

PREVALENCE OF ORAL DISEASE IN VARANASI DISTRICT - DENTAL CARIES AND DENTAL FLUOROSIS (ORIGINAL STUDY)

RAJUL VIVEK^{a1}, T.P. CHATURVEDI^b, ATUL BHATNAGAR^c AND RAJIV PRAKASH^d

^aFaculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

^bDepartment of Orthodontics, Faculty of Dental Sciences, IMS, Banaras Hindu University, Varanasi, India

^cDepartment of Prosthodontics, Faculty of Dental Sciences, IMS, Banaras Hindu University, Varanasi, India

^dSchool of Materials Science and Technology, IIT, Banaras Hindu University, Varanasi, India

ABSTRACT

The objectives of the present study were to estimate the prevalence of dental caries and dental fluorosis on permanent tooth in the selected age-groups in the urban areas of Varanasi District, Uttar Pradesh, India. Result shows the prevalence of dental caries was 68.25% among females and 65.07% among males, it was analysed that the 100% of the surveyed population exposed to water fluoride level above normal limit but 31.45% affected with fluorosis. Overall prevalence was found 66.66%. Females had higher caries prevalence than males and Questionable fluorosis. Males (.87%) are affected more as compared to females (.23%)

KEYWORDS: Dental Caries, Dental Fluorosis, Prevalence, Tooth Surfaces, Awareness

Good oral health is a key component to a health life because it affects how we eat, speak and how we relate to each other with confidence of our health smile. WHO recently published a global review of oral health (Petersen et. al., 2003) which emphasized that despite great improvements in the oral health of populations in several countries, global problems still persist. This is particularly so among underprivileged groups in both developing and developed countries. Poor oral health may have a profound effect on general health, and several oral diseases are related to chronic diseases (e.g. diabetes). The experience of pain, problems with eating, chewing, smiling and communication due to missing, discoloured or damaged teeth have a major impact on people's daily lives and well-being. Oral health is an integral component of general health and is essential for wellbeing. There is evidence to prove the interrelationship between oral and general health (Grossi et. al., 1998).

Oral diseases such as dental caries, dental fluorosis periodontal disease, tooth loss, oral mucosal lesions and oropharyngeal cancers, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS)- related oral disease and orodental trauma are major public health problems worldwide. Dental caries and dental fluorosis have historically been considered the most important global oral health burdens. Both can be effectively prevented and controlled through a combination of community, professional, and individual actions. Early detection of disease is, in most cases, crucial to control of the oral condition. A thorough naked-eye oral examination with adequate light can identify many oral conditions in the early stages.

Dental caries is a multifactorial disease process initiated by specific bacteria, primarily mutans streptococci, which metabolize carbohydrates to form acids. These acids demineralise the tooth surface and eventually form a cavity. The bacteria that cause decay are usually passed from the mother to a child in the first one to two years of life. For this reason, tooth decay can be a significant problem in infants and toddlers. But tooth decay is not just a childhood disease it can continue to be a health problem throughout life.

Dental caries is the major oral health condition in developing countries, affecting 60-90% of the school children and the vast majority of adults (The World Oral Health report, 2003). In India, the prevalence of dental caries is reported to be 50-60% (Shah et. al., 2005). Most of the Indian studies that have been published focused on school children (Vecher et. al., 1952.) and only a few studies have been done among adults (Thomas et al., 1994) Earlier we had also done in study in school going children in urban and suburban Areas of Varanasi District (Chaturvedi et. al., 2012) study was aimed to estimate the prevalence of dental caries and treatment needs in school going children and results found to be very beneficial for Varanasi district.

The World Health Organization recommends basic oral health surveys in five selected age-groups (i.e., 5 years, 12 years, 17-18 years, 35-44 years, and 65-74 years)⁸ in order to estimate the magnitude of the problem and to plan intervention activities. Therefore, keeping in mind the paucity of literature on dental problems in adults and the public health importance of dental caries, this

study was planned to provide some information on the oral health needs of the adult population in Varanasi District.

Fluoride plays an important role in preventive dentistry. For more than a century, fluorides have been used to prevent dental caries. Although it has been scientifically proven that small concentrations of fluoride can significantly reduce dental caries without any ill effects; the use of fluoride is still regarded as a controversial issue (Oral Health Surveys. 1997). However, excessive intake of fluoride leads to dental and skeletal fluorosis. Dental fluorosis in teeth exhibits the first sign of fluoride toxicity in the form of “mottled enamel”. Spots and chalk white, yellowish brown and brownish black, horizontal streaks over teeth’s. Dental fluorosis is defined as a change in the mineralization in the tooth enamel due to prolonged intake of Fluoride during the period in which the teeth develop (Aoba et. al., 2002; Beltrá et. al.,2010).

India lies in a geographical fluoride belt, which extends from Turkey up to China and Japan through Iraq, Iran and Afghanistan; of the 85 million tons of fluoride deposits found on the earth is crust, nearly 12 million tons are in India (World Health Organization. Fluorides and oral health.1994; Mollert et. al., 1993).Consequently, fluorosis is an endemic condition prevalent in 17 states of India, including Uttar Pradesh (Eight districts identified as fluorosis endemic. 2011). Different studies have found very low knowledge on risk factors of fluorosis. There are a million of people unaware about the disease fluorosis. This study was conducted to create awareness about fluorosis among people and to evaluate the prevalence of fluorosis in Varanasi District.

MATERIALS AND METHODS

A cross-sectional community-based survey was conducted between December 2015 to June 2016 in urban population of Varanasi District. The study sample comprised total 1490 Adult in these 690 men and 800 women. According to the recommendations by WHO for a basic oral health survey, we decided to take adult age-groups for this study, i.e., 35-44 years. By using data for this age group, planners and decision-makers can assess the full effect of dental caries, the level of fluorosis, severe periodontal involvement, and the general effects of oral health care provided. Participants were enrolled by organizing Dental camp using the random sampling technique.

A pre-tested questionnaire (a local adaptation of WHO standard oral health questionnaire consisting of questions on personal details, oral hygiene practices,

dental problems, and care-seeking behaviour was used in the survey. The questionnaire was administered by the investigators (Dentist) and was followed by a naked-eye oral examination for dentition status, using an oral probe and mirror. Data was collected by survey teams. In survey team two dentists; they were assisted by three dental assistant for data recording. The examiner applied standardized and routinely used WHO diagnostic criteria.

Firstly, caries teeth were identified, and a diagnosis of caries was made only when there was clear evidence of loss of tooth substance. White or brown spots in enamel, the surfaces of which remained intact and glossy, were not considered to be caries. Caries were recorded as present when a lesion in a pit or on a smooth tooth surface had a detectably softened floor, undermined enamel or softened wall. “Sticky” and discoloured fissures were accepted as caries only if there was clear evidence of cavitation beginning below the fissure.

On proximal surfaces, caries were recorded when the explorer had entered a lesion. Then, the borders of caries were drawn on the related tooth figure chart. If the pattern of caries experience was symmetrical between the left and right sides of the mouth for both maxillary and mandibular teeth, the left and right surfaces were combined for each tooth. Therefore, in total, 16 master charts were prepared, one for the upper and lower right teeth, and for the upper and lower left teeth. These charts included five figures: mesial, distal, labial/vestibule, lingual/palatinal and occlusal/incisal surfaces. Furthermore, the age and gender of the patients were recorded on the chart for each caries tooth. The location of dental caries on the teeth surfaces was recorded as follows: 1, Distal; 2, Mesial; 3, Lingual-Palatinal; 4, Labial-Buccal; 5, Cervical; 6, Incisal–Occlusal; 7, Pit on the palatinal surface of the upper molar and pit on the buccal surface of the lower molar; and 8, Occlusal fissure for statistical evaluation and comparison. Thus, seven sites for molars and six sites for premolars, canines, incisors were coded . Differences in caries incidence between surfaces of individual teeth were assessed for statistical significance using the Friedman test and Dunn's Multiple Comparisons test (if $P < .05$). The Pearson Chi-Square test and Fisher's Exact Test were used to compare differences in caries prevalence of individual tooth surfaces between females and males.

In this present study we also checked the prevalence of fluorosis. This study was conducted to create awareness about fluorosis among people and to evaluate the prevalence of fluorosis. Age group was same

as we had taken for caries. In consultation with the statistician, the sample size of the study group was fixed at 100 objects. WHO questionnaires were used in the study, for collecting information on the prevalence and severity of dental fuorosis along with assessing the possible risk factor WHO questionnaire regarding awareness of fuorosis, followed by counselling. Each object was questioned about their Dental health counselling on how to maintain or prevent Dental was given. Severity of dental fuorosis was assessed using Deans Fluorosis index. Data that was obtained was entered in an MS-Excel spreadsheet and analyzed using SPSS 10.0 software.

RESULTS

In this study, 1490 persons were recorded. Table.1a and Table.1b show the distribution of caries on individual tooth surfaces. Mesial surfaces of the maxillary central and lateral incisors had the highest caries rates at 58.3% and 57.4%, respectively. Distal surfaces of mandibular central and lateral incisors demonstrated highest caries frequencies, respectively, 76.3% and 73.4%. In addition, distal surfaces of maxillary canines and of the first and second premolar teeth showed the highest caries rates, with 74.5%, 67% and 59.2%, respectively. Similarly, the highest prevalence of caries experience was observed on the distal surfaces of mandibular canines and the first and second premolar teeth (65.6%, 66% and 63.1%, respectively). On the other hand, occlusal fissures on the first and second maxillary molars demonstrated

highest caries frequencies at 51.6% and 59.9%, respectively. First and second mandibular molar teeth, occlusal fissures showed the highest caries rates (54.6% and 64.3%, respectively). Lingual surfaces of maxillary central incisors and mesial surfaces of maxillary lateral incisors and of the second premolar and molar teeth contributed significantly more caries incidence (P<.05) than the same surfaces of mandibular central, lateral incisor, second premolar and second molar teeth. On the other hand, distal surfaces of mandibular central and lateral incisor teeth, and cervical sites of mandibular lateral incisor and second premolar teeth had significantly more caries than the same surfaces of maxillary incisors, lateral incisors and second premolars. Buccal and lingual surfaces of first premolar teeth and pit sites on the buccal surfaces of second mandibular molar teeth showed significantly more caries than the same surfaces of maxillary first premolars and second molar teeth. Table.2a and Table.2b show the distribution of caries according to tooth surfaces in female and male patients. Women Teeth surfaces showed a higher incidence (56.2%) of caries than males (38.7%). When analyzing data aggregated by gender, lingual surfaces and cervical sites of maxillary central incisors, distal surfaces of maxillary lateral incisors, and mesial surfaces of maxillary second molars in women demonstrated significantly higher rates of caries than men, compared to the equivalent surfaces on maxillary central incisors, lateral incisors and maxillary second molars.

Table 1A and 1B: Number of caries surfaces (Percentage of total caries surfaces) according to jaws. Teeth on left and right sites have been combined

Maxillary Tooth	Distal	Mesial	Palatal	Labial/ Buccal	Cervical	Incisal/ Occlusal	Pit on the Buccal	Occlusal Fissure
1	113 (46.9)	143 (58.3)	107 (44.4)	50 (20.7)	11 (4.6)	12 (5)		
2	91 (39.7)	134 (57.4)	106 (46.3)	80 (34.9)	8 (3.5)	14 (6.1)		
3	82 (74.5)	29 (26.4)	40 (36.4)	18 (16.4)	10 (9.1)	5 (4.5)		
4	117 (67)	42 (24.4)	5 (2.9)	7 (4.1)	1 (0.6)	82 (47.7)		12 (7)
5	111 (59.2)	75 (40.1)	6 (3.2)	7 (3.7)	0 (0)	65 (34.8)		15 (8)
6	36 (13.1)	80 (29.1)	16 (5.8)	17 (6.2)	0 (0)	82 (29.8)	17 (6.2)	145 (51.6)
7	32 (11.7)	37 (13.5)	11 (4)	13 (4.7)	1 (0.4)	62 (22.6)	12 (4.4)	167 (59.9)
Mandibular Tooth	Distal	Mesial	Palatal	Labial/ Buccal	Cervical	Incisal/ Occlusal	Pit on the Buccal	Occlusal Fissure
1	31(76.3)	18 (45)	6 (15)	8 (20)	2 (5)	2 (5)		
2	46 (73.4)	18 (29)	23 (37.1)	20 (32.3)	7 (11.3)	8 (12.9)		
3	48 (65.6)	12 (16.9)	23 (32.4)	15 (21.1)	12 (16.9)	4 (5.6)		
4	65 (66)	16 (16.5)	21 (21.6)	16 (16.5)	13 (13.4)	37 (38.1)		2 (2.1)
5	66 (63.1)	28 (27.2)	6 (5.8)	6 (5.8)	3 (2.9)	40 (38.8)		7 (6.8)
6	36 (13.8)	43 (16.5)	12 (4.6)	36 (13.8)	1 (0.4)	78 (29.9)	47 (18)	145 (54.6)
7	26 (10)	13 (5)	9 (3.4)	21 (8)	6 (2.3)	53 (20.3)	34 (13)	173 (64.3)

Table 2A: Number of caries surfaces (Percentage of total caries surfaces) according to gender. Teeth on left and right sites have been combined (Maxillary Teeth)

Maxillary Tooth	Gender	Distal	Mesial	Palatal	Labial/ Buccal	Cervical	Incisal/ Occlusal	Pit on the Buccal	Occlusal Fissure
1	Female	63 (48.8)	82 (63.6)	65 (50.4)	24 (18.6)	2 (1.6)	8 (6.2)		
	Male	50 (44.6)	61 (54.5)	42 (37.5)	26 (23.2)	9 (8)	4 (3.6)		
2	Female	73 (50.7)	79 (54.9)	71 (49.3)	50 (34.7)	4 (2.8)	9 (6.3)		
	Male	18 (21.2)	55 (64.7)	35 (41.2)	30 (35.3)	4 (4.7)	5 (5.9)		
3	Female	51 (71.8)	22 (31)	26 (36.6)	13 (18.3)	5 (7)	3 (4.2)		
	Male	31 (79.5)	7 (17.9)	14 (35.9)	5 (12.8)	5 (12.8)	2 (5.1)		
4	Female	60 (66.7)	26 (28.9)	2 (2.2)	4 (4.4)	0 (0)	47 (52.2)		5 (5.6)
	Male	57 (69.5)	16 (19.5)	3 (3.7)	3 (3.7)	1 (1.2)	35 (42.7)		7 (8.5)
5	Female	57 (59.4)	38 (39.6)	3 (3.1)	3 (3.1)		31 (32.3)		7 (7.3)
	Male	54 (59.3)	37 (40.7)	3 (3.3)	4 (4.4)		34 (37.4)		8 (8.8)
6	Female	20 (12.1)	47 (28.5)	8 (4.8)	7 (4.2)		44 (26.7)	8 (4.8)	94 (57)
	Male	16 (14.5)	33 (30)	8 (7.3)	10 (9.1)		38 (34.5)	9 (8.2)	51 (46.4)
7	Female	21 (12.7)	13 (7.9)	9 (5.5)	9 (5.5)	1 (0.6)	34 (20.6)	7 (4.2)	108 (65.5)
	Male	11 (10.1)	24 (22)	2 (1.8)	4 (3.7)	0 (0)	28 (25.7)	5 (4.6)	59 (54.1)

Table 2B: Number of caries surfaces (Percentage of total caries surfaces) according to gender. Teeth on left and right sites have been combined (Mandibular Teeth)

Mandibular Tooth	Gender	Distal	Mesial	Palatal	Labial/ Buccal	Cervical	Incisal/ Occlusal	Pit on the Buccal	Occlusal Fissure
1	Female	20 (74.1)	14 (51.9)	5 (18.5)	6 (22.2)	2 (7.4)	2 (7.4)		
	Male	11 (84.6)	4 (30.8)	1 (7.7)	2 (15.4)	0 (0)	0 (0)		
2	Female	32 (68.1)	15 (31.9)	19 (40.4)	13 (27.7)	6 (12.8)	6 (12.8)		
	Male	6 (12.8)	3 (20)	4 (26.7)	7 (46.7)	1 (6.7)	2 (13.3)		
3	Female	29 (64.4)	8 (17.8)	18 (40)	9 (20)	10 (22.2)	3 (6.7)		
	Male	19 (73.1)	4 (15.4)	5 (19.2)	6 (23.1)	2 (7.7)	1 (3.8)		
4	Female	45 (66.2)	8 (11.8)	14 (20.6)	11 (16.2)	11 (16.2)	25 (36.8)		2 (2.9)
	Male	20 (69)	8 (27.6)	7 (24.1)	5 (17.2)	2 (6.9)	12 (41.4)		0 (0)
5	Female	31 (57.4)	15 (27.8)	3 (5.6)	2 (3.7)	3 (5.6)	17 (31.5)		4 (7.4)
	Male	35 (71.4)	13 (26.5)	3 (6.1)	4 (8.2)	0 (0)	23 (46.9)		3 (6.1)
6	Female	18 (12.5)	27 (18.8)	9 (6.3)	19 (13.2)	1 (0.7)	49 (34)	28 (19.4)	73 (50.7)
	Male	18 (15.4)	16 (13.7)	3 (2.6)	17 (14.5)	0	29 (24.8)	19 (16.2)	72 (61.5)
7	Female	18 (11)	10 (6.1)	8 (4.9)	15 (9.2)	5 (3.1)	36 (22.1)	17 (10.4)	108 (66.3)
	Male	8 (8.2)	3 (3.1)	1 (1)	6 (6.1)	1 (1)	17 (17.3)	17 (17.3)	65 (66.3)

Table.3 shows the prevalence of dental caries was 68.25% among females and 65.07% among males, and the overall prevalence was 66.66%. The analysis of dental

caries by gender showed that there was no statistically significant difference found between males and females. (P Value- .57)

Table 3: Distribution of Adults with and without caries by gender

Gender	Number of adults with dental caries (%)	Number of adults without dental caries (%)	Total
Female	546(68.25%)	254 (31.75%)	800
Male	449(65.07%)	241(34.92%)	690
Total	995(66.77%)	495(33.22%)	1490
P VALUE (.57)			

Based on Table.4 it was analyzed that the 100% of the surveyed population exposed to water fluoride level above normal limit but 31.45% affected with fluorosis. The survey was planned according to the dean fluorosis index (Table.5).The rest of the population i.e. 70% were neither exposed nor affected after mapping. An individual dietary habits and general state of health as well as the body's ability to dispose of fluoride all affect how the exposure to fluoride manifests itself. The overall prevalence of fluorosis was 31.45 among the surveyed population. Males are affected more as compared to females.

Table 4: Fluorosis Score

Status	Gender	
	Male	Female
Normal	42%	31 %
Questionable	0.87%	0.23%
Very mild	8.13%	15.73%

Table 5: Measurement of Dental Fluorosis

Category	Description
Normal	Enamel surface is smooth, glossy and appear white in colour
Questionable	The enamel shows slight aberrations, occasional spots might be seen
Very mild	It might appear as opaque white areas
Mild	White opacity of the enamel is more extensive
Moderate	It might show brown stains

DISCUSSION

The present study was based on determining the rates and incidence patterns of caries on individual tooth surfaces and Dental Fluorosis. The results of the present study showed that mandibular central incisors were least like to be caries teeth, while maxillary and mandibular molars were the most likely. Caries are also more prevalent in maxillary teeth than in mandibular teeth. The results of our study confirm the findings of Luen et al, who evaluated the ten-year incidence of dental caries in adult and elderly Chinese patients (Luanet al., 2000). They observed the lowest disease incidence on mandibular anterior teeth, and mandibular molars were apparently most susceptible to caries.

The results of the present study showed that mandibular central incisors were least like to be caries teeth, while maxillary and mandibular molars were the most likely. More caries were observed on distal surfaces of central and lateral incisors and premolars than on other

surfaces, except those of maxillary central and lateral incisors. In contrast, mesial surfaces of maxillary central and lateral incisors showed the highest rate of caries. On the other hand, occlusal surfaces, especially fissures of molars, had more caries than other sites. However, compared to mandibular jaws, caries rates in mesial surfaces were higher in maxillary teeth, except for maxillary central and lateral incisors. Generally, caries experience in lingual surfaces of anterior teeth was relatively high. In the present study, it was found that molar teeth had many more caries than incisors, canines, or premolars in both sexes. Furthermore, proximal surfaces of incisors, canines and premolars showed higher caries rates than other sites in both men and women. Occlusal fissure sites in molars showed the highest caries rates in both sexes as well. The finding that more caries teeth were observed in women than in men is in agreement with findings of other studies (Lin et al. 2001).

The purpose of this study was to make people aware about fluorosis as it has been recognized as an endemic problem affecting a lot of areas. Although the effects of the most prevalent forms of dental fluorosis are primarily aesthetic, health professionals should identify all possible sources of fluoride before considering the addition of fluoride supplements. The increased availability of fluoride and ingestion by adults from multiple sources, including Beverages, including fluoridated tap water, Foods processed with fluoridated water, Toothpaste and other oral care products, Topical fluoride and dietary supplements. This shows a need to educate people about fluorosis and about its prevention so as to find ways of combating the problem.

CONCLUSION

Conclusion drawn from present study the prevalence of dental caries was found 68.25% among females and 65.07% among males, and the overall prevalence was found 66.66%. Females had higher caries prevalence than males. The distribution of caries on individual tooth surfaces among all of the mesial surfaces maxillary central incisor showed the highest caries rates at 58.3%.All of the distal surfaces mandibular central incisor showed highest caries frequencies at 76.3% and all of the occlusal surfaces second mandibular molar, showed the highest caries rates 64.3% Among all the teeth mandibular central incisors (26.66%) are least likely to experience caries, while maxillary and mandibular molars demonstrate the highest caries rates (51.6% to 64.3%) and Questionable fluorosis Males (.87%) are affected more as compared to females (.23%) Epidemiology of any disease

is a very helpful tool to assess the actual status of the disease among population. The unique condition of India provides a very beautiful condition for the study of dental caries and dental fluorosis. The data of present study will be helpful for designing the preventive measures against dental caries and dental fluorosis in the eastern region of India.

REFERENCES

- Aoba T. and Fejerskov O., 2002. Dental fluorosis: chemistry and biology. *Crit. Rev. Oral Biol. Med.*, **13**(2):155-70.
- Beltrán-Aguilar E.D., Barker L. and Dye B.A., 2010. Prevalence and severity of dental fluorosis in the United States, 1999-2004. *NCHS Data Brief*, **53**:1-8.
- Chaturvedi T.P., Singh R.K. and Vivek R., 2012. Prevalence of dental caries and treatment needs among school going children in urban and suburban areas of Varanasi district, up, India, **45**(1):31-34.
- Eight districts identified as fluorosis endemic. 2011 Mar 12, Last accessed.
- Grossi S.G. and Genco R.J., 1998. Periodontal disease and diabetes melitus: A two way relationship. *Ann Periodontol*, **3**:51-61.
- Lin H.C., Wong M.C., Zhang H.G., Lo E.C. and Schwarz E., 2001. Coronal and root caries in Southern Chinese adults, **80**:1475-1479.
- Luan W., Baelum V., Fejerskov O. and Chen X., 2000. Ten-year incidence of dental caries in adult and elderly Chinese. *Caries Res.*, **34**:205-213.
- Mollert I.J., Prabhu S.R., Wilson D.F., Daftary D.K. and Johnson N.W., 1993. *Endemic dental fluorosis oral diseases in the tropics*. Oxford University Press: Delhi, p.68.
- Oral Health Surveys, 1997. *Basic Methods*, 4th edition Geneva.
- Petersen P.E., 2003. *The World Oral Health Report, 2003*. Continuous improvement of oral health in the 21st century — the approach of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology*, **31**(1):03-24.
- Shah N., 2005. *Oral and dental diseases: Causes, prevention and treatment strategies: Burden of disease*, National Commission on Macroeconomics and Health, 275-98.
- Srinivas R., Narayana Rao V., Vikram Simha B., Sirisha N.R., Devaki T. and Chandrasekar T., 2015. Awareness on Dental Fluorosis among School Leaving Children in an Endemic Fluoride Area of South East Indian State, **4**(1):112-114.
- The World Oral Health report, 2003.
- Thomas S., Raja R.V., Kutty R. and Strayer M.S., 1994. Pattern of caries experience among an elderly population in south India. *Int. Dent. J.*, **44**:617-22.
- Vecher B.R., 1952. Dental Survey of school children in Amritsar. *J. Indian Dent. Assoc.*, **24**:2-8.
- World Health Organization. *Fluorides and oral health*, 1994. WHO technical report series 846. World Health Organization: Geneva.