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The Effect of Non-Surgical Periodontal Treatment on Periodontal Health Andmeasuringa Specific Salivary Inorganic Ions in Smokers and Non Smokers Participants with Chronic Periodontitis

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Abstract:
Background: *Chronic periodontitis is an inflammatory disease of tissues supporting the teeth. Salivary enzymes and inorganic ions have been most intensely studied as a potential marker for periodontal disease.This study aimed to measure sodium, potassium, magnesium and calcium ions level in saliva of patients who are smokers and non smokers with chronic periodontitis before and after non surgicalperioontal treatment.*
Materials and Methods:*The study sample consists of (16) males with chronic periodontitis who are non smokers(A) and (16) males with chronic periodontitis who are smokers (B) of both gender with an age ranged (35-45) years.Unstimulated whole saliva were collected to measuresalivary inorganic ions(sodium, calcium, magnesium and potassium) by using atomic absorption spectrophotometer devicethen the clinicalperiodontal parameters were measured which include Plaque index (PLI) gingival index (GLI), probing pocket depth (PPD) and clinical attachment level (CAL), the patients treated periodonticaly by oral hygien motivation , instruction, scaling and deep scaling.Then one week after the first visit from the treatment of patients who are chronic periodontitis non smokers and patients who are chronic periodontitis smokers which referred(A1)and (B1)respectively, clinicalperiodontal parameters and unstimulated salivary sampleswerемeasured and analyzedfrom those patients.*
Results:*In the inter group comparison between (A) and (A1), there was a significant difference in the mean level of (GLI) and (PLI) indices while in the intergroup comparison between (B) and (B1), there was a significant difference in the mean level of GLI, PLI and PPD. The biochemical finding showed in theinter group comparison of salivary inorganic ions showed high significant difference in the level of Ca^{++} ions in the comparison between (A) and (B) also in (A1) and (B1) while significant difference appeared in the comparison between (A) and (A1) .The level of Mg^{++} ions showed significant difference in the comparison between (A) and (B) also high significant differences in the comparison between (A1) and (B1) but no significant differences in the comparison between (A) and (A1) also in the comparison between (B) and (B1) .The remaining minerals Na^{+} and K^{+} showed no significant difference in the comparison among these groups.*
Conclusion:*smokers with periodontitis(B) exhibited high level of salivary calcium, as compared with non-smokers with periodontitis(A), after treatment smokers with periodontitis(B1) exhibited reduced level of salivary calcium with reduction in the mean level of GLI, PLI and PPD, as compared with non-smokers with periodontitis(A1) and the differences were statistically significant.Also the level of Mg^{++} ions showed significant difference in the comparison between (A) and (B) also high significant differences in the comparison between (A1) and (B1) .So that changes in salivary inorganic ions might be useful to establish favorable response to periodontal therapy.*
Keyword:*Chronic periodontitis,smokers,inorganicions,atomicabsorption spectrophotometer,saliva.*

I. Introduction

The chronic periodontitis has been defined as "an infectious disease resulting in inflammation within the tissues supporting the teeth, progressive lossof attachment, and loss of bone." This definition outlines the major clinical and etiologicalfeatures of the disease: (1) Microbial plaque formation, (2) inflammation of Periodontium, and (3) Loss of attachment and alveolar bone. Periodontal pocket formation is usually consequences of the disease process unless gingival recession accompanies the loss of attachment, in which case pocket depths may remain shallow, even in the presence of ongoing loss of attachment and bone loss [(1)].

Saliva has been represented an important biological material to introduce new diagnostic tests which may involved to make a diagnosis and explained the pathogenesis of many systemic diseases[(2)]. Salivary fluid is an exocrine secretion consisting of approximately 99% water and the other 1% is complex of numerous organic and inorganic molecular[(3)]. Saliva contains the most important electrolytes of the body fluid (calcium,

magnesium, sodium and potassium) [4] and exerts a major influence on the initiation, maturation and metabolism of dental plaque. Salivary flow and composition influencesthe formation of calculus and periodontal disease [5].The inorganic components of plaque are predominately calcium and phosphorus,with trace amounts of other minerals like sodium and potassium. The source of inorganic constituent of supragingival plaque is primaily saliva; as the content of salivary mineralsincreases,the plaque mass becomes calcified to form calculus [6].The concentration of Salivary calcium is an important factors inperiodontal heath, rising level of salivary calcium is closely related to rapidly mineralized plaque, which turn is related to the poor oral hygiene [7,8]. Smoking is considering a major risk factor to develop and progress the periodontal disease [9]. Smoking has been shown to affect the response to surgical or non-surgical treatment of periodontal disease[10]. The effects of smoking on the periodontal tissue depend on the number and the durationofthe cigarette smoked daily [11]. Impairment of the host immune system may be one factor that explains the higher occurrence and the severity of periodontitis among cigarette smokers. Indeed, it has been shown that the functions of polymorph nuclear leukocyte such as chemotaxis, phagocytosis, and oxidative burst are decreased by substances in cigarette smoke [12,13].

II. Materials 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 (32) males with an age range from (35-45) year's old. Those patients divided into four groups, Group I(A) composed from 16 patients with chronic periodontitis non smokers, Group II(B) composed from 16 patients with chronic periodontitis smokers, the patients in the first and second group treated periodonticaly by non surgical periodontal treatment (oral hygien motivation, instruction, scaling and deep scaling) referredtoGroupIII(A1) andGroupIV(B1) respectively.Chronicperiodontitis in patients was defined as the presence of teeth with probing pocket depth ≥4mm with clinical attachment loss, this made according to the international classification system for periodontal disease [14]. All subjects 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)[15], gingival index (GLI)[16],probing pocket depth (PPD)[17] and clinical attachment level (CAL)[18] have been clinically recorded before non surgical periodontal treatment for those patients. Unstimulated whole saliva was collected between 9-12 am. Before that the patient rinses his mouth several times by water and then waits for 1-2 minutes for water clearance. After collection the sample, it transferred to the laboratory of poisoning centre to centrifuge at 4000^{rpm} for 10^{min} , freeze at (-20^{o}C) .For groups(A) and(B) the samples and the clinical indices collected before the periodontal treatment while for (A1) and (B1) the samples and the clinical indices collected after one week from the treatment. After all the samples were collected, the analysis of these samples were done by using atomic absorption spectrophotometer calibration (AAS) and the levels of sodium, calcium, magnesium and potassium in each sample were detected for each group in pre and post non surgical periodontal treatment. The results were statistically analyzed with SPSS version.

III. Results

In this study the mean ±SD of PLI, GLI, PPD and CAL in chronic periodontitisnon smokers before treatment (A) patients were (1.091 ±0.31628, 1.069 ±0.18518,4.539 ±0.70399 and 3.6625 ±0.73383)respectively while the mean ±SD of PLI, GI, PPD and CAL in chronic periodontitis non smokers after treatment (A1) patients were (0.814±0.42623, 0.838±0.31172, 3.333 ±2.39331 and 3.3938 ±0.366)respectively as shown in table 1.In the inter group comparison between (A) and (A1), there was a significant difference in the mean level of (GLI) and (PLI) indicesas shown in table 3. The mean ±SD of PLI, GLI, PPD and CAL in chronic periodontitis smokers before treatment (B) patients were (1.585 ±0.56383, 1.319 ±0.31879, 5.434 ±1.06688 and 4.78 ±1.29547) respectively while the mean ±SD of PLI, GLI, PPD and CAL in chronic periodontitissmokersafter treatment (B1) patients were (0.982 ±0.5532, 0.956 ±0.956, 4.491 ±1.32089 and 4.0125 ±1.74466) respectively as shown in table 1.There was a significant difference in the mean level of GLI,PLI and PPD in the comparison between (B) and(B1) as shown in table 3.For salivary analysis, the mean level ±SD of salivary Ca^{++}, Mg^{++}, Na^{+} and K^{+} ions in chronic periodontitis non smokers before treatment (A) patients were (1.221 ±0.5324, 0.5706 ±0.18408,5.1875 ±1.93972 and 5.5438 ±2.12696)respectively while the mean ±SD of Ca^{++}, Mg^{++}, Na^{+} and K^{+} ions in chronic periodontitis non smokers after treatment (A1) patients were (0.869 ±0.64158, 0.6788 ±0.23457, 4.4375 ±1.59034 and 6.1375 ±1.57221)respectively.The mean level ±SD of salivary Ca^{++}, Mg^{++}, Na^{+} and K^{+} ions in chronic periodontitis smokers before treatment (B) patients were (2.047 ±0.35612, 0.3513 ±0.16536,5.062 ±1.38894 and 5.856 ±2.30881)respectively while the mean ±SD of Ca^{++}, Mg^{++}, Na^{+} and K^{+} ions in chronic periodontitis smokers after treatment (B1) patients were (1.944 ±0.44605, 0.38 ±0.16721, 4.937 ±1.48183 and 5.656 ±2.18387)respectively. The previous descriptive statistics for salivary inorganic ions showed in table 2.The results of inter group comparison of salivary inorganic ions

showed high significant difference in the level of Ca^{++} ions in the comparison between (A) and (B) also in (A1) and (B1) while significant differenceappeared in the comparison between (A) and (A1).The level of Mg^{++} ions showed significant difference in the comparison between (A) and (B) also high significant differences in the comparison between(A1) and (B1) but no significant differences in the comparison between(A) and(A1)also in the comparison between (B) and(B1).The remaining minerals Na^{+} and K^{+} showed no significant difference in the comparison among these groups. All the previous intergroup comparison result about salivary inorganic ions appeared in table 4.

Table 1: Records the mean and standard deviation of PLI, GI, PD and CAL in Group I (A), Group II (B), Group III (A1) and Group IV (B1)

Groups	Descriptive Statistic	PLI	GI	PD	CAL
(A)	**Mean**	1.091	1.069	4.539	3.6625
	±SD	0.31628	0.18518	0.70399	0.73383
(B)	**Mean**	1.585	1.319	5.434	4.78
	±SD	0.56383	0.31879	1.06688	1.29547
(A1)	**Mean**	0.814	0.838	3.333	3.3938
	±SD	0.42623	0.31172	2.39331	0.366
(B1)	**Mean**	0.982	0.956	4.491	4.0125
	±SD	0.5532	0.956	1.32089	1.74466

Table 2: Records the mean and standard deviation of salivary inorganic ions in mmol/l for Group I (A), Group II (B), Group III (A1) and Group IV (B1)

Groups	Descriptive Statistic	Ca(mmol/l)	Mg(mmol/l)	Na(mmol/l)	K(mmol/l)
(A)	**Mean**	1.221	0.5706	5.1875	5.5438
	±SD	0.5324	0.18408	1.93972	2.12696
(B)	**Mean**	2.047	0.3513	5.0625	5.8563
	±SD	0.35612	0.16536	1.38894	2.30881
(A1)	**Mean**	0.869	0.6788	4.4375	6.1375
	±SD	0.64158	0.23457	1.59034	1.57221
(B1)	**Mean**	1.944	0.38	4.9375	5.6563
	±SD	0.44605	0.16721	1.48183	2.18387

Table 3: Inter group Comparison of means of PL, GI, PPD and CAL amongGroup I (A), Group II (B), Group III (A1) and Group IV (B1)

		PLI	GI	PPD	CAL
(A)and (B)	**T test**	-3.148	-2.752	-2.398	-2.873
	P-value	0.007	0.015	0.03	0.012
	Sig	**S**	**S**	**S**	**S**
(A1) and (B1)	**T test**	-1.087	-0.714	-1.495	-1.389
	P-value	0.294	0.486	0.156	0.185
	Sig	**NS**	**S**	**NS**	**NS**
(A) and (A1)	**T test**	2.544	2.058	2.474	1.913
	P-value	0.022	0.057	0.026	0.075
	Sig	**S**	**NS**	**S**	**NS**
(B) and (B1)	**T test**	2.626	2.852	3.092	1.027
	P-value	0.019	0.012	0.007	0.321
	Sig	**S**	**S**	**S**	**SN**

Table 4: Inter group Comparison of means of salivary inorganic ions in mmol/l amongGroup I (A), Group II (B), Group III (A1) and Group IV (B1)

		Ca(mmol/l)	Mg(mmol/l)	Na(mmol/l)	K(mmol/l)
A) and (B)	**T test**	-5.001	2.966	0.225	-0.39
	P-value	0.001	0.01	0.825	0.702
	Sig	**HS**	**S**	**NS**	**NS**
(A1) and (B1)	**T test**	-6.273	4.159	-0.826	0.844
	P-value	0.0001	0.001	0.422	0.412
	Sig	**HS**	**HS**	**NS**	**NS**
(A) and (A1)	**T test**	2.214	-1.324	1.91	-1.939
	P-value	0.043	0.205	0.075	0.072
	Sig	**S**	**HS**	**NS**	**NS**
(B) and (B1)	**T test**	1.428	-0.406	1.464	1.078
	P-value	0.174	0.69	0.164	0.298
	Sig	**NS**	**HS**	**NS**	**NS**

IV. Discussion

In this study, the clinical periodontal parameter which are PLI,GLI,PPD and CAL in chronic periodontitis smokers (B) showed high level scores with significant differences as compared to non smokers group (A) and this might be coincide with the effect of smoking which may represent the major risk factors for chronic periodontitis. These results in agreement with cross- sectional studies [19, 20] and longitudinal studies [21, 22, 23].These results were concluded that smokers have greater bone loss and large numbers of pathological pockets. Many studies in agreement with this study which reported increasing in the amount of plaque accumulation in smokers group as compared with non smokers group [24, 25, 26] while other studies showed no differences in the amount of plaque between these groups [27, 28]. Following non surgical periodontal treatment (motivation, instruction and scaling), mean PPD showed significant improvement in the comparison between (A) and (A1), in addition to (B) and (B1). This reduction in probing pocket depth was in agreement with different studies [29, (30, 31)] which showed that the amount of reduction in pocket depth was directly related to the previous pocket depth. After treatment in the comparison between non smokers (A1) and smokers (B1) groups showed significant improvement in the gingival inflammation but no significant differences in PPD and CAL.The explanation for the previous results might be due to the effect of treatment on smokers group which showed greater pocket reduction as compared to non smokers and this might be due to the fact that the smokers group had greater probing pocket depth so greater pocket reduction after treatment. Greater gingival recession following treatment might explain that no significant clinical attachment loss and this was in agreement with Zuabi O et al [31]. The biochemical findings in the present study showed decrease in the mean level of magnesium ion in (B) with significant difference in the comparison with (A). Magnesium status has a strong relationship with the immune system, acting as a modulator of the immune response [32], so the reduction in Mg concentrations are associated with the enhancing of the inflammatory response to bacterial plaque [33]. Also Mg deficiency associated with low bone mass, which is manifested in the oral cavity as loss of alveolar crestal bone height and tooth loss, accompanied by the stimulating the pro-inflammatory cytokines [34]. The level of Ca ion increased in (B) with high significant difference in the comparison with (A) and this might be due to the antagonist physiological action of calcium so during inflammation of the gingival, greater gingival crevicular fluid was recorded that lead to increase salivary electrolytes of mixed saliva where gingival crevicular fluid is one of its sources (Griffths et al[35] and Darany et al[36].These results were in agreement with (BasimaGh and Omar H [37]. After periodontal treatment the mean of Ca ion reduced in (A1) as compared to (A) and in (B1) as compared to (B). These results might be due to the effect of treatment on periodontal health which lead to decrease in the level of periodontal inflammation that lead to reduce in gingival crevicular fluid exudates so reduction in Ca ion concentration in saliva, in which the gingival fluid part of the saliva constituent. The concentration of Mg ion increased slightly with no significant difference and this slight elevation might be due to the reduction in the level of periodontal inflammation.

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