

Research Article

Prevalence of dental caries in first and second permanent molars

Vikas C. Desai¹, Rajendra E. Reddy², Manjula M², Shaik Hussain Saheb^{3*}

¹Assistant Professor, BLDE Collage and Hospital, Bijapur, Karnataka, India

²Department of Pedodontics and Preventive Dentistry, KIDS, Narketpally, Andhra Pradesh, India

³Department of Anatomy, JJMMC, Davangere, Karnataka, India

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*Correspondence:

Dr. Shaik Hussain Saheb,

E-mail: hussain987654321@gmail.com

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ABSTRACT

Background: This study was conducted to assess the First and Second molar permanent molar caries in school children of Nalgonda district, Andhrapradesh, India.

Methods: We have taken total 1800 school going children as study population age between 12-15 years, who lived in the same place since birth and consumed drinking water form single source.

Results: The mean of caries in first and second were 0.12 ± 0.36 and 0.36 ± 0.70 respectively and total was 0.49 ± 0.92 .

Conclusion: The prevalence of Second molar teeth was found higher than First molar teeth and these caries were untreated.

Keywords: First molar, Second molar, Dental caries

INTRODUCTION

Dental caries is a disease of involving multi factors such as genetic predisposition, diet, tooth morphology, bacteria and etc. The social and cultural environmental factors are also effect on dental caries. Oral health status of the population can get by oral health surveys this is very important to set baseline information which helpful to establish oral health plans as per as population needs. In children the dental caries is one of the most prevalent chronic disease, the treatment and prevention of dental caries is important responsibility for dentist. The most common index to determine the oral health is DMFT.¹ WHO has set goals include an average age DMFT of not more than 3 in 2000 and not more than 1 in 2010 at the age of 12.² In most industrialized countries shows overall caries rates have decreased considerably, the percentage of caries in pit and fissures compared to smooth surfaces has increased. The contributing factors for this decline in dental caries are water fluoridation, dentifrices, improved oral hygiene, changes in diet and awareness of oral

health. However dental caries still exists as burning disease in developing and under developed countries where there are inadequate resources of dental treatment, lack of public awareness and motivation.¹

First permanent molar is more vulnerable to caries due to its morphological and functional characteristics, as well as to the surrounding conditions the newly erupted permanent molars have to face. The study of MC Donalds (1998) shows that high frequency of occlusal caries on the permanent First molar for all age groups and this study concluded that first molar remains the most common site for caries with in a short period following its eruption.³ In study of Momeni et al. assessed that the prevalence of dental caries and treatment needs 12 year old children and the mean DMFT score as 0.77 among the Tehran study population. The incidence of caries among the varies teeth various considerably, there are many reasons the morphology, time of eruption and positioning of the tooth in the oral cavity confer inverted disadvantages or advantages to the various methods used

in the control of plaque and hence tooth decay and losses.⁴ The study of Chukwu GA showed that the first permanent molars accounted for 42% of all extractions due to caries which is the highest when compared to other teeth.⁵ Warren JJ study tells that in Taiwan 48% of children aged 6 years were caries free in their first permanent molars.⁶ Warnakulasuriya S study reported that the first molar caries were 36% in Srilanka school children and 11% had all first permanent molars affected by caries.⁷ The study of Hescot and reported that 4.9% of the children having First permanent molar caries at six years of age.⁸ Alshammy AR and Miller WD studies reported that the prevalence in caries of first permanent molar teeth in Kingdom of Saudi Arabia was 68 to 70% among school going children.^{9,10} These studies showed that with increasing age there was an increase in the prevalence of dental caries of the first permanent molar. The purpose of present study was to determine the prevalence of dental caries in first permanent molar among school going children of 7-10 years old in Nalgonda district, Andhra Pradesh, India.

METHODS

The present study was under taken by the department of pedodontics and preventive dentistry, Kamineni institute of dental sciences, Narketpally, Nalgonda district, India.

Study population/source of data

Total study population was 1800 school going children. Data was collected from 12-15 years old school going children of Nalgonda district, who lived in the same place since their birth and who consumed drinking water from a single source, at least in the initial 12 years of their life.

Study design

This study was a cross-sectional analytical study. Data was collected by means of structured questionnaires, intra oral examinations; and collection and analysis of drinking water samples (bore water) for fluoride concentrations. The questionnaire was used to collect information about their residential status, demographic details, eating, oral hygiene practices and exposure to fluoride. Clinical and visual examination was conducted to detect dental caries.

A pilot study was conducted before the commencement of the study on a convenient sample from the representative population of the study area. This was to determine the sample size, to assess the applicability and accuracy of the questionnaire and to verify the appropriateness of the inclusion and exclusion criteria.

A stratified random sampling technique was used. The entire geographical area of Nalgonda district was divided into 3 strata based on the concentrations of naturally occurring fluoride in drinking water. Sample size was equally divided among the three strata. Schools were selected randomly from each stratum. From each selected

school, all the children who satisfied the inclusion criteria were considered, till the required numbers of children were selected. Information on drinking water fluoride levels was obtained from the documented records of the office of the chief engineer, department of Rural Water Supply (RWS), Nalgonda.

Exclusion criteria

The children who had the following characteristics were excluded from the study.

- Children who had migrated from some other place or who were not the permanent residents of that particular area.
- Children with orthodontic brackets were excluded as this hindered diagnosis of enamel defects.
- Children with severe extrinsic stains on their teeth in whom assessing fluorosis is not possible.

Criteria followed for diagnosis of dental caries and dental fluorosis

The criteria suggested by World Health Organization (WHO) in 1997 were followed to diagnose the carious lesions. Dental caries was recorded using "Dentition status and treatment need index".⁴ The information collected from questionnaires, clinical examinations and Fluoride analysis was computerized and analysed using the Statistical Package for Social Sciences (SPSS version 16.0).

Quantitative data was summarized using means and standard deviations. Qualitative data was summarized using frequencies, percentages, and ranges. Parametric tests were used for comparisons involving continuous data. Student's t -test was used to compare two means. One way Analysis of variance (ANOVA) test was used to assess the difference in means between more than two groups. Wherever ANOVA yielded statistically significant results, Scheffe's post hoc test was used for multiple pair-wise comparisons.

RESULTS

Comparison of the mean number of untreated carious lesions in first and second molars among the study population

The mean number of untreated carious lesions in the study population was 0.49 with a standard deviation of 0.92. The mean number of first molars ($0.12 \pm .36$) involved was less than that of second molars (0.36 ± 0.70). The difference was statistically significant ($p=0.000$) (Tabale 1).

A weak negative correlation was observed between fluoride concentrations in drinking water and Dental caries prevalence which was found to be statistically significant. A strong positive correlation ($\rho = 0.932$)

between fluoride concentrations in drinking water and Dental fluorosis index score which was statistically significant.

A weak negative correlation between fluoride concentrations in drinking water and DMFT value in the present study and this was statistically significant. A weak negative correlation was observed between DFI score and DMFT scores in the present study. This finding was statistically significant (Table 2).

Table 1: Prevalence of dental fluorosis among the study population in different fluoride areas.

Fluoride areas	Dental fluorosis		Total
	Absent	Present	
Below optimal	522 (93.2%)	38 (6.8%)	560 (100%)
Optimal	71 (11.6%)	541 (88.4%)	612 (100%)
Above optimal	00 (0%)	628 (100%)	628 (100%)
Total	593 (32.94%)	1207 (67.06%)	1800 (100%)
$X^2 = 1355.547$, $df = 2$, P value = 0.000 (HS)			

Table 2: Distribution of DFI (Dental Fluorosis Index) scores among the study population in different fluoride areas.

Fluoride areas	DFI score 0	DFI score 1	DFI score 2	DFI score 3	DFI score 4	DFI score 5	Total
Below optimal	522 (93.2%)	34 (6.1%)	4 (0.7%)	0 (0%)	0 (0%)	0 (0%)	560 (100%)
Optimal	71 (11.6%)	306 (50%)	219 (35.8%)	16 (2.6%)	0 (0%)	0 (0%)	612 (100%)
Above optimal	0 (0%)	0 (0%)	17 (2.7%)	159 (25.3%)	407 (64.8%)	45 (7.2%)	628 (100%)
Total	593 (32.9%)	340 (18.9%)	240 (13.3%)	175 (9.7%)	407 (22.6%)	45 (2.6%)	1800 (100%)
$X^2 = 2828.231$, $df = 10$, P value = 0.000 (HS)							

In the above optimal fluoride area, the mean DMFT scores decreased with increasing concentration of fluoride in the drinking water up to 5.3 ppm. But, the DMFT score increased at the fluoride concentration of 9.6 ppm. The CFI score increased with increasing concentration of fluoride in the drinking water (Table 3).

Table 3: Prevalence of dental fluorosis between different age groups in the study population.

Age groups	Dental fluorosis		Total
	Absent	Present	
12 years	149 (33.6%)	295 (66.4%)	444 (100%)
13 years	144 (32.3%)	302 (67.7%)	446 (100%)
14 years	149 (35.1%)	276 (64.9%)	425 (100%)
15 years	151 (31.1%)	334 (68.9%)	485 (100%)
Total	593 (32.9%)	1207 (67.1%)	1800 (100%)

No statistically significant difference was observed in the method of cleaning, staple diet, and frequency of sweet consumption between different fluoride areas, between the different gender and age groups.

DISCUSSION

The present study was conducted to calculate prevalence dental caries in first and second permanent molar among school children of 12-15 years age of Nalgonda district, AP, India. The present study was mainly conducted on first and second permanent molar teeth because they play a key role in maintaining the dental and overall health of an individual. First permanent molar are the first

permanent tooth to erupt and exhibit a greater control over the teeth that erupt later behind and in front of them as they are forced to position to the already erupted and in occlusion functioning first molars. Moreover, they are the largest tooth in oral cavity and bear the maximum occlusal load. They are positioned in oral cavity in such a way that they influence the vertical distance of maxilla and mandible, the occlusal height and aesthetic proportions.¹¹ Apart from this, since they have the maximum root surface area they are considered to be best source of anchorage for moving the tooth. Above all the health of this tooth in particular can form a good basis to assess the oral health status of these children, since this tooth is more vulnerable to caries than others because of its functional and morphological characteristics.¹²

According to Vanderas et al. study the presence of dental caries on the primary second molars distal surfaces does not affect significantly the development of the dental disease on the permanent first molars mesial surfaces. They found the significant positive relationship between the child's age and permanent first molars mesial surface caries implied that as age increases and consequently, the time period of mesial surfaces exposed to the primary second molars carious distal surfaces increases, the probability of developing caries is greater.¹³

Mejare I et al. study reported that the progression of proximal caries from one state to another is extremely variable not only between individuals but also between carious lesions of the same individual, indicating different cariogenic conditions. Overall the odds ratio results strengthened the correlations found between the presence of primary second molars distal surface carious

lesions and the development of permanent first molars' mesial surface caries.¹⁴

The cumulative effects of the microbial deposits in the initiation of caries may not become apparent until after a few years later in life because caries is a slow growing lesion which requires time before it becomes clinically evident. To this end, studies have shown that the greatest degree of vulnerability of teeth to caries attack usually occurs during the first four years of eruption with the maximum peak at the second year of eruption period. The general higher occurrence of caries in second premolars as compared with first premolars can also be attributed to the differences in the anatomical configuration between second premolars and first premolars. The second premolars are characterised by more pronounced fissures and fossae as compared with first premolars.¹⁵

WHO has drafted new goals for 2020, entitled "Goals for Oral Health 2020". The updated objectives are intended to act as a framework for the formulation of regional and national oral health goals as the slogan "Think globally, act locally" implies. The new goals are allowing for the fact that not all recommendations are applicable equally to all countries and populations. Appropriate differentiation is therefore important.¹⁶

According to Zhang Q et al., the prevalence and severity of dental caries in the permanent dentition of these 7- to 8-year-olds was low. The severity was somewhat lower than the mean DMFT score of 0.4 for 6-year-olds in 1995 in Wuhan. The number of permanent first molars with enamel carious lesions and those with dentine carious lesions were found to be powerful caries predictors over a period of 4 years in a similar age group in Wuhan.¹⁷ Noronha et al. reported that 87% 12-year-olds children had the permanent first molar affected by caries respectively.¹⁸ Al-Shammery et al. reported a higher prevalence of caries amongst molars in primary school children whose parents had a primary level of education or illiterate.¹⁹ Good dental care, such as correct brushing technique especially after eating sugary food or drink and consuming fewer snacks during the day resulted in lower decay.²⁰ Wyne AH reported in study that as the age of the children increased and they were exposed to cariogenic factors, more and more teeth become carious, due to their anatomical structure, early eruption, and positioning in the mouth as well as Streptococcus mutants levels in the mouth, FPMs were observed to be highly susceptible to carious attack.¹

The studies of Mejare I et al., Lith A et al., Vanderas AP et al. have suggested using remineralizing rather than restorative measures to monitor proximal enamel and dentin carious lesions in permanent teeth. Although the application of such preventive measures results in a retardation of proximal caries progression, it remains to be investigated whether the retarded carious lesions increase the risk of developing dental disease on the adjacent tooth's sound surfaces.^{13,14,21}

The effect of drinking water fluoride concentration on human health, particularly dental health has been a matter of debate since the work Dean. Dean's landmark epidemiologic studies had conceptualized that 1 ppm of fluoride in drinking is 'optimum' for dental health, which offers maximum protection against dental caries, with minimal or no dental fluorosis. However, the concept that "1 ppm is optimal" was not universally accepted. Later, it became clear that factors like temperature of the area, altitude, fluoride content of foods and beverages influence the optimal water fluoride concentration.²² Galagon designed a formula ($E = -0.038 + 0.0062 X$ temperature in F° , where E is estimated water intake) for optimal concentration of fluoride in drinking water, based on mean annual temperature of the area. But the intricate interaction of multiple factors, as mentioned above, make the demarcation of 'optimum water fluoride level' a herculean task. A more precise definition of "optimum" concentration will help to promote more judicious use of fluorides in caries prevention and to set up suitable mechanisms for downward adjustment of water fluoride concentration where it is present beyond permissible limits.²³

Nalgonda district is a known endemic area for fluorosis, with a wide spectrum of severity, ranging from mild dental fluorosis to crippling skeletal fluorosis⁸. Even though Nalgonda is a known endemic area for fluorosis, areas with optimal and below optimal levels of fluoride in drinking water sources are also present. Thus, the aim of the present study was to assess the effect of fluoride concentration in drinking water on dental caries and dental fluorosis among 12-15 year old school children of Nalgonda district, Andhra Pradesh.²⁴

The study was intended to find the prevalence of dental caries and dental fluorosis in relation to fluoride ion concentration in drinking water. Commonly, all the deciduous teeth are exfoliated and all the permanent teeth, except third molars are erupted by 12 years of age. Therefore the lower age limit of the study participants was decided to be 12 yrs. Schools are the ideal settings for conducting studies of this kind. Those students in whom deciduous teeth are not exfoliated are excluded from the study. The study population contained about 61.2% of boys and 38.8% of girls.²⁵

Socio-economic status of the individuals is known to influence dental caries.²⁶ The participants of the present study were assumed to share similar socio-economic conditions, since all the children were from government schools, thus avoiding the confusion regarding socio-economic status with dental caries and dental fluorosis. Sample size was 1800 and the samples were almost equally selected from the three areas with different water fluoride levels. Children, who lived in the same place where they were born, were included in the study in order to ensure exposure to the same concentration of fluoride through drinking water.

As the ground water table has been constantly receding and some communities started getting piped water from surface water sources in the recent times, it was decided to include those children who obtained drinking water from the same source (Bore well), at least in the initial 12 years of their life. This amendment was done, keeping the fact in mind that mineralization of all permanent teeth, except third molars is completed by ten years.²⁶ Information regarding source of drinking water; oral hygiene aids used and frequency of consumption of sweets in the last 24 hours was obtained through the questionnaire, since these are the important contributing factors for dental caries and/ or dental fluorosis. To record dental caries, dentition status and treatment need index was used. Caries diagnosis was based on the guidelines given by WHO in 1997 for assessment of dental caries.²²

The average prevalence of dental caries in the present study was 35.2%, lower than average Andhra Pradesh caries prevalence of 41.5% for 15 year age group, as reported by national oral health survey and fluoride mapping - 2002-2003.²⁷

In the present study 67.06% of the children had dental fluorosis. National oral health survey and fluoride mapping by dental council of India (2002-03) found the prevalence of dental fluorosis in the state of Andhra Pradesh to be around 5% which was significantly less.²⁷ The study sample for the above mentioned study did not include the two most endemic areas of Andhra Pradesh namely Nalgonda and Prakasham district. The present study was conducted in Nalgonda district of Andhra Pradesh. The difference in the study samples between this study and of national oral health survey explains the reason for the contradictory findings. In the present study area, Nalgonda district, even low fluoride areas show fluorosis. This could be explained by A. K. Susheela's hypothesis,²⁸ that in an endemic fluorosis area, a great amount of fluoride is incorporated into the food materials and ingested into the body. Rice was the staple food of all the respondents. High temperature of Nalgonda, which necessitates greater intake of water, could also be one reason for this, as originally suggested by Galagan and Lamson, that there is a positive association between mean annual temperature and total fluoride intake.²⁹ The studies conducted in Uganda³⁰ and in USA³¹ explained the role of climatic factors on fluorosis. Using Dean's index, it was apparent that 64.8% of the children living in an area with 0.2-0.4 ppm of fluoride in the water exhibited dental fluorosis if the temperature was above 27°C.³² The least prevalence of dental caries was found in level 2 (0.71-1.2 ppm). Many studies concluded that dental caries and fluorosis are minimum at about 1ppm water fluoride concentration.³³⁻³⁵ Menon A, Indushekar KR (1999) in their study among 6-16 year old school children in Gadag and Dharwad district of Karnataka, India and reported the prevalence of dental caries to be 33% and the DMFT to be 0.65 in low fluoride area (below optimal fluoride area with a fluoride concentration of 0.5 ppm) and the

prevalence of caries in high fluoride area (optimal fluoride area with a fluoride concentration of 1.2 ppm) was 16% and the mean DMFT was 0.39. The caries experience was more in below optimal fluoride area than in optimal fluoride area.³⁶ The results of the present study were consistent with the findings of this study.

V. V. Subba Reddy & A. Tiwari (1992) in their study among 1750 school children in the age group 12-17 years, on the prevalence of dental caries in relation to fluoride levels of drinking water, in Punjab, India found the prevalence to be lowest in areas where the fluoride concentration was 1.1 ppm (dental caries prevalence was 61.24%) and 2 ppm (dental caries prevalence was 54.72%). The dental caries prevalence was relatively high in areas where the fluoride concentration was 0.3 ppm (89.03%), 3.4 ppm (72.77%), 5.4 ppm (73.61%) and 10.4 ppm (85.47%). The caries experience was more in below optimal and above optimal fluoride areas than compared to optimal fluoride areas.³⁷ The results of the present study were in harmony with the conclusions of this study.

A 1995 investigation by The National Committee on Oral Health of China (NCOH) showed the relationship between average number of decayed, missing and filled teeth (DMFT) of urban residents and fluoride concentration in drinking water to be negatively correlated but not forming a good linear relationship.³⁸ A study conducted in China reported that there was a statistically significant reduction in dental caries as the fluoride content of the drinking water increased from 0.4 to 5.6 ppm.³⁹ The present study is in accordance with the above study in concluding that there was significant reduction in caries prevalence from 0.7-5.3 ppm. In the present study the prevalence of dental caries (57%) and mean DMFT (1.17 ± 1.42) was found to be the highest in below optimal fluoride area and least in optimal fluoride area (17.2% and 0.21 ± 0.50). The caries experience in the above optimal fluoride area was intermediate (33.3% and 0.43 ± 0.67). The present study found an overall weak negative correlation between concentration of fluoride in drinking water and caries experience. In the present study second molars were found to be more commonly affected with dental caries than the first molars. The mean number of untreated carious lesions in the second molars was 0.36 with a standard deviation of 0.70 and in first molars was 0.12 with a standard deviation of 0.36. The more severe forms of dental fluorosis lead to the loss of outer enamel resulting in formation of pits. The retention of plaque and debris in these areas increases the susceptibility of the tooth for caries. The subsurface hypo-mineralization in teeth having more severe fluorosis may also inherently increase the susceptibility for caries. The differences in the involvement of molars may also be due to genetic variation, malnutrition during the mineralization of second molars, differences in the fissure systems and degree of post eruptive maturation. Moreover, the distal position of second molars compared to first molars in the dental arch may offer less accessibility for cleaning than

that of first molars. The results of the present study was consistent with the findings of study by Fantaye Wondwossen et al.⁴⁰

CONCLUSION

The following conclusions can be drawn from the study:

There was a strong positive relationship between fluoride concentration in drinking water and the prevalence and severity of dental fluorosis.

The prevalence of dental caries was more in below optimal fluoride area followed by areas where fluoride concentration was 5ppm and above. The lowest caries prevalence was found in optimal fluoride areas.

There was a negative correlation between fluoride concentration and dental caries. The prevalence of dental caries decreased with increasing concentration of fluoride in the drinking water up to 5 ppm.

Interestingly the second molars were more affected by dental caries than the first molars in high fluoride areas.

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