

## Clinical comparison of dental caries by DMFT and ICDA systems

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### Abstract

**Background and Aim:** The common method of caries status evaluation is the number of decayed, missed and filled teeth (DMFT) index. Recently the International Caries Diagnosis and Assessment System (ICDAS) has been introduced for a detailed evaluation of the dental caries. The aim of this study was to evaluate the caries status with this new system while comparing it with the DMF index as a common method.

**Materials and Methods:** A total of 110 dental students were selected randomly and examined. Examination was done in the dental unit under good light circumstances. First, all surfaces of the teeth were cleaned with a brush, rubber cup and prophylaxis paste and then rinsed. Subsequently, examination was performed in each person by two calibrated examiners according to DMFT system and ICDAS (evaluation of teeth status in occlusal and smooth surfaces in dry and wet situations according to codes of this system) and the information forms were completed. Chi square statistical test was used for data analysis.

**Results:** The mean DMFT was 7.16. According to ICDAS system nobody had 00 code meaning that at least one surface of 182 dental surfaces had a lesion. Only seven cases had codes 00-02. The results for codes 03 through 06 were as follow, respectively: 51, 49, 34, 2. Ninety nine cases had extracted or non-examinable teeth. The inter-examiner kappa coefficient was 0.916.

**Conclusion:** The new system, ICDAS, provides more accurate information than DMF for the investigators and epidemiologists. The DMFT number does not show any details about the dental status of the cases.

**Key Words:** Dental caries - ICDAS - DMF

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Received: 23 Feb 2011  
Accepted: 31 Dec 2011

The Journal of Islamic Dental Association of IRAN (JIDA) / Summer 2012 / 24 / (2)

### Introduction

Dental caries is the most common dental disease of human community. Caries detection and eval-

uation is of epidemiologic importance among different people and age ranges. More accurate diagnostic procedures will result in more valua-

ble information and more precise treatment and prophylaxis. (1,2) The most common epidemiologic scale for caries detection is DMF which was first introduced in 1930s. In this scale decayed(D), missed (M) and filled (F) teeth are evaluated and reported according to the number of teeth (DMFT) or surfaces (DMFS) involved. Since DMF is not an appropriate criterion for caries prevalence because it overestimates active carious lesions (1) new subgroups for DMF has been described. Clinically detected lesions are described as D1 through D4. D1 lesions are clinically detectable enamel caries with a sound surface. White spot and brown spots are categorized in this group. D2 comprises of cavitated lesions within enamel that are clinically detectable. D3 lesion occur in dentin and are detected clinically as macroscopic cavities. Finally, D4 lesions involve pulp. This categorization has increased the accuracy of DMF. (2) A novel system referred to as International Caries Detection and Assessment System (ICDAS) was founded by investigators of cariology. Diagnosis of caries and dental condition with this system leads to improved quality of diagnosis, prognosis, and clinical treatment. This system is accurate and reproducible and is very helpful in diagnosis of early carious lesions as well as long-term evaluations. (3,4) The system is based upon visual examination of the teeth in a clean dry and accurate environment. Therefore, there is an increased chance of detecting incipient carious lesions. In this system, dental conditions (i.e., intact, restored, impacted, extracted, etc.) are classified into scores from 0 through 9. In order to evaluate the carious state of the teeth, scores from zero through 6 are taken into consideration from the earliest state of decalcification to advanced cavitated lesions. In ICDAS system coronal carious lesions (in pits and fissures, mesial-distal, and buccal-lingual areas) root caries and lesions accompanied by restorations and sealants have different codes. Advantages of this system are as follows: condition of the tooth and the stages of caries process is easily detectable by the investigators and cli-

nicians and on the other hand it is easy to understand the severity and activity state of the lesion. Also there is a possibility to compare different studies from different parts of the world with an increased accuracy. (5,6) Several studies have been conducted about this system in different countries indicating a superb correlation of the results of ICDAS with quantitative light-induced fluorescence (QLF) and histology of the evaluated lesions, with a good reproducibility for permanent and deciduous teeth.(3,7-17) Since this system is not taught in Iranian dental faculties, this study was conducted to perform a clinical evaluation of caries using the common DMF system in comparison with ICDAS.

### Materials and Methods

One hundred-ten students of dentistry were randomly selected and evaluated in this descriptive study. The subjects were asked to fill the informed consent form prior to inclusion into the study. Demographic data were collected in questionnaire no.1. Those who had all permanent teeth and did not have any problem opening their mouths were included. Examinations were performed on a dental unit under adequate light conditions. The teeth were cleansed with a brush, rubber cup and prophylaxis paste. The questionnaires no.2 and 3 were completed by a trained and calibrated examiner according to DMF and ICDAS systems. Examinations were performed using a clean dental mirror, a WHO probe and under adequate light conditions. Each examination was initiated from the right maxillary third molar moving anteriorly, passing through left maxillary, then left mandibular and finally right mandibular teeth. Each tooth was dried prior to examination. The number of decayed (D), missed(M), and filled (F) teeth were recorded in DMFT form, then the numbers pertaining to D,M, and F were added to record the DMFT value.

According to the low accuracy of the DMFT in determination of the carious state, D1MFT and D2MFT criteria were also recorded in which

teeth with incipient enamel caries and those with cavities restricted to enamel are also included (2).

In ICDAS system, the condition of the teeth were recorded with the sequence as previously mentioned for DMF system in both moist and dried (using air syringe for 5 seconds) states. All subjects were examined by a second examiner under equal conditions. Kappa coefficient was used to assess the calibration between two examiners.

**Table 1:** ICDAS codes according to the dental conditions

code	Code Definition
Code 0	Unfilled and unsealed teeth
Code 1	Sealant applied but all pits and fissures are not covered
Code 2	Sealant applied and all pits and fissures are covered
Code 3	Tooth-colored resin or glass ionomer restoration
Code 4	Amalgam restoration
Code 5	Stainless steel crown
Code 6	Porcelain or veneer crown or PFM
Code 7	Lost or fractured restoration
Code 8	Temporary restoration
Code 9	Tooth is missing or has a certain condition
96	The tooth surface is not examinable because of poor accessibility or convenience
97	The tooth is lost due to caries
98	The tooth is lost due to reasons other than caries
99	Unrupted tooth

## Results

Among the total number of involved people in this study, 82 were women and 28 were men. The age range of the participants was 20 through 29 years. (Mean=23.5 years) Table 4 shows the frequency of the people according to the DMFT criteria. The mean DMFT for the people was 7.16. None of the participants showed zero D1MFT. In other words, in each subject there was at least one extracted, restored or decayed tooth. D1MFT for almost half of the subjects

was 11 to 15 and 14 cases showed a D1MFT of 16 to 20. D2MFT condition of the participants is represented in table 4. Only seven subjects showed a zero D2MFT, almost half of them had a D2MFT of 5-10 and five had a D2MFT of 16-20.

A total of 182 dental surfaces were evaluated by ICDAS system. (See graph 1) In this system the code 0 shows a completely intact condition. Codes 00 to 02 indicate a favorable health state and a need for dental examinations. Codes 03 to 06 show a need for restorative treatments. None of the participants had a code 00 in their dental surfaces. In other words, all subjects had at least one non-intact tooth surface. Only 6% of the people had codes 01 and 02. The findings showed that among those with amalgam restorations (n=75) 52% of cases had leaky restorations. Out of the total 67 persons with composite fillings, 53.7% had lesions around their restorations. Among all subjects, 1.8% had temporary restorations, 3.6% fractured teeth and 10.9% crowns or veneers. Kappa coefficient showed that the agreement between the two examiners was 0.916.

**Table 2:** ICDAS codes for determination of the condition of each individual tooth

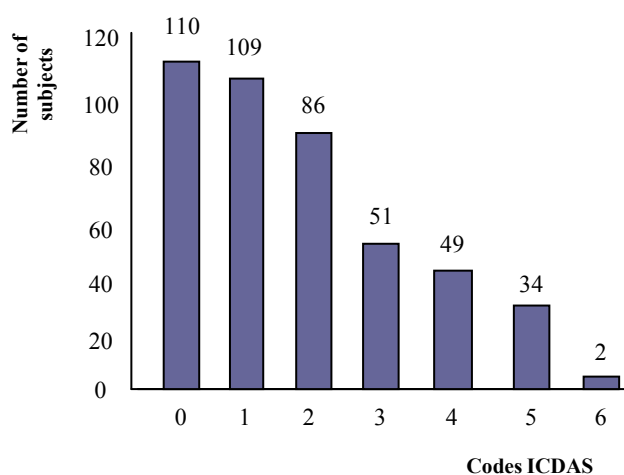
Code	Code Definition
<b>Code 0</b>	Intact tooth surface without an lesions
<b>Code 1</b>	Incipient cages in enamel
<b>Code 2</b>	Prominent changes of enamel or dentin adjacent to the margin of a restoration or a sealant
<b>Code 3</b>	Cariou lesions with the evidence of code 2 and sizes smaller than 0.5 mm around a restoration or sealant in addition to the discoloration due to demineralization
<b>Code 4</b>	Marginal caries in enamel, dentin or cementum adjacent to a restoration or sealant. This lesion has to be differentiated with amalgam shadow.
<b>Code 5</b>	A distinctive cavity around restoration or sealant; this lesion has the characteristics of code 4 and is larger than 0.5 mm.
<b>Code 6</b>	A wide distinctive cavity with exposed dentin

**Table 3:** Caries associated with restorations and sealants (CARS)

Code	Code Definition
<b>Code 0</b>	Restoration with sound margins
<b>Code 1</b>	Incipient changes in enamel
<b>Code 2</b>	Separate changes of enamel adjacent to the restoration margin/dentin adjacent to the restoration margin/ the restoration margin
<b>Code 3</b>	Cariou lesions of less than 0.5mm in size with characteristics of code 2 cavities at the margin of restoration/sealant of smaller than 0.5mm in size, along with opacity or demineralization-induced discoloration
<b>Code 4</b>	Cariou lesion of the enamel/dentin/cementum adjacent to the restoration/sealant with a shadow in dentin. This lesion must be differentiated with amalgam shadows.
<b>Code 5</b>	A separate cavity adjacent to the restoration/ sealant with an exposed dentin having signs of caries as described in code 04 in addition to the distance of > 0.5mm
<b>Code 6</b>	A separate wide cavity with exposed dentin

**Table 4:** Frequency of subjects according to their D1MFT and D2MFT

DMFT	Frequency of D1MFT	Frequency of D2MFT
0	0(%)	7(%6/4)
1-4	3(%2/8)	26(%23/6)
5-10	35(%31/8)	48(%43/6)
11-15	58(%52/7)	24(%21/9)
16-20	14(%12/7)	5(%4/5)
<b>Total</b>	110(%100)	110(%100)



Frequency of subjects according to their ICDAS codes

**Graph 1:** Frequency of subjects according to their ICDAS codes

**Discussion**

Detection of dental caries is an important step in treating this frequent disease.(17) Epidemiologically, the most common method for evaluation of caries frequency and its state in the DMF index. (1,2) This criteria contains numerous limitations. The number resulted from this evaluation does not give any information about the caries state, stage, depth of penetration, restoration types, and their conditions. In other words, DMF only provides a number that shows the teeth or surfaces which are decayed, missed or restored. It is not clear that the final number explains which of the aforementioned conditions. Furthermore, the need for health care and/or treatment of the carious teeth and regular evaluation of the teeth remains unknown. (1-6) In this investigation, the DMFT indices were higher than those recommended by WHO in 2010. In fact, it is not clear that which part of this criterion requires more attention. In addition, the type of treatment for the participants of this study remains unclear. Although the more detailed subclasses of DMFT index i.e., D1MFT and D2MFT, are taken into consideration in this study, it is known that the carious state for this population is in initial and advanced stages, but no more information is available. Therefore it is

not clear that which part of the patient care cycle should be addressed. The ICDAS system was introduced in recent years by specialists in preventive dentistry, community dentists and epidemiologists following extensive efforts in different countries. Ultimately, this system was presented to serve as a response to the shortcomings of the existing caries detection methods with the ability to visually evaluate the patients' tooth and restoration conditions with an increased accuracy. (4) This system provides an easy comparison and interpretation of the studies worldwide. It may be initially presumed that the codes of this system are numerous and challenging, but a timely attention and a straightforward training procedure makes it a logical, efficient and user-friendly system. The need for prophylaxis, restorative treatment, dental examinations, and restoration revisions is easily appraisable in this system.(7,17) Studies about this system revealed that reproducibility an accuracy of data obtained from ICDAS system is as high as those of DiagnoDent.(14,17,18) A strong relationship between the use of ICDAS system and histological evaluations have been established.(7,17) Therefore, using this system, one can evaluate the patients' caries state , dental conditions and treatment planning with a high degree of reliability.

In this study, the condition of the teeth, carious lesions, and restorations of the participants were evaluated in detail using ICDAS system. None of the subjects were caries-free and none of them belonged to the code 00. Interestingly, there is a strong need for emphasizing on dental care such as administration of antimicrobial mouthwashes and fluoride preparations, use of toothbrush and dental floss as well as regular dental visits even in students of dentistry and nursing who are considered health care providers. It was also shown that the majority of the participants belonged to the codes 3 to 5. This means that there were cavitations in enamel or dentin and the dental structure was substantially lost and a strong need for restorative treatments existed. Use of ICDAS

system provides early detection of carious lesions making it possible to contemplate preventive dental care, whereas even if the subgroups of DMF system is considered, early stages of caries management cannot be addressed.

ICDAS system provides patients with more information about their dental health conditions. Therefore, treatment remedies, the need for taking dental radiographs and the need for evaluation of the present restorations are clarified for the patients. (3)

Kappa coefficient between the two examiners was 0.916. Closer values of this coefficient to 1 shows higher agreement between two examiners. This study was in accordance with other similar works in terms of inter-examiner agreement. (8, 16,17)

This was a pioneering study in Iran in order to be in line with novel methods of caries detection in the world. In this evaluation, system training and problem-solving was carried out through communication with the founders of the system such as Ekstrand and Amaechi. It is suggested that this system be taught for dental professors and students via training workshops to evaluate the patients' conditions. Re-evaluation of the patients after a one-year follow-up session for patients included in this system is also recommended.

### **Conclusion**

The mean DMFT for the subjects in this study was 7.16. According to ICDAS system none of the subjects were considered free from caries but 109 persons belonged to the code 01, 86 persons to code02, and 103 persons to codes 03 to 06. It was also declared that a more comprehensive and accurate evaluation of teeth and carious lesions was performed using ICDAS system in comparison with DMF.

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