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PREVALENCE OF DENTAL FLUOROSIS AMONG OUT PATIENTS OF DIFFERENT AGE GROUPS REPORTING TO PRIVATE DENTAL COLLEGE, CHENNAI- A HOSPITAL BASED CROSS-SECTIONAL STUDY

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ABSTRACT:

Fluoride is a double edged sword. It possesses cariostatic property and can also cause developmental disturbances. Cariostatic effects prevent the carious decay, increasing the mineral solubility and remineralization. But with higher doses it manifests as dental fluorosis. enamel hypo mineralization manifests as mild white lesions, Pitting forming horizontal lines or large pigmented (brown to black) defects. There must be an equilibrium between the caries prevention and fluoride contribution to enamel pathology. The main aim of the study is to estimate the prevalence of dental fluorosis and to estimate the severity of fluorosis based on Dean's fluorosis index. This is a record based study with a sample size of 210, irrespective of the gender. The study was conducted at the institution and the data was collected from the patient records. The data was categorised into age groups, gender and Dean's fluorosis index. The coding was done in MS excel. The data was transferred to a host computer and processed using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA) by tabulation and graphical illustration. Descriptive statistics was used to study the data collected and to analyse frequency distribution. The results showed that prevalence of Dental Fluorosis is highest in the 21- 30 years age group (64%). 70% of the population were males. The severity of the fluorosis was predominantly moderate (33%) among the overall population, 2% of the population had questionable form of fluorosis, 22% reported with very mild forms of fluorosis, 27% had mild forms of the fluorosis and only 16% had severe manifestations of the disease. The prevalence of fluorosis was not associated with the age and gender of the patient (p value>0.05)

Keywords: Cariostatic; Dental Fluorosis; Enamel hypomineralisation; fluoridation.

INTRODUCTION:

Fluoride is a double edged sword serving as an anticariogenic agent and fluorosis inducing agent.(P. J. Riordan 1993) The cariostatic mechanisms of fluoride contribute to demineralization and remineralization of dental hard tissues. The sources may be either (1) Fluoroapatite due to the incorporation of fluoride into enamel, or (2) Calcium fluoride (CaF)-like precipitates, formed on the enamel and in the plaque after application of topical fluoride. A phosphate-protein coating of salivary origin protects these deposits. Presumably, CaF_2 has a direct and indirect effect on bacterial cells (R. Gary Rozier et al. 2010). The decline in dental caries among children in highly developed countries started to emerge around 1970 and the percentages of caries free children in different age categories have increased since then. However early childhood caries are still a global concern (Prabakar, John, and Srisakthi 2016) and this could be attributed to low economic status and literacy levels (Samuel, Acharya, and Rao 2020) . Streptococcus mutans was the main cariogenic oral microorganism causing caries (Mathew et al. 2020). This was mainly attributed to the increased use of fluorides from all sources, especially toothpastes (Marthaler 2013) (Prabakar, John, Arumugham, Kumar, and Sakthi 2018). Consumption of carbonated drinks alters the pH of the saliva and this could be another factor for dissolution of the tooth structure leading to loss of mineralisation (Pratha, Ashwatha Pratha, and Prabakar 2019). Microleakage under the pit and fissure sealants are also known to cause caries in the long term (Prabhakar, Murthy, and Sugandhan 2011; Prabakar, John, Arumugham, Kumar, and Srisakthi 2018). However the micro hardness of enamel can also be enhanced by agents like Nova Min, Bio Min and Remin Pro Containing Toothpastes (Mohapatra et al. 2019). Natural phytochemicals present in fruits and vegetables have strong antioxidant and anti-proliferative activities which could combat the effect of microorganisms (Pavithra, Preethi Pavithra, and Jayashri 2019).

The down side to the use of fluorides are mild cases of dental fluorosis which are characterized by a white opaque appearance of the enamel, caused by increased subsurface porosity. The earliest sign is a change in color, showing many thin white horizontal lines running across the surfaces of the teeth, with white opacities at the newly erupted incisor end. The white lines run along the 'perikymata', a term referring to transverse ridges on the surface of the tooth, which correspond to the incremental lines in the enamel known as Striae of Retzius. With increased dental fluorosis, the entire tooth can be chalky white and lose transparency (Goldberg 2018). Fluorosis was more prevalent in permanent teeth than in primary teeth (Paul J. Riordan 1994). This disparity could be due to the fact that mineralization of primary teeth occurs before birth and the placenta forms a barrier to the transfer of high concentrations of plasma fluoride from a mother to fetus, thus controlling, to some extent, the delivery of fluoride to the developing primary dentition. Other reasons may be that the period of enamel formation for primary teeth is shorter than for permanent teeth and that the enamel of primary teeth is thinner and has greater opacity than that of permanent teeth, which makes detection of fluorosis more difficult(Paul J. Riordan 1994) McKay and Black reported a condition they called ”Colorado brown stain” in 1916, among persons living in particular communities (McKay 1952). Eventually the term ”mottled enamel” began to be used for the condition because it was not restricted to persons from one state or region. After the discovery that the fluoride concentration of drinking water was correlated with mottled enamel, or more precisely, dental fluorosis, Dean conducted a series of surveys that elucidated the relation between the occurrence of dental fluorosis and the concentration of fluoride in drinking water. To do so, he developed a classification system in 1934 for assessing the presence and severity of dental fluorosis of teeth (Dean and Trendley Dean 1934). He modified the classification system in 1942, and it is still used today (R. G. Rozier 1994)

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There was an increase in prevalence of dental fluorosis with a corresponding increase in water fluoride content (Kumar, Pradeep Kumar, and Vijayalakshmi 2017; Kumar, Pradeep Kumar, and Preethi 2017). Prevalence of dental fluorosis was found to be 69.84% in Udaipur District of Rajasthan (Sarvaiya et al. 2012). Defluoridation must be done in areas with fluoride concentration of 4 parts per million and above as dental fluorosis is a public health problem in these areas with 100% prevalence in the population (Sukhabogi et al. 2014). Oral consumption of fluoride and fluoride containing foods can also lead to prevalence of fluorosis. (Neralla et al. 2019). However, fluoride releasing sealants have not been found to cause fluorosis (Khatri et al. 2019). Opaque defects are detected at low doses. Higher dose leads to an obvious increase of dental fluorosis, hypomineralized enamel, pitting and larger non-pigmented and

pigmented lesions and contains relatively less mineral and more proteins than sound enamel (Goldberg 2018). These lesions are different from extrinsic stains caused by smoking (Harini and Leelavathi 2019)

Enamel fluorosis is a developmental disturbance of dental enamel. The severity of dental fluorosis depends on when and how long the overexposure to fluoride occurs. The risk period in permanent teeth is between 20 and 30 months of age. It is observed there is a clear linear relationship between fluoride dose and the development of dental fluorosis, regardless of whether fluoride is ingested from drinking water, from supplements, or from other sources. In addition to water fluoridation with a variation between 0.7 to 1.0 ppm, fluoride supplements are given to children living in fluoride-deficient areas. Topical fluoride added to swallowing fluoride-containing toothpastes may also be responsible for dental fluorosis, contributing to mild to severe fluorosis (Marya 2011). A major risk factor in fluorosis is the inappropriate use of fluoride toothpaste in young children who may not be able to expectorate it adequately (Pizzo et al. 2007). Thus, the aim of the study is to estimate the prevalence of dental fluorosis and to estimate the severity of fluorosis based on Dean's fluorosis index.

MATERIALS AND METHODS:

Study setting

Case sheets of all the Patients of OP Department of the institution were reviewed for a period of 6 months [June 2019 and December 2019]. Simple Random Sampling was carried out to select a total of 210 patients**.** The study was commenced after approval from the Institutional Review Board. The ethical approval number for the study was SDC/SIHEC/2020/DIASDATA/0619-0320.

Data collection and tabulation:

To fulfil the inclusion criteria, patients who reported with dental fluorosis were included in the study. The prevalence of severity of the fluosis was assessed in these patients using Dean's fluorosis index 1942. Patients without any dental fluorosis and those unwilling for the study have been excluded from the study. Cross verification of data for errors was done photographically.

Sampling:

Data were collected from June 2019 to December 2019 for 210 patients who had dental fluorosis of varying degree. The following data were retrieved from the dental records: patient age, gender, presence of fluorosis and severity of fluorosis using Dean's fluorosis index.

Statistical analysis:

The data was transferred to a host computer and processed using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics was used to study the data collected and to analyse frequency distribution.

RESULTS AND DISCUSSION:

In the present study, the Prevalence of Dental Fluorosis is highly prevalent in the 21- 30 years age group (64%). This was the maximum prevalence group in the population.

Distribution of study subjects based on age is given in figure 1. 11% of the population was between 10-20 years of age, 64% of the population was between 21-30 years, 15% were between the age of 31-40 years, 9% of the study group was between 41-50 years and only 2 % of the sample were 50 years and above. This shows that most patients have been identified with the presence of dental fluorosis by 30 years of age.

The distribution of study subjects based on Gender was analysed in the population (Figure 2). Of the 210 patients, 30% were female and 70% were male. This result shows male dominance for the occurrence of fluorosis.

The severity of fluorosis in the population was analysed using the standard Dean's Fluorosis Index (Figure 3). The categories of the index are questionable, very mild, mild, moderate and severe. Distribution of study subjects based on Dean's Fluorosis Index are as follows: 2% of the population had questionable form of fluorosis, 22% reported with very mild forms of fluorosis, 27% had mild forms of the fluorosis, moderate fluorosis was seen in 33% and only 16% had severe manifestations of the disease

The distribution of subjects according to gender and fluorosis was analysed (Figure 4). Males reported with highest incidence of 21% moderate fluorosis followed by mild 19%, severe 13%,very mild 6% and 1% questionable. Females also had lower incidence of moderate 12%, 9% mild, 6% very mild and 3% severe fluorosis.

The distribution of subjects according to age and fluorosis was analysed (Figure 5). The most prevalent form of fluorosis among 10-20 year old patients was questionable form (25%), among 21-30 years was severe form (79.4%), among 31-40 years was questionable form (50%), among 41- 50 years was very mild form (15.2), above 50 years was moderate form (4.3%).

Fluorosis is the first visible sign of an excessive intake of fluoride during the period of enamel formation. A major risk factor in fluorosis is the inappropriate use of fluoride toothpaste in young children who may not be able to expectorate it adequately (Pizzo et al. 2007).In addition to water fluoridation with a variation between 0.7 to 1.0 ppm, fluoride supplements are given to children living in fluoride-deficient areas (Yanagisawa, Takuma, and Fejerskov 1989). Systematically administered fluorides at a concentration of 75 ppm increase the surface roughness of developing enamel crystals (Chen et al. 2006). Enamel matrix secreted during fluoride exposure fails to mineralize (referred to as 'fluorotic matrix'). The thinner the layer of enamel, the more intensely it is hypomineralized, and the more severely the adjacent ameloblasts are affected (Bronckers et al. 2009).

In this study we did not study the fluoride content in the water supply with the prevalence of fluorosis in the population. Geographic isolation and small sample size was another limiting factor. The participants in the study were not asked about family history. The caries distribution in their dentition was also not recorded. This study highlights the prevalence of dental fluorosis in a hospital based setup and it determines severity of fluorosis encountered in the study population using the Deans fluorosis index. As dentists we need to be able to identify and address public health concerns like fluorosis in the general population. (Kannan et al. 2017).

CONCLUSION:

Within the limitations of the study, it can be concluded that even though the association of dental fluorosis with age and gender is statistically not significant, the severe form of fluorosis was found to be more common among 21-30 years than other age groups and more common among males than females.

AUTHOR CONTRIBUTIONS:

Author 1 (Jerusha Santa Packyanathan) carried out the retrospective study by collecting data and drafted the manuscript after performing the necessary statistical analysis. Author 2 (Jayashri P) aided in the conception of the topic, participated in the study design, statistical analysis, supervised in the preparation of the manuscript and Author 3 (Ganesh Jeevanandan) helped in study design and coordinated in developing the manuscript. All the authors have equally contributed in developing the manuscript.

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CONFLICT OF INTEREST:
The authors state no conflict of interest.

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FIGURES:

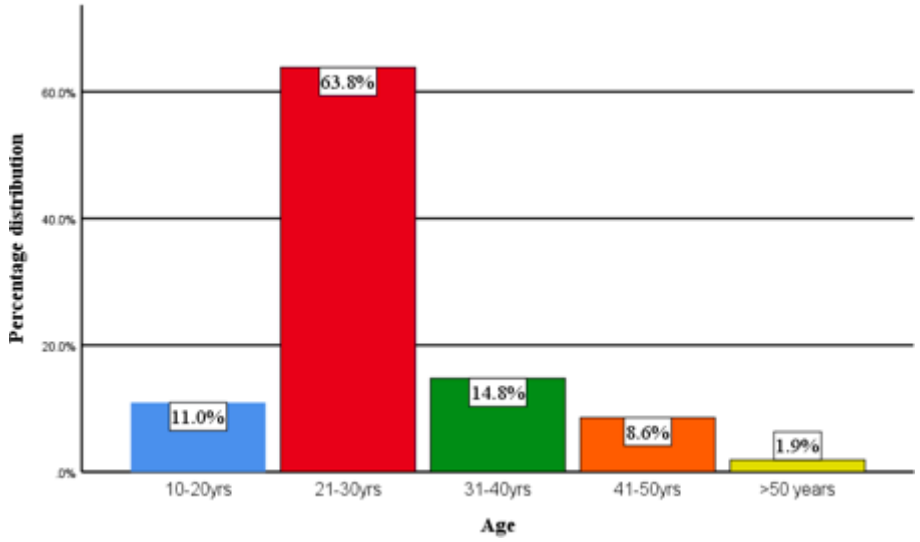

Figure 1: Bar diagram representing the distribution of study subject according to age. X-Axis and Y axis represent the age group and percentage distribution of patients respectively. Majority of the study population (63.8%) were distributed in the age group between 21-30 years (red), than the other age groups

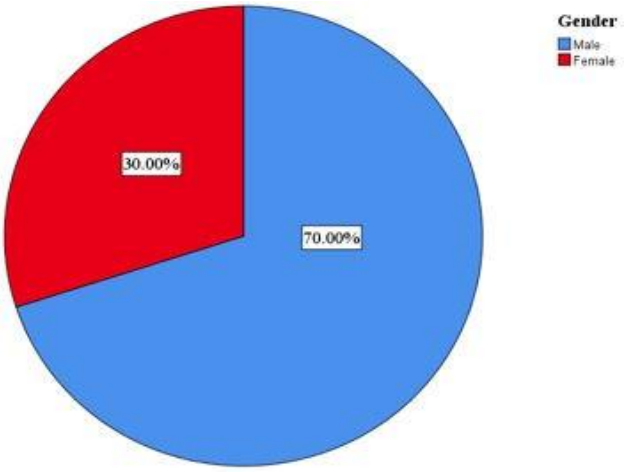

Figure 2: Pie chart represents the distribution of study subjects based on Gender. 30.0% of the study population were males (blue) and the remaining 70% were females (red).

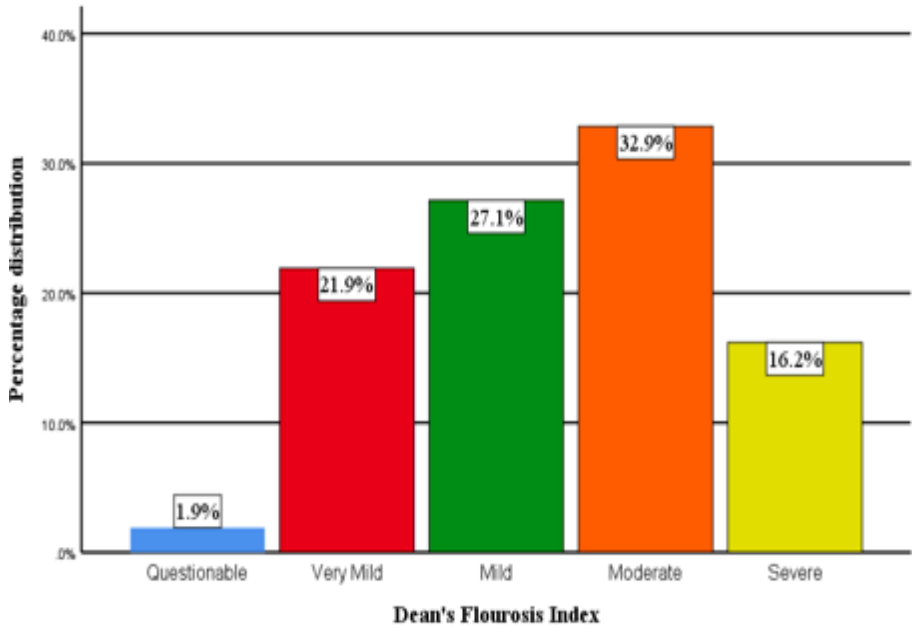

Figure 3: Bar diagram representing distribution of study subjects based on Dean's Fluorosis Index. X-Axis represents the Dean's fluorosis index categories and Y axis represents the percentage distribution in each category. The percentage distribution shows 1.9% had questionable fluorosis (Blue), 21.9% had very mild fluorosis (Red), 27.1% had mild fluorosis (Green), 32.9% had moderate fluorosis (Orange), 16.2% had severe fluorosis (light green).

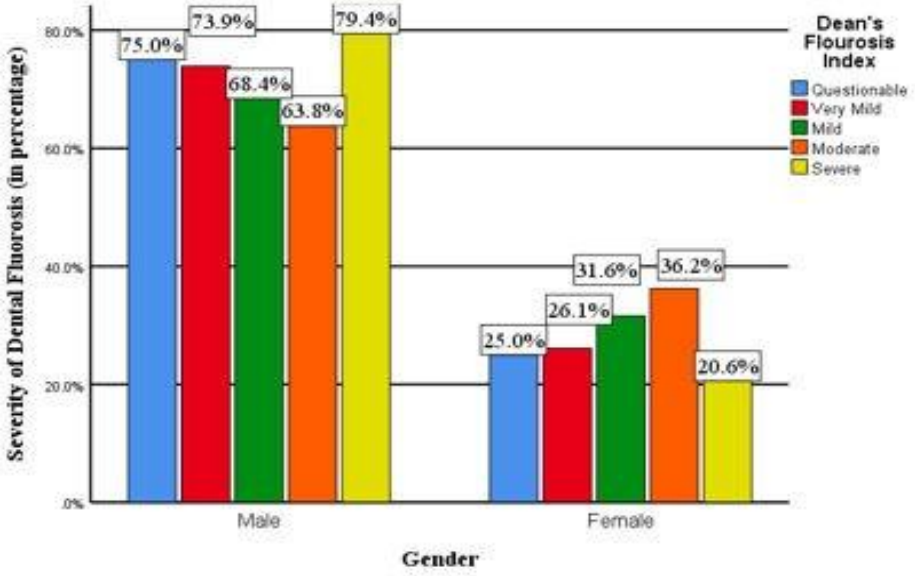

Figure 4: Bar diagram representing the association between the gender and the severity of dental fluorosis. X-Axis represents the gender and Y axis represents the severity of dental fluorosis based on Dean's fluorosis index categories. Chi square test was done and association between gender and Dental fluorosis was found to be statistically not significant [Pearson's chi square value 3.161, df - 4, p value = 0.531 ($p>0.05$)]. Even though the test was found to be statistically not significant the severe form of fluorosis (yellow) was found to be more common among males (79.4%) than females

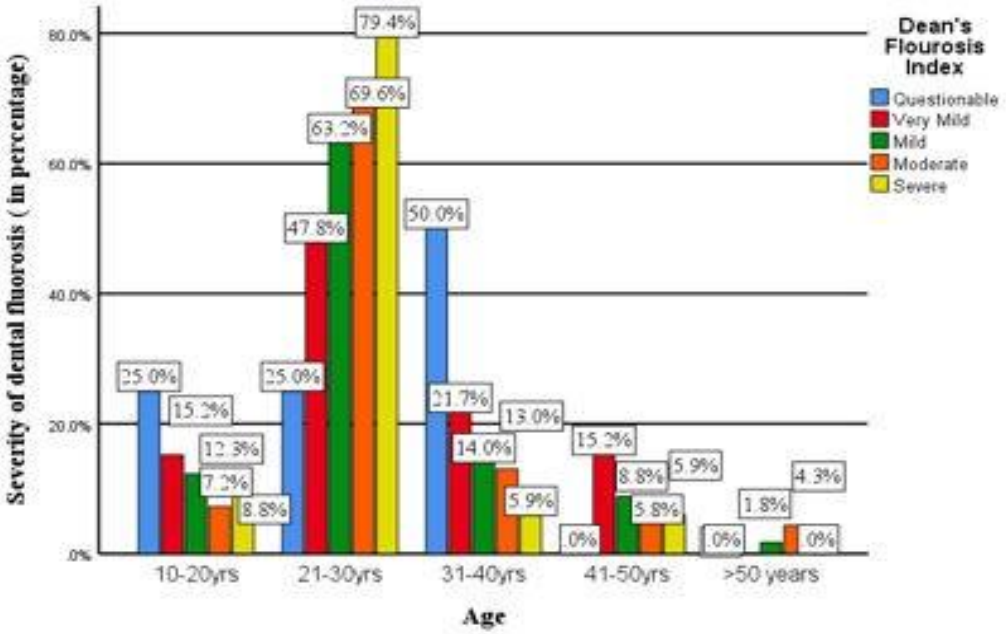

Figure 5: Bar diagram representing the association between the age and the severity of dental fluorosis. X-Axis represents the age group and Y axis represents the severity of dental fluorosis based on Dean's fluorosis index categories. Chi square test was done and association between age and Dental fluorosis was found to be statistically not significant [Pearson's chi square value 3.161, df - 4, p value = 0.168 (p>0.05)]. Even though the test was found to be statistically not significant, the severe form of fluorosis (yellow) was found to be more common among 21-30 years (79.4%) than other age groups.