The Relationship between Dental Fluorosis and Dental Caries among Dental Students of Sri Ganganagar, Rajasthan

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ABSTRACT

Background: The present study was carried out in Sri Ganganagar, Rajasthan to find out the relationship between prevalence of dental caries and dental fluorosis. Aims: To find out the association between dental fluorosis and dental caries among dental students of Sri Ganganagar, Rajasthan. Methods and Material: The present cross sectional study consisted of a convenient sample of 469 students of Surendera Group of Institutions Sri Ganganagar. Clinical examination for dental fluorosis and dental caries using the index to ICMR fluorosis index 2013 and Decayed Missing Filled teeth index (DMFT) respectively. The statistical analysis was determined by the fisher exact test and Pearson correlation test was applied to test the correlation between dental caries and fluorosis & level of significance was set at P < 0.05. Results: Severity of fluorosis among all the students where 42.2% students were Normal and 38.4%, 17.5% and 1.9% students having mild, moderate and severe fluorosis respectively. It showed that Prevalence of dental caries was significantly higher among students having no sign of fluorosis(36.9%) with comparison to those who were having moderate(6.6%) to severe fluorosis(0.4%). Conclusions: There is a need for community health activities and awareness programs to improve oral health of the people in this particular stratum of population.

KEYWORDS: Dental caries, Dental fluorosis, Inter-examiner reliability, kappa value

INTRODUCTION

Water is one of the five key elements described in “Shastra” that are required for life. It is an essential component for all living beings on earth due to its physical as well as chemical properties.¹ Although, the chemical composition of natural water is beneficial but also poses a threat in the form of diseases to the humankind, for instance, hard water. Fluoride found in water is also one of major natural component of the earth crust. It is available in many minerals, like fluorite, fluorapatite and many more, due to high electronegative.²

Fluorine is one of the most abundant element in nature. In fact, about 96% of fluorine in the human body is found in the bones and teeth.³ Fluorine is essential for the normal mineralization of the bones and formation of dental enamel.⁴ Most of the sources of natural water contain Fluoride beyond required “acceptable” lower limit of 1.0 ppm (mg/L) or a permissible limit in the absence of an alternate source of 1.5 ppm, or the WHO “desirable” upper limit of 1.5 ppm.⁵,⁶

“Fluoride is often termed a double edged weapon”– the optimal and judicious use of which offers maximum caries protection, whereas injudicious and excessive systemic consumption may lead to endemic chronic fluoride toxicity, which manifest as dental fluorosis (that starts as chalky white spots, which later turns to brown) and skeletal fluorosis.⁷ Fluoride is used in dentistry to prevent caries by forming calcium fluorapatite crystals. It is seen that calcium fluorapatite crystals are resistant to dissolution by acid, thus, resistant to caries.⁹

Dental caries is the most common oral disease amongst children and adolescents.¹⁰,¹¹ According to Miller, when acidogenic microorganisms of saliva act on the accumulated carbohydrates from food, an acid is produced which dissolves the inorganic part of the tooth.¹² The proteolytic enzymes produced by the proteolytic organisms dissolve the organic portion of the tooth. This explains the mechanism of dental caries development in a tooth.¹³

Till date very few studies are available on dental fluorosis using ICMR index hence this study was taken up to find out the association between dental fluorosis and dental caries among dental students using ICMR fluorosis index of Sri Ganganagar, Rajasthan.

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MATERIALS AND METHODS

The present cross sectional study was conducted in Sri Ganganagar during November-December 2019. Enrolled undergraduate were invited to participate in the study. Institutional ethical clearance from institutional ethical committee was obtained prior to commencement of study.

Purpose of study was clearly explained to students of institute and written consent was obtained from participants. A pilot study was conducted on 50 subjects to estimate the sample size of the study. In the pilot study prevalence of dental caries was 56%. Sample size was calculated using the formula: 
\[
n = \frac{Z^2pq}{d^2}
\]
where 
\[n=\text{sample size}, \ p=\text{prevalence of dental caries (56%)}, \ q=1-p, \ d=\text{allowable error (1.96)}, Z=\text{point on normal deviation (0.05)}\]. On calculation "n" was equal to 379 which were rounded off to 400. A response rate of 70% was found in the pilot study and to collect data from 400 subjects the final sample size was estimated to be 500.

The inclusion criteria for the study, those participants who gave consent and those who were absent at the time of data collection were excluded. So the total sample size after inclusion and exclusion criteria was 469.

Dental fluorosis was counted when the tooth was not normal, the grading for dental fluorosis was done using pre-validated ICMR fluorosis index wherein affected teeth were observed for grading of fluorosis and graded as normal, mild, moderate, severe, by giving the scores as 0,1,2,3 respectively. Each tooth was assessed and coded according to the criteria prescribed by ICMR. The inter-examiner reliability between the observers using the ICMR index was found to be 0.56-1.0 and kappa values ranging from 0.83-0.98. 14

0 (Normal) indicates enamel surface appears smooth, glossy, translucent, creamy white pale in colour. 1 (Mild) indicates enamel surface showing extensive chalky white opaque areas in two or more teeth. 2 (Moderate) indicates enamel surface showing brownish yellow or brown color horizontal lines frequently disfiguring bands or patches on two or more teeth. 3 (Severe) indicates enamel surface showing brown color with pitted, discrete or confluent, eroded or destroyed structure on two or more teeth.

Data collection was done in two parts: First part consisted of demographic profile and second part consisted of clinical examination for dental fluorosis and dental caries using the index to ICMR fluorosis index 2013 and Decayed Missing Filled teeth index (DMFT) respectively. The clinical examination was conducted by a single calibrated examiner for whom kappa statistics was determined 88% 2 days prior to study. Examination was carried using, natural light, mouth mirror, explorer and patients were seated in well illuminated room.

Statistical analysis: The data was analyzed with IBM SPSS (Statistical Package for the Social Sciences) Statistics Windows, Version 20.0. was used for the statistical analysis. The statistical analysis was determined by the fisher exact test and Pearson correlation test was applied to test the correlation between dental caries and fluorosis & level of significance was set at \(P < 0.05\).

RESULTS

The total study participants were 469, among those majority of population belonged to state of Rajasthan(155) and Punjab(164) so data was dichotomize into Rajasthan, Punjab and others(150), (Manipur, Arunachal Pradesh, Uttar Pradesh, Gujarat, Maharashtra, Kerala, Assam, Himachal Pradesh, Jammu & Kashmir etc). Table 1 shows mean age and state distribution of study population. Overall mean age of students was 20.94±1.89.

Table 1: Demographic Data

<table>
<thead>
<tr>
<th>Demographic Factor</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE</td>
<td></td>
</tr>
<tr>
<td>Rajasthan</td>
<td>155(33.1%)</td>
</tr>
<tr>
<td>Punjab</td>
<td>164(35%)</td>
</tr>
<tr>
<td>Others</td>
<td>150(31.9%)</td>
</tr>
<tr>
<td>AGE (Mean ±SD)</td>
<td>20.94±1.89</td>
</tr>
</tbody>
</table>

Table 2: Severity of Dental fluorosis

<table>
<thead>
<tr>
<th>Severity of dental fluorosis</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>198 (42.2%)</td>
</tr>
<tr>
<td>Mild</td>
<td>180 (38.4%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>82 (17.5%)</td>
</tr>
<tr>
<td>Severe</td>
<td>5 (1.9%)</td>
</tr>
</tbody>
</table>

Table 3: State wise prevalence of dental Fluorosis among students. Prevalence of Dental fluorosis in Rajasthan, Punjab and others state was 25.8%, 21.7% and 10.2% respectively (sum of mild moderate and severe fluorosis). The results are found to be statistically significant.

Table 4 shows Association between Dental fluorosis and Dental caries. It showed that Prevalence of dental caries was significantly higher among students having no sign of fluorosis(36.9%) with comparison to those who were having moderate(6.6%) to severe fluorosis(0.4%). The association between dental fluorosis and dental caries was statistically significant.

Table 5 shows correlation between dental fluorosis and DMFT. Pearson correlation(r) was -.217 which shows that there was a weak but statistically significantly negative association between dental fluorosis and dental caries.

DISCUSSION

Dental fluorosis is defined as a disturbance of dental enamel caused by excessive exposure to high concentrations of fluoride during tooth development. In India, the most common cause of fluorosis is fluoride-
Table 3: State Wise prevalence of dental fluorosis among the students. *p <0.05 (Statistically significant)

<table>
<thead>
<tr>
<th>STATE</th>
<th>FLUOROSIS [N(%)]</th>
<th>Dental Caries present N (%)</th>
<th>Dental Caries absent N (%)</th>
<th>fisher exact</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rajasthan</td>
<td>Normal (34(7.2%))</td>
<td>84(17.9%)</td>
<td>73(15.6%)</td>
<td>0.001*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mild (84(17.9%))</td>
<td>230(48.4%)</td>
<td>278(57.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate (180(38.4%))</td>
<td>73(15.6%)</td>
<td>278(57.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe (173(36.9%))</td>
<td>73(15.6%)</td>
<td>278(57.8%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Association between dental fluorosis and dental caries. *p <0.05(Statistically significant)

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Dental Fluorosis</th>
<th>Dental Caries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Fluorosis</td>
<td>1</td>
<td>-2.17***</td>
</tr>
<tr>
<td>Dental Caries</td>
<td>-2.17***</td>
<td>1</td>
</tr>
<tr>
<td>P value</td>
<td>&lt;0.01*</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Correlation between Dental fluorosis and DMFT. **. Correlation is significant at the 0.01 level (2-tailed).

laiden drinking water which is sourced as groundwater from deep-bore wells.16 Dental caries and fluorosis have been studied together in various populations worldwide to notice the relationship between these conditions with controversial results.17,18 But there is no consensus on whether dental fluorosis increases, decreases or has no effect on the risk of dental caries.19

This study to the best of the knowledge of authors shall be a pioneer study revealing the dental fluorosis using ICMR index. The comparison with other studies is being difficult as no study about association between dental caries and dental fluorosis using ICMR index has published till date.

In the present study, 469 dental students were observed. The prevalence of dental fluorosis in the study population was 57.8% and prevalence of dental caries was 64.24%. This finding was in agreement with the finding as reported by Shekar C et al in 2012.8 A high prevalence of dental fluorosis exist in participant from Rajasthan (25.8%) and Punjab (21.7%) which are closely similar to previous study done by choubisa in 200120 and Shashi A et al in 201121 respectively. Out of 469 students, 38.4% having mild fluorosis, 17.5% having moderate fluorosis and 1.9% having severe fluorosis. These results are in accordance with the previous finding Patil S D et al in 2017.22 In present study it was seen that dental caries prevalence was higher among students having no sign of fluorosis which is in contrast to study conducted by Sharma A et al in 201923 and Rojas CLG et al in 2018.24 In these studies author found dental caries prevalence was higher in students having fluorosis.

In our study dental caries being lower in students having fluorosis. Similar findings were observed earlier by Tsutsui et al in Japanese communities25, Kotecha P V et al26, and also by Mascarenhas AK et al.27

In present study negative correlation between prevalence of dental fluorosis and dental caries, similarly DMFT was found in study conducted by Tuli A et al.28 Dissimilar correlation found in study conducted by Kola S R et al in 2018.29

CONCLUSION

In human nutrition, fluorine plays a dual role, to prevent dental caries at a certain level of intake and can cause serious damages in bony and dental tissues. The severity of dental fluorosis increased and prevalence of dental caries decreased which shows significantly negative association among caries prevalence and severity of dental fluorosis. Hence there is a need for community health activities and awareness programs to improve oral health of the people in this particular stratum of population.

REFERENCES


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