
A case control study on the effect of Diabetes and Hypertension on oral health

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Abstract: Diabetes and hypertension causes dysfunction in oral components like salivary glands and oral mucosa. Patients with poorly controlled glycemia may present reduction of salivary flow rate and as a consequence, an increased risk to develop oral injuries and impairment on velocity and quality of wound healings. Moreover, presence of hypertension increases the probability of xerostomia (associated or not to salivary flow deficiency) as the number of cardiovascular drug administration increases. The aim of the study is to evaluate the effect of diabetes and hypertension on oral health. It is a university setting study. 300 patients who reported to a private dental college with diabetes, hypertension and both, 100 in each group were randomly selected. The periodontal status and the radiographs of these patients were collected after reviewing case sheets of patients and compared with their medical condition using Chi square test and analysed. The results were represented in the form of bar graphs. The age group which was most commonly affected was 51-60 years (37%). Males (53%) were most affected when compared to females (46%). Generalised chronic periodontitis was mostly seen in patients with both diabetes and hypertension (77%) but was not statistically significant ($p>0.50$). Radiovisiography / Orthopantomogram was mostly taken for patients with diabetes (17%) and for those patients who had generalised chronic periodontitis (24%). Within the limits of the study, periodontal destruction is increased in patients with both diabetes and hypertension, as compared to patients with diabetes alone and hypertension alone.

Keywords: Diabetes, Hypertension, Oral Ulcers, Periodontitis, Radiographs.

INTRODUCTION

Diabetes and hypertension causes dysfunction in oral components like salivary glands and oral mucosa. Diabetes mellitus is an important independent risk factor to oral health [(Sahakyan *et al.*, 2010)],[(Venugopal and Uma Maheswari, 2016)]. Both diabetes and hypertension may promote dysfunction in different tissues and all types, including oral health components as the salivary glands. Patients with poorly controlled glycemia may present reduction of salivary flow rate and as a consequence, an increased risk to develop oral injuries and impairment on velocity and quality of wound healings [(Deshpande, Jain and Sharma, 2010)],[(Chaitanya *et al.*, 2017)]. Moreover, presence of hypertension increases the probability of xerostomia (associated or not to salivary flow deficiency) as the number of cardiovascular drug administration increases [(Rojo-Botello and García-Hernández, 2012)],[(Subashri and Uma Maheshwari, 2016)].

Oral conditions are known to affect almost the majority of the world's population. More than 7% of the world population suffers from severe chronic periodontitis [(Huang and Xu, 2020)],[(Misra *et al.*, 2015)]. Epidemiological studies points that there are various oral manifestations of diabetes such as periodontitis, xerostomia, root caries, candidiasis [(Sreebny and Schwartz, 1997)],[(Maheswari *et al.*, 2018)]. These are pathways linking diabetes with oral diseases, especially periodontitis, which is often referred to as the sixth complication of diabetes [(Needleman, Karimbux and Van Dyke, 2001)],[(Steele *et al.*, 2015)]. Dentists have a rare opportunity to detect cases of hypertension [(Mealey, 2006)],[(Warnakulasuriya and Muthukrishnan, 2018)]. It is the utmost responsibility of a dental clinician to tell the patient about their hypertensive state and to provide them medical advice. There are no recognised oral manifestations of hypertension, but antihypertensive drugs can often cause side effects, like dry mouth, gingival hyperplasia, salivary gland pain or swelling, lichenoid dry reactions, erythema multiforme, taste sense alteration and paresthesia [(Christensen *et al.*,

1977)],[(Patil *et al.*, 2018)]. Dental disease is often an oral manifestation of acute, chronic and systemic disease [(Yetis, 2018)],[(Chaitanya *et al.*, 2018)]. Studies have indicated that affiliations such as heart disease, diabetes and hypertension often can be discovered during routine visits to the dentist [(Fox, 1992)],[(Rohini and Kumar, 2017)].

Periodontitis is one of the most chronic infectious diseases. Periodontitis is a common chronic inflammatory disease characterized by destruction of the supporting structures of the teeth (the periodontal ligament and alveolar bone) [(Fox *et al.*, 1994)],[(Dharman and Muthukrishnan, 2016)]. It is highly prevalent and has multiple negative impacts on quality of life [(Muthukrishnan, Kumar and Ramalingam, 2016)],[(Subha and Arvind, 2019)]. The mouth is an ideal breeding area for bacteria and those affected by periodontal disease are at high risk, for potentially fatal bacteria entering the bloodstream via infected oral tissue. Epidemiological studies confirm that diabetes may be a crucial risk factor for periodontitis [(Zheng, no date)],[(Muthukrishnan and Bijai Kumar, 2017)]. Periodontitis is a disease, during which the inflammation extends and leads to tissue destruction and alveolar bone resorption. Alveolar bone resorption can be evaluated by means of Radiovisiography / Orthopantomogram, which is important for diagnosis and to know the extent of disease progression [(Choudhury, 2015)]. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

So this study was basically to evaluate the effects of diabetes and hypertension on oral health, which helps in early diagnosis, intervention, resulting in better prognosis.

MATERIALS AND METHODS

Study setting

It is a university setting study.. The pros of the study is easy retrieval of data, less time consumption. The cons of the study is the researcher's personal bias. The study was initiated after approval from the institutional review board and it was covered by the following ethical approval number ; SDC/SIHEC/2020/DIASDATA/0619-0320.

Sampling

It is a retrospective study. Data was collected from July 1, 2019 to November 30th, 2019. A total of 86,000 case sheets were reviewed. Cross verification of data for errors was done by photographic evaluation and presence of additional reviewers Simple random sampling was done to minimise sampling bias. Internal validity included the randomisation of patients with diabetes and hypertension. External validity included extrapolation to the South Indian population.

Data collection

Data which included the periodontal status, medical condition and presence of Radiovisiography / Orthopantomogram were obtained after reviewing case sheets of the patients. Datas were entered in a methodical manner in excel and imported to SPSS (Statistical Package for the Social Sciences)and variables were defined. Incomplete or censored data was excluded from the study.

Analytics

IBM SPSS software 2.0 was used for statistical analysis. Independent variables included age, gender. Dependent variables included diabetes, hypertension and both diabetes and hypertension. Descriptive analysis was used to describe age and gender distribution of the study population. Chi square test was used to correlate medical condition and periodontal status and medical condition and presence of Radiovisiography / Orthopantomogram. The results were represented in the form of bar graphs and tables.

RESULTS AND DISCUSSION

The results inferred from the study is as follows:

Age and gender distribution of the study population was shown in Table 1 and Table 2. In relation to age distribution of the study population it was found that the most common age group affected is 51-60 years (37%). Next to this group is 41-50 years (28%) [Figure 1]. In relation to gender distribution of the study population it was found that the males are most commonly affected (53%) than females (47%) [Figure 2]. In relation to association between medical condition and periodontal status it was found that generalised chronic periodontitis was seen mostly in patients with both diabetes and hypertension (77%), whereas localised chronic

periodontitis was seen in 39% of the patients with hypertension. However, the association between medical condition and periodontal status was not statistically significant ($p = 0.034$)[Figure 3 and Table 3].

In relation to the association between medical condition and presence of Radiovisiography / Orthopantomogram it was found that Radiovisiography / Orthopantomogram was mostly taken for patients with diabetes (17%) and least for patients with both diabetes and hypertension (7%). However, the association between medical condition and presence of Radiovisiography / Orthopantomogram was not statistically significant ($p = 0.77$)[Figure 4 and Table 4]. In relation to the association between periodontal status and presence of Radiovisiography / Orthopantomogram it was found that the Radiovisiography / Orthopantomogram was present mostly for patients with generalised chronic periodontitis (24%) when compared to patients with localised periodontitis (10%). However, this association was not statistically significant ($p = 0.665$)[Figure 5 and Table 5]

Periodontitis is the second largest health problem and advances periodontal disease affects 10 to 15% of the population worldwide [(Petersen, 2004)]. Diabetes is an important public health problem, affecting 245 million people worldwide and similarly hypertension is the most common public health problem in developed countries [(Slots and Chen, 1999)].

In relation to age distribution of the study population, 51-60 years age groups were mostly affected by periodontitis, whereas literature by Taylor et al [(Taylor, 2001)], stated that 31-40 years age groups were commonly affected. The reason could be differing sample size and geographic location. Risk of periodontitis increases as age increases, because of poor oral hygiene maintenance, dietary habits, etc.

In relation to the gender distribution of the study population, males were most commonly affected (53%) than females (47%) with periodontitis. The probable reason could be poor oral hygiene maintenance as males are less conscious about oral hygiene when compared to females, also smoking habit is more prevalent in males than females, which predisposes to periodontitis. Literature by Chandra et al [(Chandra *et al.*, 2013)] was in line with the present study. However literature by Apoorva et al [(Apoorva, Sridhar and Suchetha, 2013)] stated that periodontitis was more prevalent in females than in males. The reason could be differing sample size, geographic location.

In relation to the association between periodontal status and medical condition, it was seen that generalised chronic periodontitis was mostly seen in patients with both diabetes and hypertension. However, literature by Apoorva et al [(Apoorva, Sridhar and Suchetha, 2013)] stated that generalised chronic periodontitis was most prevalent in patients with diabetes. This is due to the reason that in case of diabetes, xerostomia is most common, which leads to more plaque and calculus accumulation and poor wound healing which predisposes to periodontitis.

In relation to the association between periodontal status and presence of Radiovisiography / Orthopantomogram, it was found that Radiovisiography / Orthopantomogram was taken mostly to patients with generalised chronic periodontitis. This was in line with the study by Jonasson et al [(Jonasson, Jonasson and Kiliaridis, 2006)] The reason for this is alveolar bone destruction is evident in case of generalised chronic periodontitis. So to diagnose the extent of disease progression, presence of Radiovisiography / Orthopantomogram is essential in case of generalised chronic periodontitis. Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Mathew *et al.*, 2020)

LIMITATIONS

The limitation of the study is sample size, single centered study and examiner’s subjectivity. The future scope of this study is to do extensive research with large sample size, to evaluate the effect of diabetes and hypertension on oral health, so that early diagnosis can be done, leading to early intervention and better prognosis.

TABLES AND GRAPHS

Table 1: Table depicting the descriptive distribution of age of the study population

Age	Frequency	Percent
31-40	21	7.0
41-50	85	28.3
51-60	108	36.0
61-70	74	24.7
71-80	12	4.0
Total	300	100.0

Table 2: Table depicting the descriptive distribution of gender of the study population

Gender		Frequency	Percent
Valid	Male	160	53.3
	Female	140	46.7
	Total	300	100.0

Table 3: Table depicting the association between periodontal status and medical condition. Association was found to be statistically insignificant (Pearson Chi square test-6.787, p value-0.34 (p>0.05), hence statistically not significant)

		Periodontal status		Total	Overall p-value
		Localised periodontitis	Generalised periodontitis		
Medical Condition	Diabetes	36	64	100	
	Hypertension	39	61	100	
	Both	23	77	100	>0.05
Total		98	202	300	

Table 4: Table depicting the association between Medical condition and RVG/ OPG. Association was found to be statistically insignificant (Pearson Chi square test-5.135, p value-0.077 (p>0.05), hence statistically not significant)

		RVG/ OPG		Total	Overall p-value
		present	absent		
Medical Condition	Hypertension	10	90	100	
	Diabetes	17	83	100	>0.05
	Both	7	93	100	
Total		34	266	300	

Table 5: Table depicting the association between Periodontal status and RVG/ OPG. Association was found to be statistically insignificant (Pearson Chi square test-0.188, p value-0.665 (p>0.05), hence statistically not significant)

		RVG/ OPG		Total	Overall p-value
		present	absent		
Periodontal status	Localised periodontitis	10	88	98	
	Generalised periodontitis	24	178	202	>0.05
Total		34	266	300	

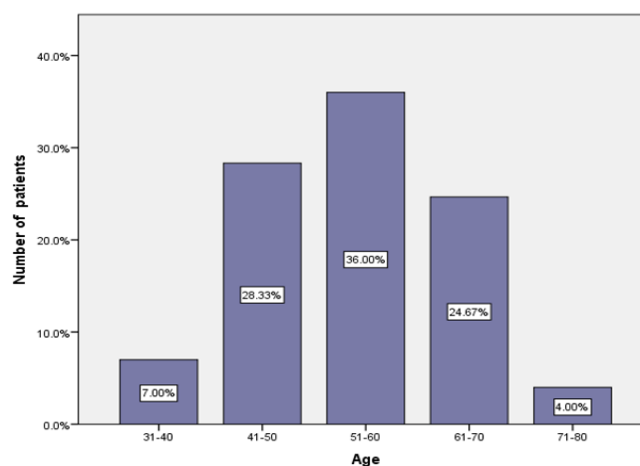


Fig.1: Bar graph depicting the age distribution of the study population where X axis denotes the age group and Y axis denotes the number of participants in each age group. It is seen that the most common age group affected with diabetes and hypertension is 51-60 years (36%).

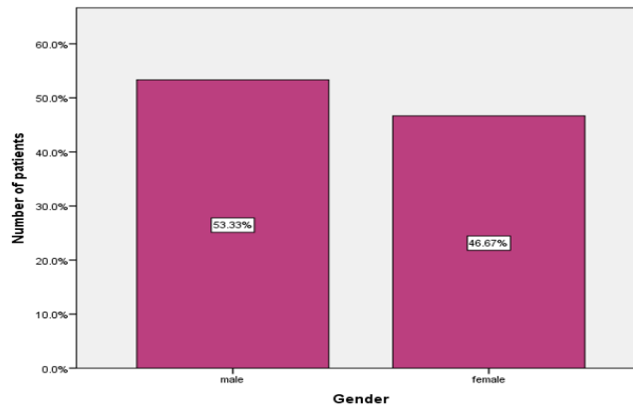


Fig.2: Bar graph depicting the gender distribution of the study population where X axis denotes the gender (males and females) and Y axis denotes the number of participants in both gender. It is seen that the males (53.3%) are most commonly affected than females (46.7%)

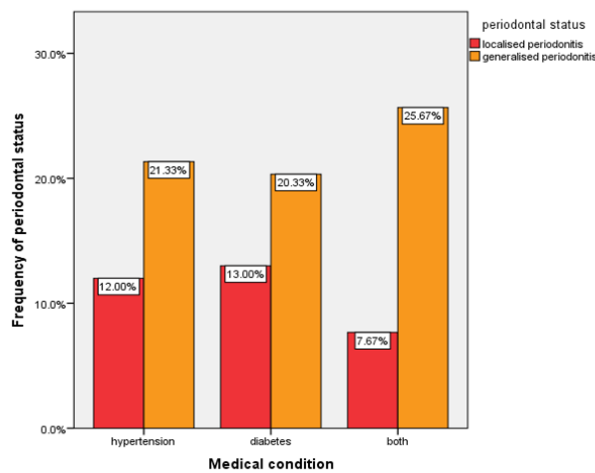


Fig.3: Bar graph depicting the association between medical condition and periodontal status where X axis denotes the medication condition (hypertension ,diabetes and both) and Y axis denotes the periodontal status [generalised (Orange) and localised periodontitis (Red)]. Pearson Chi square test-6.787, p value-0.34 (p>0.05). It is seen that generalised chronic periodontitis was seen mostly in patients with both diabetes and hypertension (26 %). Association was found to be statistically insignificant.

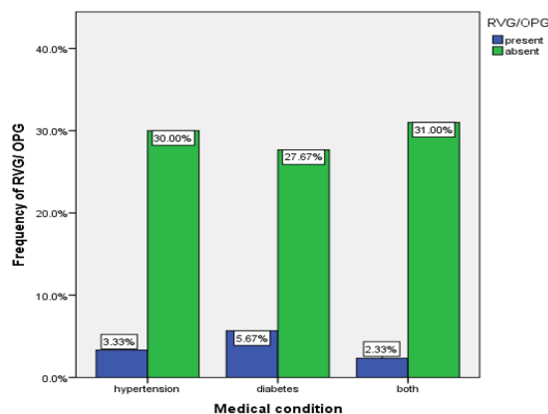


Fig.4: Bar graph depicting the association between Medical condition and RVG/ OPG, where X axis denotes the medical condition (hypertension , diabetes and both) and Y axis denotes frequency of RVG/ OPG [present (Blue) and absent (Green)]. Pearson Chi square test-5.135, p value-0.077 (p>0.05) . It is seen that Radiovisiography / Orthopantomogram was mostly taken for patients with diabetes (5.67%). Association was found to be statistically insignificant.

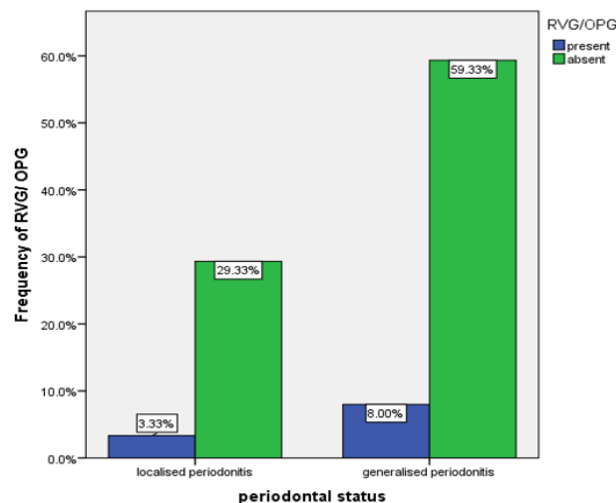


Fig.5: Bar graph depicting the association between periodontal status and RVG/ OPG where X axis denotes the periodontal status (generalised and localised periodontitis) and Y axis denotes Frequency of RVG/ OPG [present (Blue) and absent (Green)]. Pearson Chi square test-0.188, p value-0.665 (p>0.05). It was seen that Radiovisiography / Orthopantomogram was present mostly for patients with generalised chronic periodontitis (8%). Association was found to be statistically insignificant

CONCLUSION

Within the limits of the study, periodontal destruction is increased in patients with both diabetes and hypertension as compared to patients with diabetes alone and hypertension alone. Diabetes mellitus and hypertension is a disease of which the general public and practicing dentists and dental hygienists should be aware. Knowledge of dentists regarding the effects of diabetes and hypertension on oral health is important which usually helps them in early diagnosis, intervention, patient motivation and better prognosis.

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AUTHOR’S CONTRIBUTION

First author (Vaishali. S) performed the analysis and interpretation and wrote the manuscript. Second author (Dr. Manjari Chaudhary) and third author (Dr. Revathi Duraisamy) contributed to conception, data design, analysis, interpretation and critically revised the manuscript. All the authors have discussed the results and contributed to the final manuscript.

Conflict of Interest

None

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