

## KNOWLEDGE AND AWARENESS ABOUT PERIODONTAL RISK AND ORAL HEALTH PRACTICES IN DIABETIC PATIENTS

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### ABSTRACT

*The objectives of the study were to assess the knowledge and awareness of diabetic patients for the risk of systemic and oral diseases as complications associated with diabetes and to assess the attitudes of diabetic patients towards sustaining good oral health through proper oral hygiene and regular dental checkups. Four hundred self administered questionnaires were distributed, only completed questionnaires were used for data analysis. In the current study more than half of the participants had Type 2 diabetes and rest had Type 1 diabetes. Among the participants in current study majority of participants, 59% had awareness about systemic disease as compare to the awareness about risk of oral disease in diabetes. Among 40% of the participants who were aware about oral complications, majority of them were aware about the occurrence of tooth mobility and bleeding gums. The attitude of majority of diabetic patients towards sustaining good oral health in the present study was negative for dental visitings. Most of the diabetic patients either visit when necessary or never visit the dentist. Half of the diabetic patients follow tooth brushing twice a day. People with diabetes have limited or no knowledge and awareness about oral health associations with diabetic problem. In addition diabetic people have reduced compliance and adherence with dental checkups and positive oral hygiene behavior respectively. Furthermore the source and mode of obtaining information about oral health with regards to diabetic complication is inadequate and not to their reach and access.*

**Key words:** Diabetes, Periodontal disease, Oral health, Systemic disease

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### INTRODUCTION

Worldwide an adult population has got effected by diabetes mellitus (DM) BY 8.5% showing it as a public

health problem.<sup>1</sup> Abnormally high level of glucose in the blood leads to DM which is heterogeneous group of clinical and genetic metabolic disorders. It is categorized as type 1 (DM I) and type 2 (DM II).<sup>2</sup> Separate estimation of DMI & DMII prevalence globally is not shown because this requires sophisticated laboratory tests.<sup>3</sup>

DM in adults has increased to 422 million in 2014 from 108 million in 1980.<sup>1</sup> In developed countries and developing countries there would be rise in numbers of DM in adults till 20% and 69% respectively between 2010 & 2030.<sup>4</sup> Mortalities occurred due to DM in 2012 was 1.5 million and in addition deaths happened due to systemic diseases such as cardiovascular caused because of high glucose level was 2.2 million. There is an economic loss to a greater in patients, their families and health care system because of DM. Oral health get compromised severely as the patients with DM suffers carious lesions, dry mouth, infections in oral cavity, diseases related to periodontium, and salivary gland problems and taste problem due to sensory disorders.<sup>5</sup> Among all the oral problems the most frequent is the periodontal disease, in which there is loss of connec-

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tive tissue surrounding the tooth leading to a chronic inflammatory condition. There is an increase in the evidence about a bidirectional strong relation between DM and diseases of periodontium.<sup>1</sup> Moreover the infection in periodontium can lead to DM complications.<sup>5</sup> In addition other consequences can lead to DM in younger populations other than periodontal diseases because of behavioural factors such as westernized lifestyles, poor eating habits and obesity.<sup>6</sup>

Unfortunately, diabetic patients do not show satisfactory oral health because of unawareness among them about the bidirectional association between oral health and DM and therefore do not show significance to routine dental checkups. Due to this, to some extent, quality of life is compromised. Psychotherapy courses and managing oral health problems, positive behavioural changes and healthy eating habits with reinforcement of instruction on good oral health can save patients of DM from getting oral health problems and eventually improve oral health related quality of life.<sup>1,7</sup>

This study will be useful in identifying the current baseline information. The findings of the study will help in advocating health authorities to draft policies to increase dental health education for diabetic population if required.

## OBJECTIVES

Objective was to assess the knowledge and awareness of diabetic patients for the risk of systemic and oral diseases as complications associated with diabetes and also to assess the attitudes of diabetic patients towards sustaining good oral health through proper oral hygiene and regular dental check up.

## METHODOLOGY

In the current study, a self administered questionnaire was utilized to assess the aim of the study. A cross sectional descriptive survey was employed. The questionnaire questions were related to the participant's ethnicity, age, sex, type and duration of diabetes and their awareness for oral and systemic diseases as complications associated with diabetes. In addition questionnaire also included questions on information about their attitudes towards maintaining good oral health. Different response formats were used in the questionnaire such as 'yes', 'no', 'i do not know,' encircling option for disease name according to patient's awareness. A pilot study was conducted on 10 diabetic patients to assess the response of participants to the questionnaires before carrying out the study.

Non-probability Convenience Sampling was done. The sample size of 400 Diabetic patients was required to fulfill the objective of our study at 95% confidence level. We assumed 50% prevalence of good knowledge, 5% bound of error and inflated the sample by 10% to account for non response and incomplete interview. The sample size was calculated by Raosoft Sample size calculator.

Four hundred questions were distributed to the diabetic patient attending the out-patient diabetic clinic in Abbasi Shaheed Hospital, the largest government hospital in Karachi, Pakistan. Verbal consent was taken from those patients who were eligible on the basis of being diagnosed as having diabetes mellitus and in addition who understand Urdu and English (optional). The patients who needed assistance in filling out the form were given assistance by the investigator.

Data were collected over a period of four to five months. Although none of the patients refused to participate in filling out the questionnaire but the completely filled questionnaire were taken for the data analysis. Therefore four hundred questionnaire were entered into statistical package of social sciences (SPSS) version 16.

For statistical analysis the descriptive statistics concerning the percentages of responses will be computed to provide information about frequency distributions.

## RESULTS

The majority of diabetic patients participating in the current survey were 53% Urdu speaking and majority were females.

The mean of the participants' age was 51 years. 98% percent of the participants were dentulous. Of the edentulous participants, all were wearing complete dentures. The mean of the participants' diabetes duration was 3 years.

With regards to diabetic patient's knowledge and awareness of systemic and oral complications associated with diabetes, the percentage of participants in this study who were aware of their increased risk for eye disease were (15%), heart disease (29%), kidney diseases (5%), periodontal disease (11%), dental caries (2%), and oral fungal infections (1%). 40% percent of participants were unaware of the fact that diabetes increase risk of oral disease. 81% were unaware of the serious consequences of dry mouth on their oral health. The majority of the participants (89%) were aware that bleeding during brushing is a sign of gingival disease, 47% brushed twice a day, and a significantly higher number of respondents (52%) brushed once a day. A significant proportion (81%) never used dental floss, 18% reported using dental floss once a day. The questionnaire also revealed that there is a relatively low percentage (3%) of yearly visits to a dental clinic and 44% visited, when necessary. Only 13% reported they visited for a regular dental check-up. In response to the question about whether they would wish to save a mobile tooth, 64% of participants said they would prefer extraction of an anterior tooth and 47% would prefer extraction of posterior tooth. Time and cost factors were likely to influence the consent for extraction of either anterior or posterior tooth (62% and 59%, respectively). As for the sources of participants' knowledge and awareness of their increased risk for oral diseases, 1% of the participants had received this information from

TABLE 1

Gender		Marital status				Employed	Family income (11000-20000)
Male	Female	Single	Married	Widow	Divorce	Male	Female
Male	Female	Single	Married	Widow	Divorce	Male	Female
Male	Female	Single	Married	Widow	Divorce	Male	Female

TABLE 2

ETHNICITY					
	URDU SPEAKING	PUNJABI	BALOCHI	SINDHI	PATHAN
Frequency	214	68	26	74	18
Percentage	53%	17%	7%	18%	5%

TABLE 3: PERCENTAGE AND FREQUENCY OF THE DIABETIC PATIENT HAVING KNOWLEDGE ABOUT THE RISK OF SYSTEMIC AND ORAL DISEASES AND THEIR DIABETIC STATUS.

Variables	Frequency	Percentages	
Type of diabetes (type 1)	136	34%	
Type of diabetes (type 2)	256	64%	
Taking medication for diabetes	226	57%	
Taking insulin injection	186	47%	
Smoking tobacco habit	80	20%	
Smokeless tobacco habit	24	6%	
History of tobacco using	6	1.5%	
Awareness about the risk of systemic disease	234	59%	
Awareness about the risk of oral disease	158	40%	
Patient's awareness about occurrence of systemic disease	Heart disease	116	29%
	Eye disease	60	15%
	Kidney disease	18	5%
	Skin disease	2	1%
	Bone disease	4	1%
	hypertension	2	1%
Patient's awareness about occurrence of oral disease	Bleeding gums	44	11%
	soreness	2	1%
	Dry mouth	38	9%
	Dental caries	8	2%
	Bad breath	2	1%
	Fungal infection	4	1%
	Tooth mobility	56	14%
	Tooth loss	38	9%

dentists, 11% from doctors, and 1% from other sources such as television programs, the Internet, magazines, and friends. 21% of people were interested in getting information on factors which would help them in keeping good oral health. Majority of the participants prefer television and pamphlet sources for the information regarding the risk factors, for keeping good health.

**DISCUSSION**

In the current study more than half of the participants had Type 2 diabetes. The present rise in diabetes is not because of a shift in genetic factor only but also due to environmental factor as a result of habits related to the life style. There is an increased

TABLE 4: SHOWING THE PERCENTAGE OF DIABETIC PATIENT HAVING ATTITUDE TOWARDS SUSTAINING GOOD ORAL HEALTH.

Variables		Frequency	Percentage
Tooth brushing	Once a day	208	52%
	Twice a day	190	47%
	Thrice a day	----	-----
	Never	2	1%
Dental floss	Once a day	72	18%
	Twice a day	----	-----
	Thrice a day	4	1%
	Never	324	81%
Visiting dentist	Once 6 months	50	13%
	Once a year	12	3%
	When necessary	178	44%
	never	160	40%
Wish to save posterior mobile tooth		188	47%
Wish to save anterior mobile tooth		128	64%
Factors influencing the extraction decision	Time	256	62%
	Cost	234	59%
Edentulous		10	
Complete denture wearer		10	

TABLE 5 : SHOWING SOURCES OF PARTICIPANT'S KNOWLEDGE

Variables		Frequency	Percentages
Getting information from doctor or dentist		184	46 %
knowledge about diabetes		226	57%
Receiving information about link between diabetes and oral complication		86	21%
Sources of knowledge	Dentist	4	1%
	doctor	44	11%
	Magazines	2	1%
	TV	2	1%
	Radio	-----	-----
	Program	-----	-----
	Internet	2	1%
	Family	2	1%
	Friends	-----	-----
Any other	-----	-----	

prevalence of diabetic problems worldwide.<sup>8</sup> Among the participants in current study majority of participants 59% had awareness about systemic disease as compare to oral disease in diabetes. The result of the present study is in accordance with the previous studies in which it was suggested that in more than half of the patients of DM there was unawareness about the link between oral health and a metabolic disorder that is

diabetes mellitus, the latter if left untreated may lead to compromised periodontal health.<sup>9-14, 15-24</sup>. Moderate periodontitis effects approximately 40-60% adult population worldwide.<sup>25</sup> This supports the result of current study which shows that among 40% of the participants who were aware about oral complications, majority of which about 14% and 11% were aware about the occurrence of tooth mobility and bleeding gums respectively.

TABLE 6: SHOWING THE PATIENTS PREFERENCES ABOUT RECEIVING INFORMATION, RISK FACTOR AND DIABETES FOR BETTER ORAL HEALTH.

Interested in getting information for having good oral health		
Preferablesources for awareness about risk factors for keeping good oral health.	Pamphlets	64 (16%)
	Television	176 (44%)
	Dental health education program	50 (13%)
	Dental access centers	48 (12%)
	Health professionals	62 (15%)

TABLE 7

	Mean
Age	51 years
Since how long patients had diabetes	3 years

Patient's awareness on occurrence of possible systemic disease due to diabetes

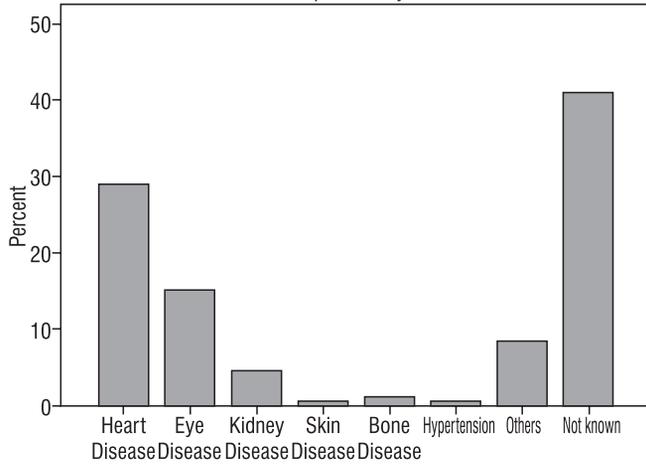


Fig 1

Taking into view the bidirectional association between periodontal health and DM, and impact of good oral health in maintenance of healthy periodonsium , it is recommended to make assured that the patients with diabetes mellitus must be educated and motivated to keep their oral health and hygiene good and are given risk assessment and recommendation for regular oral health checkups as a part of diabetes care regularly. The risk population group such as patients with diabetes mellitus are highly recommended for diagnosis and treatment of oral health related to periodontal disease for prevention in further deterioration of DM and oral health.<sup>26-32</sup> The interventional studies shows evidence about the bidirectional association between periodontal health and DM, suggesting that due to

Patient's awareness on occurrence of possible oral disease due to diabetes

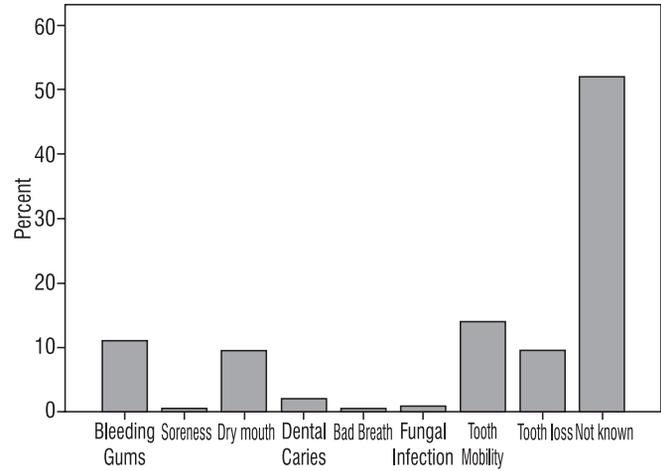


Fig 2

Patient's sources of knowledge regarding increased risk of oral diseases in diabetes mellitus

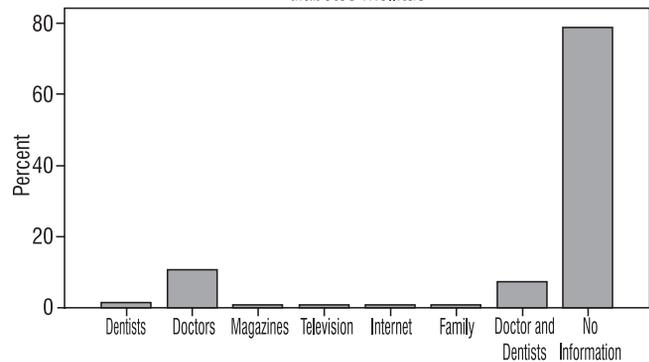


Fig 3

Patient's interested in getting information on factors which will help them in keeping good oral health

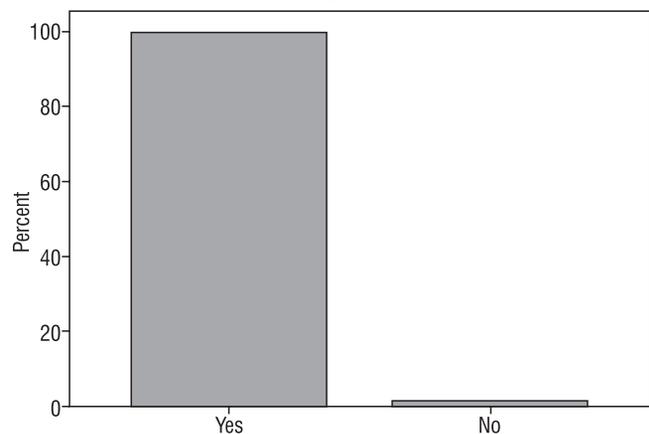


Fig 4

improved periodontal health in DM patients there is improved control in blood glucose level.<sup>25-27,33</sup> Increased blood glucose level increases levels of cytokines and mediators in gingival crevicular fluid and saliva, development of Avanced Glycation products (AGE) and oxidative stress in periodontal tissue, this lead to destruction of periodontium, exaggerated periodontitis

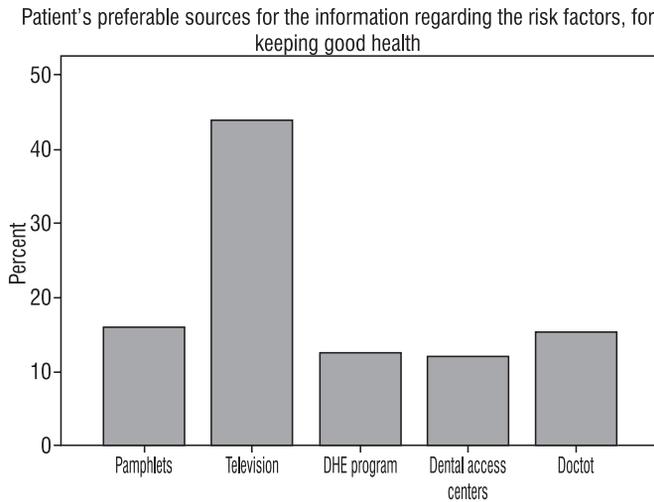


Fig 5

and eventually breakdown of collagen fiber of periodontal ligament resulting of formation of periodontal pocket due to interaction between AGE and receptor of AGE(RAGE).<sup>26</sup> Similarly inflammatory response of periodontium increases or promote level and measures of systemic oxidative stress and increase levels of C-reactive protein, acute phase reactants and biomarkers of oxidative stress in serum. Though inflammation of periodontium is slowly progressive disease but the destruction is irreversible.<sup>34,35</sup> Due to irreversible nature of periodontal tissue destruction, there is a great concern that patients of DM should not delay in seeking help for good oral health to further prevent DM complications and compromised periodontal health should not be kept unresolved.<sup>25</sup> However existing studies suggests that there is interaction between characteristics of inflammation, immune functioning, neutrophil activity and cytokine morphology.<sup>36</sup> The attitude of majority of diabetic patients towards sustaining good oral health in the present study is negative with aspect of dental visiting. Most of the diabetic patients either visit when necessary or never visit the dentist. The access and use of dental services in low and middle income countries is low such as in India<sup>16,22,42</sup>, Malaysia<sup>15,19</sup>, Jordan<sup>17</sup> as compare to developed countries<sup>37</sup> such as USA<sup>10,22,31-42</sup>, UK<sup>52</sup>, Finland<sup>47</sup>, Sweden<sup>10</sup>, Ireland<sup>22</sup>, UAE<sup>12</sup>, Saudi Arabia<sup>24,28</sup> and Korea Republic.<sup>49</sup> Still among high income countries in Asia the percentage of dental visits rate is shown similar to that of low income countries (10-45%) except India(75.6%).<sup>46</sup> Correspondingly, access to dental care services is also vital factor for having successful dental visits. The impact of sponsored dental services in Sweden and permitted public dental services in Australia have shown no such positive results and difference towards access and uptake of dental treatments and visits as compare to those without these benefits.<sup>46</sup>

In the present study less than half of the diabetic patients follow tooth brushing twice a day. This is in accordance to the previous studies (mean 49.3%, 95% CI 35.70-62.90).<sup>51</sup>

Previously done studies have stated that the regular dental flossing practice is rare and is once a day among quarter of the DM patients. This is similar to the results of the current study which shows only 18% of the diabetic patients undertook flossing once a day. Most remarkably there is poor compliance of oral hygiene practice and dental visits in DM patients. Across 20 the results have shown that only half of the patients with diabetes (mean 54%, 95% CI 42.80-65.25) had visited dentists in annually.<sup>51</sup>

The results of current studies has showed that about 62 % of diabetic patients have refused the dental treatment because of time scheduling and 59% have rejected the dental treatment due to high escalating cost of the treatment. These results are in accordance with the previous studies which suggested that the most distinguished reasons among DM patients for not actively taking dental visits for treatment and acceptance of referrals is escalating cost of dental care in high income countries and perception about lack of need for oral health, absence of symptomatic dental problems, dental anxiety and phobia and access such as difficulty in scheduling an appointment example time in low income countries.<sup>11,12,15,16, 21,43</sup>

In present study about 57% of participants had been given information about diabetes and majority of which had received information about the systemic complications in diabetes as compare to oral health related information with regards to diabetic complications from medical doctors. This finding is related to the previous studies which explored that the general physicians and diabetes and health care providers did not deliver any information about oral health and oral health related complications in diabetes among diabetic patients.<sup>8,10-13,21,32,38,44</sup>

Similarly there is significant association of sufficient oral health knowledge with higher level of education(p=0.05)(20) and with receiving dental health education(p=0.008).<sup>9,44</sup> The coordination of dental doctors with regards to participation in multidisciplinary team has positive impact in other area of clinical care such as antenatal care. There is an example of Midwifery Initiated Oral health (MIOH) program in Australia which shows tremendous improvement in the oral health of pregnant women because of the coordination of dental doctors with midwives about the oral health knowledge and self belief to promote oral health.<sup>52-54</sup>

The successful and essential part of the diabetic care includes oral health education in diabetic patients leading to improved knowledge, attitudes and practices.<sup>55-57</sup>

Previous studies done in Pakistan and other countries have shown that participants who were given instructions by health care professionals about brushing and flossing had this greater dental practice adherence (p=0.002) and dental visit compliance(p=0.002).<sup>9,23</sup> Keeping in view the previous studies, this study conducted in Karachi in contrast have shown that diabetic

patients have an interest in retrieving information about oral health, preferably maximum from media then pamphlets as compare to counselling from health professionals.

**CONCLUSIONS**

The data of current study concludes that patients with diabetic mellitus have very less or no knowledge, awareness and information about link between diabetic problems and their oral health related complications. In addition diabetic people have reduced compliance and adherence with dental checkups and positive oral hygiene behaviour respectively. Furthermore the source and mode of obtaining information about oral health with regards to diabetic complication is inadequate and not to their reach and access.

**Recommendations**

It is highly recommended to make certain that patients of diabetes mellitus should be aware and given information and knowledge about possible risk of oral complications and motivated to increase dental compliance.

Multidisciplinary team work involving dental doctors or oral health care providers along with other health care providers including diabetic care providers should be involved in promoting oral health and motivating their diabetic patients to achieve dental compliance and checkups. Furthermore according to the demand and reduced access to health centers, the planning should be made to deliver the information through media and pamphlets.

In addition few more suggestion, firstly making policies through working in partnership with different agencies as these agencies work together to ensure that oral health promotion policies for prevention of oral health complications in diabetic problem are established, implemented, monitored and evaluated.

Secondly common risk factor approach through health promotion strategy recommends the potential for dealing with combination of health problems together effectively. thirdly through behavioural science where patient centered counselling technique in general dental practice through traditional approaches of dental health education is used.

**REFERENCES**

- 1 Muhammad AN, Lamiah AG, Marium AK, Noura AB et al. The burden of diabetes, its oral complications and their prevention and management. *Macedonian Med Sci* 2018; 20(6):1545-53.
- 2 American Diabetes Association. Standards of medical care in diabetes—2011. *Diabetes care*. 2011; 34(Supplement 1):11–61
- 3 World Health Organization. Global report on diabetes:World Health Organization. 2016.
- 4 Shera AS, Jawad F, Maqsood A , Prevalence of diabetes in Pakistan. *Diabetic*
- 5 Association of Pakistan and WHO Collaborating Centre for Diabetes. *Diabetic Clin Pract* 2007;76(2):219-22.
- 6 Indurkar MS, Maurya AS, Indurkar S. Oral Manifestations of

- Diabetes. *Clinical Diabetes*. 2016;34:54–57.
- 7 Kim DL, Kim SD, Kim SK, Park S, Song KH. Is an oral glucose tolerance test still valid for diagnosing diabetes mellitus? *Diabetes & metabolism journal*. 2016;40(2):118–28.
- 8 Ava N, Mohammadali B, Niloofar J, Soraya K, Mina M. Oral health-related quality of life in diabetic patients *Diabet Metab Disorders* .2014;13(1):32
- 9 Eldarrat AH. Diabetic patients: their knowledge and perception of oral health. *Libyan J Med*. 2011;6:1–5. doi: 10.3402/ljm.v6i0.5691
- 10 Yuen HK, Wolf BJ, Bandyopadhyay D, Magruder KM, Salinas CF, London SD. Oral health knowledge and behavior among adults with diabetes. *Diabet Res Clin*. 2009; 86(3):239–46.
- 11 Orlando VA, Johnson LR, Wilson AR, Maahs DM, Wadwa RP, Bishop FK, et al. Oral health knowledge and behaviors among adolescents with type 1 diabetes. *Int J Dent*. 2010, Article ID:942124
- 12 Moore PA, Orchard T, Guggenheimer J, Weyant RJ. Diabetes and oral health promotion: a survey of disease prevention behaviors. *J Am Dent Assoc*. 2000;131(9):1333–1341
- 13 Alves C, Brandão M, Andion J, Menezes R. Oral health knowledge and habits in children with type 1 diabetes mellitus. *Braz Dent J*. 2009;20(1) : 70–73.
- 14 Arunkumar S, Amur S, Sambrani U, Burde KM. Survey on awareness and knowledge about the effect of diabetes mellitus on systemic and oral health in patients visiting general medicine outpatient Department in Dental Hospital. *J Krishna Inst Med Sci*. 2015;4(2):100–106,
- 15 Sandberg GE, Sundberg HE, Wikblad KF. A controlled study of oral self-care and self-perceived oral health in type 2 diabetic patients. *Acta Odontol Scand*. 2001;59(1):28–33.
- 16 Sahril N, Aris T, Asari AS, Yaw SL, Saleh NC, Omar MA, et al. Oral health seeking behaviour among Malaysians with type II diabetes. *J Public Health Aspects*. 2014;1:1–8.
- 17 Aggarwal A, Panat SR. Oral health behavior and HbA1c in Indian adults with type 2 diabetes. *J Oral Sci*. 2012;54(4):293–301
- 18 Al Habashneh R, Khader Y, Hammad MM, Almuradi M. Knowledge and awareness about diabetes and periodontal health among Jordanians. *J Diabetes Complicat*. 2010;24(6):409– 414
- 19 Allen EM, Ziada HM, O'Halloran D, Clerehugh V, Allen PF. Attitudes, awareness and oral health-related quality of life in patients with diabetes. *J Oral Rehabil*. 2008;35(3):218– 223.
- 20 Badiah B. A preliminary survey on awareness of periodontal risk and oral health practices among diabetic patients in hospital Kuala Lumpur. *Malaysian Dent J*. 2012;34(1):1–7
- 21 Bahammam MA. Periodontal health and diabetes awareness among Saudi diabetes patients. *Patient Prefer Adherence*. 2015;9:225–233
- 22 Bowyer V, Sutcliffe P, Ireland R, Lindenmeyer A, Gadsby R, Graveney M, et al. Oral health awareness in adult patients with diabetes: a questionnaire study. *Br Dent J*. 2011;211(6):E12
- 23 Kamath DG, Nayak SU, Pai KK, Shenoy R. Knowledge and awareness of oral health among diabetic patients—a cross-sectional study from Mangalore City. *Int J Diabetes Dev Ctries*. 2015;2:71–75
- 24 Mirza KM, Khan AA, Ali MM, Chaudhry S. Oral health knowledge, attitude, and practices and sources of information for diabetic patients in Lahore, Pakistan. *Diabetes Care*. 2007;30(12):3046–3047
- 25 Sadeghi R, Taleghani F, Farhadi S. Oral health related quality of life in diabetic patients. *J Dent Res Dent Clin Dent Prospects*. 2014;8(4):230–34..
- 26 Chapple ILC, Genco R, and on behalf of working group 2 of the joint EFP/AAP workshop. Diabetes and periodontal diseases: consensus report of the joint EFP/AAP workshop on periodontitis and systemic diseases. *J Clin Periodontol*. 2013; 1340011
- 27 Wang X, Han X, Guo X, Luo X, Wang D. The effect of periodontal treatment on hemoglobin A1c levels of diabetic patients: a sys-

tematic review and meta-analysis. *PLoS One*. 2014;9(9):e108412.

28 Simpson TC, Weldon JC, Worthington HV, Needleman I, Wild SH, Moles DR, et al. Treatment of periodontal disease for glycaemic control in people with diabetes mellitus. *Cochrane Database Syst Rev*. 2015;11:CD004714

29 Faggion CM, Cullinan MP, Atieh M. An overview of systematic reviews on the effectiveness of periodontal treatment to improve glycaemic control. *J Periodont Res*. 2016;51(6):716–25

30 Botero JE, Rodríguez C, Agudelo-Suarez AA. Periodontal treatment and glycaemic control in patients with diabetes and periodontitis: an umbrella review. *Aust Dent J*. 2016;61(2):134–48

31 International Diabetes Federation Clinical Guidelines Task Force. IDF Guideline on oral health for people with diabetes. 2009. <https://www.idf.org/component/attachments/attachments.html?id=729&task=download>. Accessed 20 Sept 2017

32 The Royal Australian College of General Practitioners. General practice management of type 2 diabetes 2016–18: 2016. <https://www.racgp.org.au/download/Documents/Guidelines/Diabetes/2015diabetesmanagement.pdf>. Accessed 20 Sept 2017.

33 Poudel P, Griffiths R, Wong VW, Arora A, George A. Knowledge and practices of diabetes care providers in oral health care and their potential role in oral health promotion: a scoping review. *Diabetes Res Clin Pract*. 2017;130:266–67.

34 Engebretson S, Kocher T. Evidence that periodontal improves diabetes outcomes: a systematic review and meta-analysis. *J Clin Periodontol*. 2013;40(14):S14:S153-63

35 Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. *Lancet*. 2005;366(9499):1809–1820.

36 Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. *Diabetologia*. 2012;55(1):21–31.

37 Taylor JJ, Preshaw PM, Lalla EA. Review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *J Clin Periodontol*. 2013;40(14):113-34.

38 World Bank, World Development Indicators. <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>

39 Kejriwal SR, Bhandary R, Thomas B. Assessment of knowledge and attitude of diabetes mellitus type 2 patients about their oral health in Mangalore, India. *Univ Res J Dent*. 2014;4(1):44–47.

40 Tomar SL, Lester A. Dental and other health care visits among US adults with diabetes. *Diabetes Care J*. 2000;23(10):1505.

41 Macek MD, Tomar SL. Dental care visits among dentate adults with diabetes and periodontitis. *J Public Health Dent*. 2009;69(4):284–89.

42 Moffet HH, Schillinger D, Weintraub JA, et al. Social disparities in dental insurance and annual dental visits among medically insured patients with diabetes: the diabetes study of northern California (DISTANCE) survey. *Prev Chronic Dis*. 2010;7(3):A57

43 Kanjirath PP, Kim SE, Inglehart MR. Diabetes and oral health: the importance of oral health-related behavior. *J Dent Hyg*. 2011;85(4):264–72.

44 Karikoski A, Ilanne-Parikka P, Murtomaa H. Oral self care among adults with diabetes in Finland. *Community Dent Oral Epidemiol*. 2002;(30):216–23.

45 Al Amassi BY, Al Dakheel RS. Oral hygiene practice of adult diabetic patients and their awareness about oral health problems related to diabetes. *J Dent Oral Hyg*. 2017;9(2):8–14.

46 Lee H-K, Choi S-H, Won KC, Merchant AT, Song K-B, Jeong S-H, et al. The effect of intensive oral hygiene care on gingivitis and periodontal destruction in type 2 diabetic patients. *Yonsei Med J*. 2009;50(4):529–536.

47 Chrisopoulos S, Harford JE, Ellershaw A. Australian institute of health and welfare. 2016. Oral health and dental care in Australia: key facts and figures 2015;24-36.

48 Goldsmith MR, Bankhead CR, Austoker J. Synthesising quantitative and qualitative research in evidence based patient information. *J Epidemiol Community Health*. 2007;61:262–270. doi: 10.1136/jech.2006.

49 Oh J, Gjelsvik A, Fuller D, Walsh E, Paine V, Leonard L. Less than optimal dental care among Rhode Island adults with diabetes: the need to assure oral health Care for all Adults with diabetes. *Med Health R I*. 2012;95(3):91–93.

50 Ummadisetty T, Chava VK, Bhumanapalli VRR. Diabetes and periodontitis: how well are the patients aware about an established relation? *J Indian Soc Periodontol*. 2016;20(4):472–75.

51 Bowyer V, Sutcliffe P, Ireland R, Lindenmeyer A, Gadsby R, Graveney M, et al. Oral health awareness in adult patients with diabetes: a questionnaire study. *Br Dent J*. 2011; 211(6):769.

52 Sahril N, Aris T, Asari AS, Yaw SL, Saleh NC, Omar MA, et al. Oral health seeking behaviour among Malaysians with type II diabetes. *J Public Health Aspects*. 2014;1(1):2055-7205.

53 Aggarwal A, Panat SR. Oral health behavior and HbA1c in Indian adults with type 2 diabetes. *J Oral Sci*. 2012;54(4):293–301.

54 Prakash P, Rhonda G, Vincent WW, Amit A, Jeff R.F, Chee L.K, Ajesh G. Oral health knowledge, attitudes and care practices of people with diabetes: a Cochrane Database Systematic review. 2018;18: 77

55 Bangash RY, Khan AU, Manzoor MA. Diabetic Patients; Level Of Awareness About Oral Health Knowledge, Attitude And Practices. *PODJ*. 2011;31(2):292–95

56 Poudel P, Griffiths R, Wong VW, Arora A, George A. Knowledge and practices of diabetes care providers in oral health care and their potential role in oral health promotion: a scoping review. *Diabetes Res Clin Pract*. 2017;130:266–67.

57 Johnson M, Ajwani S, Bhole S, Blinkhorn A, Dahlen HG, Ellis S, et al. Promoting oral health in pregnant women through midwifery practice: an innovative approach. *HNE Handover*. 2013;6(1):32.,

58 George A, Lang G, Johnson M, Ridge A, De Silva AM, Ajwani S, et al. The evaluation of an oral health education program for midwives in Australia. *Women and Birth*. 2016;29(3):208–13.

59 Nakre PD, Harikiran AG. Effectiveness of oral health education programs: a systematic review. *J Int Soc Prev Community Dent*. 2013;3(2):103–15.

60 Colagiuri R, Girgis S, Eigenmann C, Gomez M, Griffiths R. National evidenced based guideline for patient education in type 2 diabetes. Canberra: Diabetes Australia Guideline Development Consortium and the NHMRC; 2009.

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