

Oral health status and treatment needs among 12- and 15-year-old government and private school children in Shimla city, Himachal Pradesh, India

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Abstract

Objectives: To assess the dental caries, periodontal health, and malocclusion of school children aged 12 and 15 years in Shimla city and to compare them in government and private schools. **Materials and Methods:** A cross-sectional study of 12- and 15-year-old children in government and private schools was conducted in Shimla city, Himachal Pradesh, India. A sample of 1011 school children (both males and females) was selected by a two-stage cluster sampling method. Clinical recordings of dental caries and malocclusion were done according to World Health Organization diagnostic criteria 1997. Periodontal health was assessed by Community Periodontal Index of Treatment Needs index. The data collected was analyzed by SPSS package 13. The statistical tests used were *t*-test and Chi-square tests. **Results:** The prevalence of dental caries was 32.6% and 42.2% at 12 and 15 years, respectively. At the 12 years of age, the mean decayed, missing, filled teeth was 0.62 ± 1.42 and it was 1.06 ± 2.93 at 15 years of age. Females had higher level of caries than males at both the ages. At both ages, mean of decayed teeth was statistically higher in government schools as compared with private schools. Children in government schools had significantly less number of mean filled teeth at both ages as compared with private schools. The healthy component of gingiva was present in higher percentage of children in private schools as compared with government schools at both the age groups. The prevalence of malocclusion among the 12- year-old (58.1%) was more as compared with that among the 15-year-old (53.5%). **Conclusion:** The caries experience of 12- and 15-year-old children was low but the prevalence of gingivitis and malocclusion was quite high. Effective oral health promotion strategies need to be implemented to improve the oral health of school children further in Shimla city.

Key words: Dental caries, school children, Shimla, treatment needs

INTRODUCTION

Good oral health is important because the experience of pain, problems with eating, chewing, smiling, and communication due to missing, discolored, or damaged

teeth have a major impact on people's daily lives and well-being. Furthermore, oral diseases restrict activities at school, at work, and at home causing millions of school and work hours to be lost each year throughout the world.^[1] 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.^[2] Historically, most important global burdens of the oral health are dental caries and periodontal diseases.^[1]

As dental caries is the most common dental disease with high prevalence, it is crucial to control the disease process by assessing and rendering the treatment required along with spreading awareness regarding its prevention.

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But for developing appropriate preventive approaches, anticipating utilization patterns, and planning effectively for organization and financing of dental resources, the knowledge of oral health status and treatment needs of populations with different characteristics is important.

The schools remain an important setting, offering an efficient and effective way to reach children worldwide and, through them, families and community members. School age is an influential stage in people's life when lifelong sustainable oral health related behaviors, as well as beliefs and attitudes, are being developed. Children are particularly receptive during this period and the earlier the habits are established, the longer lasting the impact. Moreover, the messages can be reinforced regularly throughout the school years.^[3]

Various studies have been conducted in different parts of our country, but the literature is very scant for cross comparison in terms of caries status and treatment needs as well as the periodontal status of school children in India. As there are no earlier studies on oral health status of school going children aged 12 and 15 years in Shimla city, the present study was conducted with the following objectives:

- To assess the dental caries, periodontal health, and malocclusion of school children aged 12 and 15 years in Shimla city
- To compare the oral health status and treatment needs in government and private schools
- To establish a reliable baseline data for development of national/regional oral health programs.

MATERIALS AND METHODS

A cross-sectional epidemiologic study was conducted among the school-going children aged 12 and 15 years in Shimla city. Ethical approval to conduct the study was obtained from the Institutional Review Board of H.P. Government Dental College and Hospital, Shimla. Written consent for the participation of the children in the study was obtained from the principals of the concerned schools.

A pilot study was conducted by randomly selecting one government and one private school from the available list of schools obtained from the Directorate of Education, H.P. Results from this pilot study showed the prevalence of dental caries was 23.4%. The sample size was calculated by taking this prevalence rate and computed using the Epi Info, Version 6 statistical package at 95% confidence interval which came out to be 985.

The sample frame consisted of middle and high schools (public and private) in Shimla city. The study

sample was recruited by a two-stage cluster sampling technique. For the purpose of the study, Shimla city was arbitrarily divided into four geographical regions, which correspond to the four varying demographic areas of the city: Shimla municipal and three Shimla Planning Areas (Dhalli, Tutu, and New Shimla). Schools from each region were randomly selected to obtain the desired sample size, such that there was an equal representation from each of the four zones. Out of the total number (43) of government (26) and private schools (17), seven public and five private schools were randomly selected. In the second stage, eligible schoolchildren were stratified according to age and gender, and randomly selected in proportion to the total number of 12- and 15-year old students enrolled in each school to reach the sample of about 1011 subjects over a period of 3 months April-June 2009. The fluoride levels in water in Shimla city are less than 1.5.^[4]

Data collection was carried out by one of the authors (SF) trained for clinical examination during several educational and clinical sessions in the Department of Public Health Dentistry, Government Dental College, Shimla. The author was assisted by an alert and co-operative recording assistant. Data regarding general information, oral hygiene practices were obtained through interview and recorded on a modified World Health Organization (WHO) proforma.^[5] The various oral hygiene variables recorded were oral hygiene aids which included toothbrush, finger and tree sticks; oral hygiene material like tooth paste, toothpowder and others, and frequency of brushing that included once a day and twice a day.

The subjects were examined by Dunning type III^[6] clinical examination for caries status and treatment needs, periodontal status and malocclusion in their respective schools on a comfortable chair. The procedure, diagnostic criteria, and treatment codes followed those recommended by WHO (1997)^[5] for assessment of dental caries and its treatment needs and malocclusion. Clinical examination for periodontal health was done as per Community Periodontal Index of Treatment Needs (CPITN)^[7] index. The periodontal indicators assessed were gingival bleeding and calculus for 12-year-old age group, while gingival bleeding, calculus, and periodontal pockets for 15 years. Intraexaminer reproducibility as determined using Kappa statistic was 0.85.

Inclusion criteria

School children (male and female) who have completed their 12 and 15 years of age.

Children present on the day of examination.

Exclusion criteria

Those children who refused to participate were excluded. Medically compromised children.

Also, the children under going orthodontic treatment were excluded for analysis of malocclusion.

A referral was forwarded to the parents of the children in need of dental care. At the conclusion of the survey, an oral health education session and tooth brushing demonstration was conducted in each classroom.

Statistical analysis

The data collected was analyzed by Statistical Package for Social Sciences (SPSS) package 13. The statistical tests used were *t*-test for continuous variables and Chi-square tests for categorical data. A level of $P \leq 0.05$ was considered statistically significant.

RESULTS

Of the total study population, 49.2% were in the 12 years age group and 50.8% were in the 15 years age group. Among the 12-year age group, there were 322 (64.8%) males and 175 (35.2%) females, while in the 15-year age group there were 304 (59.2%) males and 210 (40.8%) females. Among the 12-year age group, 46.1% of children were in government schools and 53.9% of children were in private schools, whereas in the age group of 15 years 48.6% of the children were in government schools and 51.4% were in private schools.

A total of 100% of the children in private schools used toothbrush and tooth paste as compared with government schools (95.4% used tooth brush and 93.6% used tooth paste) and the difference was statistically significant, $P < 0.001$. The frequency of brushing twice a day was statistically higher in private schools than government schools.

The prevalence of dental caries at 12 years was 32.6% and at the age of 15 years it was 42.2%. The prevalence of dental caries in government schools was 41.9% and in private schools it was 33.5% and the difference was statistically significant ($P < 0.01$).

At the age of 12 years, the mean decayed, missing, filled teeth (DMFT) was 0.62 ± 1.42 and it was 1.06 ± 2.93 at the age of 15 years. The difference at two age groups was statistically significant ($P < 0.001$). At both the

age groups, females showed higher mean DMFT as compared with the males and difference is statistically significant at 12 years. Subjects brushing their teeth once a day had higher mean DMFT as compared to those who brush twice a day and the difference is statistically significant at 12 years [Table 1]. Females had higher number of mean decayed teeth (0.65) than males (0.44) which is statistically significant. At both ages, mean of decayed teeth was statistically higher in government schools as compared with private schools. Children in government schools had less number of mean filled teeth at both ages as compared with private schools and the difference was statistically significant.

Table 2 shows that at the age of 12 years, 50.1% of children required restorative and endodontic treatment and at the age of 15 years, 50.5% of children required restorative and endodontic treatment. The greatest need was for single surface restorations (46.6% in 12 years and 47.6% in 15 years). The treatment need was higher in government schools at both the age groups but significantly higher at 12 years ($P < 0.01$).

There was significant age difference regarding CPITN scores. The percent of children with healthy component of gingiva was higher at 15 years of age than 12 years. Higher percentage of children had calculus at 15 years as compared with 12 years.

Table 1: Mean caries experience (DMFT) in relation to age, gender, schools, brushing frequency

Mean DMFT in relation to age and gender				
Age	Sex	Mean DMFT	S.D	P value
12 years	Male	0.537	1.330	0.007*
	Female	0.794	1.490	
	Total	0.620	1.420	
15 years	Male	0.996	2.417	0.232
	Female	1.152	3.443	
	Total	1.060	2.930	
Mean DMFT in relation to schools				
Age	Schools	Mean DMFT	S.D	P value
12 years	Government	0.615	0.937	0.807
	Private	0.638	1.052	
15 years	Government	1.036	1.443	0.712
	Private	1.083	1.462	
Mean DMFT in relation to brushing frequency				
Age	Frequency of brushing	Mean DMFT	S.D	P value
12 years	Once brushing	0.743	1.135	0.008*
	Twice daily brushing	0.485	1.297	
15 years	Once brushing	1.108	1.546	0.857
	Twice daily brushing	0.933	1.253	

DMFT = Decayed, missing, filled teeth

At the age of 12 years, majority of the subjects (75.4%) had a score of 1 (bleeding gums) and 14.1% had healthy periodontium, while at the age of 15 years, 57.0% had a score of 1 (bleeding gums), 18.9% had healthy periodontium, 18.7% had a score of 2 and 5.4% had a score of 3 and no one had a score of 4 [Table 3].

At both the age groups, higher percentages of children were having healthy sextants in private schools as compared with government schools. At 12 years, there was statistically higher percentage of children having calculus in government schools as compared with private. At the age of 15 years, there was a significant correlation between frequency of brushing and CPITN scores [Table 3].

A total of 48 children (4.7%) had already undergone or were undergoing orthodontic treatment at the time of examination and these subjects were excluded for analyzing Dental Aesthetics Index (DAI) score. It was

observed that a highly significant difference existed in the number of children seeking orthodontic treatment between government and private schools in favor of private schools ($P < 0.001$). The prevalence of malocclusion among the 12-year-old (58.1%) was more as compared with that among the 15-year-old (53.5%). The severity percentages of malocclusion as per DAI index are shown in Table 4.

The percentage of subjects with “no or minor malocclusion” increased from 41.9% (40.2% males and 45.2% females) at 12 years to 46.5% (45.3% males and 48.2% females) at 15 years. At both ages, malocclusion was more in males than in females [Table 4].

DISCUSSION

A cross-sectional study was carried out to assess the oral health status and treatment needs among school children in Shimla city, Himachal Pradesh, India. The 12 and 15 age groups were chosen for this study, as

Table 2: Assessment of treatment needs among study population according to age and schools

Age	School	No. of subjects examined	No of subjects affected (%)	Pit and fissure sealants (%)	One-surface restoration (%)	Two-surface restoration (%)	Pulp care (%)	Extraction (%)
12 yrs	Government	229	161 (70.3)	2 (1.3)	78 (48.4)	38 (23.6)	30 (18.6)	13 (8.1)
	Private	268	88 (32.8)	4 (4.6)	38 (43.2)	21 (23.8)	17 (19.3)	8 (9.1)
	Total	497	249 (50.1)	6 (2.5)	116 (46.6)	59 (23.7)	47 (18.8)	21 (8.4)
15 yrs	Government	250	165 (66)	1 (0.7)	84 (50.9)	31 (18.8)	33 (20)	16 (9.6)
	Private	264	95 (35.9)	1 (1.1)	40 (42.2)	20 (21.0)	21 (22.1)	13 (13.6)
	Total	514	260 (50.5)	2 (0.7)	124 (47.6)	51 (19.6)	54 (20.8)	29 (11.3)

P value: 0.01 at 12 years and 0.08 at 15 years

Table 3: CPITN scores in relation to age, gender, and schools

CPITN scores in relation to gender and schools at 12 years							
Gender/school	CPI score			Total (%)	<i>P value</i>		
	0 (Healthy %)	1 (Bleeding %)	2 (Calculus %)				
Male	39 (12.1)	248 (77.1)	35 (10.8)	322 (100)	<0.05*		
Female	31 (17.7)	127 (72.4)	17 (9.9)	175 (100)			
Total	70 (14.1)	375 (75.4)	52 (10.5)	497 (100)			
Government school	13 (16.6)	186 (51.0)	30 (58.8)	229 (100)	<0.001*		
Private school	65 (83.4)	180 (49.0)	23 (41.2)	268 (100)			
Total	78 (100)	366 (100)	53 (100)	497 (100)			

CPITN scores in relation to gender and schools at 15 years							
Gender/school	CPI score					Total (%)	<i>P value</i>
	0 (Healthy %)	1 (Bleeding %)	2 (Calculus %)	3 (Shallow pocket %)	4 (Deep pocket)		
Male	55 (18.1)	174 (57.5)	58 (19.0)	17 (5.4)	0	304 (100)	>0.05*
Female	42 (20.0)	119 (56.6)	38 (18.1)	11 (5.3)	0	210 (100)	
Total	97 (18.9)	293 (57.0)	96 (18.7)	28 (5.4)	0	514 (100)	
Government school	35 (14)	133 (53.2)	62 (24.8)	20 (8)	0	250 (100)	>0.05*
Private school	75 (28.4)	138 (52.1)	44 (16.5)	8 (3.0)	0	264 (100)	
Total	110 (21.4)	271 (52.7)	106 (40.1)	28 (5.4)	0	514 (100)	

*Statistically significant

Table 4: Prevalence of malocclusion severity according to DAI scores

Age in years	Gender		No or minor malocclusion (DAI≤25)		Definite malocclusion (DAI 26-30)		Severe malocclusion (DAI 31-35)		Handicapping malocclusion (DAI≥36)	
	(N)		N	%	N	%	N	%	N	%
	N	%								
12	Male	311	125	40.2	110	35.4	55	17.7	21	6.7
	Female	166	75	45.2	58	34.9	26	15.7	7	4.2
	Total	477	200	41.9	168	35.2	81	17.0	28	5.9
15	Male	289	131	45.3	96	15.6	45	15.6	17	5.9
	Female	197	95	48.2	57	15.7	31	15.7	14	7.1
	Total	466	226	46.5	153	15.6	17	15.6	31	6.4

DAI = Dental aesthetics index

these are global monitoring ages for dental caries for international comparisons and monitoring of disease trends. The present study sample consisted of school children from both public and private schools in order to have representation of children from all the social, economic, and cultural communities.

At both the age groups, around 97% of population used tooth brush and tooth paste for cleaning their teeth. This clearly indicates their awareness about oral hygiene. At the age of 12 years, most of them (64%) used to brush once a day which is in line with the findings of Joshi and Rajesh,^[8] but high as compared with findings of Harikiran and Pallavi^[9] and Peng *et al.*,^[10] and less as compared with Petersen *et al.*,^[11] The frequency of brushing twice was more common in private schools as compared with government schools which was also reported by Kumar *et al.*,^[12] Tanni,^[13] and Petersen.^[14] In the present study, as the frequency of brushing increased prevalence of dental caries decreased. Similarly, with the increase in the frequency of brushing the prevalence and severity of periodontal diseases decreased. The reason being obvious, that there is significant correlation between plaque retention and gingival inflammation.^[15]

In the present study, it was observed that the prevalence of dental caries was higher at the age of 15 years (42.2%) as compared with 12 years (32.6%) which was also reported by Rodrigues and Damle,^[16] Singh *et al.*,^[17] Naidu *et al.*,^[18] and Goyal *et al.*^[19] The reason for the higher prevalence of dental caries at 15 years as compared with 12 years is that caries being a continuous and cumulative process had obviously increased with a span of 3 years, as well as the number of teeth increases at the age of 15 years.

In the present study, the mean DMFT at 12 years and at 15 years was 0.62 and 1.06, respectively which was also reported by Naidu *et al.*,^[18] and Petersen and Kaka,^[20] but is less than 2.4 as reported by National Oral Health Survey in H.P.^[4] Females had a significantly higher

mean DMFT value than males. This is in line with the findings of Al Shammery and Guile,^[21] Dummer *et al.*,^[22] Sogi and Bhaskar,^[23] and Singh *et al.*^[17] This may be due to the fact that teeth erupt earlier in females than males which lead to prolonged exposure of the teeth to the oral environment in females.

At both the age groups, there was statistically significant difference in mean DMFT between the government and the private schools. The level of caries was higher in children attending government schools which is in line with the findings of Almeida *et al.*,^[24] but in contrast to results reported by Tanni,^[13] Ojofeitimi *et al.*,^[25] This may be due to lack of awareness, affordability, or underutilization of dental care facilities by the children in the government schools. So, further studies are needed to assess the various barriers for utilization of services.

The mean filled teeth and missing due to other reasons were high in private schools which may be attributed to parents' attitude and dental awareness, of children in private schools which is reflected in the child's oral health maintenance. The mean of missing teeth due to other reasons was higher in private schools probably due to intervention with orthodontic treatment in these children.

At the age of 12 years, gingivitis was the main finding in about 70% of children which was also reported by Petersen *et al.*,^[11] and Kumar *et al.*,^[12] but is less as compared to the results reported by Dhar *et al.*,^[26] (85%) and Addy *et al.*,^[27] The higher proportion of gingival bleeding may be due to mixed dentition period, shedding of primary teeth, and pubertal changes in girls.

The overall high prevalence of gingivitis at both the age groups may be due to ineffective oral hygiene measures. As the present study showed that about 97% used tooth brush, but the gingivitis present in most of the school children reflects irregular brushing methods which can be due to inadequate brushing time, ineffective

brushing technique, or both factors, or it may also be possible that some of the children did not brush as they claim. Data collected through interviewing has limitations, so over reporting is possible regarding use of tooth brushing.

It was found that the children in private schools had higher proportion of healthy gingiva as compared with government schools which was also reported by Kumar *et al.*^[12] This may be due to somewhat irregular oral hygiene practices in government school children.

A total of 41.9% of the population at 12 years and 46.5% at 15 years presented no or minor malocclusion, indicating no or slight need for treatment which was also reported by Jenny *et al.*,^[28] The severity levels of malocclusion assessed to be 35.2% definite malocclusion with elective need for orthodontic treatment at 12 years; and 15.6% at 15 years, and 17.0% severe malocclusion at 12 years and 15.6% at 15 years; and 5.9% % handicapping malocclusion at 12 years and 6.4% at 15 years with mandatory orthodontic treatment need are similar to the results reported by Chi *et al.*,^[29] and Jenny and Cons.^[30]

There was no significant gender difference in DAI scores, though girls had a slightly lower score at 12 years age as compared with boys. This is comparable with the reports of Otuyemi *et al.*,^[31] which did not find any significant sex differences in the mean DAI score of Nigerian children.

The limitation of the present study was that the socioeconomic status of the subjects could not be assessed because the children could not be relied upon for this information and the collection of information from the school was not feasible.

CONCLUSION

From the present study, it is concluded that the prevalence of dental caries at the age of 12 years was 32.6% and 42.2% at the age of 15 years. The mean DMFT was 0.06 at the age of 12 years and 1.02 at the age of 15 years, which means that caries prevalence in 12- and 15-year-old children in Shimla city falls within the “very low” category as defined by the WHO. Dental caries was higher in government schools as compared with private schools. The maximum need was for one-surface restoration in both the age groups. Gingivitis was higher at the age of 12 years as compared with 15 years. The children in the private schools had higher proportion of healthy gingival as compared with

government schools. The prevalence of malocclusion among the 12-year-old was more as compared with that among the 15-year-old. As to improve the oral health of children in Shimla, the following recommendations are given:

- Oral health promotion through well-structured oral health education program can create positive change in awareness for special groups like school children
- Reinforcement of knowledge is necessary which can be done by incorporating chapters on oral health and oral hygiene in school textbooks. Also, the teachers training programs can ensure continuity of reinforcement
- Implementation of school dental health programs focusing on preventive programs like fluoride mouth rinse and tooth brushing programs
- Preventive services should be given high priority and needs to be started at an early age to target the primary dentition and future caries in permanent dentition
- Regular interval screening programs to assess the oral health and treatment needs of school children and provision of treatment as per the need.

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