, deficiencies in iron, folate or vitamin B12, hypoenocrine states such as hypothyroidism, Addison's disease (adrenocortical insufficiency), diabetes mellitus, blood disorders (acute leukemia, agranulocytosis), immune disorders such as HIV infection, thymic aplasia, xerostomia due to irradiation, drug therapy, cytotoxic drug therapy and Sjogren's syndrome. [22]

Nocturnal denture wearing. Nocturnal denture wear plays a role in the etiology of denture stomatitis. Nocturnal and continuous prostheses wear could reduce the protective effect of saliva, decrease the cleaning effect of the tongue, prevent proper oxygenation of the palatal mucosa and, finally, increase local trauma to the mucosa. These effects make denture wearers more prone to mucosal mechanical and microbial injuries and, therefore, increase the risk of denture stomatitis. [23]

3. THERAPY

Patients with denture stomatitis should be examined for the adequacy of the dentures. Thorough evaluation and correction of oral and denture hygiene measures should be done and nocturnal wearing of dentures should be discouraged. Emphasis should be made on twice weekly soaking of dentures for 15–30 min in white vinegar (diluted 1:20), 0.1% hypochlorite solution (diluted Milton's solution), or chlorhexidine solution. [24] Denture stomatitis can be effectively managed with antifungal agents, and the condition shows complete resolution within 12–14 days. [25] 2% Miconazole, available in gel form, can be applied (two to three times daily for 1 or 2 weeks) directly to the previously cleaned denture surface. Nystatin is another topical antifungal agent used in cases of denture stomatitis. It can be used in the form of liquid suspension, cream and pastille. However, systemic antifungal agents should be reserved for cases which do not respond well to topical antifungal therapy. Fluconazole (FLZ) has been widely used because the drug is economic, has lower toxicity and has high bioavailability. Ketoconazole is also used systemically in a single dose of 200 mg during 14 days. This is a hepatotoxic drug and can result in cardiac arrhythmias when used in combination with antihistamines or macrolide antibiotics. Amphotericin B was previously used in the treatment of Candida associated denture stomatitis. However, its use has shown a decline because it is extremely nephrotoxic and is administered intravenously. [26]

There are many evidences showing a new alternatives, such as the use of microwave irradiation at a specified setting and exposure time, are bactericidal and fungicidal. [27,28] But so far, there has been only few studies reported the use of microwave irradiation to sterilize microorganisms on denture surfaces. Rohrer and Bulard [29] showed that microwaving at high setting for eight minutes would sterilize acrylic dentures contaminated with *C. albicans* suspension. Ribeiro D et al. [30] in their study evaluated the clinical effectiveness of two exposure times (2 and 3 minutes) of microwave irradiation on the disinfection of complete dentures and concluded that microwave irradiation for 3 minutes may be a potential treatment to prevent cross-contamination. Thomas and Webb [31] demonstrated that microwaving of dentures at medium setting (350W, 2450 MHz) for six minutes caused minimal change which was considered to be harmless in the long-term.

Laser beam, cryosurgery, electrosurgery and scalpel surgery are successfully practiced in treating the infection, especially for type II and type III infection. Implant overdentures can be effective in controlling denture stomatitis by preventing trauma to the oral mucosa in edentulous elderly. [32]

4. CONCLUSION

Having in mind that the denture stomatitis is the most common inflammatory reaction that occurs in the carriers of dentures, being mostly asymptomatic, it is desirable that these patients schedule regular dental checks for early diagnostics of changes and their treatment. The choice of treatment depends on the cause of a change. In most patients, the removal of mechanical and traumatic factors, as well as good oral hygiene and hygiene of dentures, yields satisfactory results.

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