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Denture Stomatitis – A Clinical Update

Abstract: Denture stomatitis is a benign condition, usually asymptomatic, that can affect edentulous patients. Studies have reported a prevalence of denture stomatitis affecting over 75% of denture wearers and, whilst the aetiology may be multifactorial, *Candida albicans* has a strong association with the condition, along with denture trauma and poor denture hygiene being associated local risk factors. This paper describes the aetiology, diagnosis and treatment of denture stomatitis, with the aim of helping clinicians to provide appropriate management of this condition.

CPD/Clinical Relevance: Denture stomatitis can be a recurrent problem amongst denture wearers and is often asymptomatic to the patient. Dental practitioners should be able to identify and manage this condition.

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Denture stomatitis (DS) is a benign and common disorder that affects denture wearers. It may be described as a chronic inflammation, with erythema of the oral mucosal tissues supporting a removable prosthesis,[1] and is not caused by an allergy to the denture's constituents. DS has also been known by other names including 'chronic denture palatitis', 'chronic atrophic candidiasis', 'denture sore mouth' and 'denture-induced candidiasis'. The condition is usually asymptomatic, but can give rise to bleeding of the affected areas of mucosa, a burning sensation, halitosis, a bad taste and xerostomia.[2,3] The prevalence of DS ranges from 15–77.5%[1,4,5] and, whilst a higher incidence has been reported in the elderly and females,[1,5,6] this is not always the case.[7] This marked difference in prevalence can be attributed to different populations of patients studied. Various studies have found that those patients that are institutionalized are especially susceptible to DS, possibly as a result of their impaired immune system, overall general health, xerostomia, decreased motor function leading to an inability to carry out good oral hygiene, and the reliance on others to carry out oral hygiene measures.[8,9,10]

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Presentation

Denture stomatitis can affect both partial and complete denture wearers,[2] although is commonly seen on the palatal mucosa beneath a maxillary complete denture.[1,5,11] DS rarely affects the lower arch, possibly as a result of the washing effect of saliva and the cleansing action of the tongue, whereas in the upper arch the prosthesis may have a better peripheral seal and thus contain its own micro-environment.[12]

The most widely used classification for DS is that of Newton[11] who classified the condition according to the clinical appearance of the inflamed mucosa underneath the denture:

- Type I (Figure 1): localized areas of inflammation, possibly caused by trauma;
- Type II (Figure 2): generalized erythema covering the denture-bearing area. This is the most common presentation;[9]
- Type III (Figure 3): inflammatory papillary hyperplasia, usually affecting the hard palate or alveolar ridges.

The condition was later re-classified by Budtz-Jorgensen and Bertram[13] according to the type of inflammation observed on the mucous membrane (Table 1).

Aetiology

The aetiology of DS appears to be multifactorial.[1,5,12] *Candida albicans* has been shown to be highly implicated in the aetiology of DS,[1,8,12,14] and may account for 90% of cases of denture stomatitis.[15] However, a number of bacteria, such as Staphylococcus, Streptococcus, Fusobacterium and Bacteroides species,[9] can also be involved. Candida's change in role from commensal to parasite occurs when there is a change in the immune balance between host and fungus. It is the host's weaker defence mechanisms and the presence of ideal growth conditions for the Candida that allows the tissue irritation.[8,9] Acrylic resin has been shown to be suitable for fungi to colonize,

providing suitable conditions for adherence and proliferation, and this is also the case with the use of resilient soft linings as they have a relatively high surface porous texture.

Risk factors

Not all denture wearers suffer from DS, and a number of local and systemic factors have been shown to predispose an individual to the condition (Table 2). Long-term soft tissue trauma from poorly fitting or unstable dentures, patients with parafunctional habits, or those with surface roughness have been associated with Newton Type I lesions,[5,13] the inflammatory changes arising as a result of increased occlusal loading[16] and an increase in Candida receptor molecules within the tissues. Patients who wear implant-supported prostheses that have a greater distribution of occlusal loads compared to conventional prostheses have been shown to have significantly decreased numbers of DS episodes.

In addition, the relatively rough-fitting surface of the denture facilitates the retention of micro-organisms, and may act as a reservoir. Surface irregularities can also shield micro-organisms from physical oral hygiene measures.

Poor denture hygiene allows the increased growth of pathogenic micro-organisms within the dental plaque on the fitting surfaces of dentures, and there is a strong association between lack of denture hygiene and Newton Type II and III lesions.[1,5,12] Continuous wearing of a denture, especially at night, allows Candida to colonize the biofilm on the mucosa under the denture.[17] A relatively anaerobic environment is created with a decreased pH, which favours the growth of Candida. In addition, saliva is prevented from being able to cleanse the denture-bearing area and allows proliferation of pathogenic species.[13] Dentists may also not be very attentive towards the quality of denture hygiene in their patients.[18]

Smoking is a systemic risk factor for DS, and smokers have been shown to have increased rates of *Candida* coverage[19] and increased chances of being an oral Candida carrier. The exact reason why smokers are predisposed to DS is unclear, but it is thought that aromatic hydrocarbons in smoke cause localized epithelial alterations.

Denture wearers with a high sugar intake in their diet are also at greater risk of DS as a result of glucose being able to stimulate the growth of Candida species and increasing the adhesion of fungi within the dental plaque. Sugar consumption may be just as significant as poor denture hygiene in the development of DS.[8]

Other systemic factors have been shown to predispose denture wearers to DS, and these include: nutritional deficiencies (iron, folate, Vitamin B_{12}),[5,21] immune deficiencies (HIV),[5,20,21] the use of broad spectrum antibiotics,[5,15,21] corticosteroid therapy,[5,20,21] xerostomia[21] and radiotherapy to the head and neck area.[21]

Diagnosis

Diagnosis can be based upon the clinical appearance of a well-demarcated area of erythema corresponding to the fitting surface of the denture. Tissue biopsy is not usually warranted unless there are other suspicious features of the condition. If a biopsy were to be taken, histology will show evidence of proliferative or degenerative responses, along with reduced keratinization and epithelial atrophy. A Gram-stained smear of the palate can demonstrate the presence of Candidal hyphae, and swabs can also be taken of the fitting surface of the denture.

Management

It is important to treat all patients with DS, even if the condition is mild and asymptomatic, to prevent it progressing to the Type III form when a surgical option (scalpel, cryosurgery, laser

Figure 1. Newton's Type I denture stomatitis showing areas of localized inflammation.

Figure 2. Newton's Type II denture stomatitis showing generalized erythema covering the denture-bearing area.

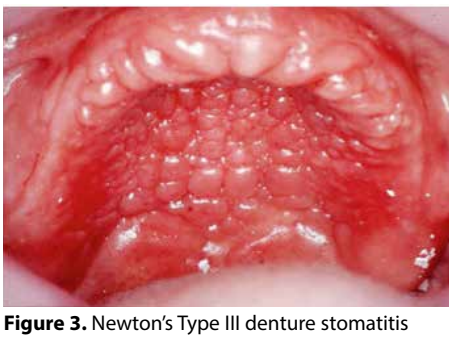

Figure 3. Newton's Type III denture stomatitis showing inflammatory papillary hyperplasia.

	Newton, 1962[11] (Clinical Appearance)	Budtz-Jorgensen and Bertram, 1970[13] (Inflammation Observed)
Type I	Localized inflammation	Simple localized inflammation
Type II	Generalized erythema covering the denture-bearing area	Simple diffuse inflammation
Type III	Inflammatory papillary hyperplasia	Granular inflammation

Table 1. The classifications of denture stomatitis.

Local Risk Factors	Systemic Risk Factors
■ Denture trauma ■ Poor denture hygiene ■ Nocturnal denture wear	■ Smoking ■ Diabetes ■ Nutritional deficiencies ■ Immune deficiencies ■ Broad spectrum antibiotics ■ Corticosteroid therapy ■ High carbohydrate diet ■ Xerostomia ■ Radiotherapy

Table 2. Local and systemic risk factors for denture stomatitis.

Treatment Options	
Management of underlying systemic disease	■ Smoking cessation advice ■ Dietary advice ■ Liaison with GMP ■ Salivary substitutes
Improve fit of poorly-fitting dentures	■ Smooth rough areas of denture ■ Use of tissue conditioners ■ Provision of new denture
Improve denture hygiene	■ Improved brushing of denture ■ Leaving denture out at night ■ Use of sonic bath ■ Soak dentures in hypochlorite ■ Microwave disinfection
Use of topical and systemic antifungals	■ Miconazole oral gel ■ Fluconazole capsules ■ Nystatin oral suspension

Table 3. Treatment options for denture stomatitis.

a

b

Figure 4. (a, b) *Viscogel* (Dentsply) is a suitable tissue conditioner.

Figure 5. A complete upper denture relined with *Viscogel* (Dentsply) tissue conditioner.

surgery or electro-surgery) is likely to be needed for management. In addition, patients suffering from DS may also develop angular cheilitis, classically presenting as bilateral erythematous fissuring at the corners of the mouth. The treatment of DS should target the aetiological and risk factors discussed earlier, and a number of treatment modalities may be needed (Table 3).

Management of underlying systemic disease

This is needed not just for the patient's overall general health, but also to ensure that any underlying systemic risk factors for DS are investigated and reduced, where possible, and liaison with the patient's GMP may be needed. All smokers should be offered smoking cessation advice, and some patients may benefit from dietary advice (especially in relation to carbohydrate intake), and some may benefit from the prescription of saliva substitutes for the treatment of xerostomia.

Improving the fit of poorly fitting or unstable dentures

This is needed in order to eliminate soft tissue trauma from the denture. Treatment may involve smoothing rough areas of the fitting surface of the denture, relining the denture, or remaking the denture.

If a new denture is prescribed, the elimination of tissue inflammation should be achieved before new impressions are taken. Tissue conditioners, such as *Viscogel* (Dentsply, Weybridge, UK) (Figures 4a and b) can be used to improve the fit and stability of existing dentures temporarily, as well as reduce inflammation of the mucosa (Figure 5). Anti-fungal agents have previously been incorporated into soft lining materials, but with limited success. Tissue conditioners should be used with caution as they have been shown to promote the growth of Candida and can also be difficult for patients to keep clean, resulting in the persistence of inflammation. Continuous cleaning of these conditioning materials can also alter their structure and properties through water absorption,

leading to hardening and distortion.[22] The use of a sponge to aid cleaning of soft linings has been suggested, but this can result in less thorough cleaning. If tissue conditioners are used, regular review of the patient should be carried out in order to check that the tissue conditioner is still viable, as their rapid deterioration can cause further mucosal trauma. Repeated replacement may be needed.

Improvement in denture hygiene

This is needed to reduce the micro-organism populations on the fitting surface of the dentures and is an essential part of management. Various methods of denture hygiene have been advocated, and active methods appear to be more successful than passive methods.[23] Effective active methods for cleaning dentures are thorough brushing of the denture in combination with the use of a non-abrasive proprietary paste or warm soapy water, and this should be carried out after every meal. Resolution of DS has been shown to be hastened if the patient can remove the dentures for an extended period of time (up to six weeks),[17] although patients may not be willing to do this. However, it is essential that patients remove their dentures at night. It is now deemed acceptable to leave dentures to dry out overnight as firstly, organisms that inhabit the biofilm do not survive prolonged drying out and secondly, there is no evidence that leaving dentures to dry out overnight will cause the acrylic to warp.[24] Improved denture hygiene is key to treating all types of DS and patients must understand the importance of their own denture hygiene regimen. The use of a sonic bath filled with suitable cleaning solution can also be beneficial, and these are relatively inexpensive for the patient to purchase.

Passive methods of denture cleaning include soaking the dentures in antimicrobial mouthrinses and microwave disinfection. Chlorhexidine mouthwash is widely available and exhibits good antibacterial and antifungal properties. Acrylic dentures that are soaked in 2% chlorhexidine solution have inhibited Candida growth, and a 2% chlorhexidine solution has also been found to prevent the adherence of Candida for a longer period of time when compared to other antifungal solutions, such as Amphotericin B and Nystatin. However, as soon as treatment was stopped, DS recurred.[25] This, along with the fact that, as chlorhexidine gluconate mouthrinse is only available as a 0.2% solution in the UK, the use of chlorhexidine should only be considered for controlling plaque, but not for inhibiting the growth of Candida. In addition, 0.2% chlorhexidine solution is not normally recommended to be used daily as a denture cleaner, as this may lead to staining of the denture and altered taste.

Sodium hypochlorite solution can be used to soak dentures, and this can lead to a significant reduction of both Candida and plaque. Patients suffering from DS should soak acrylic dentures twice daily for 15 minutes in a 0.02% (50 parts water in 1 part *Miltons)* solution. This method of disinfection should be used for short periods of time only as the hypochlorite will eventually bleach the acrylic resin and corrode any metal components.[26]

The use of a 'denture box'[27] has been suggested to aid disinfection of dentures, especially for those wearers with dexterity problems.

In addition to methods of thorough cleaning of the denture itself, the use of a toothbrush to clean the palate after every meal and at night for a period of three months can reduce palatal inflammation, and patients who carry out this regimen are nearly four times as likely to stay in remission of DS. This may be as a result of the palatal biofilm being removed, leading to increased keratinization, a reduction in the infiltration of inflammatory cells, and an increased proliferation of fibroblasts and collagen synthesis. The overall result is the formation of a mechanical barrier to microbial colonization.[28]

Microwave disinfection of dentures is a relatively cheap and safe method for cleaning dentures, and full sterilization of complete dentures has been achieved using a setting of 650W for 3 minutes. This process has been shown to be as effective as the use of topical anti-fungal agents for treating DS, and is favoured over anti-fungal treatments as it is unlikely to lead to resistant strains of Candida developing. However, this method of denture cleaning should be used with caution as the heat generated can alter the dimensional stability of the dentures.

Use of topical and systemic antifungal agents

This can be used to treat cases of DS that fail to respond to local, conservative measures. Antifungal agents should not be used as a sole treatment modality as, whilst antifungal medication can significantly reduce palatal inflammation, if they are prescribed in isolation without assessment of underlying causes, relapse occurs within 2–4 weeks of stopping treatment.[29,30] However, the benefits of using an antifungal medication are enhanced if used in conjunction with improved denture hygiene.[29] If antifungal medication is used, one of the following drugs is recommended[26] to be prescribed for a treatment period of 7 days:

- Miconazole 24 mg/ml gel – applied to the fitting surface of the denture four times daily;
- Fluconazole 50 mg capsules – one to be taken daily;
- Nystatin 100,000 units/ml oral suspension – 1 ml oral rinse four times daily after food for five minutes, and then swallowed.

The topical application of miconazole gel has the advantage in that the drug is held in close contact with the affected mucosa for a long period of time, and is available in a sugar-free presentation. Miconazole gel can be beneficial for patients with poor compliance for removing their dentures at night, and can also be used for the treatment of angular cheilitis as it is effective against *Staphylococcus aureus.* Its use should be continued for 48 hours after the lesions have healed. Care should be taken for patients undergoing anticoagulant therapy as miconazole has been shown to enhance the effect of warfarin. The use of systemic fluconazole may have the added benefit of eliminating yeasts that are present in the gastrointestinal tract, but should not be prescribed for patients taking warfarin or statins, and fluconazole should not be prescribed for a period of longer than 14 days duration. Nystatin oral suspension can be prescribed where the use of miconazole or fluconazole is contra-indicated. If nystatin oral suspension is used, patients must be

instructed to remove their dentures whilst rinsing, otherwise the drug is unlikely to come into contact with the inflamed mucosa.

Recent developments

Further proposed ideas to prevent the recurrence of DS include:

- The use of polymerized coatings on the denture surface to reduce the adherence of *Candida albicans*;
- Incorporating Candida-specific antibodies within the denture material; and
- The use of antifungal agents within the denture material.

Conclusion

Denture stomatitis is a condition that commonly affects denture wearers, and should be treated even if asymptomatic. The condition requires a combined treatment approach from both patient and clinician, and the role of the patient must be stressed. Management of aetiological risk factors is key in order to prevent recurrence. Treatment modalities may include:

- Treatment of any underlying systemic risk factors;
- Improvement in the fit of existing dentures;
- Replacement of existing dentures;
- Improved denture hygiene; and
- The use of antifungal agents.

Whichever methods are employed, the main aim of treatment is to eradicate the biofilm from the patient's dentures. Regular review of patients suffering from DS is essential in order to ensure long-term successful treatment of the condition.

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