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Dental Fluorosis and the Prevalence of Dental Caries in Children Age on 6-16

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Abstract:
Fluoride is a double edged sword. The fluoride produces a dose-dependent effect on the dentition. However, this is not confined to increased caries resistance. Fluoride causes various disorders, together called as fluorosis, if accumulated above certain levels in the body. The aim of the study is to assess the dental caries and dental fluorosis prevalence among 6 to 15-year-old school children. 50 school children in the age group of 6-16 years were selected for the study and were divided into six age groups. The children were assessed for dental fluorosis according to Dean's criteria Index of Fluorosis , and dental caries according to WHO basic survey guidelines. The overall health status of the child was assessed by DMFT index. The results of the present study revealed that the prevalence of grade 2 fluorosis was the highest and grade 5 fluorosis was the lowest in all the age groups. Number of children was highest in the age group between 15-16 years followed by the age group between 6-7 years. The overall DMFT increased as the age of the children increased in the different age groups. The DMFT increased as the severity of fluorosis increased upto grade 2 and then decreased from grade 3 to grade 5. In conclusion, my findings showed that the risk of dental fluorosis was significantly higher in the areas showing more fluoride content in drinking water and to a lesser degree of dental caries in the same area. There was also an increased problem of dental fluorosis with the passage of time. It is recommended to reduce the fluoride content of drinking water in the high fluoride area by making either alternative sources available or providing water with reduced fluoride content.

Keywords*: Fluroid; Double edge; DMFT.*

1. Introduction

Dental fluorosis, also called mottling of enamel, is a developmental disturbance of dental enamel caused by the consumption of excess fluoride during tooth development.(Nilay Shah 2004) The World Health Organisation has stated that the upper limit of fluoride concentration in drinking water

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should be at 1.5 mg/l. Meanwhile, as the proverb says 'the lesser the better', The Bureau of Indian standards has fixed that the Indian standards of drinking water should be at 1.0 mg/l. The World Health Organisation has also stated that fluoride I'd the most effective agent in dental caries prevention.(Kotecha et al. 2012)

In past few decades, the increase in fluoride exposure in various forms and types, it is most likely to be the reason for an increase in the prevalence of mild to moderate forms of dental fluorosis in many countries, even if a controlled water fluoridation has been established in that concerned country.(Aoba and Fejerskov 2002)The hypomineralisation in dental fluorosis, can change the metabolism in any one or all the phases of amelogenesis. The chronic endemic dental fluorosis is a hypoblast a or hypomineralization of enamel that range in appearance from light white striation a of a small area to dark brown stain affecting the entire crown.(Bagramian, Narendran, and Ward 1989)

Dental fluorosis if not prevented during childhood can lead to hampered dental esthetics during adulthood.(Selwitz, Ismail, and Pitts 2007) The study of fluoride's property in prevention of dental caries has carved a best example in extensive epidemiological research for betterment of humans. The prevalence of fluorosis is being increased in number of countries, India being one of them too.(A, U, and A 2009)

Each numerical score or grade of dental fluorosis has a descriptive criteria. The score 0 notes that the enamel shows no evidence of fluorosis. Grade 1 says enamel shows definite evidence of fluorosis namely areas with parchment- White colour that total less than one third of the visible enamel surface. Includes fluorosis confined only to incisal edges of anterior teeth and cusp tips of posterior teeth. Grade 2 denotes parchment- White fluorosis totals at 1/3 of the visible enamel surface, but less than 2/3. (Ganesh et al. 2013)Grade 3 shows parchment- White fluorosis totals at least 2/3 of visible enamel surface. Meanwhile grade 4 indicates when enamel shows staining in conjunction with any of the preceding levels of fluorosis. Staining is defined as an area of definite discolouration that may range light to very dark brown.(P. R. Kumar and John 2011) In grade 5 discrete pitting of enamel exists, unaccompanied by evidence of staining, of intact enamel. A pit is defined as a definite physical defect in the enamel surface with a rough floor that is surrounded by intact enamel. The pitted area is usually stained or differs in colour from the surrounding enamel. (Ramkumar and Shanmugasundaram 2014)Whole grade 6 gives both discrete pitting and staining of the intact enamel, as grade 7 denotes confluent pitting of the enamel surface. Large areas of enamel may be missing and anatomy of the tooth altered. Dark brown stains are seen.(Grobler, Louw, and Van W. Kotze 2001)

The present study was conducted in a school to determine the caries experienced in children having dental fluorosis and the correlation of the two interrelated afflictions.

2. Materials And Method

50 students were selected in this study. Before visiting the school, prior permission was taken from the local school authorities and the college's assistant dean of research. The children selected for the study were divided into five groups according to age variation, 6-7(group 1), 8-10 (group 2), 11-12 (group 3), 13-14 (group 4), 15-16 (group 5) respectively. Information was collected via a structured pro forma, which included demographic variables such as name, age, sex, permanent address, past address along with scores for dental fluorosis and dental caries.

All the data collected was compiled to do statistical analysis. The statistical analysis was done using Microsoft excel. Single examiner performed all the

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procedures in this study. The single examiner concept maintains consistency and eliminates inter examiner bias.

3. Results And Discussion

The students whom were divided into five groups consist of 34% males and 66% of females.(Graph 1 and table 1). The number of subjects belonging to each age group, group 1,12 (24%), group 2,4 (8%), group 3, 6(12%), group 4,10(20%), group 5,18(36%). (Table 1 and graph 2). The number of children having dental fluorosis, and dental caries with or without dental fluorosis is also varied.(graph 3)

The number of children having dental fluorosis also varied according to grade of fluorosis. (Table 2 and graph 4). In group 1, out of total 11 children whom were having fluorosis,3 children (27.3%) had grade 1 fluorosis, 5 children (45.5%) had grade 2 fluorosis, non had grade 3 fluorosis, but 2(18.2%) had grade 4 fluorosis and 1(9.1%) had grade 5 fluorosis. In group 2, out of 2 students, non had grade 1, grade 3, grade 4 or grade 5 fluorosis. 2(100%) had grade 5 fluorosis. In group 3, out of 6 students, 3(50%) had grade 1 fluorosis, 3(50%) had grade 2 fluorosis and non of them had grade 3, grade 4 or grade 5 fluorosis. In group 4, out of 9 children, 2(22.2%) had grade 1 fluorosis, 4(44.4%) had grade 2 fluorosis, 2(22.2%) had grade 3 fluorosis, 1(11.1%) had grade 4 fluorosis and non had grade 5 fluorosis. In group 5, out of 13 students 2(15.4%) had grade 1 fluorosis, 4(30.7%) had grade 2 fluorosis, 5(38.5%) had grade 3 fluorosis, 2(15.4%) had grade 4 fluorosis, and non had grade 5 fluorosis.

In the present study it was observed that in all the age groups as the severity of fluorosis increased from grade 1 to grade 2, the number of children in each age group is increased. The number of children having grade 5 fluorosis is the least. Also it was noted that the percentage of fluorosis increased from grade 1 to grade 3 and then decreased from grade 3 to grade 5. The overall percentage of grade 1 fluorosis is 24.4%, grade 2 fluorosis is 43.9%, grade 3 fluorosis is 17.1%, grade 4 fluorosis is 15.4%, and grade 5 fluorosis is 2.4%.(Table 2)

A different rates dental fluorosis the DMFT recorded also varied. The overall DMFT increased as the as the age increases. The DMFT of group 1(5) decreased to 0 at group 2 and increased to 2 in group 3. It further increased to 8 in group 4 and had the highest in group 5 which is 9. (Table 3 and graph 6)

The mean of DMFT according to age group and grades of fluorosis is also calculated. (Table 3 and graph 7). In group 1, the DMFT is decreased as the severity of fluorosis is increased from grade 1 to 2. It decreases again in grade 3 and remains 0 til grade 5. In group 2, group 3, group 4, and group 5 the number of children with DMFT increases as the severity of fluorosis increases from grade 1 to grade 2. But decreases when it comes to grade 3 until grade 5. The mean DMFT decreases from group 1 to group 2 , which is from 0.28 to 0, and increases to 0.13 in group 3 and to 0.7 in group 4, yet decreases to 0.43 in group 5. (table 3 and graph 7)

3.1 Figures

Table 1 Distribution of sample by age In number and percentage

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Age group	Male (num)	Male(%)	Female (num)	Female (%)	Total num	Total(%)
6-7 (group 1)	8	8	16	16	24	24
8-10(group 2)	2	2	6	6	8	8
11-12 (group 3)	0	0	12	12	12	12
13-14 (group 4)	8	8	12	12	20	20
15-16 (group 5)	16	16	20	20	36	36
Total	34	34	66	66	100	100

Table 2 Distribution of sample according to age group, grades and percentage of fluorosis

Age group	Number of students	Grade 1(%)	Grade 2(%)	Grade 3(%)	Grade 4(%)	Grade 5(%)
Group 1	11	27.3	45.5	0	18.2	9.1
Group2	2	0	100	0	0	0
Group3	6	50	50	0	0	0
Group4	9	22.2	44.4	22.2	11.1	0
Group5	13	15.4	30.7	38.5	15.4	0
Total	41	24.4	43.9	17.1	12.2	2.4

Table 3 Number and mean of DMFT according to age group and grades of fluorosis

Grades	No	DMFT	Mean	No2	DMFT2	Mean2	NO3	DMFT 3	Mean3	No4	DMFT 4	Mean4	No5	DMFT 5	Mean5
Grade 1	3	3	1	0	0	0	3	0	0	2	1	0.5	2	0	0
Grade 2	5	2	0.4	2	0	0	3	2	0.67	4	4	1	4	7	1.75
Grade 3	0	0	0	0	0	0	0	0	0	2	2	1	5	2	0.4
Grade 4	2	0	0	0	0	0	0	0	0	1	1	1	2	0	0
Grade 5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	11	5	1.4	2	0	0	6	2	0.67	9	8	3.5	13	9	2.15

Table 4 Correlation coefficient between grades of fluorosis and DMFT for different age groups

Age group	Group 1	Group 2	Group 3	Group 4	Group 5
r	0.73521	0	0.61237	0.95579	0.61732

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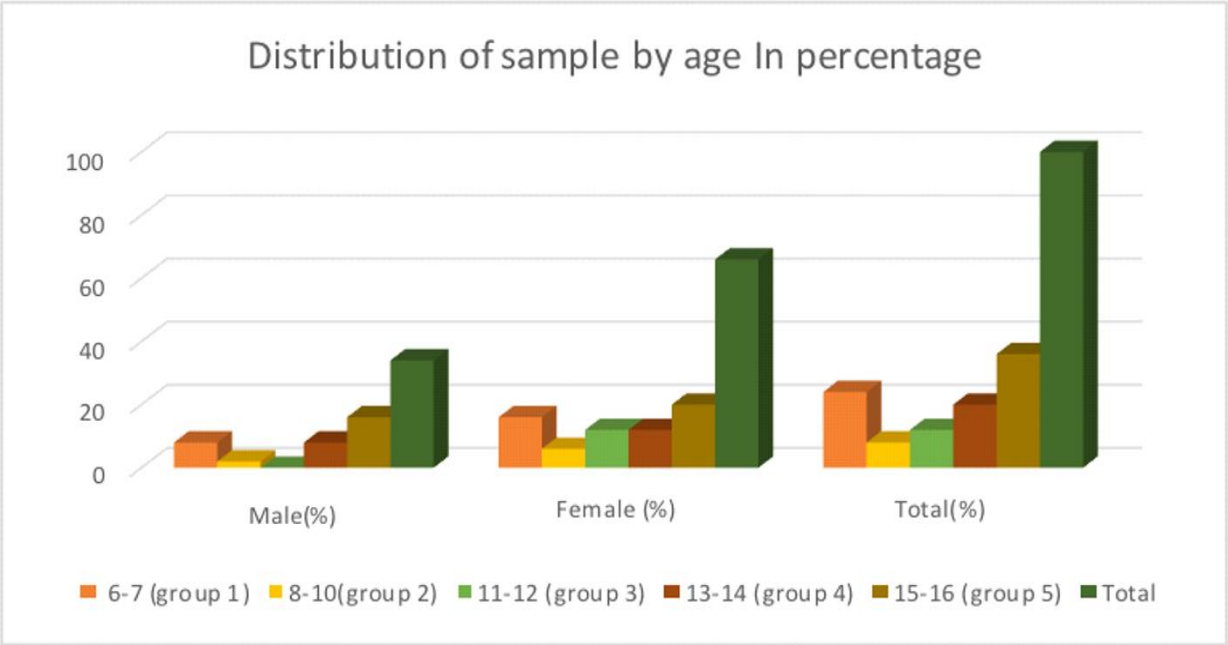
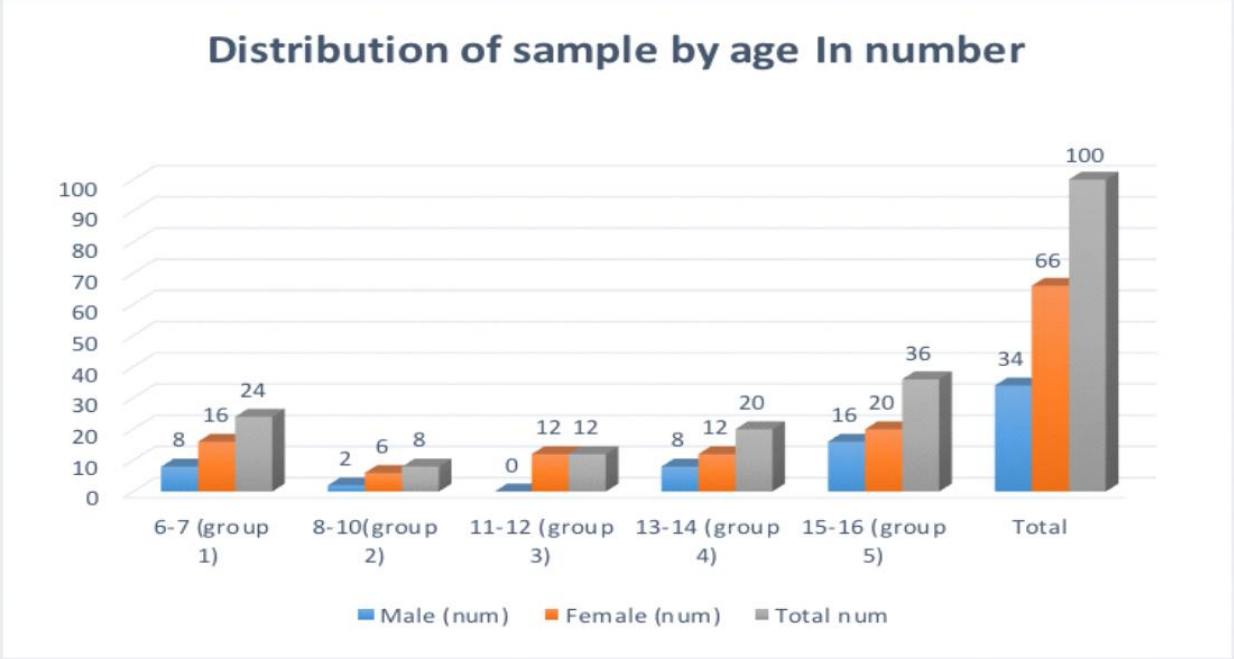
Graph 1 Distribution of sample by age In percentage



Graph 2 Distribution of sample by age



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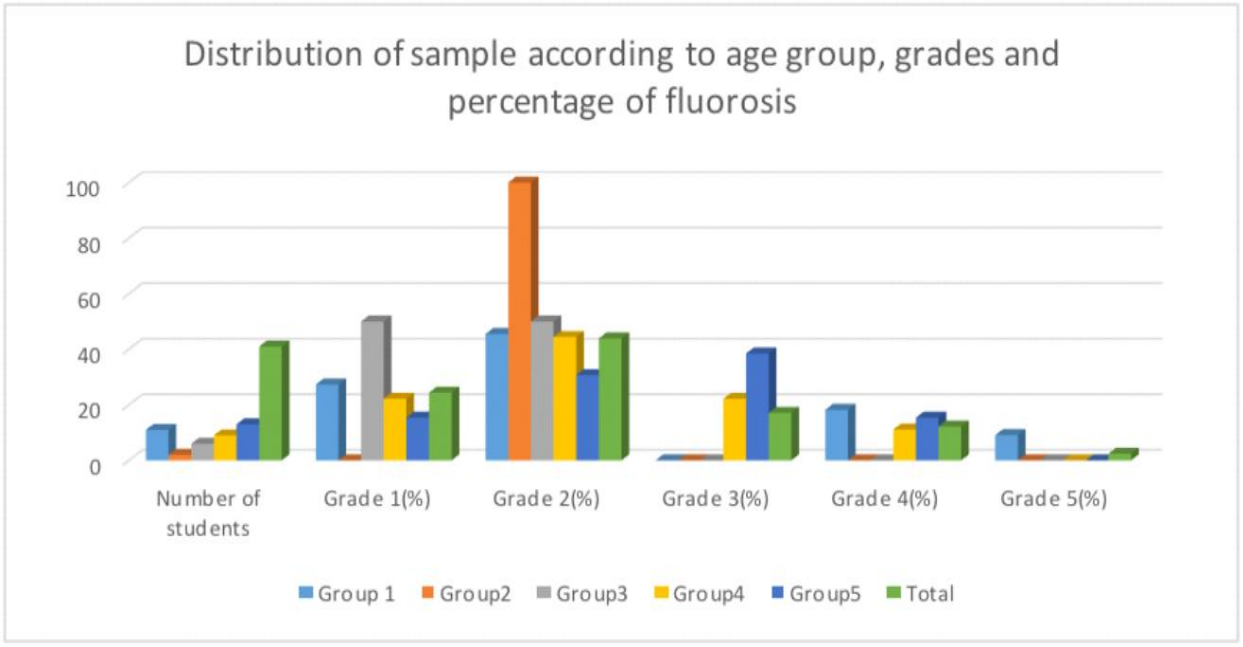
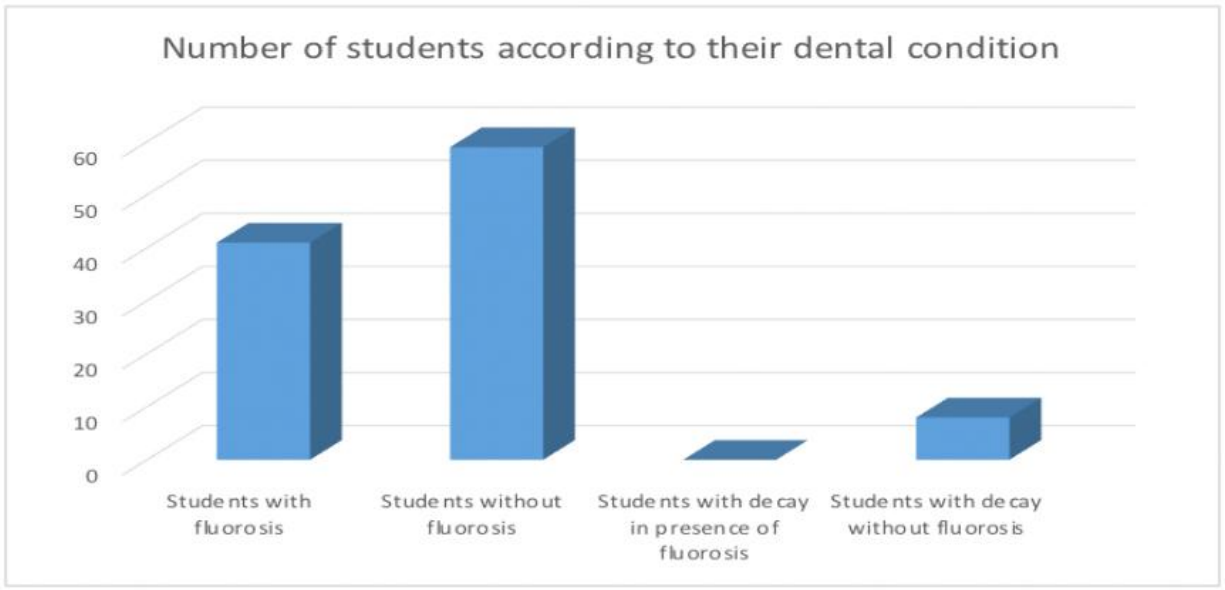
Graph 3 Number of students according to their dental condition



Graph 4 Distribution of sample according to age group, grades and percentage of fluorosis



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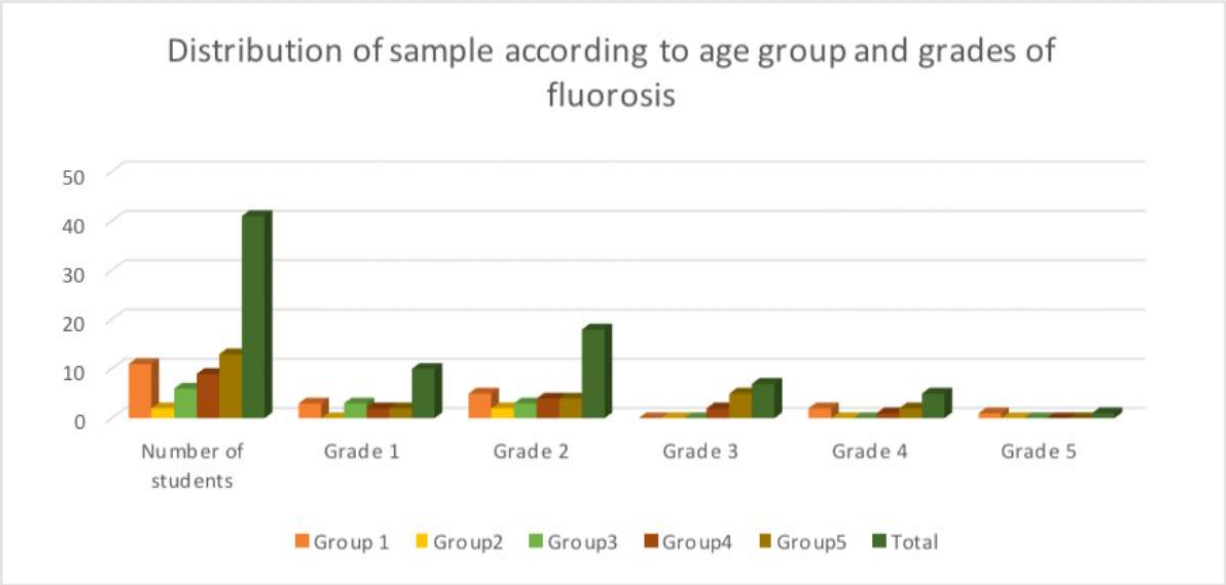
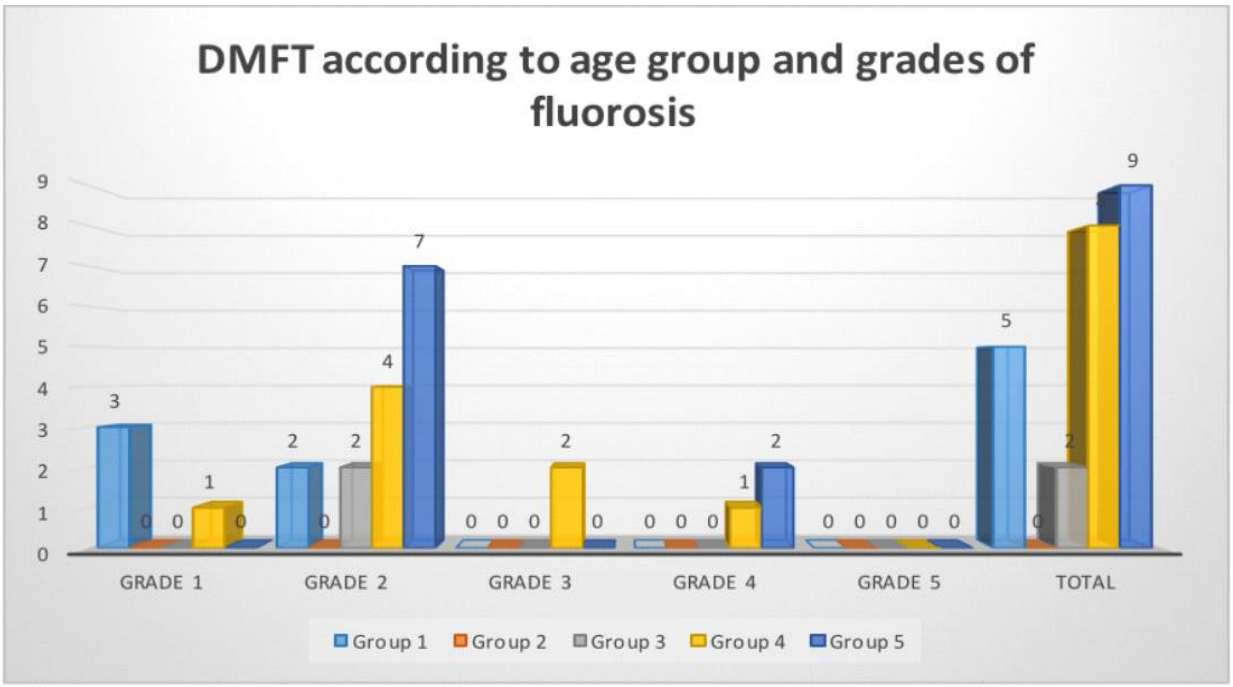
Graph 5 Distribution of sample according to age group and grades of fluorosis



Graph 6 DMFT according to age group and grades of fluorosis



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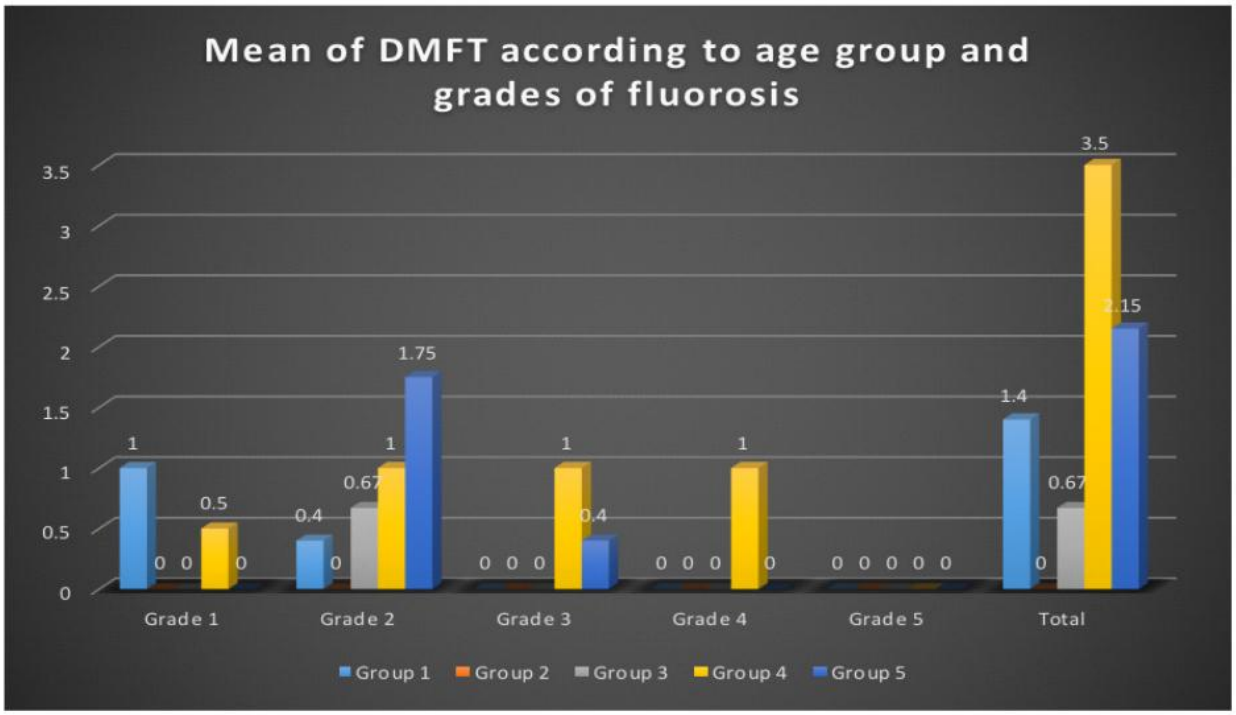
Graph 7 Mean of DMFT according to age group and grades of fluorosis



These findings do not tell us about the period of fluoride ingestion in the studied population. Dental fluorosis develops only when one is exposed to high fluoride level during 0-6 yr of age when dentition develops. Once fluorosis develops, it is permanent.(Varma et al. 2005)

Dental fluorosis a developmental defect resulting from incorporation of fluoride in enamel forming fluorohydroxyapetite crystals during the process of mineralization. Thus, if an association were to be found between dietary fluoride supplement and dental fluorosis, the supplements should have been administered during the ages at which teeth undergo mineralization.(Jain et al. 2011)

A number of studies have been conducted in various parts of Malaysia to collect epidermiological data on fluorosis and dental caries but still current update is required. This was one of the main reason for selecting this area for the present investigation.

Various studies (Naseem Shah 2005), (Vuhahula et al. 2009)conducted to assess Dental Fluorosis have reported a high prevalence of grade 2 fluorosis in school. My study in accordance with them as the percentage of grade 2 fluorosis is the highest in our study. It might be because of the fluoride level in drinking water may be so high to cause the severe fluorosis. Even if the fluoride level of the drinking water is high, as the climate and lifestyle pattern differ at different geographical locations, the effect of fluoride also differ, being more pronounced in drier, hotter more arid regions where there is more need of water.

The present study was observed that the highest number of children having dental fluorosis Was in age group of 15-16(group 5). It may indicate that several years after tooth eruption, there was a trend towards an increasing enamel surface destruction in children exhibiting pronounced degree

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of subsurface senates hypomineralisation at the time of eruption.

In my study, The overall percentage of dental fluorosis was more in females than males. This might be caused by the increased number of females than males in that particular area.

The number of children having grade 5 fluorosis was the least.this was accordance with the findings reported by (Bruun and Thylstrup 1984)

The result of present study conducted also revealed that the overall DMFT increases as the children get older in various age groups which was coincided with the studies conducted by (P. M. Kumar et al. 2005). Age may act as confounding factor as as far as the relationship between caries and age is observed. The reason nay be that as the age of children increases their experience, changing lifestyles and increased exposure to cariogenic diet from the time of teeth eruption till the time teeth are in situ.

Authors(Acharya and Anuradha 2003) have reported as the severity of dental fluorosis increses the DMFT increased unto the level of mild fluorosis and then decreased as the severity increased from moderate to severe fluorosis. These findings were similar to the results found in my study.

4. Conclusion

From this survey we can conclude that dental fluorosis is present in Paris district and dental caries was seen in conjunctions with fluorosis in all age groups of children but the correlation between these two variables was the strongest in the lower age groups. The difference in dental caries decreased while difference in dental fluorosis increased justifying the need for removing the confounder in the analysis. The crude, and age and sex adjusted relative risk also increased for dental fluorosis for high fluoride area. Further, it also indicates that fluoride in water is more a risk factor for fluorosis than a protective factor for dental caries. In conclusion, my findings showed that the risk of dental fluorosis was significantly higher in the areas showing more fluoride content in drinking water and to a lesser degree of dental caries in the same area. There was also an increased problem of dental fluorosis with the passage of time. It is recommended to reduce the fluoride content of drinking water in the high fluoride area by making either alternative sources available or providing water with reduced fluoride content.

5. Acknowledgment

The authors of this study acknowledge the institute, for their help towards collecting all the patient case records and other data in relevance to the current study.

6. Conflict Of Interest

The authors declare that there was no conflict of interest

7. Reference

1. Acharya, S., and K. P. Anuradha. 2003. “Correlation between Water Fluoride Levels and Dental Caries in Davangere District, India.” *Indian Journal of Dental Research: Official Publication of Indian Society for Dental Research* 14 (3): 146–51.
2. Aoba, T., and O. Fejerskov. 2002. “Dental Fluorosis: Chemistry and Biology.” *Critical Reviews in Oral Biology and Medicine: An Official Publication of the American Association of Oral Biologists* 13 (2): 155–70.
3. A, Tuli, Rehani U, and Aggrawal A. 2009. “Caries Experience Evidenced in Children Having Dental Fluorosis.” *International Journal of Clinical Pediatric Dentistry* 2 (2): 25–31.
4. Bagramian, R. A., S. Narendran, and M. Ward.

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1989. "Relationship of Dental Caries and Fluorosis to Fluoride Supplement History in a Non-Fluoridated Sample of Schoolchildren." *Advances in Dental Research*. https://doi.org/10.1177/08959374890030021501.

5. Bruun, C., and A. Thylstrup. 1984. "Fluoride in Whole Saliva and Dental Caries Experience in Areas with High or Low Concentrations of Fluoride in the Drinking Water." *Caries Research*. https://doi.org/10.1159/000260802.
6. Ganesh, C., N. Ganasundram, G. Maragathavalli, and T. N. Uma Maheswar. 2013. "Prevalence of Dental Caries in Different Grades of Dental Fluorosis in Salem and Dharmapuri Districts Aged 15 to 17 Years." *Journal of Indian Academy of Oral Medicine and Radiology* 25 (4): 251.
7. Grobler, S. R., A. J. Louw, and T. J. Van W. Kotze. 2001. "Dental Fluorosis and Caries Experience in Relation to Three Different Drinking Water Fluoride Levels in South Africa." *International Journal of Paediatric Dentistry / the British Paedodontic Society [and] the International Association of Dentistry for Children* 11 (5): 372–79.
8. Jain, M., L. Sawla, A. Mathur, T. Nihlani, D. Prabu, and S. Kulkarni. 2011. "The Relationship between Dental Caries and Dental Fluorosis in Low, Moderate and High Fluoride Areas of Udaipur District, India." *Nigerian Dental Journal*. https://doi.org/10.4314/ndj.v17i2.63180.
9. Kotecha, P. V., S. V. Patel, K. D. Bhalani, D. Shah, V. S. Shah, and K. G. Mehta. 2012. "Prevalence of Dental Fluorosis & Dental Caries in Association with High Levels of Drinking Water Fluoride Content in a District of Gujarat, India." *The Indian Journal of Medical Research* 135 (6): 873–77.
10. Kumar, P. Mahesh, T. Joseph, R. B. Varma, M. Jayanthi, and Others. 2005. "Oral Health Status of 5 Years and 12 Years School Going Children in Chennai City-An Epidemiological Study." *Journal of the Indian Society of Pedodontics and Preventive Dentistry* 23 (1): 17.
11. Kumar, Pradeep R., and Joseph John. 2011. "Assessment of Periodontal Status among Dental Fluorosis Subjects Using Community Periodontal Index of Treatment Needs." *Indian Journal of Dental Research: Official Publication of Indian Society for Dental Research* 22 (2): 248–51.
12. Ramkumar, G., and P. Shanmugasundaram. 2014. "A STUDY ON CRIPPLING IN SKELETAL FLUOROSIS." *International Journal of Current Research and Review* 6 (23): 26.
13. Selwitz, Robert H., Amid I. Ismail, and Nigel B. Pitts. 2007. "Dental Caries." *The Lancet* 369 (9555): 51–59.
14. Shah, Naseem. 2005. "Oral and Dental Diseases: Causes, Prevention and Treatment Strategies." *National Commission on Macroeconomics and Health Background Papers-Burden of Disease in India*, 275–98.
15. Shah, Nilay. 2004. "Pharmaceutical Supply Chains: Key Issues and Strategies for Optimisation." *Computers & Chemical Engineering* 28 (6): 929–41.
16. Varma, R. B., M. Jayanthi, P. Mahesh Kumar, and T. Joseph. 2005. "Oral Health Status of 5 Years and 12 Years School Going Children in Chennai City - An Epidemiological Study." *Journal of Indian Society of Pedodontics and Preventive Dentistry*. https://doi.org/10.4103/0970-4388.16021.
17. Vuhahula, E. A. M., J. R. P. Masalu, L. Mabelya, and W. B. C. Wandwi. 2009. "Dental Fluorosis in Tanzania Great Rift Valley in Relation to Fluoride Levels in Water and in 'Magadi'(Trona)." *Desalination* 248 (1-3): 610–15.