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Evaluation of questionnaire- based diabetes mellitus screening concept in chronic periodontitis - A cross-sectional observational study

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Abstract

Diabetes mellitus (DM) has become highly relevant global health problem with increasing prevalence. It is well known that DM and Periodontitis interact bi direction ally. DM affects the severity of periodontitis and the response to periodontal treatment, which is dependent on glycemic control. The early detection of DM reduces morbidity and mortality, which makes screening programs an issue of high clinical importance. In general, DM screening in dental settings is a promising approach to detect previously unknown (pre)DM.

Aim: To evaluate the efficacy of FINDRISC questionnaire for screening diabetes mellitus type 2 in chronic Periodontitis patients.

Material and methods: Patients with mild to severe chronic Periodontitis were selected. General and Periodontal findings were recorded and analyzed. They received the Finnish Diabetes Risk Score (FINDRISC) questionnaire to screen for diabetes. Patients with FINDRISC score of ≥ 12 = FINDRISC+ and with score ≤12 = FINDRISC-. The FINDRISC+ patients are then referred to further Dialectological examination.

Results: A total 102 patients with mean age of 44.5 years completed the study. Of these participants, n= 20 (19.6%) were previously known diabetic=70 (72.5%) were non-diabetic and n=9 (8.8%) were newly diagnosed as diabetic. Patients with FINDRISC+ (Group B) had higher mean age, greater number of missing teeth, higher values of PPD and CAL & at least on with suppuration than the FINDRISC- patients (Group A).

Conclusion: The FINDRISC questionnaire is effective in diagnosing the previously unknown pre-DM in chronic Periodontitis patients. It is an easy, chairside non-invasive method suitable for dental settings.

Keywords: chronic Periodontitis, DM screening, questionnaire, Type 2 diabetes mellitus.

Introduction

Diabetes mellitus (DM) is a type of metabolic disorder characterized by a hyperglycemic state due to defects in insulin secretion, insulin activity, or both[1]. DM has become highly relevant global health problem within creasing prevalence. The prevalence in India according to estimates in 2019 showed that about 77 million individuals had diabetes which is expected to rise over 134 million by 2045. Studies have shown about half of these individuals (approximately 57%) remain undiagnosed [2]. Pre-diabetes is defined as hyperglycemia below pathologic threshold (HbA1c levels = 5.7- 6.4%), these individuals are at increased risk for microvascular diseases & developing overt diabetes.

Periodontal disease is a chronic inflammatory disorder characterized by destruction of periodontium and supporting tissues. There is an evident bidirectional relationship between diabetes mellitus and Periodontitis [3,4,5].

DM affects the periodontal inflammation and its response to periodontal treatment. Studies have shown that early detection of diabetes reduces morbidity and mortality which makes an early screening & timely intervention is significantly important[6]. The dental professionals play an important role in screening for DM in previously unknown or pre-diabetics. The two different DM screening methods available are- invasive blood collection for HbA1c test and a non-invasive questionnaire -based screening followed by reference of at-risk patients to general physicians or diabetologists.

The non-invasive technique is best suited for dental settings as it is cost-effective and also patients willingly participate in a questionnaire-based screening method compared to the invasive blood collection method.

Several questionnaire-based screening methods have been tested for its effectiveness in various studies. The Finnish diabetes risk score (FINDRISC) was developed to identify subjects at high risk for type diabetes mellitus[7]. The current study is a cross sectional observational study for evaluation of FINDRISC questionnaire in patients with chronic periodontitis.

Material And Method

The current study is an observational cross-sectional study carried out at Government dental college & hospital, Aurangabad. The data was collected from the outpatient department of Periodontology in patients having mild, moderate or severe chronic periodontitis. A total of 102 patients with mean age of 44.15 years were selected for the study.

Finnish Diabetes Risk Score (FINDRISC)

It is a risk score form in single page questionnaire in which total risk score is sum of individual scores and it ranges from 0 (low risk) to 26 (high risk)[7]. This deter mines the risk of developing type 2 diabetes mellitus (T2DM) within the following 10 years. Based on previous pilot study, the cut-off value for the total score for each patient was set at 12 points[8] (Figure 1).

Patient selection

Inclusion criteria

- Patients with 30 to 60 years of age
- Subjects with mild to severe periodontitis with and without Type 2 DM

Exclusion criteria

- Patients having any other disorder like rheumatic diseases, infectious diseases, immuno suppressive dis orders
- Patient on any medications other than diabetes.

• Patients having tobacco or alcohol habit.

• Pregnancy, lactation

Procedure

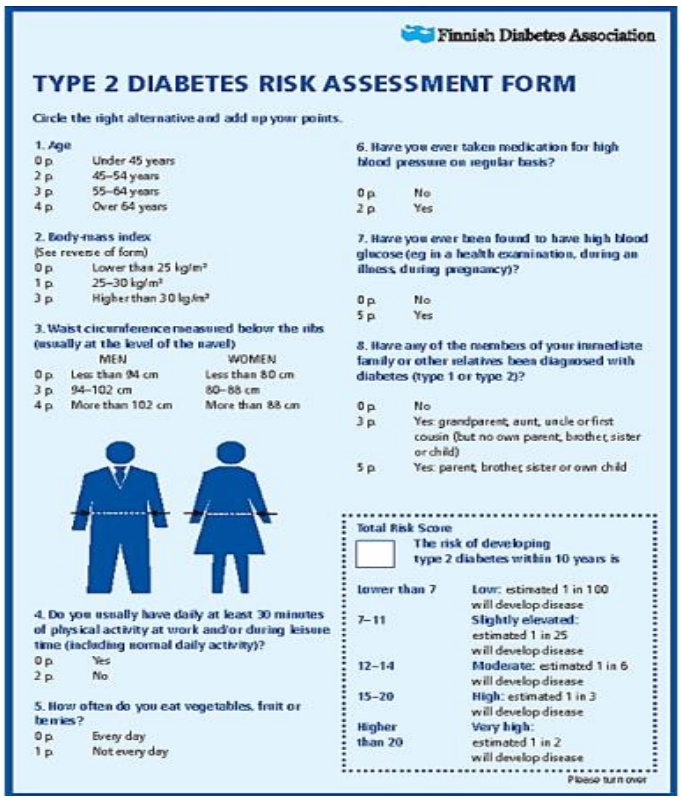
102 patients who met the inclusion criteria were selected for the study. General data including patient's age, sex, and smoking habits were recorded. Also, patients were inquired about any previous periodontal therapy and whether patient is currently a known diabetic or not. After obtaining written informed consent from patients, FINDRISC questionnaire was filled. Patients with total FINDRISC score of >12 were FINDRISC positive (FINDRISC +) and total score of < 12 were considered FINDRISC negative (FINDRISC -). The FINDRISC – patients were routinely treated with non-surgical treatment whereas all the FINDRISC + patients were referred to general physician or diabetologist for testing HbA1c levels to confirm diabetes type 2. According to International Expert Committee, an HbA1c > 5.7% was interpreted as diabetic patient.[9]

Periodontal examination was done using a specially designed proforma including probing pocket depth (PPD), clinical attachment loss (CAL), bleeding on probing (BOP), mobility of teeth, recession, number of missing teeth, number of teeth with suppuration were noted. The periodontal examination of all selected patients was done by the same experienced periodontist. The periodontal diagnosis (severity) was done based on the PPD, BOP, CAL level findings (American Academy of Periodontology, 2015) [10]

Statistical Analysis

Statistical analyses were performed using SPSS for Windows, version 24.0. All metric variables were tested for their normal distribution using the Kolmogorov – Smirnov test.

A t- test was used for comparisons of two independent, normal-distributed samples. The two dependent samples were analysed using a t test for paired samples. For analyses of categorical data, a Chisquared or Fisher exact test was used. For all statistical analyses, two-sided significance testing was performed, and a P value.


Finnish Diabetes Association

TYPE 2 DIABETES RISK ASSESSMENT FORM

Circle the right alternative and add up your points.

1. Age
0 p. Under 45 years
2 p. 45–54 years
3 p. 55–64 years
4 p. Over 64 years

2. Body-mass index
(See reverse of form)
0 p. Lower than 25 kg/m²
1 p. 25–30 kg/m²
3 p. Higher than 30 kg/m²

3. Waist circumference measured below the ribs (usually at the level of the navel)

	MEN	WOMEN
0 p.	Less than 94 cm	Less than 80 cm
3 p.	94–102 cm	80–88 cm
4 p.	More than 102 cm	More than 88 cm

4. Do you usually have daily at least 30 minutes of physical activity at work and/or during leisure time (including normal daily activity)?
0 p. Yes
2 p. No

5. How often do you eat vegetables, fruit or berries?
0 p. Every day
1 p. Not every day

6. Have you ever taken medication for high blood pressure on regular basis?
0 p. No
2 p. Yes

7. Have you ever been found to have high blood glucose (eg in a health examination, during an illness, during pregnancy)?
0 p. No
5 p. Yes

8. Have any of the members of your immediate family or other relatives been diagnosed with diabetes (type 1 or type 2)?
0 p. No
3 p. Yes: grandparent, aunt, uncle or first cousin (but no own parent, brother, sister or child)
5 p. Yes: parent, brother, sister or own child

Total Risk Score

The risk of developing type 2 diabetes within 10 years is

Lower than 7	Low: estimated 1 in 100 will develop disease
7–11	Slightly elevated: estimated 1 in 25 will develop disease
12–14	Moderate: estimated 1 in 6 will develop disease
15–20	High: estimated 1 in 3 will develop disease
Higher than 20	Very high: estimated 1 in 2 will develop disease

Please turn over

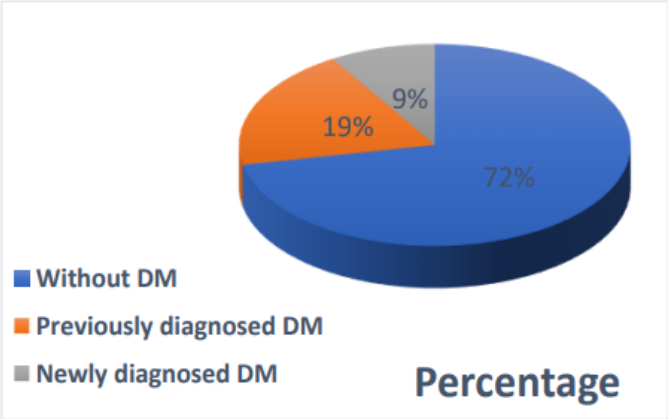
Figure 1: Finnish Diabetes Risk Score Questionnaire.

Results

Table 1: Gender comparison between Find risc score < 12 and Find risc score ≥ 12 respectively.

Gender	Group A FS < 12 (N=73) N (%)	Group B FS≥ 12 (N=29) N (%)	Chi square test	P value, Significance
Male	35 (57.4%)	17 (65.4%)	Chi =0.486	P =0.416
Female	26 (42.6%)	9 (34.6%)		

Figure 2: Pie Diagram showing percentage of patients with, without and newly diagnosed T2DM



Patient related details

A total 102 patients with mean age of 44.5 years completed the study. Among them, 61 (59.80%) were males, and 41 (40.20%) were females. Of these participants, n= 20 (19.6%) were previously known diabetic = 70 (72.5%) were non-diabetic and n=9 (8.8%) were newly diagnosed as diabetic. (Figure 2)

Table 2: Comparison of quantitative parameters between Findrisc score < 12 and Findrisc score ≥ 12 respectively

	Group A FS < 12 (N=73) Mean (SD)	Group B FS≥ 12 (N=29) Mean (SD)	Unpaired t test	P value, Significance
Age	40.12 (10.2)	54.31 (7.69)	T = -6.757	P< 0.001**
Missing teeth	1.35 (1.46)	3.44 (2.08)	t = -5.738	P< 0.001**
PPD	3.82 (0.89)	4.6 (0.97)	t = -3.865	P< 0.001**
CAL	3.8 (0.93)	4.92 (0.94)	t =-5.482	P< 0.001**

Table 3: Comparison of parameters between Findrisc score < 12 and Findrisc score ≥ 12 respectively.

	Group A FS < 12 (N=73) N (%)	Group B FS≥ 12 (N=29) N (%)	Chi square test	P value, Significance
Presence of Tobacco habit	9/73 (12.3%)	16/29 (55.2%)	Chi =20.590	P< 0.001**
BOP +ve	46/73 (63%)	26/29 (89.7%)	Chi = 7.096	p =0.008*
Recession Present	33/73 (45.2%)	29 /29 (100%)	Chi = 26.142	p < 0.001**
Suppuration present	2/73 (2.7%)	10/29 (34.5%)	Chi = 20.146	p < 0.001**
Previous Periodontal T//T	7/73 (9.6%)	5/29 (17.2%)	Chi = 1.171	p =0.279

DM Screening & Diabetological findings

Approximately one-third of patients (n=29; 28.4%) were FINDRISC+, based on the cut-off point as 12. All the patients with currently known DM were FINDRISC+ (n= 20; 100%) whereas the remaining 9 patients were referred to the general practitioner for clarification of Diabetologically conspicuous findings (HbA1C ≥5.7%). With the application of the FINDRISC questionnaire, 9 previously unknown (pre-DM) patients were identified. Out of the 9 patients, 5 patients had HbA1c levels ≥5.7.

Oral findings

There were several differences in the oral findings between the diabetologically conspicuous (HbA1c ≥5.7%) and inconspicuous patients (HbA1c <5.7) (Table 2 & Table 3). Patients with FINDRISC+ (Group B) had higher mean age, greater number of missing teeth, higher values of PPD and CAL & at least on with suppuration than the FINDRISC- patients (Group A).

Discussion

Willer et al reported that a steep rise of type 2 diabetes mellitus (T2DM) and associated complications go along with mounting evidence of clinically important gender differences. T2DM is more frequently diagnosed at lower age and body mass index in men; however, the most prominent risk factor, which is obesity, is more

common in women. Furthermore, sex hormones have a great impact on energy metabolism, body composition, vascular function, and inflammatory responses[11]. In our study, males with FINDRISC score ≥ 12 were more than females, however, the values were not statistically significant.

Quantitative parameters (Table 2) show higher mean age in Group B indicates higher risk of T2DM in older age. Age at diabetes diagnosis was inversely associated with risk of all-cause mortality and macrovascular and microvascular disease. Identification and quantification of the increased risk of Table 2: Comparison of quantitative parameters between Findrisc score < 12 and Findrisc score ≥ 12 respectively Table 3: Comparison of parameters between Findrisc score < 12 and Findrisc score ≥ 12 respectively First Author's Name, et al.

International Journal of Medical Sciences and Advanced Clinical Research (IJMACR) © 2018, IJMACR, All Rights Reserved Page 5 mortality and vascular disease conferred by younger age at type 2 diabetes diagnosis may enable to provide greater opportunities for interventions to reduce risk of complication-associated morbidity and mortality for this increasing population demographic developing type 2 diabetes[12].

Tern oven et al [15], have reported that the percentage of sites with CAL ≥ 5 mm was significantly higher in poorly controlled T2DM than in a moderately controlled and controlled group. Anil et al 16 in his study showed the proportion of periodontitis among the controlled T2DM group, uncontrolled T2DM group without microvascular complications, and uncontrolled T2DM group with microvascular complications was 75%, 93.4%, and 96.6%, respectively.

The uncontrolled T2DM group with microvascular complications showed the highest percentage of sites with CAL ≥ 6 mm. In this study, PPD and CAL values in Group B are higher than the Group A.

Obradovic et al[17] stated that periodontal disease is more severe in smoker diabetics than non-smoker diabetics. Although, smokers show less signs of clinical inflammation and gingival bleeding compared to non-smokers, there is strong dose dependent influence of smoking on periodontal tissues with increased severity in smokers. In this study, 55% of diabetic patients had habit of either smokeless tobacco or cigarette smoking. Around 90% of Group B patients have bleeding on probing with indicates more periodontal inflammation than Group A.

The present study demonstrates that performing a chairside FINDRISC questionnaire in dental settings can depict subjects with undiagnosed hyper glycaemia, which allows for early diagnosis of diabetes by referring these subjects to medical doctors for further investigation.

Borrell et al. analysed data from NHANES-3 to estimate the predicted probability of having undiagnosed diabetes. They demonstrated that self-reported in formation obtained from a standard health history, coupled with findings from a periodontal examination in the dental office, resulted in predicted probabilities of undiagnosed diabetes between 27 percent and 53 percent. Barasch et al. explored the utility of random plasma glucose levels for screening for prediabetes or previously undiagnosed diabetes in community dental practices. Of 418 subjects who qualified for testing in 28 dental practices, 18 percent had diabetes or prediabetes [18,19]. A follow-up survey found that blood glucose testing was well-received by both practitioners and patients[19].

Lalla et al. did the first prospective study aiming to investigate the dentists' role in identifying patients with undiagnosed prediabetes and diabetes.

The combination of the HbA1c value, the number of missing teeth and the percentage of periodontal pockets of ≥ 5 mm in depth appeared to have the biggest prognostic value in identifying patients with undiagnosed hyper glycaemia. The presence of ≥ 4 missing teeth or ≥ 26 percent of teeth with deep pockets correctly identified 73 percent of true cases[20].

Herman et al have demonstrated that an estimated 30 percent of nondiabetic adults ≥30 years of age seen in general dental practices have dysglycemia and that high-risk adults can be identified using a questionnaire that assesses sex, history of hypertension, history of Dyslipidemia, history of lost teeth, and random capillary glucose or self-reported BMI ≥ 35 kg/m221.

Lindstrom et al introduced a questionnaire Diabetes Risk score which included age, BMI, waist circumference, history of antihypertensive drug treatment and high blood glucose, physical activity, and daily consumption of fruits, berries, or vegetables as categorical variables. The Diabetes Risk Score was composed as the sum of these individual scores & value varied from 0 to 20. To predict drug-treated diabetes, the score value ≥9 had sensitivity of 0.78 and 0.81, specificity of 0.77 and 0.76, and positive predictive value of 0.13 and 0.05 in the 1987 and 1992 cohorts, respectively[7].

Li et al[22], Makrilakis et al23 & Schmalz et al24 have done similar study with FINDRISC questionnaire inundatal nosed diabetes patients in Greek and German populations respectively.

Conclusion

The present study shows that FINDRISC questionnaire is effective in diagnosing the previously unknown pre-DM in chronic periodontitis patients. It is an easy, chair side noninvasive method suitable for dental settings.

However, further studies using larger sample size and longer follow-up should be carried out for further research.

Acknowledgment

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