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Evaluation of Dental Caries in Primary and Permanent Molars of 6-8 Years Old Children Using Caries Assessment Spectrum & Treatment (CAST) Tool

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Keywords

Dental caries, Primary and permanent molars, CAST Index

Abstract

Evaluation of dental caries with an index that covers the whole spectrum of the disease is essential to understand the disease burden among a specific population.

Aim: Evaluation of dental caries using Caries Assessment Spectrum and Treatment (CAST) Index in the primary and permanent molars of 6-8 years old children of North 24 Parganas, West Bengal, India.

Methods and Material: A total of 214 children of 6-8 years old age group were examined clinically after taking consent from the parents and the caries score of permanent and primary molars were evaluated based on CAST scores. The statistical analysis was done using IBM SPSS statistics 23.0 (IBM Corporation, Armonk, NY, USA).

Results: Among the study population, the majority of the permanent first molars (84.1-90.2%) were scored as sound (code 0). For the primary molars, almost 32.7-41.1% of the teeth was scored as sound (code 1), and lowest number of teeth (0-0.5%) had fissure sealant (code 1). Moreover, males had higher risk of having dental caries compared to females and the age group 7-8 years was more caries prone than the 6 year old children.

Conclusion: In a highly populated country like India, the CAST index has been proven to take minimal armamentarium and lesser time comparing other indices. Moreover, it also records a restored tooth as sound and functioning tooth which helps better understanding of the treatment need.

1. Introduction

In recent decades, a wide variety of new methods have been developed to measure caries in a population¹⁻⁸. These methods detect caries lesions based on various diagnostic potentials. Some methods are able to

measure early non-cavitated enamel lesions, which are observed only after drying the tooth surface, as indicated in the International Caries Detection and Assessment System (ICDAS)⁵. Others can detect early non-cavitated enamel lesions without the need to dry

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the tooth surface, as indicated in the Caries Assessment Spectrum and Treatment (CAST)⁹.

For epidemiological surveys, a simpler index which encompasses the full process of caries, has always been crucial. In 2010, Frencken¹¹ first introduced the Caries Assessment Spectrum And Treatment (CAST) index which encodes the full spectrum of the disease i.e absence or presence of caries, dental caries progression and protection by sealant as well as treatment by restoration for carious lesions in enamel and dentine, and pulp involvement with or without abscess formation. Apart from that, the strengths of the ICDAS II and PUFA indices are also incorporated in CAST index. From CAST scores DMF score can be obtained, thereby retains the use of DMF scores. Progress in the sequence of the dental caries process directly synchronizes with the ascending order CAST codes. Hence, advanced the carious process, higher is the CAST code. Another advantage is that, CAST codes consider a restored tooth as a functioning tooth¹¹.

No evidence of dental caries status evaluation using CAST Index among the elementary school going population of North 24 Parganas, West Bengal, India can be found in the literature.

The aim of this study is evaluation of dental caries using Caries Assessment Spectrum and Treatment (CAST) Index in the primary and permanent molars of 6-8 years old children of North 24 Parganas, West Bengal, India. The objectives of the study are to understand the caries prevalence among 6-8 yrs old children, the treatment need and to provide the preventive care, if necessary. Children in the age of 6 to 8 years are considered target group as the first permanent molar erupts in this age and if neglected, these teeth are vulnerable to caries. In our study, the correlation of status of molars is emphasized because at the age of 6-8 years, anterior teeth are in the state of exchange. Hence, the exclusion of incisors and canines in this study supplied us a homogeneous sample of population. Other authors like Honkala et al and Stephenson J et al also followed the same approach⁽¹³⁾⁽³²⁾.

2. Materials and Method

It was a cross-sectional study carried out among a total of 214 children of 6-8 years old children of North 24 Parganas, West Bengal, after getting the ethical clearance from the Institutional Ethical Committee.

Using CAST index, the data regarding the caries score of primary and permanent molars were obtained.

Inclusion criteria were those children whose parents had given consent, whose Frankl behaviour rating scale was 4 and all four permanent molars has erupted fully. Whereas if any of the premolars erupted, then the participant is excluded as it is difficult to determine that its primary antecedent tooth was lost due to normal exfoliation or extraction because of caries. Children who have acute pain or severe facial swelling with respect to any tooth or children with any physical and/or mental disabilities, children having underlying systemic complications specifically any neurological diseases, children under any neurologic or analgesic medications were excluded from the study.

3. Dental Examination

After brushing each tooth surface was examined with a sterile dental mirror and CPI probe (a periodontal probe ending with a 0.5mm ball) which removed dental plaque or debris if present even after brushing. During examination, artificial light (torch) was used to illuminate the oral cavity. Evaluation of teeth was done according to the CAST codes which covers the full extent of caries stages.

A form was developed for this study in which the score of each tooth's surface was recorded. If same surface was having two conditions, the higher score was recorded, for example, a filling in one pit and an enamel lesion in another is present then score for enamel lesion was given. For the intraexaminer reliability, about 5% of the evaluated population was re-examined.

4. Results

Among the study population of 214 children the gender distribution were almost the same (Female 49.1%, Male 50.9%). Table 1 shows the age-sex distribution of the study population.

Age (in years)	Female	Male	Total
6	46 (43.8%)	33 (29.4%)	79
7	30 (28.6%)	42 (38.5%)	72

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8	29 (27.6%)	34 (31.2%)	63
Total	105 (49.1%)	109 (50.9%)	214

Table 1. Age-sex distribution of the study population

Table 2 shows the percentage distribution of caries status of the study population based on the CAST index in primary first and second molars and permanent first molars. Among the permanent first molars majority (84.1-90.2%) was scored as sound (code 0), 1.9-4.2% had fissure sealant (Code 1), 0.5-1.4% of the teeth had code 2, 4.2-5.6% of the teeth had code 3, 1.4-2.8% of the teeth had code 4, 0.9-3.3% had code 5, 0-0.5% of the teeth had code 6. No teeth among the permanent molar teeth had code 7 or code 8.

For the first and second primary molars, almost 32.7-41.1% of the teeth was scored as sound (code 1), the lowest number of teeth (0-0.5%) among the first and second primary molars had fissure sealant (code 1). Among the carious teeth, majority had code-5 (18.7-29.4%) and code-2 (18.3-24.8%). Figure 1 illustrates the distribution of CAST scores among the study population.

Tooth	CAST Score (%)								
	0	1	2	3	4	5	6	7	8
16	90	1.	0.	4.	1.	0.	0.	0	0
	.2	9	5	7	4	9	5		
26	89	2.	0.	4.	1.	0.	0.	0	0

	.7	3	9	2	9	5	5		
36	84	3.	0.	5.	2.	2.	0	0	0
	.1	7	9	6	8	8			
46	84	4.	1.	4.	2.	3.	0	0	0
	.1	2	4	2	8	3			
54	36	0	20	1.	2.	27	6.	0.	4.
	.9		.1	4	8	.6	5	5	2
64	37	0	19	2.	1.	27	7	0.	3.
	.9		.2	3	9	.6		5	7
74	32	0	18	4.	1.	29	8.	1.	3.
	.7		.3	7	9	.4	4	4	3
84	36	0	18	2.	4.	27	6.	1.	2.
	.4		.7	3	7	.1	5	4	8
55	41	0	21	6.	2.	20	6.	0.	0.
	.1		.5	5	8	.6	1	5	9
65	39	0	21	5.	4.	22	6.	0.	1.
	.3			1	2	.4	1	5	4
75	36	0.	23	2.	5.	20	7	0.	3.
	.4	5	.8	8	6	.1		5	3
85	39	0.	24	4.	5.	18	4.	0	2.
	.7	5	.8	2	1	.7	7		3

Table 2. Distribution of CAST codes in evaluated molar teeth

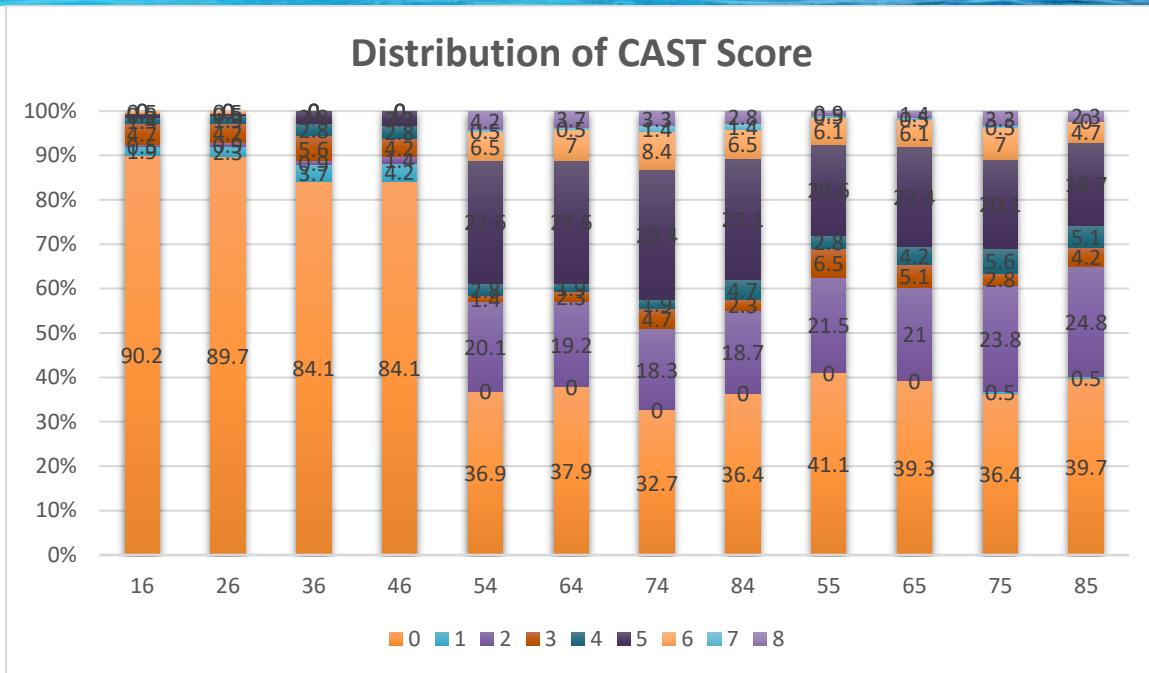


Figure 1. Distribution of CAST score among the study population

Figure 2 shows the comparison of CAST scores between the permanent and deciduous first molars. It is evident from the figure that the majority of the

permanent molars were healthy compared to the deciduous first molars. Maximum of the deciduous first molars had code-2 and code-5.

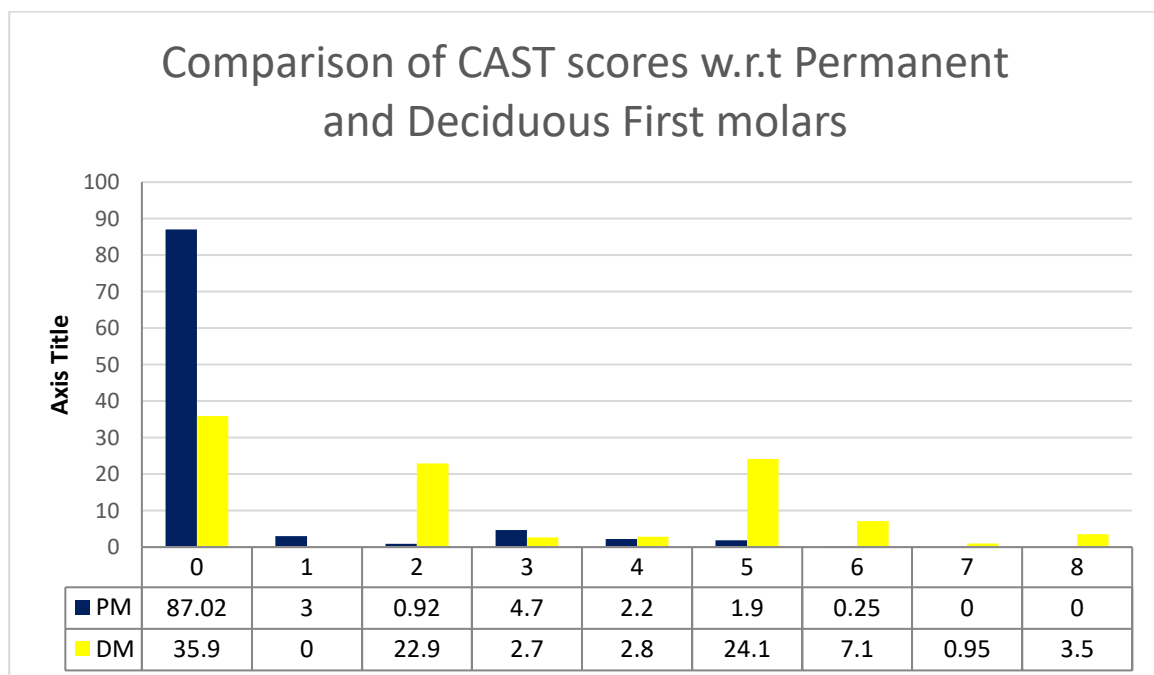


Figure 2. Comparison of CAST scores w.r.t Permanent and Deciduous First molar

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Table 3 shows the association between the CAST scores of 3 or higher and demographic variables such as age and gender. It revealed that males had 1.09 times higher risk of having CAST score or 3 or more compared to females. Also, the age group 7-8 had 1.114 times higher risk of having CAST score or 3 or more compared to the 6 year old children. However the results were not statistically significant.

Variables	CAST Score \geq 3 n (%)	Unadjusted Odd's Ratio	95% CI
Gender			
Female	78 (49.7%)	1.097	0.598-2.013
Male	79 (50.3%)		
Age (Years)			
6	59 (37.6%)	1.114	0.592-2.097
7-8	98 (62.4%)		

CI: Confidence interval; CAST: Caries Assessment Spectrum and Treatment

Table 3. Association between having CAST score of ≥ 3 with demographic, knowledge and oral health related variables

Table 4 illustrates the correlations of CAST codes in evaluated molar teeth. The analysis of CAST codes in primary second and permanent first molars shows a strong correlation between caries stages in the right and left sides of the oral cavity.

	Spearman's rho	p-value
Left-right correlations		
16/26	0.761	<0.001*
46/36	0.785	0.005*
55/65	0.822	<0.001*
85/75	0.569	<0.001*
54/64	0.686	<0.001*

74/84	0.47	<0.001*
Neighbouring teeth correlations		
16/55	0.303	<0.001*
26/65	0.256	<0.001*
36/75	0.231	0.001*
46/85	0.247	<0.001*
55/54	0.614	<0.001*
65/64	0.430	<0.001*
75/74	0.237	<0.001*
85/84	0.326	<0.001*
Upper-lower jaw correlations		
16/46	0.532	<0.001*
26/36	0.572	<0.001*
55/85	0.369	<0.001*
54/84	0.442	<0.001*
65/75	0.619	<0.001*
64/74	0.425	<0.001*

Table 4. The correlations of CAST codes in evaluated molar teeth (Spearman's correlation coefficient)

The correlation of first and second primary teeth was stronger for the left side of the mouth and in mandible the correlation was stronger in the right side, r was 0.326 and 0.237 in right and left side ($p < 0.001$), respectively. For the adjacent primary and permanent molars r values were lower than 0.5, which meant a weak correlation.

With regard to the teeth situated in opposite jaws the study revealed that the correlations between left primary second molars were the strongest (0.619). The weakest correlations were found between right primary second molars (0.369). All the correlations were statistically significant.

5. Discussion

In the present study, significant relationship between the prevalence of dental caries and gender was found. It revealed that males had 1.09 times higher risk of having CAST score of 3 or more compared to females. This result is in line with the findings of a longitudinal study by Baginska et al¹⁰, which stated gender to be a

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dental caries predictor with boys being more affected than girls.

Our study reported a high prevalence of caries in deciduous molars which is in agreement with previously reported data by Das D et al in 2013¹². They evaluated dental caries experience in school children of 6-8 years and found out 58.99% prevalence of dental caries in primary dentition which is slightly lower than our finding at 63.1%. They have also evaluated the caries prevalence of permanent dentition of the same age group which was 15.11%. It is comparatively higher than our finding of 12.85%.

It was also observed that more than 3.3% of primary molars were in serious stage of pulpal involvement while only 0.5% of permanent molars suffered from pulp involvement and abscess. There was also a positive correlation found between DMFT level and PUFA index which shows the fate of severe dental caries when left untreated^{14,15}.

In the present study, the percentage of teeth showing mortality (CAST code 8) was comparable between lower first lower primary molar (2.8%-3.3%) and lower second primary (2.3%-3.3%). The study of Baginska and Stokowska¹⁰ reported high percentage morbidity of second primary molars while several other studies revealed the opposite¹⁶⁻¹⁸.

In this population, about 3% of the permanent molars were having dental caries and about 0.5% of the upper permanent first molars were cavitated with a pulpal exposure. This could be attributed to the fact that only 3% of the total permanent first molars were having sealants. This result is in contrast with the study conducted by Baginska et al¹⁰ where 34.9% of the permanent first molar was sealed with sealant and dental carious lesion (CAST code 4 and 5) was much lesser at about 2.1%. Sharma et al. conducted a study among 5-8 years' age group of children in Nagrota Bagwan of Kangra, Himachal Pradesh, where they found out that the need of pits and fissure sealants among the children was highest (almost 50%)¹⁹. For those children who were high at risk of developing dental caries, pit and fissure sealants are advised²⁰⁻²².

In our study, around a quarter of the children (24.18%) had distinct cavitation (CAST code 5) in primary molars dentition. A recent study²³ showed similar results in 6- to 7- year-old Polish children. The prevalence of cavitated dentine lesions (a CAST score of 5) and pulp involvement was high in the primary molars.

It was also observed that pulpal involvement (CAST code 6), the category where distinct dental cavity reaches the pulp along with/or the presence of root fragments, was found to be the most serious stage in 6.5% (primary teeth) and 0.5% (permanent teeth) of the subjects.

No teeth were scored with CAST code 9 (teeth that didn't correspond to any of other categories like tooth missed due to trauma). This result was in accordance with other contemporary studies by Bangiska et al, Shyam R et al and others^{10,24,25}.

A strong correlation was found between molars situated on the opposite side of the jaws measured by the CAST index in both primary and permanent dentitions. In our study, the correlation of the status of first and second primary teeth was stronger for the left than for the right side of the mouth; Spearman Ratio (r) was 0.614 and 0.430 in maxilla and in mandible the correlation was stronger in the right side, r was 0.326 and 0.237 in right and left side ($p < 0.001$), respectively. This is in line with the findings of Baginska,¹⁰ but only for the maxillary arch. However, Doneria et al²⁶ showed a stronger correlation between right side of the first and second primary molars of the lower arch.

We found a strong correlation between the conditions of contralateral molars measured by the CAST index in primary dentition. A certain degree of symmetry in caries distribution was also observed for teeth in upper and lower jaws, which is in accordance with the previous reports by Burnside G et al^{27,28}.

With regard to the teeth situated in opposite jaws the study revealed that the correlations between left primary second molars were the strongest. The weakest correlations were found between right primary second molars. This result is in contrast with the contemporary studies by Baginska et al and others^{10,27,29}, that showed that inter-arch correlation of CAST codes among second primary molars are relatively weak.

Caries observed in more than two surfaces of primary second molars may be a clinically useful predictor at 6 years of age for future caries development in the next 6 years on mesial surfaces of permanent first molars, and/or as a whole develop an extensive amount of lesions in permanent teeth³⁰. The combination of quicker lesion progression in the primary enamel, its relative lack of thickness, and the proximity of the relatively larger pulp chamber could

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be the probable risk factors when compared to permanent teeth³¹.

Hence, the present study showed the usefulness of the CAST index but the generalizability is limited as the disease prevalence and treatment needs were assessed in a local city population.

6. Conclusion

The CAST index has been proven to take minimal armamentarium and lesser time comparing other indices gaining popularity over 50 countries since its emergence. The need for awareness around caries prevention has again come to the light as the result of our study has shown very limited amount of sealant in permanent dentition and almost minimal in case of primary dentition. Overall, our study has put forward an avenue of betterment for children considering the present scenario of non cavitated lesion, the need for diet counselling and oral hygiene awareness.

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