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## Prevalence of Diabetes in Completely Edentulous Patients - A Retrospective Cross-Sectional Teaching Hospital Based Study

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**Abstract:** Diabetes is one of the most common systemic conditions seen in middle-aged and elderly people in India. It has severe health and lifestyle complications which have a negative impact on the health of the individual, one of them being poor oral health. Numerous studies have shown the correlation between diabetes and periodontal diseases. However, very few studies show a relation between diabetes and edentulism [partial and complete]. The aim of this study was to find a correlation between diabetes and complete edentulism in a teaching hospital-based study. A retrospective descriptive study was conducted using the patient records from June 2019-March 2020 and patients who were diabetic and completely edentulous at the time of the visit at a university dental hospital in Chennai were analyzed. Out of the 62 patients, the age group most commonly associated with complete edentulism was 51-70 years [69.35%] followed by 71+ age groups [17.17%]. The population showed an equal ratio of male to female patients. The most common period of edentulism in the 51-70 age group was 36 months. The same in the 30-50 age group was 3 months and in the 71+ age group, it was 12 months. Only 4.8% of the patients were smokers. The most common group with complete edentulism was found to be males between the age of 50-70 who had no other systemic conditions except for diabetes and had their period of edentulism to be 36 months with a prevalence of 11.2%. The study found a significant association between diabetes and duration of edentulism ( $p=0.012$ ). The limitations to the study are that other factors which might influence edentulism such as stress and socioeconomic status of the patient were not considered. The results might vary if a larger population with a greater geographic diversity will be studied. This study showed an association between diabetes and complete edentulism

**Keywords:** Age, diabetes, edentulism, hypertension, smoking.

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### INTRODUCTION

Replacement of missing teeth is an important step in maintaining proper oral hygiene whether it is done via prosthesis for single tooth replacement in the form of FPDs, implants (Kannan, 2017; Duraisamy *et al.*, 2019) (cement-retained, being the most common of implants. (Ajay *et al.*, 2017)) or multiple tooth replacements in the form of RPDs, CDs, etc. This has become a difficult task in patients with underlying systemic conditions which reduce the health and functionality of these prostheses due to the ill effect they have on the oral cavity. The main conditions which show this effect are hypertension, endocrine hormone deficiency and diabetes. Diabetes, along with its complications, presents to be one of the most significant chronic health problems in the world (International Diabetes Federation, 2015; Taboza *et al.*, 2018). It affects a large number of the population and has become one of the most important risk factors in old age. Several studies have linked diabetes with oral diseases like periodontitis and edentulism (Taylor, Preshaw and Lalla, 2013). A study by Jyothi *et al.* showed patients with partial edentulism in both the upper and the lower arches to be the most periodontally compromised (Jyothi *et al.*, 2017). Periodontitis can also cause problems in marginal integrity of all-ceramic restorations (Ashok and Suvitha, 2016; Ganapathy and Sathyamoorthy, 2016; Ranganathan and Ganapathy, 2017). A study showed Aloe vera is useful in reducing symptoms of periodontitis and bleeding gums (Subasree, Murthykumar and Others, 2016). This can be used by pregnant women who experience gingival inflammation (Basha, Ganapathy and Venugopalan, 2018). Periodontitis has been established to be a major complication of diabetes in the oral cavity.

Edentulism is also a common oral health condition in India with one study showing 13.1% of the population being completely edentulous (Memon *et al.*, 2018). It is known to serve as a terminal sign of ongoing systemic illness (Latif and Vieira, 2017). This has been proved by various studies performed across the board which successfully links the primary symptoms of multiple developing systemic conditions to be observed in the oral cavity.

There are numerous factors associated with edentulism, which include oral habits like smoking and tobacco chewing. Other factors include socioeconomic status, education attainment, access to care and physical and mental health (Friedman and Lamster, 2016). It has been shown that the presence of systemic conditions like uncontrolled diabetes mellitus type 2, hypertension, HIV status, obesity and poor mental health can lead to loss of dentition individually and collectively.

Smoking is a well-known cause for edentulism through its effect on marginal bone loss and periodontal health as well as an increased predisposition to tooth decay (Mai *et al.*, 2013). Tobacco, in analogous to smoking, also contributes to early loss of dentition. There is limited research to show the relation of diabetes and the development of complete edentulism. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

Hence, the aim of this study is to try and provide a link between diabetes and complete edentulism.

## MATERIALS AND METHODS

### Study Design and Setting

This retrospective study examined the records of 86000 patients between June 2019-March 2020 in which 916 patients were undergoing prosthetic rehabilitation in a university dental hospital in Chennai, were shortlisted based on the inclusion criteria/exclusion criteria. Ethical approval was obtained from the Institutional Human Ethics Committee (IHEC). The study population included patients who were diabetic and edentulous at the time of their first visit.

### Data Collection

The inclusion criteria for the study were

- Patients who were diagnosed as completely edentulous and who had a history/were under medication for Diabetes Mellitus
- Patients who knew the time period of their complete edentulism

Patients who were partially edentulous and became completely edentulous during subsequent visits were excluded from the study. Patients who were not aware of the time period of their complete edentulism were excluded in the study. Duplicate and incomplete patient records were excluded from the study. In total, 62 patients were included and divided into 3 different age groups such as 31 to 50 years, 51 to 70 years and 71+ years. Other details such as age, gender was also recorded. The data set was also reviewed by an external reviewer (Inter reviewer reliability  $k = 0.87$ ) to decrease bias.

### Statistical Analysis

Microsoft Excel 2016 (Microsoft Office 10) data spreadsheet was used to tabulate data and later exported to the Statistical Package for Social Science for Windows (Version 20.0, SPSS Inc., Chicago, Illinois, USA) and was subjected to Chi-Square test.

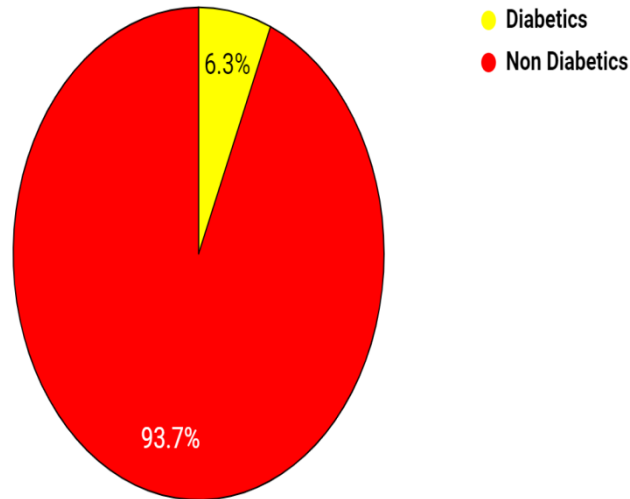
## RESULTS AND DISCUSSION

Out of the 916 patients diagnosed with complete edentulism, the final dataset consisted of 62 patients of Indian origin diagnosed with diabetes and complete edentulism. [Figure 1] The mean age of the patients was  $62.38 \pm 9.17$  years. The study showed an equal ratio of males [50%] to females. [50%] [Figure 2]. The age group most commonly associated with complete edentulism was 51-70 years with a prevalence of 69.35% which was followed by the 71+ group with a prevalence of 17.74%. [Figure 3] The most common period of edentulism in 51-70 age groups was found to be 36 months and that in the 30-50 age group was found to be 3 months. The average period of edentulism in the 71+ age group was 12 months.

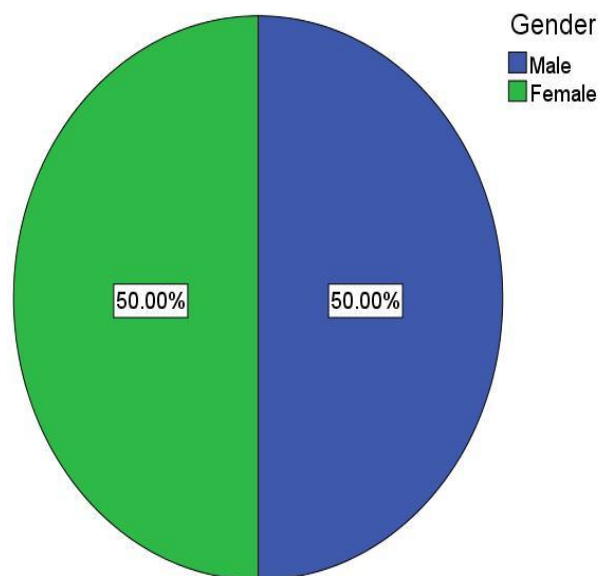
When treating a completely edentulous patient, the esthetics, function and comfort should be restored (Jain *et al.*, 2018). Any systemic condition that the patient might have lagged the process of prosthetic rehabilitation as it hinders the prosthesis from being useful. For example, prosthesis in patients with bony defects is imperative but it is difficult to place a normal prosthesis due to the defect. (Ashok *et al.*, 2014). Hence it is important to

consider the condition before deciding on the type of treatment. The link between diabetes and edentulism, though not established strongly yet, still exists because of compelling evidence strongly yet, still exists because of compelling put forth by various studies.

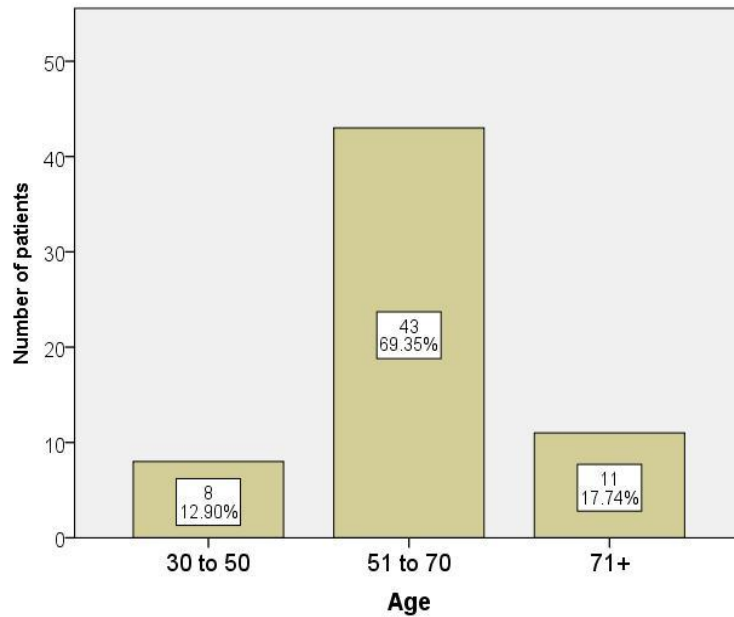
Frequency of diabetes among completely edentulous patients.



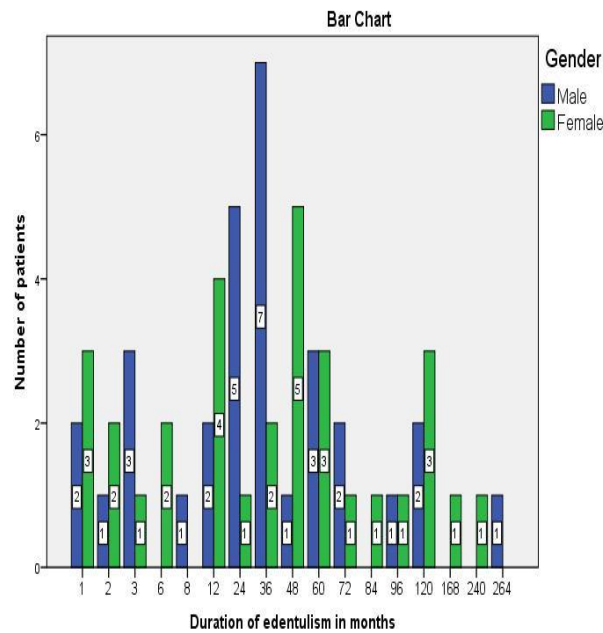
**Fig.1: Pie chart representing the number of completely edentulous patients who were diabetic. Total percentage of diabetic patients are represented by yellow and the total number of non-diabetic patients are represented by red. The figure above shows 93.7% of the 916 completely edentulous patients to be non-diabetic and only 6.3% of the completely edentulous patients to be diabetic. The study had a very small number of diabetic patients, so the results may not hold much validity.**



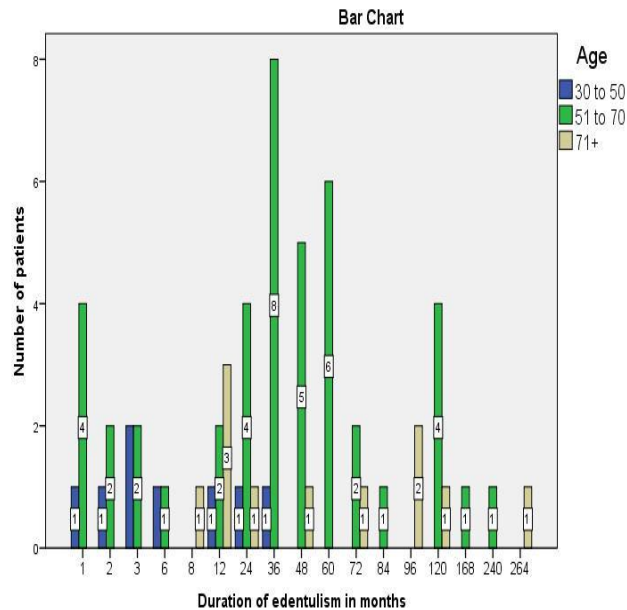
**Fig.2: Pie chart representing the male to female ratio of the completely edentulous patients who were diabetic. Male patients with diabetes are represented in blue while female patients with diabetes are represented in green. The study had an equal male to female ratio with both the genders having 50% prevalence.**



**Fig.3:** Bar graph representing the frequency of the age groups of the population under study. The X axis represents the age groups and the Y axis represents the frequency of completely edentulous patients who were diabetic. The highest frequency was shown by the 51 to 70 age group [69.35%] followed by the 30 to 50 age group [12.90%]. The age group of 71+ showed a frequency of 17.74%. The study had a high population of completely edentulous diabetic patients between the age of 51 to 70 years.



**Fig.4:** Bar Graph representing the association between gender and duration of edentulism in months. X axis represents the various duration of edentulism in months recorded in the study and the Y axis represents the frequency of the patients having the particular duration of edentulism in months. Completely edentulous diabetic male patients are represented as blue and completely edentulous diabetic female patients are represented as green. The most frequent duration of edentulism in males was noted to be 36 months and the most frequent duration of edentulism in females was noted to be 48 months. There was no significant difference seen in the duration of edentulism between males and females. Chi-Square test was done and the association between the gender and the duration of edentulism in months was found to be statistically not significant, since p value was found to be  $p=0.33(p>0.05)$ .



**Fig.5: Bar Graph representing the association between age and duration of edentulism in months. X axis represents the various duration of edentulism in months recorded in the study and the Y axis represents the frequency of the patients having the particular duration of edentulism in months. The patients aged 30 to 50 years are represented in blue, patients aged 51 to 70 years and beige represents the patients aged above 71 years. The most frequent period of edentulism was seen to be 36 months in the 51-70 age group. It was noted that the maximum duration of edentulism for people aged 30 to 50 was 36 months. And simultaneously, most of the patients aged 51 to 70 and 71+ had a higher period of edentulism. This could be because of their acceptance of edentulism as a phenomenon associated with old age. Chi-Square test was done and the association between the age group and the duration of edentulism in months was found to be statistically significant since, since p value was found to be  $p=0.021$  ( $p<0.05$ ).**

In this study, the most common group with complete edentulism was found to be males between the age of 50-70 who had no other systemic conditions except for diabetes and had their period of edentulism to be 36 months with a prevalence of 11.2%. There was no significant difference in the duration of edentulism between males and females ( $p=0.33$  ( $p>0.05$ )) [Figure 4]. According to the National Health and Nutrition Examination Survey, the prevalence of edentulism among people above the age of 60 was 25% (Beltrán-Aguilar *et al.*, 2005). This study showed a prominent number of people being diabetic and edentulism ( $p=0.012$  ( $p<0.05$ )) [Figure 5], which promotes a link between the two and a study was done by Patel *et al* supports these results (Patel, Kumar and Moss, 2013).

Only 4.8% of the population were smokers so any conclusion based on this variable would have led to bias. But a study done by Krall *et al* showed a positive relationship between smoking and development of edentulism (Krall *et al.*, 1997). This finding can be supported by another study done by Souto *et al* in which newer smokers were shown to be more vulnerable to edentulism when compared to past smokers (Souto *et al.*, 2019).

This study showed hypertension to a cofactor along with diabetes to be responsible for edentulism. This finding is supported by a study done by Carissa *et al* which showed edentulism and hypertension to be linked (Carossa *et al.*, 2000). Another study done by Yusuf *et al* shows a relation between complete edentulism and hypertension (Ayo-Yusuf and Ayo-Yusuf, 2008).

It is important to consider the management of the prostheses given to diabetics as it will be more challenging for them to maintain a normal oral hygiene by conventional methods. Their mouths are more prone to bacterial and fungal infections due to the high glucose level in the saliva. A study by Selvan *et al* showed fifth-generation cephalosporins to be effective against MRSA (Selvan and Ganapathy, 2016) so it can be used during the management of cellulitis (Vijayalakshmi and Ganapathy, 2016). Sometimes, based on the underlying condition, a special prosthesis has to be prepared (eg, in a study by Venugopalan *et al*, a patient with percutaneous fistula having complete edentulism in the lower arch was given a magnetically retained silicone prosthesis (Venugopalan *et al.*, 2014)). Diabetes may delay procedures like gingival cord packing during impressions difficult as the bleeding will be prolonged visibility will be hindered. (Kannan and Venugopalan, 2018)

Diabetes is an important systemic condition for dentists to understand due to its influence on oral health. The limitation of this study mainly being its low sample size and geographic similarity, makes its claim's validity doubtful. Nevertheless, if the same study is done with a larger population, the results might be similar to this one. Our institution is passionate about high quality evidence based research and has excelled in various fields (Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

### LIMITATIONS

Our study had few limitations such as a limited sample size. Other factors such as stress, socioeconomic conditions were not obtained. The study did not include a high number of tobacco users and smokers, which can alter the results.

### CONCLUSION

By the results given, a link between diabetes and development of complete edentulism can be established. ( $p=0.012$ ) However, to solidify this claim, the same study should be repeated in a larger population with a greater geographic diversity.

### FUTURE SCOPE

Analysis of the relation between diabetes and complete edentulism may help in preventing loss of teeth by prosthetic rehabilitation or by using more efficient methods of maintaining oral hygiene.

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