

# Dental Caries in Primary and Permanent Molars in 7-8-Year Old School Children Evaluated with Caries Assessment Spectrum and Treatment (CAST) Index from Bangalore North

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## ABSTRACT

**Introduction:** Caries is a common biofilm-mediated chronic disease that affects all ages. So, the study was done to evaluate caries in primary and first permanent molars of 7-8-year-old children by the Caries Assessment Spectrum and Treatment (CAST) index and to find whether there was any correlation between the caries stages in such teeth.

**Materials and methods:** The study covered 100 7-8-year-old children from randomly selected schools in the North Bangalore. The prevalence of CAST categories was evaluated with regard to the first and second primary, and first permanent, molars. The Spearman's rank correlation coefficient was used to explore the correlation of the distribution of CAST codes among the evaluated teeth. This parameter is compared using Kruskal-wallis non parametric test. The level of statistical significance was established at  $p < 0.1$ . The intra-examiner reliability was determined by the unweighted kappa coefficient.

**Results:** With regard to deciduous teeth, 70% subjects showed a dentin cavity (code 5) as the most serious caries stage. In 1<sup>st</sup> and 2<sup>nd</sup> primary molars, caries was most often recorded at the stage of cavitated dentin lesion. With regard to the permanent molars, enamel lesions were most prevalent (code 3) and most lesions were scored at the non-cavitation level. Teeth with pulpal involvement, sepsis and extracted due to caries were found to be more prevalent in first, and then in second primary molars. The strong correlation was found in teeth present in maxilla and mandible. The 'r' value was 0.217 and 0.109 in maxilla and mandible ( $p < 0.1$ ), respectively. For neighbouring primary and permanent molars 'r' values were lower than 0.1, which meant a weak correlation.

**Conclusion:** A strong correlation was found between the status of teeth from the maxilla and mandible. The study proved the usefulness of the CAST index in epidemiological surveys.

**Keywords:** Caries pattern, CAST index, Children

## INTRODUCTION

Untreated caries can lead to pain, loss of teeth and impaired quality-of-life. The development of a caries lesion is the result of a complicated interplay of many factors. In most cases, caries develops slowly and the process may arrest spontaneously. However, the disease is not usually self-limiting and without adequate treatment the process can continue until the tooth is destroyed. Therefore, there is increasing emphasis on the importance of effective early intervention and a prerequisite is reliable assessment of the presence and activity of a lesion at an early non-cavitated stage of the disease process.<sup>1,2</sup>

Dental caries remains a serious problem in many populations worldwide with a marked increase in prevalence over the last decade; hence a continued surveillance of the dental epidemiological status is of paramount importance. Dental

caries, if left untreated can lead to pain, loss of teeth, and impaired quality of life.

DMFT, the most commonly used tool, ignores the presence of precavitated lesions and is unable to categorize caries in different stages of its advancement. From the practical point of view, the most advantageous solution in epidemiological surveys is to use a single index describing the full continuum of a disease.

Hence, an innovative caries detection index namely Caries assessment spectrum and treatment (CAST) has been introduced, which has the integral capability to record the whole progressive spectrum of dental disease and also the inclusion of filled teeth in the category of sound teeth.<sup>3-5</sup>

Many initiatives were taken since late 19<sup>th</sup> century to develop an index that records the diverse spectrum of this pandemic disease.<sup>6</sup> One such remarkable step against the apparent need was taken almost a decade back, when a visual/tactile inspection based caries index was introduced as ICDAS (International Caries Detection and Assessment System). This index records both the restorative and the carious status from earliest visual change in enamel to the dentinal cavitation in a two digit coding system. However, ICDAS faced the reluctance for its application due to multiple reasons with its complicated recording criteria topping the list.<sup>7,8</sup>

Furthermore, the burden of dental caries in developing countries is fundamentally because of the untreated part of dental caries. Thus, as a perceptible need in 2010, PUFA/pufa (Pulpal involvement, Ulceration, Fistula, Abscess) was reported that pertinently record the later consequences of dental caries. However, PUFA was recommended to be used as an adjunct to standard caries indices.

Keeping in view the intricacy of ICDAS, restraint nature of PUFA and no potential ways to compare their outcomes with DMF, suggests the need for the introduction of a superior doorstep for the diagnosis of initial reversible stages of caries development. This goal was accomplished in 2011, when the potencies of ICDAS, PUFA and the DMF index were amalgamated by the faction of people from the Radboud University Nijmegen

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Medical Centre, The Netherlands (Jo E. Frencken, Rodrigo G. de Amorim) and from the University of Brasília, Brazil (Jorge Faber and Soraya C. Leal). This innovation has been given the title “Caries Assessment Spectrum and Treatment” (CAST) as illustrated in table-1. This index is proposed to be used worldwide.<sup>7</sup>

CAST index reports the progressive nature of dental caries which will facilitate the health-care providers to present the real picture of preventable carious lesions, which up till now was just accounted as cavities in epidemiological studies.<sup>9</sup>

Hence the objective of the study was to evaluate caries in primary and permanent molars of 7-8 years old children from Bangalore North by the CAST index and to find whether there was any correlation between caries stages in such teeth.

## MATERIAL AND METHODS

The presented data is a part of a cross-sectional survey conducted in the North Bangalore. Parents or caregivers were asked to sign a written statement of consent for child’s participation in the study. In total, 100 children aged between 7 and 8 years were examined during the study. Only those children who had all four permanent molars fully erupted were selected for a further analysis. We also excluded subjects with any of the premolars erupted because in those cases we were not able to determine whether a primary molar was exfoliated or extracted due to caries. The minimum size of the sample population was calculated with the help of sample size calculator software and size was determined to be 100 subjects.

### Dental examination

The dental examination was performed by one examiner. The teeth were evaluated according to the CAST recommendations mentioned in Table-1. The index has a hierarchical structure and covers the full spectrum of caries stages, from a sound surface, pit and fissure sealants, dental fillings, caries lesions in enamel and dentine, a pulpal and periapical inflammation, through to a tooth loss due to caries. The prevalence of particular conditions from tooth reversible premorbidity (Enamel lesions) through to tooth’s mortality (Extraction) was calculated pursuant to the scheme suggested by Frencken et al.<sup>7</sup> Prior to the survey, a training session consisting of the theoretical and practical parts was conducted. The theoretical part included the study of the literature and materials provided by the authors of the CAST

index; then the extracted primary and permanent molars were evaluated with regard to the presence of CAST codes.<sup>10</sup>

During the survey, the children were examined in school rooms where an artificial light was used to illuminate the oral cavity. The status of each tooth surface was checked using a plane dental mirror and a periodontal probe ending with a 0.5 mm ball. The probe was also used for the removal of dental plaque or debris present despite prior tooth brushing. A dental examination was carried out for all teeth present in the child’s mouth. The status of each tooth’s surface was recorded separately on a form developed for this study (Table-2). If two conditions were present on the same surface, e.g. a filling in one pit and an enamel lesion in another, or an enamel lesion in one pit and a cavity in another, the higher score was recorded. If an abscess or a fistula was present, all surfaces with an open cavity were scored with code 7. The highest code for each tooth was selected for a further analysis. About 5% of the evaluated population was re-examined at the end of each day in order to determine the intra-examiner reliability.

## STATISTICAL ANALYSIS

The prevalence of each caries stage was evaluated with regard to all deciduous and permanent teeth, and separately to the first and second primary, and first permanent, molars. The Spearman’s rank correlation coefficient was used to explore the correlation of the distribution of CAST codes between first and second primary molars, second primary and first permanent molars, the counterpart molar teeth from the right and left side of the dental arch and the molars located in the opposite jaws. The level of statistical significance was established at  $\alpha < 0.1$ . The intra-examiner reliability was determined by the unweighted kappa coefficient. The parameter is compared using Kruskal-wallis non parametric test.

## RESULTS

With regard to deciduous teeth, 70% subjects showed a dentin cavity (code 5) as the most serious caries stage. In 1<sup>st</sup> and 2<sup>nd</sup> primary molars, caries was most often recorded at the stage of cavitated dentin lesion. Serious morbidity was found to be more prevalent in 1<sup>st</sup> and then in 2<sup>nd</sup> primary molar. Pulp involvement (Code 6) was more prevalent in 1<sup>st</sup> primary molar.

For permanent teeth, enamel lesions were most prevalent

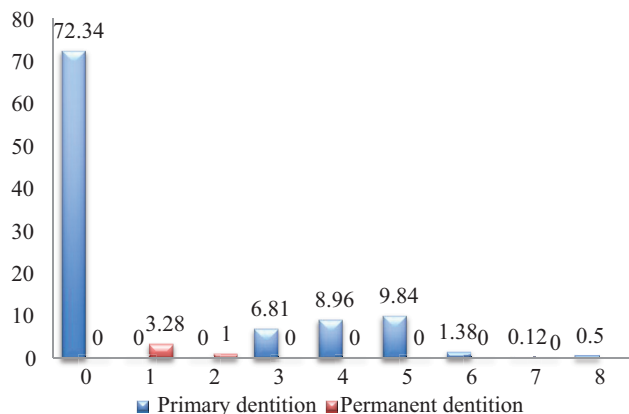
Cast codes Characteristics	Code	Description	Concept of health
Sound	0	No visible evidence of a distinct carious lesion.	Healthy
Sealed	1	Pit and / or fissures are at least partially sealed with a sealant material	
Restored	2	A cavity is restored with a (in)direct restorative material	
Enamel	3	Distinct visual change in enamel only. A clear caries discolouration is visible with or without localised enamel breakdown	Reversible premorbidity
Dentin	4	Internal caries-related discolouration in dentin. The discoloured dentin is visible through enamel which may or may not exhibit a visible localised breakdown of enamel	Morbidity
	5	Distinct cavitation into dentin. The pulp chamber is intact.	
Pulp	6	Involvement of pulp chamber. Distinct cavitation reaching the pulp chamber or only root fragments are present.	Serious morbidity
Abscess/fistula	7	A pus containing swelling or a pus releasing sinus tract related to a tooth with pulpal involvement.	
Lost	8	The tooth has been removed because of dental caries.	Mortality
Other	9	Does not correspond to any of the other categories.	

**Table-1:** Caries assessment spectrum and treatment (cast) index

Group	N	Min	Max	Mean	Std. Deviation	U	Sig	p value
Upper Right	99	0.000	10.000	2.687	2.884	4423.500	NS	0.217
Upper left	99	0.000	12.000	3.343	3.114			
Lower Right	99	0.000	11.000	2.152	2.647	5462.500	NS	0.109
Lower Left	99	0.000	12.000	1.727	2.910			

NS: Significant Note: This parameter is compared using Kruskal-wallis non parametric test

**Table-2:** Permanent molar with Primary molar



**Figure-1:** Enamel lesions

(code 3). No children could be put under categories 7 and 8 in permanent teeth (Figure-1). In permanent molars, most lesions were scored at the non cavitated level. The prevalence of sealants and restoration were very less. Results Strongly suggests lack of awareness for prevention of oral diseases is actually leading to the deteriorating oral health status. The strong correlation was found in teeth present in maxilla and mandible. The 'r' value was 0.217 and 0.109 in maxilla and mandible ( $p < 0.1$ ), respectively (Table-3). For neighbouring primary and permanent molars 'r' values were lower than 0.1, which meant a weak correlation.

## DISCUSSION

This study has been undertaken to evaluate the complete spectrum of dental caries experience using a new caries detecting tool CAST index. This index has the integral capacity to record the whole progressive spectrum of dental caries. Gives a modern approach to filled teeth due to their inclusion in the category of sound teeth. It is useful for prevention and risk assessment of caries. Promising index for epidemiological research studies.

This index was developed because of the need to find a reliable, pragmatic cohesive and easy to read reporting system which is based on the strengths of PUFA and ICDAS-II indices and provide a link to the widely used DMF index (M and F component). It covers the total dental caries spectrum – from no carious lesion, through caries protection (sealant) and caries cure (restoration) to carious lesions in enamel and dentine, and the advanced stages of caries lesion progression in pulpal and tooth surrounding tissue.<sup>6</sup> It does not record active and inactive carious lesions. The CAST index has not been validated, nor has its reliability been tested. It is also not suggested for use in clinical trials. Other limitation can be that it does not provide data on treatment or preventive measures required for each code. CAST index can be used to determine the level of dental caries, whether in enamel or in dentine. Enamel caries lesions in the CAST instrument are represented by one category only, in

ICDAS system, three different stages are represented as enamel lesions. Reporting of the caries status according to CAST allows for the presentation of a pre morbidity stage, which will be helpful in preventive care. CAST index is helpful in scoring Dentin lesions which can be treated at initial stages.<sup>11</sup>

We observed that the pulpal involvement, the category involving a cavity reaching the pulp or the presence of root fragments, was found to be the most serious stage in 10% (primary teeth) and 0.3% (permanent teeth) of the subjects.

The neglects in dental treatment with regard to the deciduous dentition have been observed worldwide. It was previously proven that the dmft level positively correlated with the number of teeth scored with the pufa (pulpal involvement-ulceration-fistula-abscess) index assessing the consequences of untreated dental caries.<sup>12,13</sup>

We decided to primarily concentrate on the correlations between the status of molars because of the considerable dynamics of front teeth exchange in children at the age of 7–8 years. we excluded incisors and canines from the analysis which helped us to keep the homogeneity of the study population. We observed that the percentage of teeth with enamel lesions was at a similar level for second primary and first permanent molars, but with regard to first primary molars the prevalence of code 3 was lower. The tendency that cavitated lesions were more prevalent in primary than in permanent molars was very clear. The presented results are in accordance with the study of Honcala et al.<sup>14</sup> On Estonian children aged 7 and 8 years who assessed molar teeth by the ICDAS criteria. The enamel lesions visible on wet teeth (ICDAS code 2), located on occlusal surfaces of first permanent molars (up to 17% of the teeth) were most prevalent in their study. The highest percentage of teeth with dentine lesions in Estonian children was observed for lower second primary molars. At the age of 7-8-years the factors causing dental caries act too short to induce the development of deep cavities in permanent teeth. Primary teeth are also more prone to a faster lesion progression from enamel to dentine and then to the development of pulpitis due to a lower thickness and a relatively larger pulp chamber in comparison to permanent teeth. In the present study, the percentage of molars with a serious morbidity (involvement of pulp and tooth surrounding tissues) was especially high for second primary molars, and these teeth also showed the highest tooth mortality (CAST code 5 and 6). This observation is in contrast to many previous studies where first primary molars were reported to be more affected than second ones. Occlusal surfaces of permanent molars and buccal pits of lower molars are most prone to the development of caries lesions. sealants are strongly recommended in the high risk populations.<sup>15</sup>

## CONCLUSION

CAST has introduced a new paradigm by reassessing the pathogenesis of dental caries. Paradigm has shift from curative

to preventive dentistry. On the basis of these results CAST index may be proposed to have the potential for scoring the whole spectrum of dental caries.

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