

Evaluating the Validity of ICDAS II and Cast Index among 18 To 50 Years Old Population In Chengalpattu District-A Cross Sectional Study

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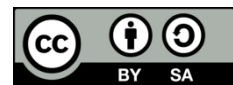
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ABSTRACT

Dental caries remains a prevalent public health issue worldwide, demanding effective diagnostic tools. The International Caries Detection and Assessment System (ICDAS II) and Caries Assessment Spectrum and Treatment (CAST) index are widely used methods, yet their validity in specific populations like those in Chengalpattu District, India, remains understudied.

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I. INTRODUCTION

Dental caries is regarded as a communicable disease that demineralizes the surface of the enamel, causing malfunction in the teeth.^{1,2} There are now three distinct environments that can influence the development of dental caries: the host, the agent, and the environment.³⁻⁵ According to published research, Lactobacillus and Streptococcus species are the most common bacterial species used in disease models of dental caries.^{6,7} But because the organisms that cause disease are more intricate in nature—many different bacteria, including candida, have been identified in biofilm—biofilm is more likely to accumulate pathogenic organisms.⁸ Given that the WHO has quantified the prevalence of dental caries, there is a pressing need to evaluate the carious lesion using more precise models or techniques.

Even though a number of approaches have been used to quantify the risk of carious lesions, a few different indices are more flexible when used with community-based models.⁹

The degree of carious lesion was evaluated in the literature using a variety of techniques, such as DMFT and DMFS, which were created back in the 1940s.^{10,11} But since the assessment has to be more accurate, these indices were not thought to be more sensitive to the current situation.

Since then, the International Caries Detection and Assessment instrument (ICDAS) scoring system has been the main instrument used to assess carious lesions.¹² ICDAS was created in a way that, with the right illumination, epidemiological researchers and clinicians can use quickly and simply. Depending on the degree of the lesion, the ICDAS detection system uses a classification system that goes from 0 to 6.¹³ Since underprivileged nations are thought to be more susceptible to carious lesions, the procedure of fully drying the teeth in order to diagnosis early enamel carious lesions continues to be more difficult there. The system is currently being examined.

In order to evaluate the carious lesion, the Caries Assessment Spectrum and Treatment index (CAST) was added to the latest literature, eliminating the drawbacks of the ICDAS scoring method. The CAST system was appropriate for conducting field surveys.¹⁴ Dental caries is classified in this index based on a variety of factors, such as pulp involvement, abscess/fistula, and advanced enamel and dentine lesions, in addition to other clinical outcomes.¹⁵ Using the visual-tactile assessment as its foundation, the CAST index is applicable to epidemiological surveys.

Globally, the estimation of dental caries is estimated to be in high range, in particular to Indian population, the high-risk population remains increasing.^{16,17} Due to this factor, caries diagnosis method should help in assessing the untreated decay in more accurate and rapid method. When compared to other developed or developing nations, the reporting of pre-cavitated caries lesions hasn't been particularly noteworthy because untreated dental caries exhibits an above-par ratio in the Indian population. Given that a few recent systematic reviews have suggested that the population ratio may have increased alarmingly, there is a complete lack of unanimity about dental caries.

Considering each of these aspects, the best course of action is to select the best diagnostic criteria from the literature's existing indices. Based on this, we are required to examine the research hypothesis, which states that the assessment of dental caries differs between the two different detection instruments, ICDAS II and CAST.

To be more precise in time duration and reliability of these two tools to be tested, the aim of the study is designed to evaluate the caries diagnostic potentials of International Caries Detection and Assessment System (ICDAS) II and Caries Assessment Spectrum and Treatment (CAST) indices in estimating the caries prevalence rate among 18-50 years old population. The results from the end of study could provide a better insight in tools for assessment of dental caries in community based, clinical based and epidemiological research-based assessment of dental caries for estimating caries prevalence and burden.

II. MATERIALS AND METHODS:

Study design:

This descriptive cross-sectional study was conducted on 18–50-year-old population residing in and around the Chengalpattu district, Tamilnadu. The study was carried out between September and December of 2023.

Ethical clearance:

The study was subjected and obtained Ethical clearance from Institutional Review Board, Adhi Parasakthi Dental College and Hospital.

Sample population:

Convenience sampling was used to select the patient in order to create a study sample from the patient population reporting to the screening camps conducted by adhiparasakthi dental college and hospital. Written informed consent was obtained from each and every participant in the study before it was conducted, following an explanation of the study's objectives. Participants with severely decaying teeth and excruciating toothaches were not allowed to be recruited due to eligibility requirements. Congenital deformity patients were excluded from the study.

Sample size calculation:

The sample size was estimated prior to the start of the study from existing literature. With a probability of statistical significance, alpha error set at 5% (two tailed) and power set at 90% and probability of Beta error - 10%, a total of 209 sample size was obtained, which was rounded off to 200 sample size. The sample size was achieved by convenience sampling methodology from the population reporting to the screening camps. Patient with carious lesion were included for the assessment with both ICDAS II and CAST scoring system.

Examiner's calibration:

Principal investigator of the study assigned two examiners for the assessment of ICDAS II and CAST scoring system. The two examiners were graduated dental students who were trained with the help of an expert in the field of assessment. The examiners were assigned to assess both the ICDAS II and CAST system on participants. The basic training and calibration was done in the outpatient attending for management of dental caries. After calibration, the study subjects were recruited and both examiners examined same participants twice, individually with two different data scoring sheets, which were monitored under supervision of principal investigator. The examiners were equipped with a proper illumination, dental chair setting, plane dental mirror, 3-way syringe, and WHO periodontal probes. All the participants were examined and inter examiner reliability was assessed. The same participants were followed after a period of one week for reassessment.

Clinical examination:

The participants were examined whilst seated on a portable dental chair using artificial light with the aid of plane mouth mirror, WHO periodontal probe and disposable gauze. A 3-in-1 syringe was used to dry the tooth surface to detect pre-cavitated enamel lesions with ICDAS II. If two conditions existed on the same surface, the higher score was recorded.

ICDAS II scoring system:

- | | |
|---|--|
| 0 | Sound |
| 1 | First visual change in enamel |
| 2 | Distinct visual change in enamel |
| 3 | Localized enamel breakdown (without clinical visual signs of dentinal involvement) |
| 4 | Underlying dark shadow from dentin |
| 5 | Distinct cavity with visible dentin |
| 6 | Extensive distinct cavity with visible dentin |

CAST index scoring system:

The CAST index scoring system is as follows: “0: sound”, “1: sealant”, “2: restoration”, “3: enamel lesions”, “4, 5: dentine lesions”, “6: pulp involvement”, “7: abscess/fistula”, “8: tooth loss”.

Statistical analysis:

The data obtained from the study were subjected to statistical analysis using SPSS v 26.0 (IBM Corp). Descriptive statistical analysis of the study population was done followed by the assessment of Intra and Inter examiner reliability was done using Kappa coefficient. Statistical significance was set to p-value <0.05.

III. RESULTS:

Table 1: Time duration comparison of assessment of ICDAS 2 score and CAST score system between two examiners

	ICDAS 2	CAST	p-value
TIME DURATION - Examiner 1	8.14 ± 0.88	4.22 ± 0.79	<0.001*
TIME DURATION - Examiner 2	8.14 ± 0.88	4.26 ± 0.80	<0.001*

Table 1 describes the comparison of time duration between ICDAS 2 scoring system and CAST scoring system which were done by two calibrated examiners. The time duration for assessing using ICDAS 2 scoring system was 8.14 ± 0.88 for both examiners, and for CAST scoring system, it was 4.22 ± 0.79 and 4.26 ± 0.80 for examiner 1 and 2. The difference between the two-scoring system was found to be statistically significant showing the ICDAS 2 scoring consumes more time in assessment than CAST system.

Table 2: Inter examiner reliability assessment of two examiner scoring ICDAS 2 and CAST scoring system.

Inter examiner reliability of scoring assessment between two examiners			
	Examiner 1	Examiner 2	p-value
ICDAS 2	0.837		<0.01*
CAST	1		

Table 2 describes the inter examiner reliability of two examiners, assessing ICDAS 2 and CAST. In ICDAS scoring assessment conducted by two examiners, the kappa coefficient was assessed and it was found to

show perfect agreement between two examiners. In CAST scoring assessment, the inter examiner reliability score was 0.83, which was also found to show strong positive agreement between the two examiners. On assessment of ICDAS 2 score in 100 patients by two examiners, there was a difference in scoring system among score 4, and score 6 with dentinal lesion and pulpal involvement among two examiners.

On assessment with CAST scoring system among the two groups, there was no significant difference in the scoring system among the two calibrated examiners.

IV. DISCUSSION:

The descriptive cross-sectional study aimed to evaluate the caries diagnostic capacity of the international caries detection and assessment system (ICDAS 2) and the Caries Assessment Spectrum and Treatment (CAST) system.

The effectiveness of the two-scoring system was evaluated using existing literature in the fields of pediatric dentistry, preventive medicine, and epidemiology research. Based on the prevalence of FPM caries among the participants, Gudipaneni R K et al (2022) did an analysis among 390 children, which revealed that the prevalence rate was consistent with the current study, indicating that caries were detected accurately by the CAST method. This article considered the DMFT/DMFS assessment of dental caries detection to be rather tough when compared to the ICDAS II and CAST scoring systems.¹⁸

Similarly, Frencken JoE et al. (2011) conducted an epidemiological survey on complete CAST using ICDAS II and PUFA and found comparable results to our current study. In epidemiological surveys, the CAST index's effectiveness is viewed as promising. CAST incorporates elements from the ICDAS II and PUFA indices, as well as missing and filling parts of the DMF index.¹⁹

Campus et al. (2019) conducted an assessment alongside the Nyvad Criteria using the CAST system among Italian schoolchildren, and the results were similar to the current study, indicating a higher level of reliability agreement between examiners in CAST scoring.²⁰

To assess its temporal efficiency, Radje et al (2021) conducted a study in the existing literature and found that the CAST system was significantly easier and faster than the ICDAS system. The contradicting statement claimed that DMF was easier to use than the CAST system.²¹

One of the study's strengths is that it uses a larger effective sample size to analyze the scoring system. Inter examiner dependability was evaluated, and time period assessment during the examination process was deemed a strength. The study's limitations are evaluated in such a way that this study used convenience sampling in factors such as age, location, gender, and occupation, which may not be considered as factors to generalize the results.

V. CONCLUSION:

The CAST system was determined to be more effective than the ICDAS II scoring system when it came to reliability and time period assessment for examination. This study finds that the CAST approach can be employed in epidemiological surveys for more successful diagnosis.

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