

Pattern of Dental Caries among Adults in Parts of Eastern Uttar Pradesh, India- A Retrospective Study

¹Vertika Gupta, MDS, Department of Dentistry, Hind Institute of Medical Sciences, Barabanki, Uttar Pradesh, India

²Purna Vishwanath, BDS, Department of Dentistry, Hind Institute of Medical Sciences, Barabanki, Uttar Pradesh, India

³Nalini Tripathi, MDS, Department of Dentistry, Hind Institute of Medical Sciences, Barabanki, Uttar Pradesh, India

Corresponding Author: Vertika Gupta, MDS, Department of Dentistry, Hind Institute of Medical Sciences, Barabanki, Uttar Pradesh, India

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Abstract

Background: Dental caries is a common oral disease which is on a rise in developing countries such as India. Comprehensive knowledge of caries pattern is important for formulating preventive strategies so that the exact pattern of caries attack can assist in knowing the distinct etiology behind its progression.

Aim: The aim of the present study was to investigate in detail the pattern of dental caries among adults in parts of Eastern Uttar Pradesh, India.

Materials And Methods: The retrospective study was carried out on the data collected from the treatments records of 6500 subjects who attended the dental unit of the institute between December 2017 to December 2019. The study population consisted of four age groups consisting of adults from 18-34 years of age, 35-44 years, 45-64 years, and 65 years above of age. The information on age, gender, tooth and tooth surfaces involved/affected by caries, distribution of caries in maxilla and mandible and treatment details on restorations were collected from

the records by three examiners. The data was entered into excel sheet and subjected to statistical analysis. Differences in caries incidence between surfaces of individual teeth were assessed for statistical significance using Student t test. Chi square test was used to compare differences in caries prevalence between age groups and gender.

Results: Caries prevalence was highest in subjects belonging to 35-44 years old age group (32.63%). Females (69.78%) showed the higher incidence of caries as compared to males (30.21%). Maxillary segment (57.10%) showed more distribution caries as compared to mandibular segment (43%).The most affected teeth due to caries were molars and the least affected teeth were mandibular anteriors and the most commonly affected surface was occlusal followed by interproximal areas.

Conclusion: The results concluded high caries incidence on occlusal surfaces in molars especially in first molars among the population and there the results of this study can be used to carry out other epidemiological studies and

intervention programs on prevention of dental caries among the population.

Keywords: Age groups, Caries pattern, Dental caries, Eastern Uttar Pradesh, Gender, Tooth surface

Introduction

Dental caries is an irreversible oral health disease which is a microbial disease affecting all age groups.^[1] Caries has multi-factorial etiology and prevention of this disease need a thorough knowledge about its etiology. It is well known that acid-producing bacterias are the main etiological agent of dental caries but apart from this dietary and host factors also play an important role. Caries pattern is one of the most important factors in caries etiology.

Individual tooth surfaces can have different susceptibility to dental caries due to the varied anatomy of each tooth.^[2, 3]

In-depth information on subjects' caries pattern can prove an insight into the progression of the disease.^[4]

Detailed information on caries pattern can help the dental professional to identify the individual at high caries risk and assist them in deciding the preventive strategies in reducing disease burden.

India is a diverse country with respect to culture, religion food habits, race, and caste. The pattern of caries may vary drastically in different parts of India.^[5]

A thorough search on the literature on caries pattern show limited data from India and most of them concentrated on caries pattern in children^[6,7] and very few studies on in adults especially elderly but such data is few and limited.^[8,9,10]

There is presently no data or literature on pattern of caries among adults of Eastern Uttar Pradesh especially belonging to Barabanki, Faizabad, Gonda.

Thus the aim of our study was to determine the pattern of dental caries among different age groups, gender tooth surfaces and tooth types in parts of Eastern Uttar Pradesh.

Material and Methods

A retrospective, cross-sectional study was conducted among the subjects belonging to three parts of Eastern Uttar Pradesh namely Barabanki, Faizabad, Gonda who attended the Department of Dentistry of our institute. The data for 6500 subjects belonging to these areas who visited our unit over a period of two years from December 2017 to December 2019 were retrieved from the dental records. The study population consisted of four age groups consisting of adults from 18-34 years of age, 35-44 years, 45-64 years, and 65 years above of age. The inclusion criteria were: (1) subjects who belonged to these areas and these age groups. The exclusion criteria were: (1) subjects with incomplete records, (2) those who did not belong to above mentioned areas, (3) missing and extracted teeth.

The records were reviewed to collect information on age, gender, tooth, and tooth surfaces involved/affected by caries, distribution of caries in maxilla and mandible, treatment details on restorations. The records were reviewed by three examiners. The interexaminer agreement was determined using Cohen Kappa value which was between 0.7-0.9. The intraexaminer reliability was evaluated for all examiners on three separate occasions with a Kappa score between 0.8-1.0.

The location of dental caries on the teeth surfaces was recorded as follows: occlusal/incisal, mesial, distal, lingual/palatal, labial/ buccal, cervical. Thus six sites for all teeth were recorded in both maxilla and mandible. Zsigmondy Palmer system was used as tooth numbering system. The data obtained was entered in data spreadsheet and subjected to statistical analysis using SPSS Version 20 software (Chicago, IL, USA).

Differences in caries incidence between surfaces of individual teeth were assessed for statistical significance using Student t-test. Chi-square test was used to compare differences in caries prevalence between age groups and gender.

Results

In this study, a total of 6500 subjects were evaluated from dental records out of which 3971 were with caries or filling and 2529 subjects were carious free. Among the subjects with caries 2771(69.7%) were females and 1200 (30.2%) were males. The difference between males and females with caries was highly significant (p<0.00001).

(Table 1)

Table 1: Caries presence according to gender and age groups.

Caries	Without Caries		With Caries		Total		Chi 2	p value
	N	%	N	%	n	%		
Gender							433.00	p<0.00001
Female	1108	43.81	2771	69.78	3879	59.67		
Male	1421	56.18	1200	30.21	2621	40.32		
Total	2529		3971		6500		346.38	p<0.00001
Age Groups								
18-34	590	23.32	1182	29.76	1772	27.26		
35-44	439	17.35	1296	32.63	1735	26.69		
45-64	729	28.52	870	21.90	1599	24.60		
65 +	771	30.48	623	15.68	1394	21.44		
Total	2529		3971		6500			

The percentage of subjects suffering from caries in the age group from 35-44 years old was high (32.6%) followed by 18-34 years old age group (29.7%). The age groups 45-64 and 65 above showed 21.9% and 15.6% caries prevalence respectively. The difference between the age groups for caries prevalence was highly significant (p<0.00001).

(Table 1)

Table 2 shows the distribution of examined carious teeth according to the jaws. The data showed that the most affected teeth were molars (41%). In the study first and second maxillary molar were most susceptible to dental

caries at 12% and 11% respectively while mandibular canine and central incisor were least susceptible to caries at 4.47% and 4.95% respectively. The distribution of caries was more in the maxilla (57.1%) as compared to the mandible (43%).

Table 2: Distribution of examined carious teeth according to jaw (Percentage of total carious surface)

Tooth Number	Maxilla (n %)	Mandible (n %)	Total (n %)
1	7039 (9.26%)	3761(4.95%)	10800 (14%)
2	6203 (8%)	3797 (5%)	10000 (13%)
3	4100 (5%)	3400 (4.47%)	7500 (10%)
4	4200 (6%)	3800 (5%)	8000 (11%)
5	4600 (6%)	3900 (5.13%)	8500 (11%)
6	9101(12%)	7299 (9.60%)	16400 (22%)
7	8163 (11%)	6637 (8.73%)	14800 (19%)
Total	43406 (57.10%)	32594 (43%)	76000 (100%)

Table 3 shows the distribution of caries according to the tooth surfaces comprising of both maxilla and mandible. A total of 4, 56,000 sites were evaluated for 4, 03,000 caries surfaces in 76,000 teeth. Out of this 2, 74,842 teeth were decayed and 1, 28,158 were filled teeth. The most frequently affected site was occlusal (92.5%) and the least affected sites were lingual/palatal (9.0%).

Table 3: Caries incidence according to surfaces affected

Surface Affected	Total No.	Decayed	Filled
	Subject (%)	Subject (%)	Subject (%)
Occlusal/Incisor	191431 (47.5)	136220 (49.5)	55211 (43.0)
Mesial	78267 (19.4)	51872 (18.8)	26395 (20.5)
Distal	63885 (15.8)	42238 (15.3)	21647 (16.8)
Buccal/Labial	30569 (7.5)	17563 (6.3)	13006 (10.1)
Lingual/Palatal	17325 (4.2)	10425 (3.7)	6900 (5.3)
Cervical	21523 (5.3)	16524 (6.0)	4999 (3.9)
Total	403000	274842	128158

Table 4 and 5 shows the distribution of carious tooth surfaces according to the individual teeth in both maxilla and mandible. Distal surfaces of maxillary first and second premolar showed highest caries rates i.e. 20.2% and 18.1% respectively. Mesial surfaces of maxillary central incisor and lateral incisor had the highest carious frequencies which were 20.8% and 17.8% respectively. Likewise, palatal surfaces of maxillary central incisor and

lateral incisors showed the highest caries rates among all the teeth i.e. 21.43% and 18.26 % respectively. The labial surface of the maxillary lateral incisor had high caries rate (22.83%) followed by maxillary central incisor (18.56%). Maxillary first molar and second molar showed the highest caries frequencies on occlusal surfaces i.e. 22.73% and 16.83%. In mandibular segment, the highest caries rate was seen on distal and mesial surfaces of the second premolar and the first molar. The lingual surface of the

first premolar (21.2%) and the buccal surface of first molar (22.1%) were most affected by caries. The occlusal surfaces of the first molars were more affected by caries followed by the second molars. (Table 5). The cervical surface for the first premolar in both the maxillary and the mandibular segments showed the highest caries rate. The differences in caries incidence between the surfaces of individual teeth were found to be highly significant in both the quadrants ($p < 0.01$).

Table 4: 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	Buccal/Labial	Cervical	Occlusal/Incisal
1	5764	10346	2401	3064	2989	12326
(%)	14.98	20.84	21.43	18.56	23.73	14.23
2	4415	8850	2046	3768	2428	9822
(%)	11.48	17.83	18.26	22.83	19.27	11.34
3	3941	4181	1737	2149	1967	8284
(%)	10.24	8.42	15.5	13.02	15.61	9.56
4	7778	5181	916	1553	1657	10421
(%)	20.22	10.43	8.17	9.4	13.15	12.03
5	6964	7090	1059	1710	1258	11490
(%)	18.1	14.2	9.45	10.36	9.98	13.26
6	6044	7787	1663	2305	1312	19688
(%)	15.71	15.6	14.84	13.96	10.41	22.73
7	3548	6194	1381	1955	983	14580
(%)	9.22	12.48	12.32	11.84	7.8	16.83
Total	38454	49629	11203	16504	12594	86611
t (6df)*0.01%	9.157**	8.827**	8.022**	7.876**	6.670**	8.637**

*df= degree of freedom ** $p < 0.01$

Table 5: Number of caries surfaces (Percentage of total caries surfaces) according to jaws. Teeth on left and right sites have been combined.

Mandibular Tooth	Distal	Mesial	Lingual	Buccal/Labial	Cervical	Occlusal/Incisal
1	2441	4854	537	1388	481	8410
(%)	9.59	16.94	8.77	9.86	5.38	8.02
2	2588	2881	734	2104	1109	9692
(%)	10.17	10.06	11.98	14.95	12.42	9.24
3	2946	2009	1095	1690	1703	6569
(%)	11.58	7.01	17.88	12.01	19.07	6.26
4	4242	2141	1299	1761	1857	15463
(%)	16.68	7.47	21.21	12.5	20.79	14.75
5	4679	5244	954	1525	940	17481
(%)	18.39	18.31	15.58	10.84	10.52	16.67
6	5155	7054	870	3119	1516	25409
(%)	20.27	24.63	14.21	22.17	16.97	24.24
7	3380	4455	633	2478	1323	21796
(%)	13.29	15.55	10.33	17.61	14.81	20.79
Total	25431	28638	6122	14065	8929	104820
t6df* (0.01%)	9.009**	5.867**	8.672**	8.692**	7.108**	5.570**

*df= degree of freedom, **p<0.01

Discussion

The pattern of caries provides an insight into the etiology and susceptibility of the disease.^[4] The dental caries pattern includes the rate of attack, progression and distribution of caries among the population which could assist in the prevention of caries.^[11]

The treatment records of the patients were used as this method is an inexpensive method of data collection.^[1] However this method may be less expensive but various aspects like dietary habits, oral hygiene practice might had been missed out.^[11] The present study showed that mandibular canine and central incisors were least affected by caries while maxillary and mandibular molars were the

most affected teeth. These findings were similar to the study conducted by Demirci et al.^[12], Luan et al.^[13] and Carlos et al.^[14] This could be due to the close location of the mandibular anterior teeth to the salivary ducts of submandibular salivary glands and easiness of brushing of these teeth leading to less caries in these teeth while the morphology of molars with deep pits and fissures, the early eruption of these teeth are few factors for making these teeth more susceptible to caries.^[15, 16]

In our study maxilla was more affected by caries as compared to mandible which is in accordance to the finding of Demirci et al.^[12] and Said et al.^[17] but on the contrary studies done by Manji et al.^[16] and Macek et

al.^[15] showed mandibular segment was more involved with caries. In our study it was found that occlusal surface was the most affected site by caries (47.5%) of which the molars contributed the most this was in accordance to the findings of several studies.^[18,19,20] This means that inspite of difference in dietary habits, economy, cultural practices, oral hygiene habits in different population, the occlusal surface of molars are most affected in the dentition. This could be due to the morphology of molar teeth with deep pits and fissures, large-sized crown making them more retentive to food and plaque leading to carious attack by bacteria and early eruption of the tooth could also be a reason.^[17] The fact that occlusal surfaces are more caries prone also indicates that there is a lack of awareness about preventive procedure like pit and fissure sealing.^[11]

It was also observed in this study that the next carious site which was more prone to decay was interproximal areas which suggest lack of oral hygiene preventive measures like flossing can be a cause of higher carious attacks on mesial (19.4%) and distal (15.8%) sites in both the quadrants. The similar finding can be seen in another study done by Baranwal et al.^[1] in which mesial and distal surfaces documented high caries rate after the occlusal surface.

More caries was observed in our study on distal surfaces of all premolars in both the quadrants this is similar to the results observed in studies done by Chestnut et al.^[2] and Demirci et al.^[12] Mesial surfaces of maxillary anterior teeth showed high caries rate especially in the central incisor (20%) followed by lateral incisor (17%). The results of the present study were similar to Chestnut et al.^[2] and Demirci et al.^[12] with respect to approximal caries. In this study approximal surfaces of first molars were more susceptible to caries than second molars among the study samples similar to the studies done by Eklund et

al.^[21] and Stenlund et al.^[22] It had been observed that adjacent approximal tooth surfaces had more caries susceptibility^[3, 23]. The difference in caries susceptibility and progression of lesions can be due to chemical and structural differences of enamel between contacting surfaces.^[22]

Several studies say that the tooth which erupts early may be at a disadvantage as they may be more susceptible to caries.^[22, 24] The post-eruptive maturation of enamel fails in preventing caries on approximal surfaces. During tooth eruption, the proximal surfaces between the already erupted adjacent tooth and still erupting tooth becomes a retentive area of plaque in the self-cleansing. Thus there is establishment of caries-producing plaque leading to caries in approximal areas.^[23]

In the present study high caries incidence was seen on palatal surfaces of maxillary anterior teeth and buccal surfaces of mandibular first molars. Studies done by Said et al.^[17] and Demirci et al.^[12] also observed the same in their findings.

Occlusal surfaces of first molars in both the segments showed highest caries incidence especially the pits and fissures than other sites. The mandibular first molars were more prone to caries than maxillary first molars This was followed by occlusal surfaces of second molars These finding were similar to the study conducted by Eklund et al.^[21] and Said et al.^[17] The reason could be complicated morphology of the surface, access for effective brushing being difficult in these areas also the majority of fissures in the molars already shows early signs of carious involvement soon after eruption.^[25, 26]

This study showed that although an increase in the incidence of caries was seen in age groups 35-44 years old, a decreases with an increase in age was observed in other age groups which is similar to the finding of Manji et al.^[27] In agreement with most of the studies^[8, 28, 29] it

was observed that in this study caries experience was more in females (69.78%) as compared to males (30.21%) which is in contrast to a study done by Baranwal et al.^[1] and Maru et al.^[30] This could be due to early eruption of teeth in girls, lack of financial independence in females, the difference in attitudes and dietary pattern between working males and housewives.^[31]

Limitations of our study were that these results cannot be generalized to the whole population of the Eastern Uttar Pradesh region. Secondly, other factors such as dietary habits, oral hygiene practices, socio-economic status, and cultural practices were not taken into account. However, the results of our study can provide baseline data for the planning and execution of various preventive programs that will assist in controlling the disease burden.

Conclusion

Within the limitation of our study, we concluded that mandibular anteriors are least prone to caries while maxillary and mandibular molars demonstrated the highest caries experience. Maxillary teeth are more prone to caries as compared to mandibular teeth and the occlusal surface in molars shows the highest incidence of caries. Therefore morphology of teeth is an important factor in caries etiology and should be considered an important factor in the prevention of plaque for healthy oral hygiene.

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