Correlation of Dental Fluorosis with Dental Caries among Adult Population Attending A Private Dental College in Chennai

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Abstract

Fluoride is known as a double edged sword, for both its anticariogenic activity and dental fluorosis in excessive exposure. Results on whether dental caries and dental fluorosis are positively correlated or negatively correlated vary among different researches, thus making it an unsolved area. Hence this study aims to correlate dental fluorosis to dental caries among the adult population attending a private dental college in Chennai.The study includes 258 participants aged 18 years and above, with dental fluorosis. Recorded data was retrieved from patient records in Saveetha Dental College. Record details related to the number of carious lesions present was analysed and Dean's Fluorosis Index (1942) was used to assess the severity of fluorosis among the study population. Descriptive statistics and Pearson correlation were used to analyze the data. Among the participants, 36.4% had carious lesions ranging between 2-3, followed by 27% having more than 4 carious lesions. Mild form of fluorosis was seen among 34.8% of the study population, 9.3% experienced a severe form of fluorosis. Weak correlation between dental caries and dental fluorosis was found at r = 0.03. For the study population, weak correlation between dental fluorosis and dental caries were found, though prevalence of fluorosis was high among the participants. Given the prevalence of fluorosis, defluoridation of water should be considered as a priority.

Keywords - *endemic fluorosis, fluoridation, dental caries, adult, tamil nadu*

Introduction

Dental fluorosis also called mottling of enamel is a developmental disturbance of enamel caused by excessive ingestion of fluoride during tooth development. For fluorosis to develop, the excessive exposure to fluoride must occur during the period of tooth formation, as it will interfere with the ameloblast activity producing a defective matrix causing deposition of calcium fluorapatite crystals. One of the principal reasons for dental fluorosis is the result of drinking water drawn from ground water sources containing a high fluoride content [1] usually more than 2.0 ppm [2,3]. Dental fluorosis manifests as white opaque striations running across the teeth in milder forms whereas advanced stages appear as stained pitted, porous enamel prone to wear and fracture. The reason fluorosis is known as a double edged sword is because there is a strong link established between carious lesions and fluoridation where fluoride gels, fluoride based sealants [4-6], pastes, varnished were proven to prevent dental caries from 23-36% as observed in populations compared to placebo [7], but in excessive quantities causes dental fluorosis and in extreme cases, skeletal fluorosis.

Dental caries is an irreversible [8-10], multifactorial disease of the oral cavity [11] caused mainly by microbial plaque adhesion [12] and local factors like deleterious

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habits [13], poor oral hygiene, salivary gland dysfunction [14] raising ultimately causes problems in mastication leading to nutritional problems [15,16], speech, daily activities [17] and presents as a global burden of oral disease. Evidence suggests fluoride based sealants and such products have been preferred to prevent dental caries [18].Many reports suggest caries prevalence tends to decrease with increasing fluoride level, thus indicating a negative association between fluoride and caries [19] , however a few studies report a positive correlation between fluoride and dental caries as well, especially in high fluoride areas [20]. Due to scarcity in studies relating to these parameters and the varying results, the relationship between them is still undecided.

Fluorosis is worldwide in distribution and endemic in at least 25 countries. As of the data in the year 2014, the population at risk as per population in habitation with high fluoride was 11.7 million. States like Rajasthan, Gujarat, Andhra Pradesh are the worst affected states, while Tamil Nadu, West Bengal, Uttar Pradesh, Bihar, Assam are mildly affected states [21] . Even though prevalence studies related to dental caries and fluorosis are plenty especially among young population, there is a scarcity of research done to correlate dental caries to dental fluorosis and since parts of Tamil Nadu are fluoride endemic areas, this study was designed and conducted to assess the correlation of dental caries to dental fluorosis among adult population, attending a private dental college in Chennai. The objectives of the study are to determine the caries prevalence, to determine the severity of dental fluorosis, to correlate dental fluorosis with dental caries among study participants.

Materials and Method

A retrospective study was done by evaluating and analysing 258 patient case records visiting a dental hospital from August (2019) - January (2020) with dental fluorosis. Prior to the start of the study, ethical approval number (SDC/SIHEC/2020/DIASDATA/0619-0320) was obtained from Scientific Review Board, Saveetha Dental College, SIMATS. Data such as age, gender, number of carious lesions, severity of fluorosis were documented. The validated, reliable tool, Dean's Fluorosis Index 1942 was used for scoring. The scoring method used is, 0 - Normal, 0.5 - Questionable, 1 - Very mild, 2 - Mild, 3 - Moderate, 4 - Severe. Patient records with age 18 and above with fluorosis were included in the study. Patients under special care and incomplete case records were excluded from the study. The 258 patient case records were reviewed and cross verification was done through intraoral photographs by the examiners. The caries status was recorded as the number of carious lesions present. The data thus collected, was entered in excel sheet and imported to IBM SPSS Version 23.0 for statistical analysis. The data was analyzed using descriptive statistics and Pearson's correlation. Statistical significance was set at $p < 0.05$

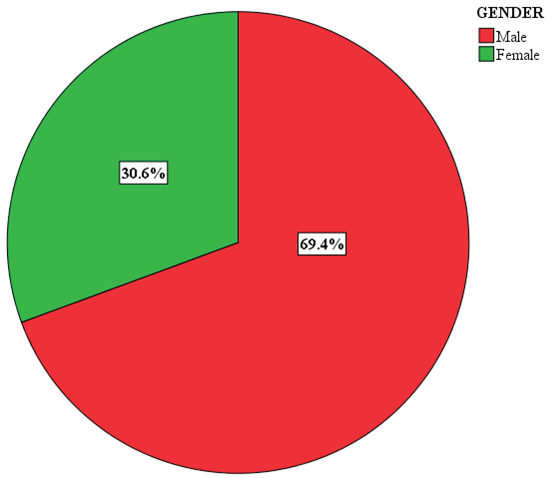

Figure 1: The pie chart represents the distribution of study participants based on gender, where 69.38% were males and 30.62% were females, thus showing a male predominance in the current study population.

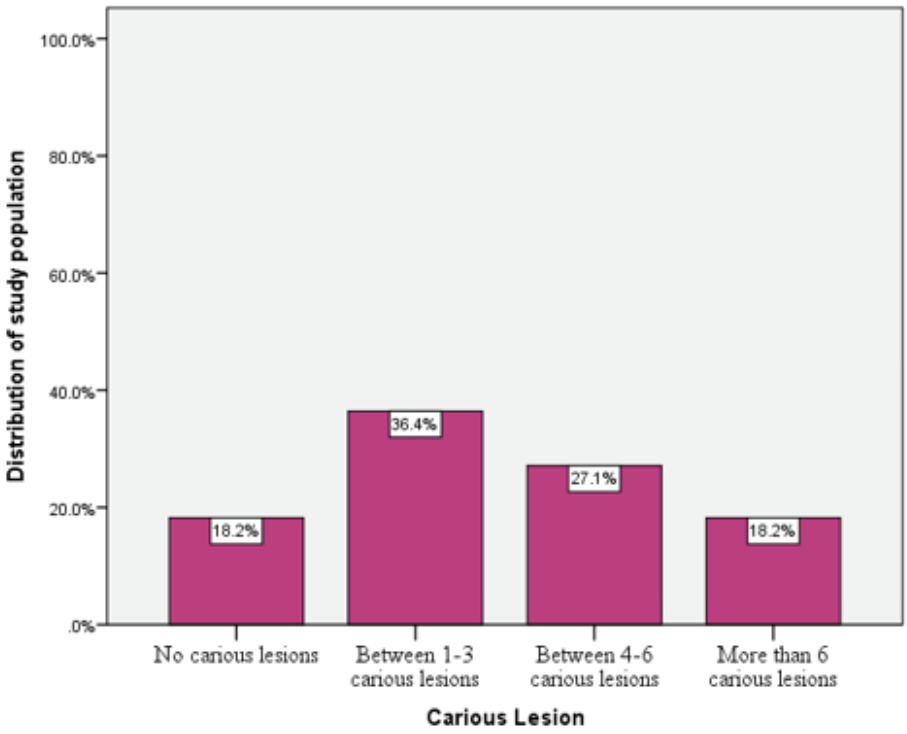

Figure 2: The Bar Graph represents the distribution of study participants based on the number of carious lesions. X axis represents the number of carious lesions and Y axis represents the percentage distribution of participants based on number of carious lesions. Among the study population, the majority of the population (36.4%) had 1-3 carious lesions.

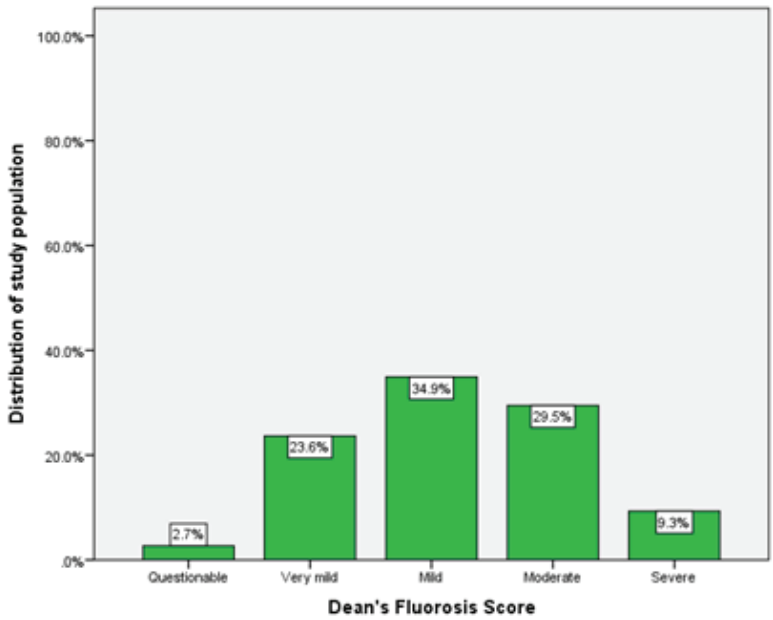

Figure 3: The bar graph represents the distribution of participants based on the Dean's Fluorosis Index. X axis represents the severity of fluorosis based on Dean's Fluorosis Index criteria. Y axis represents the percentage distribution of participants based on severity of fluorosis. Among the study population, the majority of the participants (34.9%) had mild fluorosis. Hence, a mild form of fluorosis was prevalent among the study population.

Table 1: The table represents the correlation between Dean's Fluorosis score and carious lesions. Pearson correlation test was used; *correlation coefficient (r) - .035; p value - 0.5; hence statistically not significant.

Variables	Pearson correlation value (r)	p- value
Dean's Fluorosis score and Carious lesions.	.035*	0.5

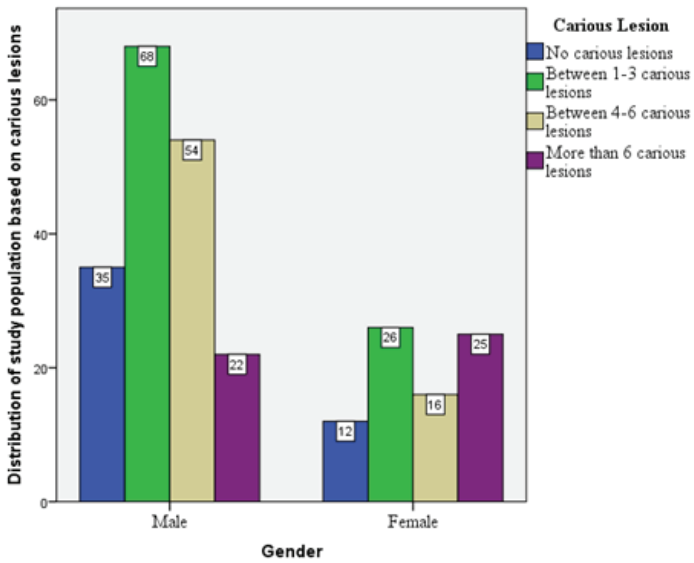

Figure 4: The bar graph represents the association between gender and carious lesion. X axis represents the genders, male and female. Y axis represents the distribution of study population based on carious lesions. Prevalence of dental caries in total was more in males (55.8%) as compared to females (25.8%). Chi square test was used to determine the association and it was found to be statistically significant. Pearson Chi square value = 14.218, df = 3, p value = 0.003, hence statistically significant.

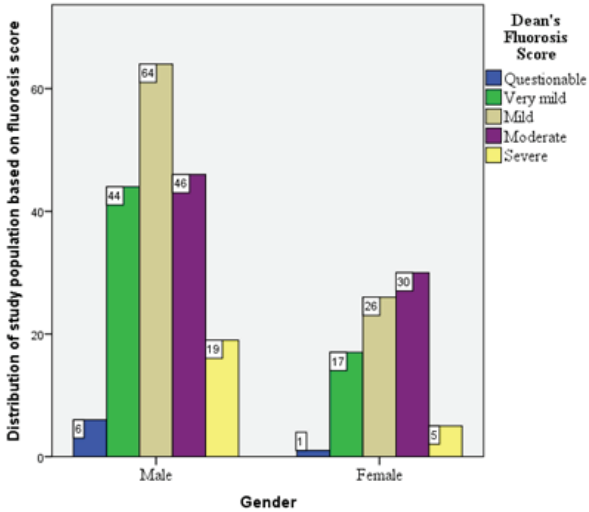

Figure 5: The bar chart represents the association between gender and fluorosis. X axis represents the genders, male and female and Y axis represents the distribution of study population based on fluorosis score. Chi square test was done and severe form of fluorosis was seen more in males (7.3%) as compared to females (1.9%), there was no significant association observed. Pearson Chi square value = 5.110, df = 4, p value = 0.2, hence not statistically significant.

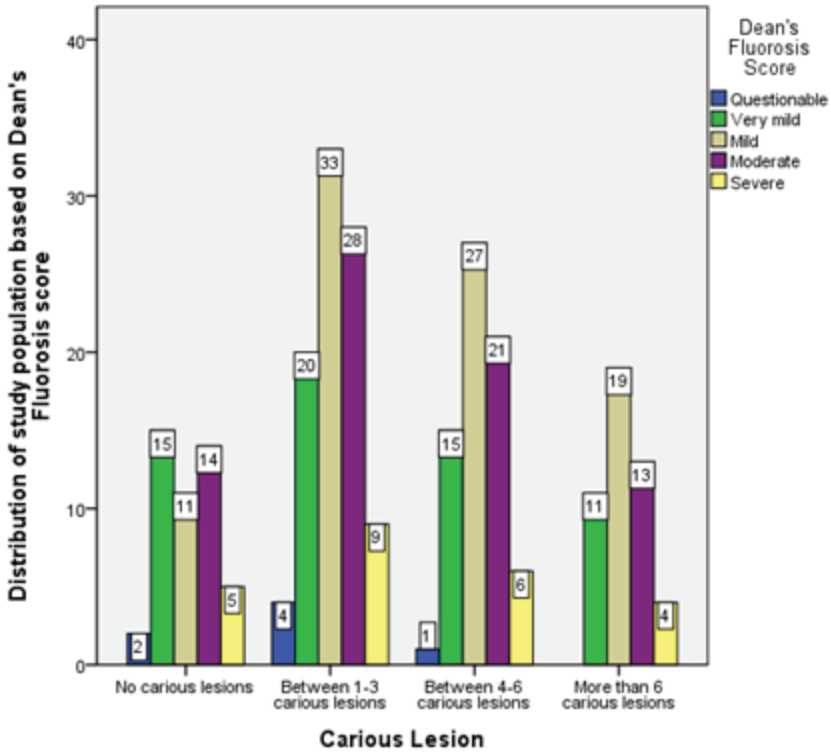

Figure 6: The bar chart represents the association between dental fluorosis and carious lesion. X axis represents the carious lesion and Y axis represents the distribution of study population based on Dean's fluorosis score. Chi square test was done, over all mild forms of fluorosis was more prevalent (70.6%) with regard to carious lesions but no statistical significance was observed. Pearson chi square value = 7.363, df = 12, p value = 0.8, hence not statistically significant.

Results and Discussion

The study comprises 258 participants, out of which 69.4% were males and 30.6% were females, as seen in Figure 1. The mean age of the participants were 28.0±8.8. The distribution of participants according to number of carious lesions shows 36.4% had between 1 - 3 number of carious lesions, 27.1% had between 4-6 number of carious lesions, 18.2% of the study participants had more than 6 numbers of carious lesions and similarly 18.2% had no present carious lesions (Figure 2). Figure 3 depicts the distribution of participants according to Dean's fluorosis score, which reveals among the study population, 34.9% had mild degrees of fluorosis, followed by 29.5% having moderate fluorosis, very mild fluorosis was seen among 23.6% of the participants, 9.3% had severe degrees of fluorosis and about 2.7% had questionable degrees of fluorosis. A statistically significant association (p = 0.003) was found between gender and carious lesions (Figure 4). Among the study population, those who had questionable fluorosis, only 4 of them had carious lesions between 1-3, among the 61 participants who had very mild fluorosis, around 20 of them had carious lesion between 1-3, followed by 15 of them having no carious lesion and 15 having between 4-6 carious lesions, and 11 of the participants had more than 6 carious lesions. About 90 participants had mild fluorosis, out of which 11 had no carious lesions, 33 had carious lesions between 1-3, 27 participants had carious lesions between 4-6 and more than 6 carious lesions were seen in 19 participants. In the current study, around 76 participants had moderate fluorosis, out of which 14 experienced no carious lesions, 28 of them had carious lesions between 1-3, 21 participants had carious lesions between 4-6, more than 6 carious lesions were seen among 13 participants. Among the 24 participants who had severe forms of fluorosis, 5 had no carious lesions, 1-3 carious lesions were seen among 9 of them, 6 participants had between 4-6 carious lesions

and 4 participants had more than 6 carious lesions. The association between dental fluorosis and carious lesion was found to be statistically insignificant (Figure 6). Pearson correlation revealed weak non significant correlation between carious lesion and fluorosis score (r = 0.03) as shown in Table 1.

Fluoride continues to be the cornerstone of caries prevention programs, that's why dental caries and fluorosis have been studied together in many researches aiming to seek associations between these two. There still exists a debate whether dental fluorosis increases, decreases or has no effect on risk of caries [22,23]. This study was conducted among the adult population attending a private dental college in Chennai, seeking treatment. The caries prevalence was high in this current study at 81.6%, similar studies reported high prevalence of caries among adults, similar to Patro BK et al 's study [24] which reported caries prevalence of 82.4% among adults, also the caries prevalence in Tamil Nadu is high in even infants and children as reported in a study [25] . The findings in the present study were found to be lower than that reported in WHO Oral Health Country Profile which was 94% [26]. However, various studies have reported lower prevalence of caries among different populations [27]. The variance in the study results could be attributed to factors like geographical location, age difference, cultural and dietary differences.

In the current study, 34.9% of the study participants had mild fluorosis, a similar finding was reported by Idon PI et al [28] where 32.1% participants reported mild fluorosis. A contrasting finding of 18.5% mild fluorosis was found in a study done by Sebastian ST et al [29], which coincides with the findings by Chaudhry M et al [30]. Dental fluorosis is mainly because of the concentration of fluoride in drinking water which varies with geography, hence the reason for contrasting results.Tamil Nadu is one of the 19 states with high fluoride contamination in drinking water, varying from 1.0 - 48 mg per litre [31]. A weak correlation between dental fluorosis and dental caries (r = .035) was reported in our study, which was contradictory to the findings by Grobleri SR et al [20] , Woondwossen F et al [32] , whereas similar findings to our studies have been reported as well by other studies [33]. In the current study, a statistically significant association was observed between gender and carious lesions, similar to other studies [34,35]. However, no there was significant association between gender and fluorosis, contrary to other studies [36] which could be attributed to the varying levels of fluoride in water and is a geographical factor. The retrospective nature of the study is a limitation, also since it was done in a hospital setting, the result might not be truly representative of the general population. Dentists are distributed throughout a community and they can be a part of an effective surveillance network [37, 38] to conduct more studies on this topic, so as to gather more evidence to solve this uncertainty regarding the correlation between dental caries and dental fluorosis.

Conclusion

Within the limits of the study, the result revealed a weak correlation between dental caries and dental fluorosis. Further studies should be conducted among larger populations to make the evidence stronger.

Acknowledgement: We would like to acknowledge the Information Technology Department of the institution for their support and assistance.

Conflicts of Interest - Nil

Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

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