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Correlation between glycemic state and tooth mobility in patients with periodontal disease

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Abstract

Objective: To evaluate the association of tooth mobility with glycemic levels in patients with periodontitis.

Method: The cross-sectional study was conducted at the Department of Oral Medicine, Ziauddin Dental Hospital, Karachi, from December 2018 to May 2019, and comprised patients of either gender with chronic periodontitis. After recording demographic details and dental charting, tooth mobility scores were correlated with gingival crevicular blood glucose, finger capillary blood glucose and glycosylated haemoglobin levels using Pearson's correlation. Linear regression was applied to assess the inter-relation between the variables. Data was analysed using SPSS 20.

Results: Of the 348 patients, 202(58%) were females and 146(42%) were males. The overall mean age was 43±10.4 years. The mean number of teeth in patients with glucose levels <180mg/dl was 25.5±2.5 compared to 23.2±2.9 in individuals with glucose levels >200mg/dl. A moderate positive correlation (r=0.658) was seen between gingival crevicular blood glucose levels and tooth mobility. Finger capillary blood glucose levels also showed good correlation

(r=0.653) with tooth mobility scores. Glycosylated haemoglobin scores showed a strong positive correlation(r=0.733). Linear regression confirmed increased glycemic levels as a risk factor for tooth mobility (p<0.001).

Conclusion: Tooth mobility and glycemic levels were found to be strongly interrelated.

Key Words: Tooth mobility, Blood glucose, HbA1c, Periodontitis, Hyperglycaemia.

Introduction

Tooth mobility (TM) is the extent of displacement of tooth in its alveolar socket, and is most commonly the consequence of ongoing periodontal inflammation and bone resorption.[1]The prevalence of TM may be linked to the high prevalence of periodontitis in Pakistan.[2]TM is a consequence of periodontal tissue destruction and loss of alveolar bone due to periodontal inflammation.[1,3]There is a diabolic connection among increased blood glucose levels and periodontal inflammation, with diabetes expanding the risk for periodontitis, and periodontal irritation contrarily influencing glycemic control.[4]The number of diabetics is increasing at an alarming rate worldwide, the prevalence being higher in developing countries compared to the developed world.According to a 2016 study, diabetes prevalence was as high as 11.7% in Pakistan.[5]The hyperglycaemia and higher glycosylated haemoglobin (HbA1c) levels in diabetes, if not controlled, act as a potent risk factor for oral diseases.[6]

TM severity may be affected by a variety of variables, including root morphology, quality of periodontal ligament attachment, alveolar bony support and overall systemic wellbeing of a person.[1,7]Systemic disturbances also have a deteriorating effect on periodontium and may cause periodontal destruction and tooth-loss.[8]Hyperthyroidism causes alveolar bone resorption and atrophy, resulting in increased mobility.Patients with excess growth hormone secretion due to hyper-pituitarism also show TM along with other oral

presentations.Osteoporosis and female sexual hormone disorders can also increase the chances of alveolar bone resorption and clinical periodontal attachment loss, causing TM.[9,10]Hyperglycaemia, or abnormally increased glucose level, in diabetes has been linked to dental caries, reduced salivary flow rate, oral candidiasis and periodontal disease (PD). Long-standing hyperglycaemia negatively affects various bodily functions, including oral health. Increased glucose levels in diabetes exacerbate the level of inflammation in the body and affect oral micro-biota.[11]Advanced glycation end substances (AGEs) produced by increased glucose levels are known to aggravate neutrophil response, resulting in periodontal inflammation causing destruction of the periodontal ligament and alveolar bonewhich are the primary supporting structures of teeth that help prevent tooth displacementin its socket.[12]

Miller's Mobility Index (MMI) is the most widely used technique to assess TM, which is checked by holding the tooth between the metallic handles of two instruments and by gently moving the tooth in the bucco-lingual or bucco-palatal direction. The movement is visually assessed and classified into grades 0-3.[13]Since high glucose levels aggravate periodontal inflammation and bone resorption, there is a high possibility of clinical attachment loss and alveolar bone resorption in patients with poor blood glucose control, which may eventually lead to TM.The current study was planned to assess the correlation between TM severity and glycemic levels and control in patients with chronic periodontitis.

Patients and Methods

The cross-sectional study was conducted at the Department of Oral Medicine, Ziauddin Dental Hospital, Karachi, from December 2018 to May 2019, with the approval of Ethics Review Committee (ERC number: 0450818QPOM). The sample size was calculated using Open Epi software.[14] Confidence interval (CI) of 95%, 5% precision and 34.5% prevalence of periodontitis were used for

sample size estimation. [15] The data was collected via consecutive sampling technique.

Those included were chronic periodontitis patients of either gender aged 25-60 years and having a minimum of 20 teeth. Those excluded were patients having purulent discharge on probing, individuals having gingival hyperplasia, and subjects having a history of cardiovascular, hepatic or renal disorders.

After obtaining informed consent, demographic details were noted, and dental charting was performed according to the Federation Dentaire Internationale (FDI) system.[16] TM was recorded as grade 1 with movement <1mm), 2 with movement of 1mm horizontally, and 3 with movement >1mm horizontally and vertically, according to MMI.[13] Blood glucose assessment was carried out by a glucometer via finger capillary blood (FCB) and gingival crevicular blood (GCB). For taking a blood sample for FCB glucose, a sterile lancet was used to puncture the finger bed, and random blood glucose (RBG) readings were recorded. The gingival crevice of anterior maxillary teeth was probed using the University of North Carolina (UNC)-15 probe. A drop of GCB was collected on the glucometer's strip and the glucose readings were noted. Intravenous (IV) HbA1c test was performed in patients with blood glucose levels in pre-diabetic (180-200mg/dl) and diabetic (>200mg/dl) ranges. Patients with HbA1c levels <5.7% were diagnosed as non-diabetics. HbA1c levels 5.7-6.5% indicated pre-diabetes and HbA1c levels >6.5% confirmed the diagnosis of diabetes.[17]

Data was analysed using SPSS 20. Frequency and percentage were calculated for descriptive variables. Mean and standard deviation were calculated for numerical data. Pearson's correlation coefficient was used to assess the correlation between TM and GCB, FSB and HbA1c levels. Linear regression analysis was performed to analyze the association between variables having a strong correlation with TMP<0.05 was taken as significant.

Results

Of the 348 patients, 202(58%) were females and 146(42%) were males. The overall mean age was 43±10.4 years. Also, 160(45.9%) subjects had low socioeconomic status (SES),and 165(47.4%)were either illiterate or had education up to the primary level (Table 1).

The mean number of teeth present was 25±3 (range: 20-28). Of all the subjects, 278(80%) had blood glucose levels in the non-diabetic range, 20(5.7%) were in the pre-diabetic range and 50(14.3%) were in the diabetic range. The mean GCB glucose was 151±60.5mg/dl, mean FCB glucose 159.8±62mg/dl, and the mean IVHbA1C score was 9.2±2.2%.

There were 1,980 mobile teeth; 1,112 (56.16%) mandibular, and 868(44%) maxillary. Among them, 942 (47.5%) teeth showed grade 1 mobility and 245(12.3%) showed grade 3 mobility.

TM scores had moderate positive correlation with GCB glucose readings(r=0.657). FCB glucose levels also demonstrated good correlation (r=0.652) with TM scores, while HbA1c scores showed a strong positive correlation (r=0.733) with TM. When HbA1c increased, there was an increase in TM scores (p<0.01) (Table 2).

According to linear regression analysis, TM was predicted to increase by 0.210mm for each percent rise in HbA1c score (p<0.001) (Figure).

Discussion

TM causes deranged occlusion, disturbed masticatory functions, and debilitated nature of life.[17] Loose teeth during mastication further harm the periodontium, exacerbating the periodontal destruction and resulting in the loss of teeth. TM has a negative impact on physical, social and psychological wellbeing of a patient.[18]The current study found that periodontitis prevailed in the older population, in females, in the uneducated and in those belonging to low socioeconomic group. Besides, almost half of the mobile teeth constituted of

grade-1 mobility. One study also reported the majority having grade-1 mobility.[19] Mandibular left central incisor showed the highest mobility scores, followed by mandibular right central incisor. As reported earlier[17], the current study also showed lower incisors as the teeth having highest mobility scores and upper left canines showing the least mobility. The possible reason scan be the shorter length of the roots of mandibular incisors compared to other teeth and greater accumulation of supra- and sub-gingival calculus on the lingual surface of mandibular anteriorteeth.[20]However, one study showed contrasting results, reporting maxillary central incisors as the most mobile teeth and mandibular canines as the least mobile teeth, andgrade-2 mobility being the most common.[21]The average number of teeth present in patients with normal glucose levels in the current study was 25.5±2.5 compared to 23.2±2.9 in individuals with glucose values in the diabetic range, indicating that uncontrolled hyperglycaemia may contribute to tooth-loss.

Considering that a variety of factors influence TM, it is clinically critical to analyse its relationship with different parameters. A specific measure of data on different related parameters has been gathered by past studies.[22,23]Therefore, in the current study, the degree of TM's association with GCB glucose, FCB glucose and HbA1c was evaluated. Increasing blood glucose and HbA1c levels were associated with increasing TM scores. Poor blood glucose control is one of the important aetiological components related to PD and destruction.[24]The mechanism by which poor glycemic control leads to TM involves increased periodontal inflammation due to the production of AGEs and pro-inflammatory cytokines likeinterleukin-1 (IL-1), tumour necrosis factor (TNF), prostaglandin oestrogen-2 (PGE2) and decreased collagen turnover rate.[25]

The current study observed moderate positive significant correlation of TM with GCB and FSB levels. Similar findings were reported earlier.[26]

TM was also correlated with HbA1c scores in the current study. HbA1c serves as a reliable indicator of chronic hyperglycaemia as it gives a three-month

glycemic history of the patient.[27] HbA1c scores, compared to random GCB and FCB glucose readings, showed stronger significant correlation (r=0.733) with TM scores, indicating that longstanding and poorly-controlled hyperglycaemiais strongly associated with loose teeth.The findings are supported by previous studies.[28,29]A study compared TM with glycemic control in well-controlled and poorly-controlled diabetic patients and found significant ($p<0.05$) association between TM and glycaemic control.[28]Another study predicted metabolic syndrome as a potent risk factor for TM.[29] One potential cause for accelerated bone resorption and TM in individuals with long-term poor glucose control is the decrease in the blood supply of supporting structures of the teeth. Inadequate blood supply causes periodontal tissue to become deprived of oxygen. A low blood oxygen level can cause osteoclast activation and, as an outcome, increased bone resorption and TM will occur.

There is scarcity of data supporting the association of FCB and GCB with TM. The current study has opened the doors for further research on the subject. More studies with a larger sample size are recommended to further explore the role of blood glucose levels in causing TM.

Conclusion

Increased blood glucose levels and HbA1c were associated with increased TM in patients with periodontitis. GCB and FSB were moderately correlated, while HbA1c scores had a strong correlation with TM scores. The strong interrelationship between TM and poorly-controlled glycemic levels highlights the need to spread awareness regarding the effects of uncontrolled hyperglycaemia on periodontal health and TM.

Disclaimer: The text is based on an academic thesis.

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Table 1: Demographic details of the participants.

	Demographics	Frequency	Percentage
Age	25-39 40-60	135 213	38.8 61.2
Gender	Male Female	146 202	42 58
Socioeconomic Status	Low Middle High	160 131 57	46 37 16
Education	Illiterate Primary Secondary Intermediate Graduate	107 58 45 73 65	30.7 16.7 12.9 21.0 18.7

Table 2: Correlation of tooth mobility scores with gingival crevicular blood glucose (GCBG), finger capillary blood glucose ((FCBG) values and and glycosylated haemoglobin (HbA1c) score.

		GCBG levels	FCBG levels	HbA1c score
Mobility scores	Pearson's Correlation(r)	.657**	.652**	.733**
	p value(<0.05)	<0.001	<0.001	<0.001
	N	348	348	52

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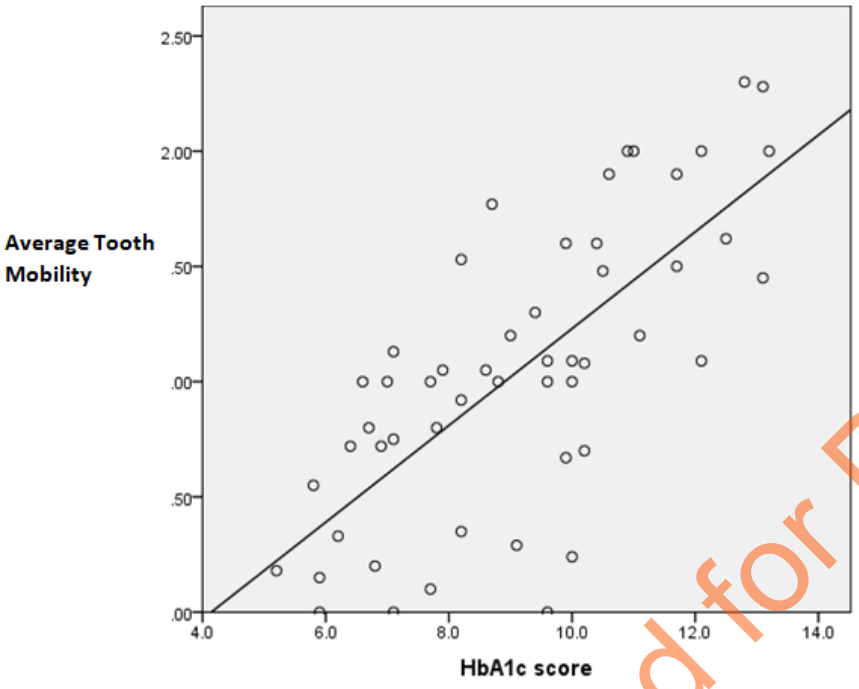

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318 **Figure: Slope of linear regression for tooth mobility values and**
319 **glycosylated haemoglobin(HbA1c) scores showing significant association**
320 **between the two variables.**

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