10.5005/jp-journals-10031-1158

RESEARCH ARTICLE

Prevalence of Deep Dental Caries and Its Association with Levels of Water Fluoridation, Age, Gender, and Oral Hygiene Status in the Semiurban Areas of Navi Mumbai

[1]Karishma R Patil, [2]Pooja R Parab, [3]Ashvini M Padhye, [4]Sabita M Ram, [5]Nandana R Patil

ABSTRACT

Aim: This survey-based study intends to explore a potential association between the prevalence of deep dental caries and variables, such as age, gender, oral hygiene status, and levels of water fluoridation in the areas of residence of the subjects.

Materials and methods: A systematic oral examination was carried out using a questionnaire and clinical examination for a sample of 487 subjects reporting to the outpatient department at MGM Dental College and Hospital. Data regarding deep dental caries, age, gender, oral hygiene status were collected in this manner. The levels of water fluoridation were determined by data collected from government water testing laboratories. Data collected were analyzed using central tendency of fluoride levels, Pearson's correlation, chi-square test, and the slice and dice technique for a confidence limit of 95%.

Results: A statistically significant association exists between fluoride levels in drinking water and deep dental caries. No significant association was found between age, gender, oral hygiene status, and deep dental caries.

Conclusion: Within the limitations of this study, the results suggest that low water fluoridation levels affect the prevalence of deep dental caries.

Clinical significance: This study stresses on the importance of water fluoridation in semi-urban areas for the prevention of dental caries and aids in the outlook toward better awareness.

Keywords: Age, Deep dental caries, Fluoride, Gender, Oral hygiene status.

How to cite this article: Patil KR, Parab PR, Padhye AM, Ram SM, Patil NR. Prevalence of Deep Dental Caries and Its Association with Levels of Water Fluoridation, Age, Gender, and Oral Hygiene Status in the Semiurban Areas of Navi Mumbai. J Contemp Dent 2016;6(2):137-141.

Source of support: Nil

Conflict of interest: None

[1,2]Student, [3]Head, [4]Dean, [5]Honorary Professor

[1]Department of Endodontics/Community Dentistry, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

[2]Department of Community Dentistry, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

[3]Department of Periodontics, MGM Dental College and Hospital Navi Mumbai, Maharashtra, India

[4]Department of Prosthodontics, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India

[5]Department of Endodontics, MGM Dental College and Hospital Navi Mumbai, Maharashtra, India

Corresponding Author: Karishma R Patil, Student, Department of Endodontics/Community Dentistry, MGM Dental College and Hospital, Navi Mumbai, Maharashtra, India, Phone: +912227436604, e-mail: karipatil@gmail.com

INTRODUCTION

Oral health is a part of general health and affects various aspects of the quality of life. It is found that 36% of the world's population has dental caries with a higher prevalence among developing nations. This implies implementing strategies in order to promote balanced oral health in these nations. Caries being a multifactorial disease,[1] a number of studies have been performed determining the influence of risk factors, such as age, gender, dietary patterns, and socioeconomic status of various populations on the prevalence of dental caries. The prevalence of dental caries in India in 1940 was 55.5%, and was further reported to be 68% in 1960.[2] A few others reported the prevalence to be 60 to 65%.[3,4] This descriptive cross-sectional study intends to explore a potential correlation between some of these factors namely fluoride exposure, age, gender, and oral hygiene status and prevalence of deep dental caries for subjects residing in semi-urban regions of Navi Mumbai. A possible evident association between the prevalence of deep dental caries and these variables would better equip the dental personnel to implement appropriate preventive and restorative treatment plans for the patients.

MATERIALS AND METHODS

This study was carried out in the outpatient department at MGM Dental College and Hospital, Navi Mumbai, India. Simple random sampling was done for a total of 487 subjects entering the premises for dental checkup. Based on the data collected, five semi-urban areas within the Raigad district namely, Panvel, Karjat, Khalapur, Uran, and Pen formed the basis of this study.

Informed consent was obtained from every subject, prior to examination. The present study protocol was approved by the Ethical Committee of MGM Dental College and Hospital, Navi Mumbai, India.

The inclusion criteria were as follows:

- Participants aged 18 years and above
- Participants with one or more decayed teeth showing symptoms of pain/sensitivity or a history of the same
- Participants who were independent and fully conscious while answering questions
- Participants with fully erupted teeth (including 3rd molars).

The exclusion criteria were as follows:

- Patients below 18 years of age
- Noncarious teeth
- Shallow caries without symptoms of pain or sensitivity
- Unerupted or impacted teeth
- Erosion/attrition/abrasion exposing dentin or pulp.

Materials used:

- Mouth mirror
- Straight probe
- Questionnaire.

The questionnaire consisted of age, gender, area of residence, and a Simplified Oral Hygiene Index (OHI-S)[5] indicating oral hygiene. The age of the subjects were recorded under age groups 18 to 35, 36 to 55, and 55+. Teeth with deep dental caries were identified using a mouth mirror and probe. Symptoms, such as sensitivity or pain on hot and cold intake and depth of the carious lesion were used as a measure to determine the carious involvement. Those teeth that gave symptoms for pulpal involvement or a history of the same were also considered. The number of teeth with deep dental caries were recorded for each subject. The oral hygiene status was recorded using the OHI-S index. Considering the Debris and Calculus Index, the oral hygiene status was categorized accordingly as good, fair, and poor. Fluoride levels in the drinking water were recorded based on the information obtained from areas of residence. These were calculated for semi-urban areas within Raigad district of Navi Mumbai, namely, Panvel, Karjat, Khalapur, Uran, and Pen based on the simple random samples obtained. Corresponding fluoride values were collected from government water testing authorities at Kokan Bhavan, Navi Mumbai, India. These levels were measured against the minimum recommended fluoride values in controlling dental caries (0.5–1.0 mg/dL).[6,7]

RESULTS

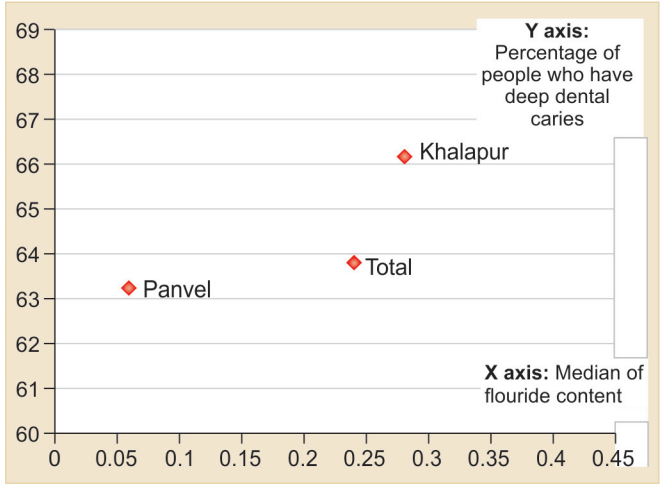
Test 1: Central Tendency (Median) of Fluoride Levels

The average, median, standard deviation, and range of fluoride content in Panvel, Karjat, Khalapur, Pen, and Uran, and all five regions together were calculated (Table 1).

The mean, average, and standard deviation values consider outliers in the population. Hence, a central tendency (median) provides a better measure to evaluate the fluoride content. An overall median value of not more than 0.5 mg/L was noted. Table 1 reveals all five blocks showing a median fluoride content of 0.24 mg/L. However, the number of subjects from Uran and Pen were less than 15. Hence, a scatter plot was denoted for Table 1 comparing median of fluoride content in Panvel, Karjat, and Khalapur with corresponding percentage prevalence of deep dental caries (Graph 1).

Table 1: Average, median, standard deviation, and range of fluoride content in Panvel, Karjat, Khalapur, Pen, and Uran, and all five regions together

Region	*Average*	*Median*	*Standard deviation*	*Range*
Panvel	0.22	0.06	0.34	0–1.96
Karjat	0.49	0.41	0.52	0.01–2.7
Khalapur	0.3	0.28	0.2	0.03–0.5
Pen	0.66	0.315	0.92	0.02–4.77
Uran	0.17	0.165	0.13	0.01–0.32
Overall	0.4	0.24	0.57	0–4.77



Graph 1: Scatter plot for Table 1 comparing median of fluoride content in Panvel, Karjat, and Khalapur with corresponding percentage prevalence of deep dental caries

Test 2: Pearson's Correlation between Age, OHI-S, and Number of Teeth with Deep Dental Caries

Age and OHI-S showed the following correlation with the severity of deep dental caries. This correlation was carried out by mapping the exact number of teeth with deep dental caries (indicator of severity) with the actual age and OHI-S score.

Pearson's correlation produces two important results:

1. How strong a correlation is based on the magnitude of the variable value compared to the reference (here, number of teeth with deep dental caries, which is taken to be 1).

Table 2: Results from Pearson's correlation

Number of teeth with deep dental caries	*Age group 18–35*	*Age group 36–55*	*Age group > 55*	*Grand total*
0	33%	35%	46%	35%
1	41%	35%	24%	37%
2	17%	19%	18%	18%
3	5%	4%	4%	5%
4	2%	3%	4%	3%
5	1%	3%	2%	1%
6	0%	1%	2%	0%
7	0%	0%	0%	0%
20	0%	1%	0%	0%
Grand total	100%	100%	100%	100%

Table 3: The severity (number of teeth with deep dental caries) and its prevalence among the different age groups

Variables	*Number of teeth with deep dental caries*
Age	0.032
OHIS	0.188
Number of teeth with deep dental caries (indicator of severity)	1

2. Positive or negative correlation, which tells us how the variables behave with respect to each other, i.e., direct or indirect proportion.

The OHI-S having a greater value determines (0.188) that OHI-S has a greater degree of association with the severity of deep dental caries, as compared to age (0.032). Also, since both values are positive, there exists a positive correlation between age and OHI-S, and the number of teeth with deep dental caries. This means that, as OHI-S and age increase, the severity or number of teeth with deep dental caries increases (Table 2).

Another notable result obtained was that although the severity (number of teeth having deep dental caries) increases with age, its prevalence is highest among the youngest age group (18–35) and it decreases with age (Table 3).

Test 3: Chi-square Test

Chi-square tests are essentially used to determine whether different sections of the population have similar relationships with an expected outcome. Here the different sections of the population are:

- Age group – Three age groups 18 to 35, 36 to 55, 55+ (three groups within the population).
- Gender – Male and female (two groups within the population).
- OHIS – Good, fair, and poor (three groups within the population).

If there were no significant differences between different sections of a population with respect to the expected outcome (deep dental caries), then our hypothesis would be proved wrong and the p-value would be < 0.05. Here, with reference to each of the three sections of the population, there are significant differences with regard to deep dental caries for each section of the population. Hence, when the population is segmented by age, each of the age groups has a different correlation with the presence of deep dental caries.

In each case the p-values are more than 0.05, which means each segment of the population does not behave similarly. This validates our results from the Pearson's test, in which it was observed that severity and prevalence of deep dental caries is different for different age groups, i.e., each group behaves differently (Table 4).

To simplify this, the slice and dice technique was used in which it was found that of all the subjects, deep dental caries prevailed in 35% of them. The prevalence was found to be higher in men, at 38%, and slightly lower in women, at 32% (Table 5). Also, among the 258 subjects considered for the OHI-S index those that had a good index, 155 (60%) had deep dental caries and among the 199 that had a fair index, 137 (69%) had deep dental caries while amongst the 26 subjects that had a poor OHI-S index, 17 (65%) had deep dental caries (Table 6).

DISCUSSION

There has been significant interest in the dental community to investigate fluoride levels in drinking water[8] and its possible relation to dental caries.[9] This has led to several surveys being conducted based on various demographic parameters and techniques to determine the fluoride levels. The overall fluoride levels were best measured using the central tendency (median) value and were found to be as low as 0.24 mg/L. Benefits of water fluoridation as a preventive measure for caries

Table 4: Results of the chi-square test

Parameter	*Max chi-square limit*	*Chi-square*	*p-value limit*	*p-value*
Age group	5.991	2.925297	>0.05	0.231622
Gender	3.841	1.957595	>0.05	0.161771
OHIS	5.991	4.489052	>0.05	0.105978

Table 5: Slice and dice analysis for gender

Percent of prevalence found or not with gender	*M*	*F*	*Grand total*
Found	38%	32%	35%
Not found	62%	68%	65%

Table 6: Slice and dice analysis for OHI-S index

Teeth	*Good*	*Fair*	*Poor*	*Grand total*
With dentinal caries	155	137	17	313
Without dentinal caries	103	62	9	174
Grand total	258	199	26	487

has been presented in a number of studies.[9] One such study showed the prevalence of caries to be 23% lower on exposure to fluoridated water.[10] Gender differences in caries have also been observed. Surveys carried out in Hungary, India and part of Brazil have led to an observation of higher prevalence in women as compared to men.[11] This was attributed to earlier eruption of teeth in females,[12] certain hormonal changes, and snacking during cooking.[13] On the contrary, the study showed that deep dental caries was found to be higher in men (38%) than in women (32%). However, gender could not be considered significant since a definite conclusion cannot be made owing to a part of the population. Hence, gender was considered only to an extent that it makes the point of there being difference between men and women for the prevalence of deep dental caries in the given sample population. Age has proved to be another important risk factor in the prevalence of dental caries. Various studies found a notable association between the two, most of which were performed on children or age groups below 18 years.[14,15] Manji et al[16] studied the caries pattern in rural Kenya and found caries to be more prevalent amongst the older age groups than younger while severity was greater among the 25 to 34 age group. The current study accounted for a high prevalence of deep dental caries amongst the younger age group (18–35 years). This could be attributed to lifestyle and dietary habits of these respondents. Since demographic behavior varies from place to place, it is imperative to carry out localized surveys to better understand the problem and subsequently determine a relation or the lack of it. The general standards of oral hygiene was found to be a good indicator[17] for the prevalence of dental caries.[18] Subjects with a good OHI-S index had a lesser percentage of deep dental caries (60%) as compared to the ones with fair (69%) and poor (65%). This implies implementing strategies that pay greater attention to financial hardships and other correlates of poverty in order to promote balanced oral health.

CONCLUSION

- *Fluoride vs Deep Dental Caries*: According to recommended fluoride levels of 0.5–1 mg/L in drinking water, the median values for each of the five blocks were found to be less (0.24 mg/L). This is validated by our analysis as we found 63.8% prevalence of deep dental caries in these five blocks.
- *Age and OHIS vs Deep Dental Caries:* There is a stronger correlation (0.188) between deep dental caries and OHI-S as compared to age (0.032). Another notable result was that the prevalence of deep dental caries decreases with age, but its severity increases with age.
- *Behavior of Subgroups among Age and OHI-S*: Each subgroup within age (18–35, 46–55, 55+), gender (male and female), and OHI-S (good, fair, and poor) behaves differently compared to other subgroups. Prevalence of deep dental caries was highest in the age group 18 to 35. Subjects with a good OHI-S index had a lesser percentage of deep dental caries (60%) as compared to the ones with fair (69%) and poor (65%). These findings may necessitate different treatment considerations and courses.
- *Gender vs Deep Dental Caries*: From the slice and dice technique, we found a higher prevalence of deep dental caries in men (38%) than in women (32%). However, a generalization on account of the correlation cannot be made since this variable may act differently in different sets of population.

CLINICAL SIGNIFICANCE

Research has led to a significant interest in the dental community to investigate the possible relation between dental caries and different parameters, with fluoride levels in water being one of them. The provision and use of fluoride supplements, topical fluoride gels, and foams must be emphasized and targeted toward persons and groups at a high risk of developing caries. Such reports aided by accurate measurements of fluoride levels in water can enable local municipal bodies to ensure fluoridation of community water as per recommendations of health advisory bodies. From a clinician's perspective, these results can be factored into the treatment process and patients may be suggested preventive and curative measures specific to the local problems. Dentists and other health-care providers may also consider the risk status in terms of age, gender, and oral hygiene to determine the appropriate intensity of treatment.

REFERENCES

1. Ferraro M, Vieira AR. Explaining gender differences in caries: a multifactorial approach to a multifactorial disease. Int J Dent 2010;2010:649643, 5.
2. Moses J, Rangeeth BN, Gurunathan D. Prevalence of dental caries, socio-economic status and treatment needs among 5 to 15 years old school going children of Chidambaram. J Clin Diagn Res 2011 Feb;5(1):146-151.
3. Shouri KL. Dental caries in Indian children. Indian J Med Res 1941;29:709-722.
4. Ramchandran K, Rajan BP, Shanmungan S. Epidemiological studies of dental disorders in Tamil Nadu population, prevalence of dental caries and periodontal diseases. J Indian Dent Assoc 1973 Apr;45(4):65-70.
5. Page RC, Martin JA, Loeb CF. The Oral Health Information Suite (OHIS): its use in the management of periodontal disease. J Dent Educ 2005 May;69(5):509-520.

6. Gao HJ, Jin YQ, Wei JL. Health risk assessment of fluoride in drinking water from Anhui Province in China. Environ Monit Assess 2013 May;185(5):3687-3695.
7. Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. Community Dent Oral Epidemiol 2004 Oct;32(5): 319-321.
8. Chavan P, Bangale S. A comparative study of groundwater with special reference to fluoride concentration in some parts of Raigad District, (MS) India. Der Chemica Sinica 2014;5(5):77-80.
9. Featherstone JDB. Prevention and reversal of dental caries: role of low level fluoride. Community Dent Oral Epidemiol 1999 Feb;27(1):31-40.
10. Hopcraft MS, Morgan MV. Exposure to fluoridated drinking water and dental caries experience in Australian army recruits, 1996. Community Dent Oral Epidemiol 2003 Feb;31(1):68-74.
11. Lukacs JR. Sex differences in dental caries experience: clinical evidence, complex etiology. Clin Oral Investig 2011 Oct;15(5):649-656.
12. Antunes JL, Junqueira SR, Frazão P, Bispo CM, Pegoretti T, Narvai PC. City-level gender differentials in the prevalence of dental caries and restorative dental treatment. Health Place 2003 Sep;9(3):231-239.
13. Lukacs JR, Largaespada LL. Explaining sex differences in dental caries prevalence: Saliva, hormones, and "life-history" etiologies. Am J Hum Biol 2006 Jul-Aug;18(4):540-555.
14. Ingle NA, Dubey HV, Kaur N, Gupta R. Prevalence of dental caries among school children of Bharatpur city, India. J Int Soc Prev Community Dent 2014 Jan;4(1):52-55.
15. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988–1994. J Am Dent Assoc 1998 Sep;129(9):1229-1238.
16. Manji F, Fejerskov O, Baelum V. Pattern of dental caries in an adult rural population. Caries Res 1989;23(1):55-62.
17. Mascarenhas AK. Oral hygiene as a risk indicator of enamel and dentin caries. Community Denti Oral Epidemiol 1998 Oct;26(5):331-339.
18. Axelsson P, Lindhe J. Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. J Clin Periodontol 1981 Jun;8(3):239-248.