

Reliability of Cast Index for Dental Caries Detection

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ABSTRACT

Objective: To access the inter-examiner reliability of CAST (Caries Assessment Spectrum and Treatment) index for detecting dental caries status among patients visiting a public sector dental hospital of Karachi, Pakistan.

Study Design: Cross sectional study.

Place and Duration of Study: This study was conducted in the dental diagnostic outpatient department of a public sector dental hospital, Karachi, Pakistan, over a period of one month from September 2013 to October 2013

Materials and Methods: Selected/consented participants were examined for dental caries status by the two trained and calibrated examiners using CAST index. A structured and validated proforma was used to record the findings. The inter-examiner reliability was undertaken to find out the reproducibility of this novel method of caries examination. Data entry and analysis was done using SPSS software at 5% level of significance. Descriptive statistics were performed that involved the frequencies of age and gender. Inter-examiner reliability of CAST was assessed using percentage agreement and Cohen's Kappa value.

Results: A total of 100 subjects were recruited for the present study. There were 63% females and 37% males with a mean age of 31 ± 17 years. The percentage agreements obtained for the two examiners were between 70-100% for 9 different codes of the CAST index. The Cohen's Kappa value identified was 0.99.

Conclusion: A strong inter-examiner reliability has been observed for scoring the CAST index which exemplifies the entire patho-physiological phases of dental caries. Results of this study substantiate the potential of CAST index for reproducibly scoring the enamel, dentine and pulp lesions.

Key Words: Dental Caries, Primary Prevention, Reproducibility of Results.

INTRODUCTION

In order to control the caries development by the execution of various caries-preventive strategies, diagnosis of the preliminary stages of dental caries is imperative and entails reliable and validated tools that can recognize the various stages of enamel carious lesions; both the cavitated and non-cavitated stages¹.

Dental caries has been evidently established as a multifactorial and highly preventable² oral disease that marks clinically as a path from preliminary visual change in enamel to frank cavitation. White spot enamel lesion is the foremost visible sign of dental caries that can be reversed and arrested through recommended preventive measures from being changed into a cavitated lesion^{3,4}.

DMFT (decayed missing and filled teeth) index has been established almost eighty years ago and still it is used as an effective tool to measure the dental caries status⁵. However, after an exceptional change that took place in the history of preventive dentistry which shifted the paradigm from curative to preventive dentistry⁶, critical questions raised against DMFT index. This was because of the incapability of this index to measure the early enamel and dentinal lesions and therefore may not be applied in low dental caries communities⁷.

In this context inventiveness began in order to develop an index that records the diverse spectrum and all the patho-physiological stages of dental caries⁸. ICDAS (International Caries Detection and Assessment System) was introduced ten years back and demonstrated the potential to record the carious status from most primitive visual change to frank cavitation. But, ICDAS also presented with certain limitations such as complex recording standards, non-compatibility with DMF/S, difficult outcome measure elucidations, non-differentiated criteria for measuring dental caries in primary and secondary dentition and incapability to document the complications of dental caries involving pulp and surrounding tissues^{9,10}. In developing countries, cavitated teeth are not being treated for diverse reasons¹¹, but when in 2010, PUFA/pufa (Pulpal involvement, Ulceration, Fistula, Abscess) index was reported it claim to measure the later infectious stages of dental caries ahead of the pulpal involvement and depicted the burden of untreated carious lesions. However, this index can only be complementarily applicable with other caries detection indices^{10,12}.

In this state of affairs, CAST (Caries Assessment Spectrum and Treatment) index was evolved in 2011. This index demonstrated the strengths of ICDAS, PUFA and DMF/S. CAST index has a simple,

convenient and reliable 9 digit coding system which demonstrates the complete spectrum of dental caries¹⁰. The face and content validity of CAST has already been reported and a monograph has published¹³, but, this novel index can only be recommended for use in epidemiological world, when its reliability and validity will be tested across the globe. Therefore, the present study was planned to access the inter-examiner reliability of CAST index, for detecting dental caries among patients visiting a public sector dental hospital of Karachi, Pakistan.

MATERIALS AND METHODS

This Cross sectional study was conducted in the dental diagnostic outpatient department of a public sector dental hospital, Karachi, Pakistan, over a period of one month from September 2013 to October 2013. Informed verbal consent was obtained from all the participants. Subjects with any systemic or oral disease, dental prosthesis, poor manual dexterity, absence of any indexed teeth and non consenting cases were excluded from the study. The two trained and calibrated examiners (AM, MM) performed the dental examination using a mouth mirror and a probe on cleaned and dry tooth surfaces. The novel caries assessment index; CAST was employed to record the dental caries status of all the selected participants. A structured and validated proforma including the demographic details and dental chart (for primary and secondary dentition) was used to record the findings. Inter-examiner reliability in evaluating the sound teeth, sealants, restorations and carious lesions affecting enamel, dentine and pulp in both primary and permanent dentitions, was clinically determined. This was undertaken to find out the reproducibility of this novel method of caries examination. Data was entered and analyzed using Statistical Package for Social Science (SPSS) version 16. The 'P' value was assigned at 5% and the power of the test was kept at 80%. Descriptive statistics were performed that involved the frequencies of age and gender. Inter-examiner reliability of CAST index was assessed using percentage agreement and Cohen's Kappa value. Kappa values above 0.75 signified excellent agreement, while values between 0.40 and 0.75 signified good agreement¹⁴.

RESULTS

A total of 100 subjects were recruited for the present study. There were 63% females and 37% males with a mean age of 31 ± 17 years and a range of 65 years. The percentage agreements obtained for the two examiners were between 70-100% for different codes (0-9) of the CAST index (table 1). The Cohen's Kappa value identified was 0.99.

Table No.1: CAST Codes and Inter-Examiner Percentage Agreements

CAST Codes	Code Descriptions	Percentage Agreements
0	Sound	100%
1	Sealed	80%
2	Restored	80%
3	Distinct visual change in enamel	90%
4	Internal caries-related discoloration in dentine	90%
5	Distinct cavitation into dentine	70%
6	Involvement pulp chamber	70%
7	Abscess / Fistula	70%
8	Lost	100%
9	Does not match with any of the other categories	100%
A	Absent	100%

Table No.2: The Codes and Description of CAST.

Codes	Charac-teristic	Description
0	Tooth	Sound. No visible evidence of a carious lesion is present
1	Sealed	Sealed. Pits and Fissures have been at least partially covered with a sealant material
2	Restored	Restored. A cavity has been restored with an (in)direct restorative material, currently without a dentine carious lesion and no fistula/abscess present
3	Enamel	Distinct visual change in enamel A clear carious related discoloration (white or brown in color) is visible, including localized enamel breakdown without clinical visual signs of dentinal involvement
4	Dentine	Internal caries-related discoloration in dentine The lesion appears as shadows of discolored dentin visible through enamel which may or may not exhibit a visible localized breakdown
5	Dentine	Distinct cavitation into dentine. No (expected) pulpal involvement is present
6	Pulp	Involvement of pulp chamber Distinct cavitation reaching the pulp chamber or only root fragments are present
7	Pulp	Abscess /Fistula. A pus containing swelling or a pus releasing sinus tract related to a tooth with pulpal involvement is present
8	Lost	The tooth has been removed because of dental caries
9	Other	Does not match with any of the other categories
A	Absent	The tooth has not been erupted

DISCUSSION

So far very limited data is available that can recommend the use of this newly developed pragmatic index, CAST in dental epidemiology, therefore this study was undertaken to evaluate the reliability of CAST index for identifying and recording the whole progressive spectrum of dental caries. This is one of the first epidemiology studies on CAST, which has revealed the inter-examiner reliability of this index.

The two examiners (AM, MM) were trained, calibrated and supervised by an experienced epidemiologist trained from Department of Global Oral Health, College of Dental Sciences, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands. Examiners undergone theoretical training for using CAST index, summary of the codes and criteria are shown in Table 2. The training involved recording of the index on individual subjects by the two examiners, followed by discussion sessions. This training process continued on different subjects until the two examiners consistently scored the same value of each tooth surface, achieving at least a 90% agreement for the whole mouth.

Even being a latest analytical tool employed to assess dental caries, CAST index has given a strong inter-examiner reliability in this study. The overall Cohen's kappa value found in this study was 0.99, which suggest an excellent agreement between the two observers. On the basis of these results CAST index can be proposed to have the potential for reproducibly scoring enamel, dentine and pulp lesions. In contrast the reported kappa values are 0.51 and 0.86 for ICDAS and DMFT indices, respectively^{15, 16}, whereas it was found to be 88% for another developing index for dental caries detection, the Nyvad's new caries diagnostic criteria¹.

Also this was not an unexpected finding while recording CAST scores, that 100% agreement was observed on codes 0, 8, 9 and A (sound and missing teeth). However, 90% agreement on code 3 & 4 (enamel and dentine lesion) was highly substantial and recognition should be given to the training and calibrating team of department of community and preventive dentistry, DIKIOHS, DUHS. Results demonstrated that 80 and 70% similarity was observed for restorative status (code 1 & 2) and later consequences of dental caries (code 6, 7 & 8) respectively.

CAST index has laid down the foundation to identify the pathogenesis of dental caries including the basic reversible and avettable stages of this pandemic disease. This is imperative to figure out in order to improve the oral health status especially in developing countries like Pakistan where 70% of the total population living in rural areas¹⁷, cannot afford an extra burden of treating dental diseases, specifically

caries which has been recognized as forth expensive disease to get treated¹⁸.

The likelihood that some proportion of examiners agreement can occur by chance is a recognized limitation^{19, 20}, and this study is not an exception.

CONCLUSION

A strong inter-examiner reliability has been observed for scoring the simple but structured and pragmatic CAST index which exemplifies the entire pathophysiological phases of dental caries. Results of this study substantiate the potential of CAST index for reproducibly scoring the enamel, dentine and pulp lesions. However, there is a need for more research on this unexplored endeavor.

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REFERENCES

1. Shankar S, Naveen N, Kruthika M, Vinay S, Shaikh H. Comparison of def index with Nyvad's new caries diagnostic criteria among three to six years old children in a school at Bangalore city. *Ind J Dental Res* 2012; 23 (2):135.
2. Petersen PE, Phantumvanit P, Perspectives in the Effective use of Fluoride in Asia. *J Dental Res* 2012;91(2):119-121.
3. Hiremath SS. Textbook of preventive and community dentistry. New Delhi: Reed Elsevier India Private Ltd 2007.
4. Featherstone J. The continuum of dental caries evidence for a dynamic disease process. *J Dental Res* 2004; 83(1): C39-C42.
5. Fejerskov O, Baelum V. Changes in prevalence and incidence of the major oral diseases. In: Guggenheim B, Shapiro H, editors. *Oral Biology at the Turn of the Century: Truth, Misconcepts and Challenges*. Basel: Karger;1998.p.1-11.
6. Vibeke B, Heidmann J, Nyvad B. Dental caries paradigms in diagnosis and diagnostic research. *Europ J Oral Sci* 2006;114(4): 263-277.
7. Fejerskov O. Changing paradigms in concepts on dental caries: consequences for oral health care. *Caries Res* 2004; 38(3):182-91.
8. Ismail AI. Visual and visuo-tactile detection of dental caries. *J Dental Res* 2004;83(1):C56-C66.

9. De Amorim, Guedes R, et al. Caries experience in a child population in a deprived area of Brazil, using ICDAS II. Clin Oral Invest 2012;16(2): 513-520.
10. Frencken JE, de Amorim RG, Faber J, Leal SC. The Caries Assessment Spectrum and Treatment (CAST) index: rationale and development. Int Dental J 2011; 61 (3):117-23.
11. Baelum V, van Palenstein Helderman W, Hugoson A, et al. A global perspective on changes in the burden of caries and periodontitis: implications for dentistry. J Oral Rehab 2007;34:872– 906.
12. Monse B, Heinrich •Weltzien R, Benzian H, Holmgren C, van Palenstein Helderman W. PUFA “An index of clinical consequences of untreated dental caries”. Community Dentistry and Oral Epidemiol 2009; 38(1):77-82.
13. Pitts NB. How the detection, assessment, diagnosis and monitoring of caries integrate with personalized caries management. Detection, Assessment, Diagnosis and Monitoring of Caries 2009; 1–14.
14. Fleiss IL. The measurement of interrater agreement in statistical methods for rates and proportions. Wiley: New York; 1981.p.212-232.
15. Diniz, Michele Baffi, et al. Reproducibility and accuracy of the ICDAS- II for occlusal caries detection. Community Dent and Oral Epidemiol 2009;37(5): 399-404.
16. Wyne, Amjad H., et al. Caries prevalence in Saudi primary schoolchildren of Riyadh and their teachers' oral health knowledge, attitude and practices. Saudi Med J 2002;23(1): 77-81.
17. Sattar K. A sustainable model for use of ICTs in rural Pakistan. Int J Edu and Dev using ICT 2007;3(2).
18. Kathmandu, Robert Yee. The burden of restorative dental treatment for children in third world countries. Int Dent J 2002; 52(1): 1-9.
19. Banting, David W, et al. Examiner training and reliability in two randomized clinical trials of adult dental caries. J Public Health Dent 2011;71(4): 335-344.
20. Sim J, Wright CC. The kappa statistic in reliability studies: use, interpretation, and sample size requirements. Phys Ther 2005;85(3):257-68.

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