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Is diabetes and cardiovascular disease a prevailing factor for edentulism

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Abstract

Edentulism is a stressful condition serving as a sign of constant oral and systemic disease process. As tooth loss occurs, masticatory efficiency declines, and it is customary for humans to alter their dietary consumption to compensate for the greater difficulty of eating certain foods and have difficulty chewing foods that are hard or tough in texture, even when wearing well-made dentures. The main aim of the study is to find role of systemic disease in tooth loss preceded by evaluation of various causes of tooth loss such as exacerbations of systemic disease which may or may not be followed surgical intervention or treated only by medication. A cross sectional study was conducted among 100 completely or partially edentulous patients. A set of questionnaire was prepared and responses were recorded followed by statistical analysis. The results obtained from data analysis shows that systemic diseases is a highly significant prevailing factor for edentulism and it is also observed that there is tooth loss even after the surgical intervention. We conclude by stating that systemic diseases, edentulism and nutrition are all interrelated hence treatment of edentulous state can improve nutritional status of the patients and in turn have a significant improvement in the overall systemic health of the individual.

Keywords: Edentulous, diabetes mellitus, tooth mobility, tooth loss

1. Introduction

Edentulism is an enervating condition with a multifactorial aetiology, serving as a terminal marker for oral disease. Teeth contribute to the process of mastication, speech and maintaining the facial aesthetics. Factors contributing to tooth loss include socio-economic status, education attainment, access to care, physical and mental health [1]. The consequences of periodontal disease and subsequent tooth loss not only are important considerations for the quality of life of patients but they may also affect significantly overall health by compromising patients' ability to maintain healthy diets and proper systemic control. The presence of systemic conditions such as diabetes mellitus, hypertension, cardiovascular disease, respiratory disorders, endocrine disorders, etc. can individually or collectively attribute to tooth loss. The relationship between systemic disease and tooth loss are extensively studied. Periodontitis is the sixth complication of Diabetes mellitus and both types of DM cause's loss of teeth. Cardiovascular disorders such as myocardial infarction deteriorates periodontal attachment leading to tooth loss vice versa compromised oral hygiene can aggravate the cardiovascular problems. Improving oral hygiene reduces the risk of thrombus formation and associated stroke. A study shows Hypertension causes alveolar bone loss which leads to tooth loss. Similarly Gastrointestinal disorders and Respiratory disorders has a less significance in tooth loss [2, 3].

The present study was aimed to find whether systemic disease can be a cause for tooth loss and also to correlate whether there is a significant tooth loss after surgical intervention of the systemic disease or during under medication thus analysing the frequency of tooth loss during the phase of systemic disease. This study implies the need of team work between the medical and dental practitioners. Medical practitioners should pay attention to the dental care and guidance to dental treatment, especially in patients with Diabetes, Cardiovascular disorders, Stroke, Kidney diseases, etc. Consultation between the medical and dental team responsible for treatment of patients with systemic disease is highly recommended.

2. Materials and methods

A total of 100 subjects are randomly selected for the cross-sectional study comprising of 50 females and 50 males either completely edentulous or partially edentulous patients with total number of teeth less than 10. The subjects are briefed about the study and informed consent was obtained from them. Ethical committee approval was obtained from the university. The questionnaire consists of demographic questions, history regarding systemic disease, medication and surgical history, initiation of tooth loss and frequency of tooth loss during the period of systemic disease.

3. Results

100 random samples distributed equally (50 men and 50 women) by gender was taken into the study. The questionnaire was prepared; responses were noted among the selected population group under the study and evaluated for statistical analysis by SPSS software Version 26.0. On statistical evaluation it was observed about 50% of population showed loss of teeth due to mobility among which 40% of the total populations were observed to be presented with systemic condition and the most common being diabetic followed by cardiac and other ailments with statistically significance of $3.27756E-27$ ($p < 0.05$).

Further evaluation of 40 systemic disease affected cases it was noticed the presence of disease with mean age of 9.22 years with significance of 0.058434341 and all the cases were under medication for the prescribed disease. The observations were found to have aggravated tooth loss during the course of the disease by significance of 0.008932 ($p < 0.05$), similarly tooth loss have been observed commonly after the surgery for the prescribed disease or ailments with statistical significance of 0.05626 ($p < 0.05$). Chi square test was performed to evaluate the significance of the study. The chi-square statistic is 27.8545. The p-value is .0001. The result is significant at $p < .05$ suggesting a high significance that systemic disease as a prevailing factor for edentulous situation.

4. Discussion

A study by Hosseini *et al.* shows that the relationship between complete edentulism and history of disease was statistically significant and edentulism was much more common in patients with a history of diabetes and heart disease than in others. However, the relationship between prevalence of complete edentulism and body conditions, having healthcare insurance, as well as drug use was not statistically significant [4]. In the present study overall occurrence or presence of a systemic disease in the study population showed a high significant predominant factor for their edentulous situation.

Epidemiologists consistently opined association between measures of dental status and chronic systemic diseases, especially those with prominent inflammatory components such as cardiovascular disease (CVD), type 2 diabetes mellitus (T2DM) and cancer. Such measures include history of periodontitis, periodontal pocket depth, clinical attachment loss, tooth loss, number of teeth and dental indices. There is growing evidence linking some of these measures of dental status to myocardial infarction (MI), stroke, T2DM and cancer, although most of this evidence is from case-control and cross-sectional studies [5].

A cross-sectional study by Mine *et al.* shows that there was a statistically significant difference between periodontitis and non-periodontitis groups for the prevalence of systemic diseases ($p < 0.001$). The systemic disease such as

cardiovascular disorders and endocrine disorders were observed significantly higher in subjects with one or more tooth loss than full dentate patients ($p < 0.001$) [6]. The observations in the present study were found to have aggravated tooth loss during the course of the disease by significance of 0.008932 ($p < 0.001$).

Patients with diabetes are likely to have more severe periodontitis in terms of average plaque index (PI), average gingival index (GI), and clinical attachment loss, but exhibit the same extent of periodontal disease [7]. A cross-sectional study reported that functionally edentulous (6 or fewer teeth) older men had 4.06 times greater risk of developing type 2 diabetes, regardless of age or race, than those with partial or complete dentitions. Studies on relationship between diabetes and complete edentulism are sparse. One study investigating the relationship of edentulism to diabetes reported that edentulous patients had 1.82 times greater risk of having diabetes than the dentate patient. A cross-sectional study reported that functionally edentulous (6 or fewer teeth) older men had 4.06 times greater risk of developing type 2 diabetes, regardless of age or race, than those with partial or complete dentitions. A large portion of denture wearing diabetic population remains undiagnosed of their underlying systemic condition posing them to increased risk of developing oral diseases and denture-related complications. In the present study on statistical evaluation it was observed about 50% of population showed loss of teeth due to mobility among which 40% of the total populations were observed to be presented with systemic condition and the most common being diabetic followed by cardiac and other ailments with statistically significance of $3.27756E-27$ ($p < 0.05$) [6, 7, 8].

Oral problems in diabetic patients include tooth loss, gingivitis, periodontitis, and oral soft-tissue pathology. Periodontal disease and dental caries are major causes of tooth loss. The relationship between diabetes and periodontitis has been confirmed to be a bi-directional connection, while the relationship between diabetes and dental caries is still unclear. The study by Tobaza *et al.* showed edentulous patients had significantly higher FBG levels of 155.7 ± 70.9 (mean \pm SD mg/dL) than those in the MOD/SEV (136.6 ± 33.8) and the NO/MILD (123.1 ± 36.7) groups. Differences between the latter two groups were also significant. Edentulous patients had adjusted ORs of 4.53, 4.27 and 3.95 of having $FBG \geq 126$, ≥ 150 and ≥ 180 mg/dL, respectively, in comparison with NO/MILD group. The MOD/SEV group also presented significant odds of having $FBG \geq 126$ mg/dL (OR=2.66) and ≥ 150 mg/dL (OR=2.45) than the NO/MILD group [9].

The relationship between periodontitis and cardiovascular disease has been summarized in two recent publications based on the principles of meta-analysis (Bahekar *et al.* 2007, Mustapha *et al.* 2007). The analysis by Bahekar *et al.* (2007) including five prospective cohort studies (86,092 patients) indicated that individuals with periodontitis had a 1.14 times higher risk of developing coronary heart disease than subjects without periodontitis [relative risk 1.14, 95% confidence interval (CI) 1.01–1.2, $p < 0.001$]. The case-control studies (1423 patients) showed greater odds of an association between periodontitis and coronary heart disease [odds ratio (OR) 2.2, 95% CI 1.6–3.1, $p < 0.001$]. The prevalence of coronary heart disease in the cross-sectional studies reviewed (17,724 patients) was greater among individuals with periodontitis than in subjects without periodontitis (OR 1.6, 95% CI: 1.3–1.9, $p < 0.001$) [10].

In an epidemiological study after controlling for important

cardiovascular risk factors, compared to men with 25-32 teeth at baseline, men with 0-10 teeth had a significantly higher risk of coronary heart disease (relative risk [RR]= 1.36; 95 percent confidence interval [CI]=1.11, 1.67). The relative risk increased to 1.79 (95% CI=1.34, 2.40) when limited to fatal events. Women with 0-10 teeth were also at increased risk of coronary heart disease compared to women with 25-32 teeth (RR=1.64; 95% CI=1.31, 2.05). The association was similar for fatal events (RR= 1.65; 95% CI=1.11, 2.46) [11]. The association between number of teeth and incidence of coronary heart disease was similar between men with and without a history of periodontal disease, and there was no significant association between tooth loss during follow-up and coronary heart disease [11, 12]. In the present study the observations were found to have aggravated tooth loss during the course of the disease by significance of 0.008932 ($p < 0.05$), similarly tooth loss have been observed commonly after the surgery for the prescribed disease or ailments with statistical significance of 0.05626 ($p < 0.05$).

An increase of circulating thyroid hormone, results in elevation of the basal metabolic rate. This usually occurs in middle-aged adults, although about 5% of all patients are younger than 15 years of age. In childhood, symptoms occur gradually. Emotional disturbances are accompanied by motor hyperactivity. Symptoms of overt hyperthyroidism include heat intolerance, palpitations, anxiety, fatigue, weight loss, muscle weakness, and, in women, irregular menses. Clinical findings may include tremor, tachycardia, lid lag, and warm moist skin. Symptoms and signs of subclinical hyperthyroidism, if present, are usually vague and non-specific. In advanced cases, there are atrophy of the alveolus, premature loss of primary teeth and accelerated eruption of permanent teeth [13, 14].

Tooth loss has been associated with an increased risk of vascular diseases such as coronary heart disease and cerebrovascular disease. Little is known whether hypertension is an important factor linking 2 phenomena in postmenopausal women [15]. On Comparison of an incidence of hypertension and traditional risk factors for vascular diseases between 2 age-matched groups: 67 postmenopausal women with missing teeth and 31 without missing teeth. In addition to blood pressure, serum concentration of total cholesterol, high- and low-density lipoprotein cholesterol and triglycerides, plasma angiotensin-converting enzyme activity, plasma angiotensin II concentration, plasma renin activity, and resting heart rate were measured as traditional risk factors for vascular disease [16].

Tooth loss might lead to dietary pattern change, resulting in an increased risk of hypertension because the change of dietary pattern may be associated with hypertension. Systolic and diastolic blood pressures are important predictors for cardiovascular disease and stroke in the United States and Europe as well as in eastern Asia [16]. Hypertension might be an important risk factor linking tooth loss and vascular disease risk in postmenopausal women. Subjects without missing teeth had significantly lower diastolic blood pressure than did subjects with missing teeth ($P < 0.021$). The former tended to have lower systolic blood pressure than did the latter ($P < 0.058$). There were no significant differences in other variables between subjects with and without missing teeth. The odds ratio of having hypertension in subjects with missing teeth was 3.59 (95% confidence interval, 1.10 to 11.7) after adjustment of obesity, hypercholesterolemia, and hypertriglyceridemia [17, 18]. In the present study our results suggest that hypertension may be an important factor linking

tooth loss and an increased risk of vascular diseases in postmenopausal women [19, 20].

5. Conclusion

The systemic disorders may deteriorate oral health leading to the increase of infections such as gingivitis, periodontitis and if left untreated, may cause tooth loss. Through the recognition of the systemic disease that causes tooth mobility and early tooth loss, more links can be created between general practitioners and dentists that would carry out precautionary and beneficial measures in the field of oral health. Fast and precise oral health measures can limit or reduce the oral complication as a result of systemic ailments. Since the early loss of teeth has nutritional complications and psychological effects, it could affect the quality of life. Thus, identifying systemic diseases associated with various conditions, leading to preventive measures and effective treatment to keep the teeth and delaying the loss of teeth.

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