Detection of salivary flow rate and minerals in smokers and non smokers with chronic periodontitis (Clinical and Biochemical study)

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ABSTRACT

Background: Chronic periodontitis is an inflammatory disease that affects the supporting tissues of the teeth and it's a common chronic adult condition. Smoking is considering a major risk factor for development and progression of periodontal disease, and it has an effect to the salivary minerals which cooperate with plaque and calculus initiation, maturation, and metabolism with periodontal disease formation. The purpose of this study was to evaluate the effect of smoking on the salivary minerals in subjects with chronic periodontitis compared to healthy subjects by biochemical analysis of these minerals.

Materials and methods: The study group included 75 males–25 males smokers with chronic periodontitis (G1), 25 males non-smokers with chronic periodontitis (G2) and 25 males non smokers with healthy periodontium (G3). All with an age rang 30-40 years. Clinical measurements include (PLI, BOP, PPD, CAL) were determined for each tooth except third molar. Unstimulated whole saliva was collected. PH and salivary flow rate (SFR) were obtained and the levels of five elements–sodium, potassium, calcium, magnesium, and phosphate in each specimen were analyzed.

Results: A highly significant difference in PLI in (G1) group than in (G3) group and a non significant in (G1) group than (G2) group. A highly significant relation of gingival bleeding on probing in (G2) group in compared to (G1) group with very clearly marked decrease in the total sites that bleed in smokers than non-smokers. Significant differences in PPD and CAL were found between (G1) group and (G2) group. The results of this study for salivary minerals showed that there were high significant differences between (G1) group and (G2) group for Ca^{+2}, Na^{+1} and K^{+1} ions and between (G1) group and (G3) group for Ca^{+2}, $Na^{+1,}$ K^{+1} and $Po4^{-3}$ ions while significant differences were found in (G1) group compared with the other groups for Mg^{+2} ion. Salivary flow rate was significantly higher in (G1) group compared with the other groups. A significant increase in PH level in (G1) group compared to (G3). In (G1) group, there was a significant positive correlation between the mean level of Ca^{+2} and PLI. There was also a significant negative correlation between the mean level of $Po4^{-3}$ and CAL.

Conclusions: The researcher could conclude that monitoring for changes in salivary composition might be a useful tool to detect the effect of smoking on periodontal health status.

Keyword: Chronic periodontitis, smoking, salivary minerals, Atomic absorption spectrophotometer. (J Bagh Coll Dentistry 2012;24(1):68-71).

INTRODUCTION

Chronic periodontitis is the most common form of periodontitis. It is most prevalent in adults but can be observed in children. It is associated with the accumulation of plaque and calculus and generally has a slow to moderate rate of disease progression, but periods of more rapid destruction may be observed. Increases in the rate of disease progression may be caused by the impact of local, systemic, or environmental factors that may influence the normal host-bacterial interaction [1].The saliva is a complex fluid containing a variety of mucosal host defense factors from the different salivary glands and the crevicular fluid [2]. Compelling reasons exist to use saliva as a diagnostic fluid. It meets the demands for inexpensive, noninvasive and easy-to-use diagnostic methods [3]. Saliva exerts a major influence on plaque initiation, maturation and metabolism. Salivary flow and composition influences calculus and periodontal disease formation.

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The inorganic components of plaque are calcium, phosphorous and the other minerals. As the mineral content increases, the plaque mass become calcified to form calculus [4]. Saliva and crevicular fluid play an important role in the prevention of periodontal disease and in the induction of periodontal pathology. The most important risk factor markedly affected the initiation and progression of periodontitis was smoking [5]. Smokers who exhibited greater plaque and calculus formation also had shown elevated calcium concentration and elevated calcium / phosphate ratio in plaque [6].The subjects with established periodontitis exhibited elevated concentrations of salivary electrolytes and proteins [7]. Several studies have demonstrated that the severity of periodontal disease appears to be related to the duration of tobacco use, smoking status, and amount of daily tobacco intake [8].

MARERIALS AND METHODS

Subjects included in the study were drawn from patients attending the Department of Periodontics

in the Collage of Dentistry, University of Baghdad. The study population included fifty males with chronic periodontitis, twenty five of them were smokers (G1) and twenty five were non smokers (G2). In addition twenty five male included in the study with healthy periodontium and didn't present any history of smoking (G3). All subject with an age range from (30-40) year's old and with no history for any systemic disease. The exclusion criteria applied were a course of anti inflammatory or antimicrobial therapy within the previous 3 months, a history of regular use of mouth washes, any previous periodontal treatment, habits like chewing gum and previous chemotherapy, radiation therapy, or medications that cause xerostomia. The clinical parameters, plaque index (PLI), bleeding on probing (BOP), probing pocket depth (PPD) and clinical attachment level (CAL) have been clinically recorded, PPD records have been distributed in scales; scale (I) 4-5 ^{mm} and scale (II) 6-7^{mm} while CAL records have been distributed in scales; scale (I) 1-4 ^{mm} and scale (II) 5-8^{mm}. Unstimulated saliva was collected between 9-12 am and the collection period was 5 minutes to determine the SFR. Before that the subject rinses his mouth several times by water and then wait for 1-2 minutes for water clearance. After collection the sample, it transferred to the laboratory of poisoning centre to determine the PH of saliva and then centrifuged at 4000^{rpm} for 10^{min} , freeze at (-20^{Oc}).After all the samples were collected, the analysis of these samples were done by using colorimetric spectrophotometer in the presence of phosphorus kit by the Molybdenum –Vanadate method to analyze ($Po4^{+3}$ ions) while (Ca^{+2}, Na^{+1}, K^{+1} and Mg^{+2}ions) were analyzed by using atomic absorption spectrophotometer calibration (AAS).The results were statistically analyzed with t-test,Chi-square test and spearman and pearson coefficient of correlation.

RESULTS

(G1) showed a high significant difference in PLI and BOP than that of (G3) and a significant difference between (G1) and (G2) in PPD and CAL in table (1). There were high significant differences in the level of (Ca^{+2}, Na^{+1} and K^{+1}ions) between (G1 and G2) while high significant differences in the level of (Ca^{+2}, Na^{+1}, K^{+1} and $Po4^{+3}$ions) when compared (G1) and (G3). Mg^{+2} ion reveal a significant difference between (G1 and G2) showed in table (3). There were elevated mean level of SFR with highly significant difference in (smokers) group as compared with the other groups showed in table(2). PH gets a higher score among (G1) than (G2) and (G3) showed in table (2). The coefficient of correlation showed a significant direct correlation in (smokers) group between the mean of PLI and Ca^{+2} ion mean level and significant inverse correlation between the mean of CAL and the mean of $Po4^{-3}$ ion within the same group while in healthy group (G3) there was a direct relation between BOP and K^{+1} ion level showed in table (4).

DISCUSSION

There was a high significant difference in PLI found between (G1) and (G3) could be explained in that plaque is the major etiological factor in periodontal disease and it is expected to be accumulating more in chronic periodontitis because the presence of dental plaque is the main clinical finding for chronic periodontitis and it is coinside with the severity of the disease and the time being with the disease. In addition smoking is one of the most prevalent risk factors for chronic periodontitis. The highly significant difference in the amount of gingival bleeding between (G1 and G2) with the number of bleeding sites among smokers group was greatly reduced when compared with non-smokers, the reduced bleeding has proposed to be caused by nicotine induced vasoconstriction. This is in agreement with [9]. There was an increased in PPD and CAL with its different scales in smokers group compared with non-smokers group and this could be explained from the fact that there is imbalance in the host-bacterial interactions and this imbalance may be due to changes in the composition of the subgingival plaque, with increase in the numbers and / or virulence of pathogenic organisms; changes in the host response to the bacterial challenge, or a combination of both. There was significant increase in most of salivary minerals in smokers group compared with non smokers and this could be explained that during gingival inflammation, greater gingival crevicular fluid (GCF) flow was recorded. This increase in (GCF) secretion may account for the increase salivary protein and electrolytes of mixed saliva where (GCF) is one of its sources [10]. Also, an increase of GCF volume due to the effect of cigarette smoking has been demonstrated by Kemal Ü et al [11], so this leads to increase in salivary minerals. On the other hand the controversy between the present study and other studies could be due to different techniques applied, different sample size used and different age groups. Also the levels of salivary minerals get a good relationship with the neutritional status of the individuals.

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Table 1: Records the mean and standard deviation of PLI, PPD and CAL, and the mean percentage of sites of PPD and CAL according to different scales, and BOP

Groups	PLI	BOP	PPD	CAL	Mean percentage and SD of PPD sites		Mean percentage and SD of CAL sites	
					Scale I	Scale II	Scale I	Scale II
G1	1.232±0.475	Total sites: (2468) Bleeding: 389 (15.8%)	4.346±0.377	2.767±0.499	90.72±14.907	9.27±14.906	87.08±8.968	12.09±8.968
					Scale I	Scale II	Scale I	Scale II
G2	1.141±0.317	Total sites: (2440) Bleeding: 558 (22.9%)	3.43±2.05	2.469±0.691	63.96±40.12	12.02±17.65	88.94±18.19	6.72±6.68
G3	0.379±0.294	Total sites: (2712) Bleeding:107 (3.9%)						

Table2: Descriptive statistics of salivary flow rate (ml/min) and PH; Mean and Standard Deviation for each group

	SFR (ml/min)		Salivary PH	
Groups	Mean	±SD	Mean	±SD
G1	0.792	0.243	7.705	0.299
G2	0.418	0.135	7.570	0.501
G3	0.416	0.195	7.257	0.550

Table 3: Descriptive statistics of salivary minerals concentration (mmol/L); Mean and Standard deviation for each group

Groups	Statistic	$Po4^{-3}$	K^{+1}	Na^{+1}	Mg^{+2}	Ca^{+2}
G1	Mean	2.05	0.548	11.2	8.62	3.386
	±SD	0.322	0.158	2.160	0.863	0.988
G2	Mean	1.51	0.4608	9.2	6.704	3.028
	±SD	0.481	0.089	2.449	0.814	0.893
G3	Mean	1.478	0.391	7.96	5.976	2.731
	±SD	0.677	0.280	2.150	1.159	0.499

Table 4: The coefficient of correlation (r) of the level of salivary minerals with clinical periodontal parameters among groups and their level of significant differences (P-value)

GROUPS	MINERALS	PLI		BOP	PPD			CAL	
		r	p	r	p	r	p	r	P
G1	$Po4^{-3}$	0.162	0.438	-0.06	0.839	0.004	0.987	-0.428	0.033*
	K^{+1}	-0.081	0.701	0.043	0.777	-0180	0.389	-0.084	0.689
	Na^{+1}	0.131	0.533	0.168	0.421	-0.022	0.971	0.159	0.447
	Mg^{+2}	0.288	0.163	0.161	0.442	0.197	0.345	-0.197	0.051
	Ca^{+2}	0.358	0.049	0.174	0.406	0.032	0.119	-0.217	0.297
G2	$Po4^{-3}$	0.318	0.121	0.243	0.241	0.448	0.025	0.201	0.336
	K^{+1}	-0.135	0.519	0.137	0.513	-0.023	0.914	0.128	0.542
	Na^{+1}	0.126	0.549	-0.09	0.639	0.267	0.197	0.114	0.586
	Mg^{+2}	0.583-	0.002**	0.073	0.729	-0.228	0.272	0.409	0.346
	Ca^{+2}	0.02-	0.923	0.162	0.440	0.104	0.622	-0.165	0.431
G3	$Po4^{-3}$	0.034	0.873	0.005	0.980				
	K^{+1}	0.098	0.640	0.376	0.049*				
	Na^{+1}	0.204-	0.328	-0.04	0.846				
	Mg^{+2}	-0.189	0.366	-0.08	0.689				
	Ca^{+2}	0.257	0.214	-0.136	0.501				