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Cross Sectional study

Is salivary fluoride a better noninvasive indicator of progressive periodontal disease than invasive serum fluoride – A Cross Sectional study

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Abstract: Periodontitis is seen as resulting from a complex interplay of bacterial infection and host response, modified by behavioral and systemic risk factors.There is high prevalence of endemic fluorosis among the patients in certain regions in India and scarcity of information on the effects of levels of fluoride in serum and saliva to the periodontal disease severity. Aim of the present study was to estimate the levels of fluoride in serum and saliva and in ground water of chronic periodontitis subjects in the endemic fluorosed area and to correlate the levels of fluoride in serum and saliva to the periodontal disease severity.140 subjects were divided into two groups. Group I (Test group) consisted of 100 dental subjects diagnosed with dental fluorosis and chronic periodontitis. Group II (Control group) consisted of 40 non-fluorosed subjects. Ion selective electrode method was used for assessingthe fluoride in serumand saliva. There was no significant correlation between salivary and serum fluoride levels and the periodontal disease severity. However the mean salivary fluoride levels were found to significantly influence the dental fluorosis severity (p<0.005*).

Keywords: Chronic Periodontitis, Dental Fluorosis, Clinical Attachment Level, Fluorosed teeth, Non Fluorosed teeth.

Introduction:

Periodontitis is a multifactorial disease which is associated with loss of the supporting tissues around the tooth surface. One of the major objectives of periodontal therapy is to remove mechanically the soft and hard, supra and subgingival deposits from the root surface to further stop the disease progression.[1]Bacterial growth in the dental plaque biofilm is one of the primary factor which governs the abundance of different types of species of bacteria.

Endemic fluorosis is widely prevalent in India and is one of the major health problems. Several reports are cited on the distribution of fluorine compounds in the environment, routes of penetration into living organisms, and analytical methods for the quantitative determinations of fluorine content in air, water, soil, and foods. Important contributions have been made by researchers on the role and patterns of fluorides in body fluids and soft and hard tissues, which remain in direct relationship to accumulation and elimination of fluorine.[2]Banting and Stamm[3]with regard to fluoride uptake by root tissues found that the mean fluoride concentrations in the outer layers of the tooth root were higher in teeth from a fluoridated area compared with a non-fluoridated area.

Several studies[4] have reported greater levels of gingival inflammation in the areas which are affected with endemic fluorosis. Fluorosis induces changes in hard and soft tissue of periodontium. There is a strong association of occurrence of periodontal disease in high fluorosed area.

Higher percentage of cavitation and root resorption were observed influorosed teeth and this was a common finding when extensive alveolar bone loss takes place, where cementum repair was unable to compensate for resorption. Several scanning electron microscopic (SEM) studies[5] have shown higher percentage of partial/initial mineralization of connective tissue fibers and globular mineralized debris in fluorosed teeth. In addition to these changes fluoride is known to affect fibroblast attachment and inflammatory cells like neutrophils.[6]The degree of fluorosis appears to relate to the timing, duration, and dose of fluoride exposure. Both the animal and human studies[7] which have been reviewed indicate that the transition/early maturation stage is particularly susceptible to fluoride.

Though large number of studies exists in literature comparing the influence of fluorosis on periodontal disease. No study exists in literature showing the correlation of levels of fluoride in serum and saliva to the periodontal disease severity. Hence the present study was planned to estimate the levels of fluoride in serum and saliva and in ground water of chronic periodontitis subjects in the endemic fluorosed area and to correlate the levels of fluoride in serum and saliva to the periodontal disease severity.

Materials and Method:

The present cross sectional case control study was carried out at a single center. The nature and purpose of the study was

explained to the patient and a written informed consent was obtained from all participants prior to study. Ethical committee of the institution approved the study.

Screening and Examinations

A total of 250 chronic periodontitis subjects with dental fluorosis within the age group of 35-55 years were screened. Out of which 140 subjects which fulfilled the inclusion and exclusion criteria were enrolled in the study. The subjects were selected from six regions of Nalgonda district affected with endemic fluorosis. A simple randomization approach [8] using computer-generated random numbers was employedand the subjects were categorized into 2 groups.

Group I (Test group)

100 subjects with periodontitis and dental fluorosis were included. They were categorized into 4 subgroups with 25 from each group according to the modified dean's fluoride index

Group I (Test group)

100 subjects with chronic periodontitis and dental flourosis were included. They were categorized into 4 subgroups with 25 individuals in each group according to the modified dean's fluoride index.[9]

Group II (Control group)

40 subjects without dental fluorosis consisting of 20 subjects with periodontitis and 20 without periodontitis.

After selection of subjects the following clinical parameters were recordedfor all the subjects in all the groups. A specially designed lightweight CPI probe with a 0.5mm ball tip was used, with a black band between 3.5 and 5.5mm and rings at 8.5 and 11.5mm from the ball tip.

1. CPI score (Community Periodontal Index)
2. CAL score (Clinical Attachment Level)

Inclusion Criteria:

- Chronic periodontitis patients in the age group 35-55years.
- Subjects with dental fluorosis as determined by Dean`s fluorosis index.
- At least one site with probing depth >5mm and two sites with attachment loss >6mm in 2 quadrants.
- No history of systemic antibiotic administration within the last 6 months.
- No periodontal treatment 6 months prior to the study.
- Signed informed consent.

Exclusion criteria:

- Pregnant or lactating females.
- Deleterious habits like smoking/alcohol/tobacco consumption.
- Aggressive periodontitis.
- Patients using fluoridated tooth paste since 6months.

Laboratory Procedure:

For the estimation of fluoride levels in saliva, mix of resting saliva and stimulated saliva were collected respectively by expectorating into polypropylene tubes and were immediately subjected for analysis.

Venous blood samples were collected under aseptic precautions and centrifuged at 2500 rpm for 10 min and the supernatant serum which was separated in to 3ml sterile vials and immediately subjected for fluoride analysis by fluoride specific ion selective electrode method using TISAB buffer.

Statistical Analysis

The data were analyzed using the SPSS -software 19.00 program (SPSS Inc., Chicago, IL, USA). Pearson correlation coefficient was used for descriptive analysis of the data.Inter group comparison was done by one-way analysis of variance (ANOVA). Differences were considered as statistically significant at $p<0.005$*****.

Results

This study was aimed at estimating the levels of fluoride levels in saliva and serum samples in all the 140 subjects and correlating these levels to the periodontal disease severity which was measured by calculating CPI and CAL scores.

The mean fluoride levels in saliva score is0.030 when correlated to the mean CPI score which does not indicate any correlation between them (Table 1).

		fluoride in saliva	CPI Score
fluoride in saliva	Pearson Correlation	1	0.030
	Sig. (2-tailed)	.	0.73
	N	140	140
CPI Score	Pearson Correlation	0.030	1
	Sig. (2-tailed)	0.762	.
	N	140	140

CPI = Community periodontal index

Table 1: Correlation of mean saliva fluoride scores to the mean CPI scores

The mean fluoride levels in serum and the standard deviation are calculated which was 0.018 indicated there is no correlation between the mean of serum fluoride and CPI scores (Table 2).

		fluoride in serum	CPI Score
fluoride in serum	Pearson Correlation	1	0.018
	Sig. (2-tailed)	.	0.831
	N	140	140
CPI Score	Pearson Correlation	0.029	1
	Sig. (2-tailed)	0.842	.
	N	140	140

CPI = Community periodontal index

Table 2: Correlation of mean serum fluoride levels to the mean CPI scores

Correlation coefficient value for mean and standard deviation of CAL scores and mean fluoride levels in saliva were is 0.029 which indicates no correlation between them (Table 3).

		Fluoride in saliva	CAL score
fluoride in saliva	Pearson Correlation	1	0.029
	Sig. (2-tailed)	.	0.745
	N	140	140
CAL score	Pearson Correlation	0.029	1
	Sig. (2-tailed)	0.764	.
	N	140	140

CAL = Clinical attachment level

Table 3: Correlation of the mean salivary fluoride scores and mean CAL scores

Correlation coefficient value for mean and standard deviation of CAL scores and mean fluoride levels in serum were is -0.019 which indicates no correlation between them (Table 4).

		fluoride in serum	CAL score
fluoride in serum	Pearson Correlation	1	-0.01
	Sig. (2-tailed)	.	0.841
	N	140	140
CAL score	Pearson Correlation	-0.019	1
	Sig. (2-tailed)	0.841	.
	N	140	140

CAL = Clinical attachment level

Table 4: Correlation of mean serum fluoride scores and mean CAL scores

The means of fluoride in saliva between the groups were calculated and checked for any significant variation in the intra group mean values by ANOVA test. As the fluoride scores increased there was significant difference between the control group and severe fluoride score group. This indicates that there is some significant relation ($p<0.005$***)** between the salivary fluoride levels and increase in severity of the dental fluorosis scores (Table 5).

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39.025	4	9.505	18.009	0.000
Within Groups	60.707	115	.528		
Total	99.731	119			

One-way ANOVA $p<0.005$***** is significant, ANOVA = Analysis of variance

Table 5: Mean salivary fluoride changes between the groups and fluorosis scores

Intra group comparison of means of fluoride in serum there was no significant difference in the means between the 2 groups (Table 6).

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23.698	4	5.924	1.289	0.289
Within Groups	528.888	115	4.499		
Total	552.486	119			

One-way ANOVA $p<0.005$***** is significant, ANOVA = Analysis of variance

Table 6: Mean serum fluoride changes between the groups and fluorosis scores

Discussion:

Periodontal disease is the second most common dental ailment, after dental caries, causing tooth mortality. It is widespread throughout the world. Its severity distribution, progression depends on various microbial hosts, environmental and local factors.[10]

Among various environment etiological factors, the influence of fluoride on the periodontal health is still controversial. Although studies have been conducted on the effect of elevated fluoride in drinking water on gingivitis and periodontitis, the results have been inconsistent.[5] Although fluoride decreases the caries incidence, the effects of fluoride on inflammatory periodontal disease is obscure.[11] Nalgonda district is known on the world map for high fluoride content in the ground water causing severe skeletal and dental fluorosis.[12] The aim of the present study was to correlate the altered fluoride levels of serumandsaliva to the periodontal disease severity.

Vandana and Sesha Reddy[4] assessed the periodontal status of patient in endemic fluorosed area (Davangere) by recording the OHI-S and CPITN indices. They found a strong association of occurrence of periodontal disease in high fluorosed areas.In contrast our study there was no correlation of altered fluoride levels in saliva and serum to periodontal disease severity in endemic fluorosed area (Nalgonda) on the periodontal status of the subjects with dental fluorosis.

The present study when fluoride levels in drinking water ranging from 2.7 – 7-6 were compared to Kumar andJohn[13]there was no significance of shallow pockets and CAL in fluorosed patients who have been residing in areas with high fluoride levels in drinking water ranging from 2.5ppm - 7.2 ppm.

In the present study there was no significant difference in the serum fluoride levels on CPI and CAL scores butsalivary fluoride levels were statistically significant, which may have impact on periodontal treatment. Heitz-Mayfield et al.[14] concluded that scaling and root planing alone and scaling and root planing combination with flap procedure are effective methods for the treatment of chronic periodontitis in terms of

attachment level gain.

Conclusion:

Considering the limitations of this study we can conclude thatthere was no significant correlationbetween salivary and serum fluoride levels and theperiodontal disease severity. Mean salivaryfluoride levels were found to significantly influence the dental fluorosis severity ($p<0.005$*****).Salivary estimation of fluoride is noninvasive method and can be an alternative useful tool and better indicator of the disease severity which was shown in the present study.

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