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Diabetes Mellitus and Oral Health Status: A Case-Control Study in a Tertiary Care Hospital in Bangladesh

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ABSTRACT:

Introduction: Diabetes is a long-lasting, inflammation-related metabolic disorder which is diagnosed by hyperglycemia. Increased blood glucose level adversely impacts the inflammatory response to periodontium leading to more severe gingivitis and periodontitis. Therefore, periodontitis and diabetes reciprocally and adversely affect each other.

Objective: To assess and compare the oral health condition of Diabetic and non-Diabetic patients.

Method: A case control study was conducted among 100 diabetic and 100 non-diabetic patients. The control group was matched by age and gender. The study was conducted for a period of ten months. A cheek list was prepared to generate the caries and CPITN index (Community Periodontal Index of Treatment Needs) index.

Result: Dental caries scored at least one was relatively more in non-diabetics (32%) than in diabetics (24%). However, the periodontal diseases (pyorrhea) was more in diabetic patients (89%) in compared to non-diabetics (62%). The odds ratio for CPITN Index indicated that the patients who had periodontitis were about 24 times (OR = 24.00, 95% CI 8.19- 70.26) more likely to have diabetes.

Conclusion: Diabetes is a major issue in oral health care. The evidence also recommends that oral health care providers can have a significant role to provide an operational and progressive effect on the oral health with diabetes mellitus.

KEYWORDS: Diabetes mellitus, oral health, dental caries, periodontitis.

INTRODUCTION

World Health Organization estimates that around 220 million people or 2.8% of the population suffer from diabetes worldwide. Its incidence is growing day by day which estimate that the number of diabetic patients will be almost double by the year 2030. The utmost increase in prevalence of diabetes is expected to occur in Asia and Africa region. The increased incidence rate of diabetes in developing countries is mostly due to the trend of urbanization and lifestyle changes [1]. Diabetes was estimated about 9.3% (463 million people) globally in 2019 which will expand to 10.2% (578 million) by the year 2030 and about 10.9% (700 million) by 2045. The number of diabetes is usually higher in urban society (10.8%) than the rural (7.2%) community. Furthermore, it is high in the person earning a higher than average income (10.4%) than low income (4.0%) group. One in two (50.1%) people living with diabetes do not know about their diabetes in reality [2].

A chronic disease like diabetes mellitus is actually resulting from a relative or absolute deficiency of insulin. It mainly affects the metabolism of carbohydrate, protein, and fat. The high blood glucose level is most apparent abnormality, especially following a meal. Actually diabetes is in two major forms- type I and type II diabetes. Type I diabetes is the outcome of a depletion or the elimination of insulin production by beta cells of the pancreas. On the other hand, Type II diabetes is described by a deficient response to insulin by the target cells, though insulin production is typically normal or even enhanced in those individuals [3]. According to the International Centre for Diarrhoeal Disease and Research in

Bangladesh, 7.1 million people had diabetes, 3.7million cases were undiagnosed and about 129000 deaths were attributed to the disease in 2015 [4].

Oral health is multifarious varied and includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex [5]. Gingivitis and periodontitis are the two familiar factors of threating oral health. Gingivitis is an early stage of gum disease that usually causes irritation, swelling, and bleeding in gums. This can lead to a more serious form of gum disease called periodontitis. When gum disease occurs, germs work to destroy the gums (gingiva) and the bone around the teeth. Initially it starts with plaque—a sticky film of food, saliva, and germs. Then gradually even gentle brushing can cause gums to bleed [6]. The Prevalence of untreated caries of deciduous teeth in children of 1-9 years is 43.5 %, the untreated caries of permanent teeth in people 5+ years is 30.4(%) and finally the prevalence of severe periodontal disease in people 15+ years is 23.4%, edentulism in people 20+ years is 1.2 % [7].

Diabetes is a chronic metabolic disorder which is characterized by hyperglycemia. Such raised blood glucose level adversely impacts the periodontium and causes more accumulation of dental plaque, leading to more severe gingivitis and periodontitis. Hence, periodontitis and diabetes reciprocally and adversely affect each other [8]. Diabetes has been recognized as an important risk factor for severe and progressive periodontitis resulting in the destruction of oral tissues and supporting bone around the tooth. Periodontal disease is considered the sixth complication of diabetes along with neuropathy, nephropathy, retinopathy and micro- and macro vascular diseases [9].

METHODOLOGY

It was a case control study. Here, 100 diabetics adults (males, females) and 100 non-diabetics adults (males, females) were selected by purposive sampling. Oral condition (having any of DMFT or CPITN Index) with self-reported diabetes were selected as case and oral condition (having any of DMFT or CPITN Index) without diabetes were selected as control. Verbal consent was taken prior to data collection of an age group of 35 to 70 years attending out-patient departments of Periodontology, Shaheed Suhrawardy Medical college (ShSMC), Dental Unit of Dhaka city from March 2022 to December 2022 to assess and compare the oral health condition of Diabetic and non-Diabetic patients. The procedures were surveyed in harmony with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000. The oral examination was carried out by the outdoor dental surgeons

and dental students who were placed in periodontology department. Duplicate intra-oral examinations were carried out on a purposively selected sub-sample, considered to be representative of the study subjects, in order to assess the reliability. To assess the oral health condition, dental caries was measured by WHO described DMFT (Decayed, missing and filled tooth) index and periodontal condition was measured by CPITN index (Community Periodontal Index of Treatment Needs) described by Ainamo J and others in 1982. The information regarding indices were collected by administering a check list. The examination was carried out with a mouth mirror, artificial light and caries probe. Demographic data were collected by a semi-structured questionnaire and information regarding dental caries and periodontal status were taken in both study and control groups. The control group was consisting of dental non diabetic patients matched with age and sex. As the number of insulin dependent diabetes was not sufficient in number, they were considered along with the non–insulin-dependent diabetic periodontitis patients. Statistical analysis was performed by using SPSS version 26. Chi-square test and binary logistic regression were done for comparison of proportions between the two groups.

RESULTS

The mean age of the participants was 43.40 ± 10.89 years. Among the participants, 42% were male in both the cases and controls, on the other hand, female respondents were 58% in each group. Among the respondents, 46 (46%) cases were below SSC level in education level in comparison to 20 (20%) controls. On the other hand, among the controls 28(28%) were graduate compared to 22(22 %) cases (P < 0.000).

Assessment of periodontal status (pyorrhea)

Among all of the respondents, majority 89 (89%) of the cases had periodontal diseases in comparison to 62 (62%) non-diabetic control (P < 0.000) [Table 1(b)]. Also CPITN score 4 (severe gingival recession and mobility) was found in case of about 50 (50%) of diabetic cases and 4(4%) of non-diabetic control.

Assessment of treatment needs

Oral hygiene instructions (Treatment need 1) was required for almost all non-diabetic 86 (86%) controls. On the other hand, 44% of diabetic cases and 14% of non-diabetic controls needed oral prophylaxis as professional cleaning and/or removal of overhanging fillings (Treatment need 2). Meanwhile, 53% of diabetic cases needed complex treatments (Treatment need 3) which comprise periodontal surgery. [as shown in Table 1 (b)].

Dental caries assessment

At least one decayed tooth was present in 24% diabetic case and 32% non-diabetic control. But minimum five decayed

teeth were present in case of cases (41%) in compared to no control (0%) (*P* < 0.001). On the other hand, 22% cases and 68% controls had at least one missing tooth. But minimum five missed teeth were present in case of cases (31%) in compared to controls (13%) (*P* > 0.000). The percentage of at least one filling was higher in non-diabetic control at 71% when compared to diabetic case at 26%. But minimum five filled teeth were present in case of cases (36%) in compared to controls (4%) (*P* > 0.000) [as shown in Table 2].

Binary logistic regression was performed to assess the impact of diabetes with periodontal condition. The odds ratio for CPITN Index indicated that the patients who had periodontitis were about 24 times (OR = 24.00, 95% CI 8.19- 70.26) more likely to have diabetes than the non-diabetic control [as shown in Table 3].

Table-1 (a): Comparison between cases and controls of selected socio-demographic and CPITN characteristics

Characteristics	Case f (%)	Control f (%)	Significance p<0.05
Education			
Below SSC	46 (46)	20 (20)	χ^2=18.60 df=3 p-value= 0.000
SSC	25 (25)	31 (31)	
HSC	7 (7)	21(21)	
Graduate	22 (22)	28 (28)	
CPITN			
No bleed	11 (11)	38 (38)	χ^2=94.2 df=4 p-value= 0.000
Bleeding on probing	3 (3)	39 (39)	
Subgingival pocket 1-3	12(12)	12(12)	
Subgingival pocket 4-5	24(24)	7(7)	
Subgingival pocket 6mm	50 (50)	4 (4)	
Decayed tooth			
Yes	71(71)	32(32)	χ^2=30.44 df=1 p-value= 0.000
No	29(29)	68(68)	
Missing tooth			
Yes	58(58)	86 (86)	χ^2=20.32 df=1 p-value= 0.000
No	42(42)	14(14)	
Filled tooth			
Yes	70 (70)	75(75)	χ^2=0.777 df=1 p-value= 0.378
No	30 (30)	25 (25)	

Table-1 (b): Comparison between cases and controls of CPITN characteristic and treatment need of the person

Characteristics	Case f (%)	Control f (%)	Significance p<0.05
CPITN Present			
Yes	89 (89)	62 (62)	χ^2=19.7 df=1 p-value= 0.000
No	11(11)	38 (38)	
Treatment need of the person			
Treatment need type 1	3(3)	86(86)	χ^2=18.60 df=3 p-value= 0.000
Treatment need type 2	44(44)	14(14)	
Treatment need type 3	53(53)	0(0)	

Table-2: Comparison between cases and controls regarding DMFT status

Characteristics	Case f (%)	Control f (%)	Significance p<0.05
Decayed			
1-4	24 (24)	32 (32)	χ^2=14.88 df=2 p-value= 0.001
5-8	41 (31)	0 (0)	
9-12	6 (4)	0 (0)	
Missing			
1-4	22 (22)	68 (68)	χ^2=26.2 df=2 p-value= 0.000
5-8	31(31)	13 (13)	
9-12	3(3)	5(5)	
Filled			
1-4	26 (26)	71 (71)	χ^2=54.36 df=2 p-value= 0.000
5-8	36 (36)	4 (4)	
9-12	8 (8)	0 (0)	

Table 3: Comparison of CPITN characteristics related to periodontal condition between diabetics and non-diabetics (logistic regression)

Attributes	Co-efficient (B)	S.E.	OR	95% CI for OR Upper	95% CI for OR Lower	p-value
CPITN						
No *						
Yes	3.17	.548	24.00	70.26	8.19	0.000

DISCUSSION:

In the current study, the presence of decayed teeth at least one was found to be reasonably lower in diabetic patient in comparison to non-diabetics. Similar results are found in a study done by Bacic *et al* in 1989 about the oral health status of a group of adult diabetic patients [10]. The similar result possibly due to the dietary habit of diabetic patients, which usually involves high protein fiber and scanty fermentable carbohydrates in comparison to the diet of non-diabetic patients which make less prone to dental decay. More decayed teeth in case of cases may be due to uncontrollable dietary habit of some diabetic participants.

In the current study, the presence of periodontal diseases was more in diabetics than nondiabetics. In another study done by Preshaw P M *et al* the occurrence of periodontitis risk is increased 2–3 times in diabetics in compared to non-diabetics which is the key in determining risk. Similar to the other complications of diabetes, the risk for periodontitis increases with poorer glycaemic control. The research on periodontitis and diabetes has mainly focused on type 2 diabetes (possibly because these diseases tend to present mainly in middle-aged adults), but on the contrary, type 1 diabetes is also associated with increased destruction of periodontium in children and teenagers [11]. Similar results were also reported in a study done by Matu *et al* in 2009, between periodontal diseases and diabetic patients in South Africa. The symptoms of diabetes mellitus is a systemic promoting factor and also produce gingivitis and periodontitis [12].

In another study done by Paunica *et al* in 2023, periodontitis is a chronic disease characterized by inflammatory response usually due to the presence of a bacterial biofilm which is known as dental plaque. This dental plaque affects the supporting structures of the teeth, especially the periodontium and the alveolar bone. Periodontal disease and diabetes are appeared to be interconnected in a bidirectional relationship. Diabetes mellitus has a harmful effect on periodontal disease which actually intensify its prevalence, extent and severity [13].

In the current study, the number of filled tooth is greater in non-diabetics in comparison to diabetic controls. And treatment needs level 2 and level 3 are found to be more pronounced in diabetics than in non-diabetics. These findings are contradictory with Bacic *et al* who found lower treatment needs in both the groups. The reason behind this is the variation of awareness development and patient's motivation towards dental treatment. And it also depends on the perception of the patients towards dental treatment needs which varies in different societies [10].

Dental professionals could consider assessing risk of diabetes when suspected (using a validated risk assessment tool) and liaising with the medical doctor when there is evidence of increased diabetes risk. Only diagnosed diabetic patient were taken in this study, risk was not analyzed and a small sample was used to analyze. Informing patients about the relation between periodontitis and diabetes can be aided by the use of printed copies or leaflets that the patient can take away with them after finishing the dental appointment for proper care and awareness build up. So, it's been recommended that the diabetics should be aware about taking their prescribed medications. Proper screening of diabetes should be done regularly with their oral hygiene condition. Early diagnosis and prompt treatment of diabetes is the secondary prevention in chronic diseases like diabetes mellitus which will intensify good periodontal condition.

CONCLUSION:

This case-control study establishes a strong significant relationship between diabetes and oral health which is suggestive for the individuals with diabetes at a higher risk of periodontal disease and dental caries. Early diagnosis and proper management of oral health issues are crucial for improving the quality of life as well as overall health outcomes in diabetic patients. Dental professionals, alongside healthcare providers, should collaborate to develop comprehensive care plans for diabetic patients, integrating routine oral health assessments and preventive measures as part of diabetes management.

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