Original Article

Assessment of Dental Caries Spectrum among 11 to 14-Year-Old School Going Children in India

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ABSTRACT

Introduction: The quantification of dental caries is usually done by DMFT index but efforts are being made to find an alternative. Caries Assessment Spectrum and Treatment (CAST) is a recent, innovative caries assessment tool which can be used in epidemiological surveys.

Aim: To assess dental caries using CAST index among 11-14-year-old school children in Rohtak city, Haryana, India.

Materials and Methods: A cross-sectional study was carried out among 11-14-year-old children in schools of Rohtak City using multi stage cluster sampling technique. Rohtak city was divided in to nine clusters. In the 2nd stage, one school was randomly selected from each cluster with lottery method. Finally from each selected school, every odd roll number child between age group 11-14 years, were enrolled to reach a sample of 586.

Caries was recorded using the CAST index. Each child was clinically examined by a trained examiner using CAST index. Descriptive and inferential statistics were done and Chi-square test was used to find association between caries prevalence and gender. Mann-Whitney U test was used to find any difference of mean DMFT between different age groups.

Results: A total of 586 children were examined. Prevalence of dental caries was 28.6%. Highest caries was observed in lower right first molar and lower left first molar (13.8% and 11.6%) respectively. Pulpal involvement in lower molars was found more than the upper molars.

Conclusion: CAST index presents a simple hierarchical structure of caries spectrum and is a promising index for epidemiological studies with complex quantifiability.

Keywords: Caries assessment spectrum and treatment index, Cavitations, Dental caries, Pulp

INTRODUCTION

Man has been afflicted by dental caries since time immemorial [1-4]. Dental caries manifests clinically as a course of action from initial visual change in enamel to frank cavitations extending to dentin and dental pulp [4-6]. The burden of dental caries is more among children [7-9].

Quantification of dental caries among population is the first step towards understanding trends and characteristics of the disease. Various indices have been used to measure dental caries but DMFT index is the most used one [10], but has failed to meet the new challenges of 21st century [11-14].

Many newer systems were proposed like International Caries Detection and Assessment System (ICDAS) [15-17] based on visual/tactile inspection, Pulp-Ulcer-Fistula-Abscess (PUFA) index, Significant Caries (SiC) index and specific caries index covering only a part of the wide range of caries stages [9,12,14,17]. Recently, a new instrument named CAST was developed by Frencken JE et al., [9] in which the codes are in increasing level of severity of effects of caries process [16,18-20]. Very few reports on a caries pattern covering full spectrum could be found in the literature. Thus, the present study was carried out with the aim to assess dental caries spectrum among 11-14-year-old school children of Rohtak city, Haryana.

MATERIALS AND METHODS

A cross-sectional descriptive survey was conducted among 11-14 years school going children of Rohtak city, Haryana, India, between June 2015 to August 2015. The study protocol was reviewed by Institutional Ethics Review Board and ethical clearance was granted (PGIDS/IEC/2015/53). An official permission was obtained from the District Education Officer and also from all the concerned school authorities. After explaining the purpose and details of the study, a written informed consent was obtained from the parents of all

children aged 11-14 years. Children who were uncooperative, with systemic diseases and developmental anomalies and whose parents did not give consent were excluded.

Before the start of the main study, the examiner was trained and calibrated in the Department of Public Health Dentistry, PGIDS, Rohtak. Intra-examiner reliability was assessed by re-examining 10% of sample. There was a good agreement between examinations (85%). To check the operational feasibility of the study, a pilot study was conducted on randomly selected 50 children aged 11-14 years from the list of available schools. No data from the subjects included in the pilot study was included in the main study.

Depending upon the prevalence obtained in pilot study sample size was calculated using the standard formula z^2pq/l^2 seeking results at 95% confidence interval for which the value of z=1.96, the allowable error (e) taken as 0.05. As the sampling technique employed was cluster random sampling, thus a design effect of 1.8 was used to adjust sample size. The minimum sample size was determined to be 540.

The sample frame consisted of middle and high school (private) in Rohtak city and the list was obtained from the District Education Officer. Multi stage cluster sampling technique was employed in which Rohtak city was divided in to 9 clusters. In the 2nd stage one school was randomly selected from each cluster with lottery method. Finally from each selected school, every odd roll number child between age group 11-14 years, were enrolled to reach a sample of 586.

Visit to the schools was made on the pre-decided dates. It was established during the study that on an average, it took about 15-20 minutes to examine a child. Around 25-30 children were examined in a day. Dental examination was carried out by a single investigator and a recording clerk was involved to enter the codes on the survey form. He was seated close enough to the examiner so that instructions and codes could be easily heard and the examiner could verify the correct entry of findings.

Demographic details of children were recorded including age and gender. Caries was recorded using the CAST index [9] which was carried out for all the teeth in child's mouth. Type III examination was done using mouth mirror and WHO probe. Disposable mouth masks and gloves were worn by examiner during examination. Autoclaved clinical examination instruments of 25-30 sets were carried for inspection. Children requiring immediate care were referred to the Department of Public Health Dentistry PGIDS Rohtak for further treatment.

STATISTICAL ANALYSIS

Data entry and analysis were performed using Statistical Package of Social Sciences (SPSS) software version 18.0. Descriptive statistics, including mean, standard deviations and frequency distribution were calculated. Chi-square test was used to found association between caries prevalence and gender. Mann-Whitney U test was used to find any difference of mean DMFT between different age groups. The p-value was fixed at 0.05.

RESULTS

A total of 586 subjects between ages 11-14 years were recruited for the present study. There were 73% (428) males and 27% (158) females with the mean age of 11.92±1.06 [Table/Fig-1].

The overall prevalence of dental caries was 28.6% in study subjects. Dental caries prevalence was not significantly related among different age groups [Table/Fig-2].

Age (Years)	Male		Female		Total
	N	%	N	%	
11	177	62.7	105	37.3	282
12	110	77.5	32	22.5	142
13	76	85.3	13	14.7	89
14	65	89.0	8	11	73
Total	428	73	158	27	586

[Table/Fig-1]: Characteristics of study population.

Age	Sex	N	Caries prevalence (%)
11	M	116	25.6
	F	106	35.8
12	M	110	30.0
	F	32	28.1
13	M	76	30.3
	F	13	23.1
14	M	65	20.0
	F	8	12.5
	Total prevalence	586	28.6

[Table/Fig-2]: Dental caries prevalence among study subjects in terms of age and gender.
*p=0.34 (Pearson's chi-square test applied).

Initial non cavitated lesions in enamel, cavitated lesion in enamel and distinct cavitations in dentine (code 3, 4, 5) were also recorded in primary dentition (1.5%, 0.9% and 6.8 %) and permanent dentition (5.5%, 1.2% and 14.7% respectively) [Table/Fig-3].

In the maxillary arch, left and right first molar were predominantly affected by dental caries when compared with other teeth (95.3% and 95% respectively) among which the proportion of distinct cavitations in dentine (code 5) was more (2.2% and 2.4% respectively) [Table/Fig-4].

The spectrum followed a similar pattern where lower left and right first molar were the most affected teeth (88.4% and 87.1%) and code 5 was detected predominantly (4.6% and 6%) [Table/Fig-5].

When DMFT was calculated from CAST scores, it was found that overall mean DMFT of the study population was 0.60±1.13. Mean

CAST codes	Description	Primary dentition (%)	Permanent dentition (%)
0	Sound	84.0	75.0
1	Sealed	0	0
2	Restored	1.2	1.2
3	Distinct visual changes in enamel	1.5	5.5
4	Internal caries related discoloration in dentine	.9	1.2
5	Distinct cavitations in dentine	6.8	14.7
6	Involvement of pulp chamber	5.6	2.4
7	Abscess/Fistula	0	0
8	Lost(due to caries)	0	0

[Table/Fig-3]: Prevalence of total spectrum of dental caries (CAST scores) in primary and permanent dentition.

Tooth no.	Code 0	Code 1	Code 2	Code 3	Code 4	Code 5	Code 6	Code 7	Code 8
11	99.8	0	0	0.2	0	0	0	0	0
14	99.3	0	0	0	0.2	0.5	0	0	0
16	95.3	0	1.2	0.9	0.2	2.2	0.2	0	0
17	99.1	0	0	0.2	0	0.5	0.2	0	0
21	99.6	0	0.2	0.2	0	0	0	0	0
24	98.7	0	0.2	0	0	0.9	0.2	0	0
25	99.8	0	0	0	0	0.2	0	0	0
26	95	0	1.4	0.9	0	2.4	0.3	0	0
27	99.5	0	0	0.3	0	0.2	0	0	0

[Table/Fig-4]: Distribution of cast codes in maxillary permanent teeth.

Tooth no.	Code 0	Code 1	Code 2	Code 3	Code 4	Code 5	Code 6	Code 7	Code 8
31	99.8	0	0	0	0	0.2	0	0	0
32	99.8	0	0.2	0	0	0	0	0	0
35	99.8	0	0	0	0	0.2	0	0	0
36	88.4	0	0.7	4.6	0.7	4.6	1.0	0	0
37	96.4	0	0	0	0.2	3.4	0	0	0
41	99.6	0	0	0	0.2	0	0.2	0	0
42	99.8	0	0	0	0	0	0.2	0	0
45	99.3	0	0	0	0	0.7	0	0	0
46	87.1	0	1.2	4.3	0.5	6.0	0.9	0	0

[Table/Fig-5]: Distribution of cast codes in mandibular permanent teeth.

DMFT was not significantly related in between gender. Decayed component (0.53±1.01) was the highest contributor to the DMFT scores [Table/Fig-6].

Age	Sex	N	D	M	F	DMFT±SD	p-value
11	M	116	0.60	0.01	0.09	0.70±1.19	0.12
	F	106	0.57	0.00	0.06	0.62±1.29	
12	M	110	0.32	0.00	0.05	0.36±0.77	0.07
	F	32	0.59	0.00	0.16	0.75±1.24	
13	M	76	0.54	0.00	0.12	0.66±1.25	0.38
	F	13	0.62	0.00	0.08	0.69±0.85	
14	M	65	0.57	0.00	0.05	0.57±1.04	0.74
	F	8	0.38	0.00	0.00	0.38±0.744	
Total		586	0.53±1.01	.00±.083	0.08±.429	0.60±1.13	

[Table/Fig-6]: Decayed Missing and Filled teeth (DMFT) among the study population.
* p<0.05 (Mann-Whitney U test applied).

DISCUSSION

Dental caries is still a major public health problem in many developing countries like India. It has engrossed its tentacles deep

into the regions where there is lack of public awareness, motivation and devoid resources for dental treatment are present [21,22]. Voluminous literature exists about prevalence of dental caries in Indian population but no study was found assessing full spectrum of dental caries which may be useful for planning and implementation of curative services [7]. Thus, the present study was carried out using CAST index among 11-14-year-old school children of Rohtak city, Haryana, India. The 11-14 years age group was chosen for the study taking the advantage of school setting also during this time majority of permanent teeth would have been erupted and are in a stage when the risk of developing caries is highest.

The traditional way of calculating the prevalence of dental caries is unwarranted and ought to be rectified as it does not depict the quantum of treatment required in the population. Thus, using CAST index to report caries helps in early detection and help in planning preventive actions [16].

The content and face validity of CAST Index has already been studied in 15 different countries like China, Thailand, Germany, Canada, Mexico, Brazil, Chile, South Africa, Tanzania, Nigeria, Iraq, Turkey, Finland, United Kingdom and Australia [23]. The reproducibility has been found from substantial to almost perfect depending on the age of participants.

Only few studies have been conducted using CAST Index among populations and thus limiting comparison of our results. Nevertheless, CAST scores can be compared to ICDAS and conventional caries studies. Malik A et al., in Pakistan examined adolescents and adults reporting in outpatient departments [2]. However, such hospital based studies would depict an inflated picture of CAST scores for the population; also the age group is not comparable with our study. Baginska J et al., and Khokkar V et al., conducted studies among 7-8 years in India and Poland respectively [12,24]. Kar S et al., compared CAST scores of 4-12-year-old orphan versus normal children; in absence of any other studies, comparisons were made with results of these above mentioned studies [25].

The number of sealed and restored tooth that is CAST scores 1 and 2 were similar to that reported by Khokhar V et al., and Kar S et al., [24,25], whereas the corresponding figures among Polish children was 34.9% and 7.4% respectively, indicating a much developed school based sealant programs and dental services which are usually lacking in developing countries like India. Even though, Haryana state has pioneered in the field of oral health by establishing dental units in all Primary Health Centres (PHCs), there are substantial proportions of the population with unmet treatment needs depicting a deficient oral health care delivery system. It is also been augmented with Indira Bal Swasthya Yojana, a specific programme targeting school children but our study revealed low percentage of filled teeth among study participants which might be related to lack of felt needs or ineffectiveness of this programme which should be evaluated for better effectiveness.

CAST scores 3 and 4 are comparable with ICDAS scores 1 to 4. According to the study conducted by Souza ES et al., using ICDAS, 11.63% of the subjects examined had Scores 1 to 4 compared to 6.7% in the present study [26]. Categories of CAST scores i.e., Score 5-7 can be used to assess prevalence of dental caries, which can be compared to traditional prevalence studies. About 17.1% of study subjects had either of the codes from 5 to 7 which was higher than that reported by Baginska J et al., (6.6%), and Khokhar v et al., (11.5%), Kar S et al., (4.76%), [12,24,25].

The prevalence of caries among 12 years was 24.2% which was less compared to that reported in National Oral Health Survey (52.5%), Shailee F et al., (32.6%), Das UM et al., (49.2%), Grewal H et al., (36.36%) [4,27,28]. Since, Haryana is one of the endemic fluoride area, the effect of fluoride may be responsible for low prevalence of dental caries in the study population [28]. In the present study, code 4, 5, 6 were more for mandibular left (6.3%) and right first

molar (7.4%) compared to maxillary left (2.6%) and right first molar (2.6%). The difference could be because caries develop mostly in the occlusal surfaces of permanent molars and buccal pits of lower molars.

Similarly, the mean DMFT based on CAST scores in the present study was 0.60±1.13 with decayed component (D) as the main contributor. Similar results were obtained by studies done by Shailee F et al., and Mohammadi SN et al., [4,7] and not in accordance with that reported by Sharma V et al., Goel R et al., and Dhar V et al., [6,22,29]. The mean DMFT of 12 years was 0.45 similar to 1.7 reported by National Oral Health Survey.

In the present study, dental pulp was found to be involved in 5.6% of primary dentition compared to 2.4% in permanent dentition. This can be attributed to greater time period exposure, faster lesion progression, lower enamel to dentine thickness and relatively larger pulp chamber in primary teeth.

The emphasis of CAST index is prevention and risk assessment. It will facilitate health professionals to present the real picture of preventable carious lesions to policy makers. CAST index generates scores which are detailed in nature influencing its amenability for analysis and making it difficult to compare with results of other epidemiological surveys worldwide.

LIMITATION

CAST index has been developed to snap a detailed spectrum of dental caries however, it may be difficult to assess in ages 11-14 years where lesions may be at early stages. In countries like India, where caries prevalence is low CAST may be better suited for adult and geriatric populations. The detailed scoring of CAST is advantageous but difficult to analyze and compare with existing Indices. Incipient carious lesions are characteristically diagnosed in dry environment but using CAST Index as specified by its developers leads to potentially missing these lesions. Further more studies are required for validation and reliability of the index and to make it internationally acceptable for younger age groups.

CONCLUSION

The present study evaluated the prevalence of dental caries using CAST and it was found to be low among school children and hence, the spectrum of dental caries was predominantly characterized by distinct cavitations in dentin in both primary and permanent dentition. Even though, CAST index showed promise in recording the spectrum of dental caries, further studies are required to validate the findings.

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