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Review Article

Epidemiology, etiology, and treatment of denture stomatitis

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ABSTRACT

Multiple factors are involved in the pathogenesis of denture stomatitis, which increases the risk of tissue infection and inflammation. These factors include poor oral hygiene, trauma secondary to poorly fitting prostheses, resin porosity, and bacterial plaque accumulation. Our present review discusses the epidemiology, etiology, and treatment of denture stomatitis based on data from current studies in the literature. The prevalence of denture stomatitis is significantly variable among the different studies, as previously discussed. However, the cumulative incidence of denture stomatitis among their participants ranged between 17-77%. These hugely variable rates have been attributed to the nature of data collection, diagnostic criteria, sample size, and patient demographics. Studies also show that the condition is more prevalent among elderly females. However, not many studies have reported this correlation, indicating the need for future studies. *Candida albicans* infection is the primary parameter in the etiology and pathogenesis of the condition. However, other factors related to the patient (like status of immunological response) and dentures (like hygiene) were also reported. Therefore, the management of denture stomatitis should be based on applying adequate interventions. Besides, using antifungal medications is also necessary to eradicate organism.

Keywords: Denture stomatitis, *Candida albicans*, Oral infection, Prosthesis

INTRODUCTION

Estimates show that denture stomatitis is among the most commonly reported disorder among dental prosthesis users.[1] Multiple factors are involved in the pathogenesis of denture stomatitis, which increases the risk of tissue infection and inflammation. These factors include poor oral hygiene, trauma secondary to poorly fitting prostheses, resin porosity, and bacterial plaque accumulation.[2,3] About two-thirds of upper complete denture users suffer from this condition. Most of the affected patients are usually asymptomatic, and the condition mostly occurs in the palatine mucosa. However, it should be noted that some patients might have some

clinical manifestations. These include burning sensations, pain, halitosis, and pruritis.[4]

The diagnosis of denture stomatitis is mainly dependent on clinical manifestations. These include the presence of edema and erythema on the palatal gingiva and mucosa covered by denture base.[5] In addition, infections by *Candida albicans* are usually associated with many cases. Therefore, further workup might be needed when this etiology has been determined.[6,7] It should be noted that the epidemiology and etiology of the condition are inconsistent among different studies. Accordingly, we will discuss the epidemiology, etiology, and treatment of denture stomatitis in a comprehensive literature review.

LITERATURE REVIEW

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases on which was performed 3rd December 2021 using the medical subject headings (MeSH) or a combination of all possible related terms, according to the database. To avoid missing poetential studies, a further manual search for papers was done through Google Scholar, while the reference lists of the initially included papers. Studies discussing Epidemiology, etiology, and treatment of denture stomatitis were screened for useful information, with no limitations posed on date, language, age of participants, or publication type.

DISCUSSION

Epidemiology

Many previous epidemiological studies have assessed the prevalence of denture stomatitis within different global settings. Among the various studies in the literature, estimates show that the prevalence of denture stomatitis among different adult populations ranges between 15-71%. These studies recruited patients from long-term care facilities, nursing homes, and community settings. For example, studies in Turkey, Spain, Slovenia, and Denmark reported that the prevalence of denture stomatitis in their population was 18.5%, 19.6%, 14.7%, and 65%, respectively, among denture wearers.[8-11] The study conducted in Denmark and reported high prevalence rate showed that this is attributed to the high prevalence of correlated candida infection and bad oral hygiene in their elderly population.[11] Another 2 population-based studies were also conducted in Finland. One of these studies included home-living elderly residents using a stratified sampling technique, while the other 1 included a national sample. The authors reported that the prevalence of denture stomatitis among the two studies was 35% and 48%, respectively.[12,13] The Finnish national-based survey indicated that around 44% of adults in Finland have denture stomatitis. Another national-based investigation was also conducted in Germany and reported different rates of denture stomatitis for different age groups. The authors estimated that the prevalence of condition was 18.3% and 2.5% for participants aged 65-74 and 34-44 years old, respectively.[14]

A previous study in Denmark aimed to estimate the prevalence of denture stomatitis among elderly denture wearers that were recruited from long-term care facilities and nursing settings and found that the prevalence was 34%.[15] On the other hand, another study reported that the prevalence of the condition was as twice as much as the reported prevalence in this study among community-dwelling elderly. Furthermore, previous studies in Finland also reported that the prevalence of denture stomatitis among institutionalized and home-living denture wearers was 25% and 35%, respectively. Other investigations were also conducted in South America. For instance, two previous studies in Brazil reported that the prevalence of denture stomatitis among elderly denture wearers in long-term care facilities was 54%-58.2%.[16,17]

On the other hand, another study from Chile reported that the prevalence of the condition was 34.5%. Other investigations in the literature assessed the prevalence of denture stomatitis among patients visiting prosthetic and dental clinics for replacement, adjustment, or treatment of dentures. These studies were conducted in different global communities, and cumulative incidence of denture stomatitis among their participants ranged between 17-77%. It has been suggested that the different sample sizes among the included studies were a significant factor for the different prevalence rates among these studies.[18]

Other studies also assessed the prevalence of denture stomatitis among men and women. For instance, the two previous Finnish investigations reported that the condition's prevalence was significantly higher among females. This has also been indicated in another investigation in Slovenia. In addition, another study in Chile reported that the prevalence of denture stomatitis was also lower among males than females (25.1% versus 38.7%, respectively).[1,18] However, it should be noted that not all of included population-based investigations reported the potential differences in prevalence of denture stomatitis between males and females. For instance, other studies from Brazil reported no significant association between gender of included participants and prevalence of denture stomatitis. In addition, it should be noted that some studies might have had limitations regarding sample size and data collection, which might have significantly influenced their outcomes. Therefore, further studies might still be needed for further elaboration.[18]

Etiology

The pathogenesis of denture stomatitis is mostly attributed to *Candida albicans* infection.[4] The organism is naturally present within the mouth. However, certain conditions might turn it into pathogenic and cause the disease. Severe factors were reported in this context. These include malignant diseases, immunological and endocrine disorders, diabetes mellitus, HIV,

immunosuppression, xerostomia, poor oral hygiene, tissue trauma secondary to inadequate occlusion, and continuous use of prostheses. Accordingly, the organism can invade oral tissues and break protective barriers of the oral mucosa.[19-21] However, it should be noted that different studies in the literature and previous reviews have concluded that the etiology of denture stomatitis is multifactorial.[22] Some studies also concluded that some risk factors might be associated with the patient's denture use. These include lack of appropriate denture hygiene, using mandibular versus maxillary dentures, increasing age of the used dentures, and induced inflammation and trauma secondary to wearing unfit dentures. Allergy from denture materials was also reported as a potential factor playing a role in the pathogenesis of denture stomatitis.

In this context, it has been demonstrated that bad oral hygiene is a crucial risk factor for the development of denture stomatitis. Furthermore, poor oral hygiene has been associated with different practices. For instance, some studies reported that poor oral hygiene is significantly associated with wearing prostheses while sleeping. In the same context, a previous study reported that increased severity of inflammation, greater mucosal trauma, and increased Candida colonization of oral mucosa and dentures are significant events associated with poor oral hygiene. Some studies also emphasized the role of denture structure and materials in developing denture stomatitis.[1] The primary role that has been reported in the literature is the ability of organisms within the oral cavity to form a biofilm over these structures. Poor denture fit and associated trauma and inflammation were also reported to predispose to developing denture stomatitis significantly. Moreover, various demographic factors might be significantly associated with the pathogenesis and severity of denture stomatitis. These include compromised immune functions, the presence of comorbidities, smoking, female gender, and increased duration of wearing dentures.[18]

Treatment

Evidence indicates that poor oral hygiene is the most significant factor associated with the development of denture stomatitis. However, studies also show that other factors might be associated, including reduced salivary flow, smoking, poor denture adaptation and high carbohydrate diets. In addition, it has been furtherly demonstrated that localized Newton's type I inflammation might also be associated with around 50% of denture wearers with poor filling dentures.[10,23,24] Accordingly, it has been demonstrated that to increase the efficacy of prevention against denture stomatitis, further efforts should be exerted to enhance stability, retention, and support of removable dentures. Accordingly, it has been suggested that taking adequate care of oral hygiene is important in achieving adequate treatment of denture stomatitis. In this context, previous investigations reported that the quality of used prosthesis is important in intervening against the development of denture stomatitis and not methods used.[19,25,26] Therefore, many protocols were published to enhance quality of cleaning in this regard.[26,27] However, it has been shown that anti-fungal treatment is essential to enhance adequate treatment.[28-32]

A previous report showed that miconazole had been associated with favorable outcomes when treating denture stomatitis.[33] However, evidence shows that the medication should be applied following proper hygiene approaches over the prothesis of the affected patients. Accordingly, the medication would be giving more contact with the lesion, which can significantly enhance healing and promote healing. In addition, it has been shown that systemic anti-fungal modalities should be furtherly administered when there are no clinical signs of improvement.[34,35] An 89% positive treatment response was also reported following the oral application of fluconazole (50 mg/day for 14 days).[36]

On the other hand, these studies demonstrated that the response rate among placebo patients was very minimal. However, it has been reported that after four weeks of treatment, some cases relapsed. Accordingly, it has been concluded that other topical anti-fungal modalities might be more efficacious than fluconazole oral application. On the other hand, a previous study by Martin-Mazuelos et al reported a significant regression in microbiological (78%) and clinical (97%) signs following the application of fluconazole.[37] Moreover, the authors reported that patients with recurrence after treatment were treated with itraconazole (100 mg for 18 days). This has been associated with a 77% and 100% improvement in these patients' microbiological and clinical signs.

Previous investigations also compared the efficacy of itraconazole and fluconazole in reducing mycological cultures and palatal erythema.[31,38,39] It has been found that the efficacy of both modalities was similar among different studies. However, it has been furtherly reported that some cases of disease persistence and organism recolonization were reported among these studies. Nystatin was also reported as an acceptable modality for managing fungal-related fungal stomatitis.[40] Using tables and suspensions of this modality for two weeks was also associated with enhanced treatment outcomes. In addition, a significant improvement in the clinical signs was observed when nystatin was combined with amphotericin B.[41] A previous study by Falah-Tafti et al compared the efficacy of fluconazole and nystatin and reported that treatment outcomes of denture stomatitis were more significant with nystatin, which has more abilities in reducing fungal colonization and binding.[42]

Moreover, it has been shown that the cost of the drug is not high, and the rate of nystatin fungi resistance is low compared to other anti-fungal medications.[43] Ketoconazole was also described among previous investigations as a potential treatment for denture stomatitis. However, it has been shown that the systemic administration of this drug is usually associated with

some adverse events. These include fever, abnormal tiredness, vomiting, nausea, and poor appetite.[44] The evidence further demonstrated that topical application of clotrimazole is usually associated with favorable outcomes when treating denture stomatitis.[45]

Mouthwash-based modalities were also reported in the literature. For instance, chlorhexidine digluconate (0.12%) was used to treat denture stomatitis and eliminated *Candida albicans* from the affected patients. It has been furtherly reported that this drug might also eradicate essential enzymes involved in the pathogenesis of fungal infections.[28,46] In addition, candida-induced stomatitis can also be effectively managed by a novel modality called photodynamic therapy. In this context, it has been reported that the most commonly used photosensitizers include porphyrin derivatives, toluidine blue, and methylene blue.[47-49] Further studies also evaluated the efficacy of nanomaterials in preventing denture stomatitis among susceptible patients.[50] Findings from the majority of relevant investigations show that all of the proposed anti-fungal modalities are usually effective in managing denture stomatitis, with variable clinical and microbiological outcomes. However, most of these modalities are generally accepted for managing candida-based denture stomatitis.

CONCLUSION

The prevalence of denture stomatitis is significantly variable among the different studies, as previously discussed. These hugely variable rates have been attributed to the nature of data collection, diagnostic criteria, sample size, and patient demographics. Studies also show that the condition is more prevalent among elderly females. However, not many studies have reported this correlation, indicating the need for future studies. *Candida albicans* infection is the primary parameter in the etiology and pathogenesis of the condition. However, other factors related to the patient (like the status of immunological response) and dentures (like hygiene) were also reported. Therefore, the management of denture stomatitis should be based on applying adequate interventions. Besides, using anti-fungal medications is also necessary to eradicate the organism.

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