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Oral Health Status Of School Children Aged 3-16 Years Across Mumbai Metropolitan Region, India: A Cross Sectional Analytical Study

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Abstract :

Background: *Oral problems can cause strong impact on the functional, emotional, and social aspects of children and adolescents. This study aims to assess oral health status of school children in Mumbai Metropolitan region, Maharashtra.* ***Methodology***: *oral health status was evaluated for 1700 school children aged 3-16 years across Mumbai, Maharashtra. Dental caries status, oral hygiene status, malocclusion was assessed along with basic demographic details. Frequencies and mean values were calculated and correlated with different variables.* ***Results***: *mean DMFT values were 2.6±3.025, 1.91± 2.308 and 0.16±0.713 in 3-6years, 7-12 years and more than 13years of age group respectively. Caries status was significantly associated with low socioeconomic status, malocclusion and other variables.* ***Conclusions***: *These findings suggest urgent need to address these issues and plan a comprehensive oral health program at school levels. Further research is needed for in-depth analyse of oral health related behaviour among the population to better understand the problem and plan a efficient preventive program.*

Keywords: *dental caries, school children, socioeconomic status, malocclusion*

INTRODUCTION

Oral problems can cause strong impact on the functional, emotional, and social aspects of children and adolescents. Maintenance of the oral health of this population, however, still represents a great challenge to professionals and health systems around the world.[1] According to the Oral Health in India Report, about 75% of children in Maharashtra were found to have never received any dental care, despite 46% of the children reported to have suffered from occasional or frequent toothache. Untreated dental caries (tooth decay) in permanent teeth is the most common health condition according to the Global Burden of Disease 2017.[2] In many children, these teeth stay sound, contributing to the child's health and well-being. But for an unacceptably large percentage of children, these teeth do not stay sound but are ravaged and sometimes destroyed by dental caries (dental decay). This is a preventable, global, noncommunicable disease (NCD) of medical, social and economic importance.[3]Toothache directly affects child's oral health related quality of life (COHRQoL), an important fact that can influence the performance of daily activities and school learn, leading to the development of problems that may persist through life. Children who suffer from poor oral health are 12 times more likely to have more restricted activity days including missing school than those who do not.[4]Dental caries is still a major health problem in most industrialized countries as it affects 60–90% of school-aged children and most adults.[5]

Oral health is an integral part of general health. Despite having the maximum number of dental schools in the world, dental caries, oral cancers, and periodontal diseases are areas of national oral health concern in India. To frame any national policies or manpower allocation, primary requirement is to have baseline data to know the exact prevalence of oral diseases.[6] Though there have been multiple studies on the status of oral health of children in small areas, regions or schools of Mumbai, the literature is very scant with respect to a recent comprehensive study involving multiple schools throughout the city. Hence this study was conducted with an aim to assess the Oral Health Status of children aged 3-16 years in Mumbai Metropolitan Region.

METHODOLOGY:

A cross-sectional analytical study was conducted to assess the Oral Health Status of children aged 3-16 years in Mumbai Metropolitan Region, Maharashtra. Before conducting the study, ethical clearance was obtained from the ethical committee of the institution. The study was conducted for the duration of 6 months from June to November 2023. The target population consisted of school going children of 3-16 years age, that generally covered students studying in Nursery to 10th grades. The necessary permission to carry out the study was obtained from the respective school authorities. Informed consent was obtained from parents of all the students.

Pilot study:

Prior to the commencement of the main study, a pilot study was conducted among 100 students to assess the feasibility of the study. The prevalence of dental caries and the oral hygiene levels were calculated from the collected data. Using these data, the minimum sample size required for the survey was calculated using the following formula - $\mathbf{Z^2pq/e^2}$

Z=1.96

p= prevalence (pilot study we found that 83% students have dental caries)

q= 1-p (17%)

e= error (error was fixed at 2%)

Sample size= $(1.96)^2(0.12)(0.88)/(0.02)^2$

Moreover a further 10% was added to compensate possibility of incomplete records. So total sample of 1700 was included.

Study design and sampling:

The study involved a two-stage random sampling to select a representative sample of students in classes nursery to 10th in government, private aided and private unaided schools. The sampling required complete enrolment lists of all the government, private aided and private unaided schools in Greater Mumbai municipal corporation region. This information was collected from the Municipal Corporation of Greater Mumbai (MCGM) portal. (https://portal.mcgm.gov.in/irj/portal/) In the present study number of students selected from each school was 30. This was according to the guidelines of WHO oral health surveys basic methods.[7]To reach sample size, 57 schools were selected randomly from the list of schools. In a first stage of sampling, schools were selected based on proportional random sampling taking considerations of number of schools in each category. In the second stage of sampling, school children were recruited randomly. All the students who gave consent to participate were eligible for the study. The survey procedure was designed to ensure confidentiality and voluntary participation. The answer sheet did not contain any information on the identity of the student or of the school. (Figure 1)

Training and calibration exercises

The examination was carried out by two examiners who underwent training exercises under the guidance of an expert. Calibration exercises were carried out on a group of twenty students who were examined twice on successive days to assess the consistency of intra-examiner reproducibility. Both the examiners assessed similar 20 students and inter-examiner reliability was calculated by kappa statistics. The agreement for most assessments was found to be 90%.

Data collection and examination:

A standardized proforma was used to collect the data to ensure uniformity throughout the study duration. Proforma include details of sociodemographic profile of students (age, gender, parental education,

occupation, SES etc) and oral health status. Dental caries status was assessed based on DMFT index for permanent dentition.[8] and def index for primary dentition[9]

Similarly oral hygiene was assessed by using Oral Hygiene Index-simplified (OHI-S) and it was recorded as good, fair and poor according to the scoring criteria.[10]

Malocclusion was recorded as present or absent. Brushing habits were recorded.

Sufficient number of autoclaved instruments were carried to the site of examination. The children were examined in the classroom/corridor where sufficient natural light was present for examination.

Analysis of data:

The statistical analysis was performed using IBM SPSS version 21.0, USA. Student's t-test and analysis of variance (ANOVA) were used for the comparison of two and more than two groups, respectively, followed by post hoc test. Proportions were compared between different groups by using Pearson's Chi-square test. The level of significance was set at $P < 0.05$

Result

A total of 1700 school children were included in our study.

Sample distribution according to age and gender (insert Figure 1)

The study population comprised 950 males (55.9%) and 750 females (44.1%).

Age distribution was, 18.2% (309 students) were 3-6 years old, 53.1% (903 students) were 7-12 years old, and 28.7% (488 students) were 13-15 years old.

Within age groups, males constituted 51.5% (159) of the 3-6 years group, 54.8% (495) of the 7-12 years group, and 60.5% (950) of the 13-15 years group. (Refer to Figure 1 for visual representation).

Sample distribution according to Socioeconomic status

Assessed according to the Kuppuswamy scale, the socioeconomic distribution was: 11.6% (198 students) upper class, 19.1% (325) upper middle class, 22.2% (378) lower middle class, 24.1% (409) upper lower class, and 22.9% (390) lower class. (insert Figure 2).

Prevalence of dental caries (insert Figure 3)

The prevalence of decayed, extracted, or filled teeth due to caries (DMFT/dmft) was substantial across all age groups. (Insert to Figure 3).Among 3-6 year olds, 63.4% (196 students) had decayed, extracted or filled teeth due to caries whereas in 113 (36.6%) students, dental caries was absent. In 7-13 year olds, 81% (732 students) presented with decayed, extracted or filled teeth due to caries whereas in 171 (19%) students, dental caries was absent. For 13-15 year olds, 76.60% (364 students) exhibited caries while 23.40%(114) students were caries free.

The mean DMFT/dmft values observed were 2.6 ± 3.025 in the 3-6 years age group, 1.91 ± 2.308 in the 7-12 years age group, and 0.16 ± 0.713 in the more than 13 years age group.

Sample distribution according to Oral Hygiene (insert Figure 4)

Measured by the Oral Hygiene Index-Simplified (OHI-S), 85.5% (1454) of the total study population had good oral hygiene, while 10.8% (184) had fair and 3.74% (62) had poor oral hygiene.

Within age groups, good oral hygiene was seen in 286 (3-6 years) and 21 students with fair or and 2 students with poor oral hygiene, 804 (7-13 years) had good oral hygiene. 66 were fair and 33 students had poor oral hygiene, and 365 (13-15 years) students had good oral hygiene. The oral hygiene of 97 showed fair and 26 showed (Insert to Figure 4).

Sample distribution according to presence of malocclusion (insert Figure 5)

The prevalence of malocclusion was relatively low.

Malocclusion was present in only 6.4% (109) of the total student population.

Remaining 93.6% (1591) students were free from any malocclusion. Specific numbers for malocclusion presence were 5 students in the 3-6 years age group, 57 students in the 7-13 years age group, and 47 students in the 13-15 years age group. (Refer to Figure 5)

Sample distribution according to brushing habits (insert Figure 6)

The majority of students (82%, 1394 students) reported brushing their teeth once daily, while 18% (306 students) brushed twice daily.This habit distribution was consistent across age groups, with 268 brushing once and 41 twice a day (3-6 years), 703 brushing once and 200 twice a day (7-13 years), and 423 brushing once and 65 twice a day (13-15 years). (Refer to Figure 6)

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COMPARISON OF DENTAL CARIES STATUS (DMFT and dmft) with different factors

Table 1 shows dental caries status (DMFT and dmft) according to socioeconomic status in different age groups.In the 3-6 years age group, the highest mean dmft (3.69 ± 3.095) was found in the upper lower class, followed by the lower class (mean dmft = 3.39 ± 3.824), with a statistically significant P value.

For the 7-12 years age group, DMFT and dmft values were higher in the lower socioeconomic class, which was statistically significant.Conversely, in the 13-15 years age group, the upper middle class showed the highest mean DMFT (2.76 ± 2.425), while the lower class had the lowest DMFT (1.7 ± 1.848).

Table 1: Dental Caries status according to socioeconomic status in different age groups

age group	SES	D	M	F	d	e	F	DMFT	dmft
3-6 yrs	1	0±0	0±0	0±0	1.57±2.67	0.1±0.3	0.29±0.54	0±0	1.43±2.41
	2	0±0	0±0	0±0	2.67±2.802	0.18±0.39	0.42±0.497	0±0	1.98±2.62
	3	0±0	0±0	0±0	2.29±2.498	0.08±0.278	0.15±0.362	0±0	2.28±2.451
	4	0±0	0±0	0±0	2.93±3.149	0.1±0.308	0.24±0.43	0±0	3.69±3.095
	5	0±0	0±0	0±0	3.03±2.859	0.19±0.393	0.46±0.502	0±0	3.39±3.824
	Total	0±0	0±0	0±0	2.52±2.831	0.13±0.336	0.3±0.475	0±0	2.6±3.025
7- 12 yrs	1	1.31±1.558	0±0	0.13±0.409	1.9±2.326	0.21±0.439	0.25±0.517	1.44±1.61	2.04±2.457
	2	1.51±1.651	0±0	0.15±0.36	0.87±1.767	0.16±0.37	0.28±0.51	1.66±1.674	1.13±1.827
	3	0.75±1.223	0±0	0.05±0.212	1.24±2.089	0.29±0.455	0.32±0.532	0.79±1.265	1.88±2.362
	4	0.52±1.045	0±0	0.11±0.308	1.87±2.308	0.15±0.353	0.28±0.513	0.63±1.115	2.19±2.379
	5	0.32±0.863	0±0	0.09±0.289	1.99±2.444	0.15±0.358	0.31±0.524	0.42±0.914	2.27±2.347
	Total	0.79±1.315	0±0	0.1±0.307	1.55±2.234	0.19±0.395	0.29±0.519	0.89±1.365	1.91± 2.308
>13 yrs	1	1.83±1.694	0.16±0.367	0.47±0.737	0.16±0.629	0±0	0±0	2.39±1.928	0.19±0.666
	2	2.2±2.322	0.16±0.37	0.4±0.619	0.25±1.154	0±0	0±0	2.76±2.425	0.25±0.918
	3	2.04±2	0.13±0.339	0.34±0.54	0.02±0.209	0±0	0±0	2.51±2.161	0.05±0.31
	4	1.3±1.692	0.15±0.356	0.37±0.537	0.03±0.208	0±0	0±0	1.83±2.001	0.1±0.418
	5	1.23±1.59	0.14±0.3	0.34±0.50	0.07±0.52	0±0	0±0	1.7±1.848	0.22±0.95

		7	45	8	8				9
	Total	1.66±1.892	0.15±0.353	0.38±0.578	0.1±0.622	0±0	0±0	2.17±2.101	0.16±0.713
Total	1	1.16±1.568	0.06±0.23	0.22±0.541	1.2±2.156	0.11±0.325	0.17±0.44	1.4±1.776	1.23±2.148
	2	1.42±1.86	0.04±0.203	0.19±0.438	1.03±2.04	0.12±0.329	0.23±0.457	1.65±1.981	1.06±1.906
	3	0.92±1.515	0.03±0.176	0.11±0.336	1.15±2.053	0.18±0.385	0.21±0.45	1.06±1.673	1.51±2.239
	4	0.66±1.266	0.04±0.2	0.16±0.39	1.52±2.364	0.1±0.297	0.19±0.437	0.86±1.49	1.85±2.494
	5	0.56±1.191	0.04±0.204	0.16±0.378	1.54±2.367	0.11±0.31	0.24±0.46	0.76±1.399	1.78±2.585
	Total	0.9±1.504	0.04±0.2	0.16±0.407	1.31±2.222	0.12±0.332	0.21±0.449	1.1±1.681	1.54±2.336

Table 2 shows dental caries status (DMFT and dmft) according to brushing habits in different age groups.

In the 3-6 years age group, dmft was slightly higher in students brushing once daily (2.63 ± 2.871) compared to twice daily (2.37 ± 3.923), though this difference was not statistically significant.
For 7-12 year olds, dmft was higher among once-daily brushers (1.99 ± 2.339) in students brushing once daily and lower (1.65±2.18) in students brushing twice a day.The DMFT was similar in the students brushing once and twice daily.
Notably, in the 13-15 years age group, a statistically significant higher DMFT (2.23 ± 2.167) was observed in students brushing once daily compared to those brushing twice a day (1.8 ± 1.563). The P value is statistically significant.

Table 2: Dental Caries status according to brushing habit in different age groups

age group	brushing	D	M	F	d	e	f	DMFT	dmft
1	1	0±0	0±0	0±0	2.62±2.861	0.15±0.353	0.29±0.473	0±0	2.63±2.871
	2	0±0	0±0	0±0	1.88±2.571	0.02±0.156	0.37±0.488	0±0	2.37±3.923
	Total	0±0	0±0	0±0	2.52±2.831	0.13±0.336	0.3±0.475	0±0	2.6±3.025
2	1	0.8±1.323	0±0	0.1±0.303	1.63±2.248	0.2±0.403	0.31±0.536	0.89±1.363	1.99±2.339
	2	0.79±1.291	0±0	0.12±0.32	1.26±2.167	0.14±0.362	0.25±0.454	0.9±1.375	1.65±2.18
	Total	0.79±1.315	0±0	0.1±0.307	1.55±2.234	0.19±0.395	0.29±0.519	0.89±1.365	1.91±2.308
3	1	1.71±1.952	0.15±0.359	0.38±0.575	0.07±0.533	0±0	0±0	2.23±2.167	0.14±0.651
	2	1.32±1.4	0.11±0.3	0.37±0.6	0.26±1.0	0±0	0±0	1.8±1.56	0.29±1.0

		15	12	01	2			3	27
	Total	1.66±1.892	0.15±0.353	0.38±0.578	0.1±0.622	0±0	0±0	2.17±2.101	0.16±0.713
Total	1	0.92±1.548	0.05±0.209	0.16±0.41	1.35±2.247	0.13±0.337	0.21±0.455	1.12±1.732	1.55±2.322
	2	0.79±1.286	0.02±0.15	0.15±0.396	1.13±2.097	0.09±0.304	0.21±0.423	0.97±1.422	1.46±2.401
	Total	0.9±1.504	0.04±0.2	0.16±0.407	1.31±2.222	0.12±0.332	0.21±0.449	1.1±1.681	1.54±2.336

Table 3 shows dental caries status (DMFT and dmft) according to presence of Malocclusion in different age groups.

For the 3-6 years age group, dmft was significantly higher in students with malocclusion (2.63 ± 3.03) compared to those without (0.8 ± 1.095). P value is statistically significant.In the 7-12 years age group, dmft was higher in students with malocclusion (1.97 ± 2.341) compared to those without (1.16 ± 1.567). DMFT was also higher in students with malocclusion (0.95 ± 1.505) compared to those without (0.89 ± 1.356).

Similarly, for the 13-15 years age group, DMFT was significantly higher among students with malocclusion (2.26 ± 2.139) than those without (1.32 ± 1.461). The P value is statistically significant.

Table 3: Difference in Caries status according to presence of Malocclusion in different age groups

age group	Malocclusion	D	M	F	d	e	f	DMFT	dmft
1	1	0±0	0±0	0±0	1.8±3.033	0±0	0.4±0.548	0±0	0.8±1.095
	2	0±0	0±0	0±0	2.54±2.832	0.13±0.339	0.3±0.474	0±0	2.63±3.038
	Total	0±0	0±0	0±0	2.52±2.831	0.13±0.336	0.3±0.475	0±0	2.6±3.025
2	1	0.82±1.537	0±0	0.12±0.331	0.84±1.82	0.23±0.423	0.39±0.59	0.95±1.505	1.16±1.567
	2	0.79±1.3	0±0	0.1±0.305	1.6±2.252	0.19±0.393	0.29±0.514	0.89±1.356	1.97±2.341
	Total	0.79±1.315	0±0	0.1±0.307	1.55±2.234	0.19±0.395	0.29±0.519	0.89±1.365	1.91±2.308
3	1	1±1.43	0.11±0.312	0.21±0.414	0.11±0.521	0±0	0±0	1.32±1.461	0.17±0.564
	2	1.73±1.923	0.15±0.357	0.39±0.59	0.1±0.632	0±0	0±0	2.26±2.139	0.16±0.728
	Total	1.66±1.892	0.15±0.353	0.38±0.578	0.1±0.622	0±0	0±0	2.17±2.101	0.16±0.713
Total	1	0.86±1.462	0.05±0.21	0.16±0.364	0.57±1.542	0.12±0.326	0.22±0.478	1.06±1.474	0.72±1.299
	2	0.9±1.508	0.04±0.199	0.16±0.41	1.36±2.252	0.12±0.332	0.21±0.448	1.1±1.695	1.59±2.381

	Total	0.9±1.504	0.04±0.2	0.16±0.407	1.31±2.222	0.12±0.332	0.21±0.449	1.1±1.681	1.54±2.336

Table 4 shows dental caries status (DMFT and dmft) according to the gender in different age groups.

Gender was also found to be statistically significantly associated with dental caries status across different age groups.In the 3-6 years age group, dmft was significantly higher in males (2.81 ± 3.372) compared to females (2.38 ± 2.6). The P value is statistically significant.
For 7-12 year olds, males had a higher dmft (2.02 ± 2.389), while females had lower (1.79±2.20) dmftThe DMFT was lower in males (0.85±1.33) whereas it was higher in females (0.94±In the 13-15 years age group, females exhibited a statistically significant higher DMFT (2.56 ± 2.284) compared to males (1.92 ± 1.93).

Table 4: Difference in Caries status according to Gender in different age groups

age group	Sex	D	M	F	d	e	F	DMFT	Dmft
1	1	0±0	0±0	0±0	2.09±2.608	0.15±0.359	0.34±0.501	0±0	2.81±3.372
	2	0±0	0±0	0±0	2.99±2.99	0.11±0.31	0.27±0.444	0±0	2.38±2.6
	Total	0±0	0±0	0±0	2.52±2.831	0.13±0.336	0.3±0.475	0±0	2.6±3.025
2	1	0.74±1.261	0±0	0.11±0.327	1.54±2.224	0.19±0.401	0.3±0.517	0.85±1.331	2.02±2.389
	2	0.86±1.377	0±0	0.09±0.28	1.57±2.225	0.18±0.388	0.28±0.522	0.94±1.405	1.79±2.202
	Total	0.79±1.315	0±0	0.1±0.307	1.55±2.234	0.19±0.395	0.29±0.519	0.89±1.365	1.91±2.308
3	1	1.38±1.649	0.15±0.357	0.38±0.582	0.1±0.609	0±0	0±0	1.92±1.933	0.19±0.818
	2	2.08±2.15	0.14±0.348	0.37±0.572	0.09±0.643	0±0	0±0	2.56±2.284	0.12±0.512
	Total	1.66±1.892	0.15±0.353	0.38±0.578	0.1±0.622	0±0	0±0	2.17±2.101	0.16±0.713
Total	1	0.82±1.374	0.05±0.21	0.18±0.426	1.18±2.096	0.13±0.336	0.21±0.45	1.04±1.588	1.58±2.456
	2	1±1.65	0.04±0.186	0.14±0.381	1.47±2.363	0.12±0.327	0.21±0.45	1.17±1.79	1.48±2.175
	Total	0.9±1.504	0.04±0.2	0.16±0.407	1.31±2.222	0.12±0.332	0.21±0.449	1.1±1.681	1.54±2.336

Table 5 compares the dental caries status (DMFT and dmft) amongst the different age groups, SES, Malocclusion and brushing frequency. The prevalence of dental caries was significantly differed according to different age group, different socioeconomic status , brushing habits and malocclusion.

Table 5: Comparison of dental caries status according to various parameters

Parameter	**DMFT**	**Dmft**
Age groups		
3-6 years	0±0	2.6±3.025

7-12 years	0.89±1.365	1.91±2.308
13-15 years	2.17±2.101	0.16±0.713
F Value	147.768	140.886
P value	.000	.000
Brushing		
Once	1.12±1.732	1.55±2.322
Twice	0.97±1.422	1.46±2.401
F value	1.817	2.336
P Value	0.178	0.127
Malocclusion		
Absent	1.06±1.474	0.72±1.299
Present	1.1±1.695	1.59±2.381
F value	.076	9.152
P value	.783	.003
Socioeconomic status		
Upper class	1.4±1.776	1.23±2.148
Upper middle class	1.65±1.981	1.06±1.906
Lower middle class	1.06±1.673	1.51±2.239
Upper Lower class	0.86±1.49	1.85±2.494
Lower class	0.76±1.399	1.78±2.585
F Value	19.457	3.583
P value	.000	.006

ANOVA test was used to compare Mean DMFT/def values in different parameters *P<0.05 considered as statistically significant. deft: Decayed, extracted, and filled teeth, defs: Decayed, extracted, and filled surface

DISCUSSION

The dmft is 2.62±3.025 in the 3-6 years age group. DMFT is 2.17±2.10 in the 13-15 years age group. This shows that age and tooth decay have an inverse relationship. These results also align with the study conducted by Moses where it was observed that as age advances, the prevalence of dental caries decreases. (2) Similar results were seen in the study conducted by Peterson P.E,et al (1991)[11] , Retna Kumari N (1999)[12], Dash J.K (2002)[13], Saravanan S,.et al (2003)[14] and Mahesh Kumar P(2005)[15] This could be due to the increase in age, there is an increased awareness of oral hygiene. The permanent teeth are also more resistant to the caries process than the primary teeth. In the current study, prevalence of caries was more in males than females in the age groups 1 and 2, This finding corresponds with the study conducted by Pande P 2021[16],] Hiremath A et al 2016[17],] and Sudha P 2005[18] however in the 3rd age group, females had higher DMft. The study conducted by John R. Lukacs exploring Gender differences in oral health in South Asia showed similar results where a reversal of ratio is seen in the higher age group. The prevalence of dental caries was high in the low socioeconomic status which can be attributed to their poor oral hygiene practice, lack of awareness, improper food intake and family status. This finding is similar to the study conducted by Sogi G and Baskar D.J (2001)[19], Recent studies from Europe demonstrate a significant inverse association between social class and oral health status in young children. The North Brisbane study supports these findings by confirming that preschool children from a lower socioeconomic background also have more active decay and more missing teeth from the previous disease compared with children from higher socioeconomic status levels.

In the current study, 82% (1394) students brushed their teeth only once daily while 18% (306) maintained their oral hygiene by brushing two times every day. These results are in accordance with the study conducted by Ingle et al among school children of Bharatpur city where a maximum number of children, that is, 1176 (84%) brushed once in a day[20].

CONCLUSION

Current study aimed to assess the oral health status of children aged 3-16 years across entire Mumbai Metropolitan region which showed quite a high oral health disease burden. There are differences in oral health status according to socioeconomic background, oral hygiene practices, malocclusion etc. These findings suggest urgent need to address these issues and plan a comprehensive oral health program at school levels. Further research is needed for in-depth analyse of oral health related behaviour among the population to better understand the problem and plan a efficient preventive program.

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