Effect of glycemic control on candida colonization on complete denture wearers of diabetic patients

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Objective: To assess the prevalence of Candida Albicans colonization among type 2 diabetic patients using dentures and to investigate the importance of glycemic control in limiting the presence of colonies.

Methodology: This observational prospective cohort study was carried out at the Royal Medical Services Hospitals from September 2021 to January 2022. Endocrinologist and Prosthodontist were involved in enrolling candidates for the study which included 96 patients. Denture wearers with type II diabetes were considered as the study group while denture wearers who are not diabetic were considered as controls. Samples were collected from the impression surface of the maxillary denture by scraping it with a sterile swab. Plates were examined for candidal growth after the 48 hours.

INTRODUCTION

Oral candidiasis is one of the most commonly encountered fungal infections that attack the oral mucosa through building up candidal colonies, especially in denture wearers. It can manifest itself as pinpoint or generalized erythematous, and or papillary lesions. However, candidal colonization does not always result in an actual symptomatic infection. Among the various candida species that may colonize the oral cavity, candida albicans is the commonest. It is also considered the most common virulent fungal variety of the candidaspecies. Other candida species that may colonize the oral cavity are candida tropicalis, candida glabrata, candida parapsilosis, candida stellatoidea, candida krusei and candida kefyr. Nevertheless, only few of them are able to attain virulence and cause candidiasis.

There are multiple factors that predispose to candida infection in the oral cavity, and these include tobacco smoking, long-term denture wearing, and poor oral hygiene, taking certain medications or antibiotics, and disorders with immunosuppression like diabetes mellitus (DM). Such factors are suggested to cause infection through surging the virulence and adherence of candida species. According to 9th edition of IDF atlas, there were 463 million people living with DM in 2019 and these were extrapolated to be 700 million in 2045. In Jordan, prevalence of T2DM had increased from 14% in 1990, to 16% in 2020 and is predicted to reach 20.6% in 2050.

It is well established that candida colonization is higher in diabetic patients in comparison to non-diabetics. Higher levels of salivary glucose, reduced flow of saliva, microvascular degeneration, and impaired cellular immunity affecting polymorphonuclear cells, lymphocytes and monocytes contribute to this. The aim of the study was to assess the prevalence of Candida albicans colonization among T2DM patients in denture wearers and to investigate the importance of glycemic control in limiting the presence of colonies.

METHODOLOGY

After receiving the ethical committee approval of the Royal Medical Services, this study was held in the Royal Medical Services Hospitals from September 2021 to January 2022. Out of 176 patients who were referred to the prosthodontist from the endocrine clinic, 96 met the inclusion criteria of the study. All patients gave an
informed consent for the study. Their diabetic status was determined by searching into their medical records, and then confirmed by laboratory testing; HbA1c was used to determine their diabetic status.

According to American Diabetes Association (ADA), the diabetic study group was subdivided into: a controlled diabetes group with HbA1c of less than 7%, and a non-controlled group with HbA1c of more than 7%. People without any diabetic history and a Fasting Blood Sugar of less than 100 mg/dl on two separate occasions confirmed by HbA1c of less than 5.7% were considered a control group sample. Excluded patients were recently diagnosed DM, patients who had received oral or systemic antibiotics and/or corticosteroids in the past six months, patients sleeping with their dentures, patients who are actively smoking, patients with poor oral hygiene.

The dental examination was performed and prosthodontist evaluated the dental condition of the mucosae and the dentures. Oral hygiene and sleeping habits were assessed. Patients were categorized into three groups: non-diabetic group (control group), controlled diabetes, and uncontrolled diabetes. Samples were collected from the impression surface of the maxillary denture by scraping it with a sterile swab, and immediately sending the swabs to the laboratory to be inoculated for microbiological examination. They were inoculated on Saboroura dextrose agar culture medium and incubated at 37 degrees for two days. Plates were examined for candida growth after the 48 hours.

Statistical Analysis: The data were analyzed using SPSS version 26. A p < 0.05 was considered statistically significant.

RESULTS
Out of 96 patients, 43.8% were males and 56.2% females. Mean age was 65.4 ± 9.8 years. Out of 96 patients, 55 tested positive for oral Candida (57.3%), while 41 tested negative (42.7%). Among the non-diabetic patients, 40% tested positive to oral Candida, compared to 65.2% among the diabetic patients (Table 1). Among the diabetic patients, 79.4% of patients with non-controlled blood sugar levels tested positive for oral Candida, compared to 50% among the controlled blood sugar levels group (Fig. 1).

Table 2: Swab results.

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic No</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>40.0%</td>
<td>60.0%</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>65.2%</td>
<td>34.8%</td>
</tr>
<tr>
<td>Positive</td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Controlled Yes</td>
<td>16</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>50.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>No</td>
<td>27</td>
<td>79.4%</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>20.6%</td>
</tr>
</tbody>
</table>

Fig. 1: Effect of glycemic control.

Age and gender had no statistically significant effect on oral Candida swab results (p = 0.103 and 0.57, respectively). Diabetic patients were significantly more likely to test positive than non-diabetic patients were (p = 0.019). Amongst the diabetic group of patients, having a controlled blood sugar level was significantly associated with negative oral Candida swab results (p = 0.012).

DISCUSSION
Candida Albicans resides in the mouth as an integral part of its normal flora. The ability of the Candida species, however, to adhere to oral mucosa is thought to induce formation of the biofilm and consequent
formation of candida colonies. When this colonization takes place within and under denture, it causes mucosal palatal inflammation known as denture stomatitis. While fungal infection is considered the causative factor for denture stomatitis, other contributing and predisposing factors have been studied in the literature. These factors can either be local such as the age of dentures, ill-fitting dentures, poor denture hygiene, night time denture wearing, long term antibacterial or corticosteroids topical medications. Systemic factors on the other hand include smoking, long term antibiotics, and immunosuppressive diseases such as DM.

Hyperglycemia is believed to facilitate candida colonization through different mechanisms. The salivary glucose levels are substantially increased in diabetics due to increased permeability of basement membrane of the salivary glands. Glucose is suggested to function as a necessary energy source for Candida for production of biofilm with the consequent formation of polysaccharide matrix. That also leads to protect the Candida against environmental challenges. In addition, the salivary PH was found to rapidly decline, and Alkaline Phosphatase and acid proteases production triggered which promotes growth and adherence of Candida species on the mucosal surfaces of the oral cavity.

In the present study, 40% of the non-diabetic patients tested positive to oral Candida, in comparison to 65.2% among the diabetic patients. These results confirmed the results of Belazi et al who recovered Candida from 64% of a diabetic group, and a 40% from the non-diabetic control group. Kumar et al as well found as high as 68.52% of type 2 DM group and 27% out of their diabetes-free control group to carry Candida in their oral cavity. This is similar to several earlier studies, which also found that candida colonization is significantly higher in diabetic patients than non-diabetic ones.

Regarding gender, our study had shown no statistical difference between both genders with a p value of 0.57. On the other hand, Tasneem and Irshad demonstrated that female diabetics had shown more susceptibility to Candida albicans than male diabetics had. Other researchers had found a sort of female favor with 57.4% versus 42.6% for males.

Regarding glycemic control, mycological findings in our study showed an association between candida colonization and Hb A1C, in the form of a significant lower candidacount in controlled diabetics when compared to uncontrolled ones with a p value of 0.012. These results supported the results of Chouhan et al who reported a higher candida count in uncontrolled dm than the count in controlled DM. Kumaret al also stated that salivary candida carriage was significantly higher in an uncontrolled DM group when compared with a controlled diabetics group.

In addition, Hill et al found that HbA1c of more than 12% was strongly associated with oral yeast colonization and infection. Since denture stomatitis is asymptomatic, it might reach advanced papillary stages unnoticed by the patient. At these advanced stages, it is difficult to be treated in a conservative way, and might need surgical removal in addition to the usual antifungal treatment.

**CONCLUSION**

Our study highlights the importance of good glycemic control in ameliorating and preventing occurrence of candida infection in denture wearers. Regular follow up is considered one of the cornerstones in discovering the infection at an early stage. We advise for taking swab culture for every denture wearer whose blood glucose is uncontrolled in order to start treatment planning as soon as possible.

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Drafting of the article: Ruba Al-Qaisi.

Critical revision of article for important intellectual content: Ruba Al-Qaisi.

Statistical expertise: Ruba Al-Qaisi, Razan Aburumman.

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**Conflict of Interest:** None declared.

**Rec. Date:** Jan 9, 2022 **Revision Rec. Date:** May 14, 2022 **Accept Date:** May 28, 2022

**REFERENCES**


