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Author(s)	Kanehira, Takashi; Takehara, Junji; Nakamura, Kimiya et al.
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The ICDAS (International Caries Detection & Assessment System) : a new set of caries assessment criteria

Takashi Kanehira[1)], Junji Takehara[1)], Kimiya Nakamura[2)], Hirohisa Hongo[1)], Ryo Miyake[2)] and Dairo Takahashi[1)]

[1)] Preventive Dentistry, Department of Oral Health Science, Faculty of Dental Medicine and Graduate School of Dental Medicine, Hokkaido University, [2)] Dental Clinical Division, Hokkaido University Hospital

ABSTRACT : A dental examination is a service performed by dentists in daily clinical practice. This is also performed as part of a group of dental examinations, such as school dental examinations and community health examinations. The Japan Association of School Dentists (JASD) criteria has been used for assessing dental caries in these examinations. These criteria evaluate caries on a scale of C1-C4. In an era when dental caries are pervasive, these criteria are useful.

The application of fluoride has become a widespread practice for preventing dental caries in developed countries. The decrease in the incidence of dental caries in younger patients and the reduction in the progression of dental caries is attributed to these developments.

The mean number of decayed, missing, or filled teeth among persons aged 12 in Japan is 0.84 (School Health Statistics in 2016), and an increasing number of persons have never experienced dental caries prior to adulthood. Therefore, the JASD caries diagnostic criteria are in need of an update.

In response to this situation, caries researchers in the United States and other western countries, along with general clinicians proposed a new dental caries assessment system. This is in order to accurately assess white spots on the surface of the enamel, staining of pits and fissures, and early carious lesions that do not require dental restoration.

This system which was named the International Caries Detection and Assessment System (ICDAS) is used to detect caries and assess their activity. In this paper we will discuss this new system.

Key Words : ICDAS, caries detection, new caries assessment criteria

Introduction

For dentists, dental examination is a service performed in daily clinical practice and as group dental examinations (such as school dental examinations and community health examinations). In these examinations, the Japan Association of School Dentists (JASD) criteria is used for assessing dental caries ; these criteria consist of caries for observation (CO) added to Shimada's criteria, which evaluates caries on a scale of C1-C4.

The JASD criteria anticipates treatment plans and prognoses by classifying dental caries as follows : CO → caries for observation, C1/C2 → dental fillings and other restorations, C3 → root canal treatment, C4 → prosthesis after tooth extraction. In an era when dental caries were pervasive, these criteria were useful.

As a result of the benefits of fluoridation, which began in 1945 in the United States, the application of fluoride (for example, dentifrices containing fluoride, fluoride tooth surface coating at a dental clinic, and fluoride mouth-rinsing) has become a widespread practice for preventing dental caries in developed countries. In addition, the bacterium *S. mutans* has been identified as a cause of dental caries, and the pathogenesis of dental caries (the

Address of Correspondence

Takashi Kanehira, DDS, PhD.

Preventive Dentistry, Department of Oral Health Science, Faculty of Dental Medicine and Graduate School of Dental Medicine, Hokkaido University, Kita 13, Nishi 7, Kita-ku, Sapporo, 060-8586, Japan

TEL : +81-11-706-4256 ; FAX : +81-11-706-4918 ; E-mail : bluenote@den.hokudai.ac.jp

process by which dental caries develop and progress) has been established. The decrease in the incidence of dental caries in younger patients and the reduction in the progression of dental caries is attributed to these developments[1].

In Japan, the mean number of decayed, missing, or filled teeth among persons aged 12 years is 0.84 (School Health Statistics in 2016). In addition, an increasing number of persons have never experienced dental caries prior to adulthood. Therefore, the JASD caries diagnostic criteria were in need of an update.

In response to this situation, western caries researchers and general clinicians proposed a new dental caries assessment system in 2002 in order to accurately assess white spots on the surface of the enamel, staining of pits and fissures, and early carious lesions that do not require dental restoration. This system was named the International Caries Detection and Assessment System (ICDAS). The ICDAS was revised in 2005 and named the ICDAS II. In 2012, a decision was made that the ICDAS II would not be subsequently upgraded and, that thereafter, it would be referred to as the ICDAS.

The ICDAS is considered a novel concept that has brought about a paradigm shift in dental medicine. However, dental professionals are thought to have little awareness of this concept; therefore, we would like to introduce it here.

The ICDAS

1. What is the ICDAS?

The novel ICDAS, which was based on the diagnosis of coronal caries as described by Ekstrand *et al*[2], is used to detect caries and assess their activity.

"Detection" involves determining the status of the tooth surface (sound tooth, incipient caries, or caries), sealant, and restorations ; in the case of a missing tooth, the cause of the missing tooth is also diagnosed. "Assessment" refers to diagnosing any detected caries activity. Specifically, any incipient carious lesions are examined to determine whether they will progress into caries or whether recovery to a sound tooth is possible ; the results of this examination are utilized in caries prevention and health promotion programs. In addition, if caries with large amounts of exposed dentin are detected, they are treated on the basis of their individual statuses.

2. Differences between the ICDAS and existing dental examination criteria

In the JASD criteria, the relationship between histological findings and caries severity is considered proportional, with little consideration for the risk of caries on a case-by-case basis. The JASD criteria are based on the conventional idea that because caries will not heal on their own and will progress if left untreated, early recognition and prompt treatment are crucial.

For example, C1 enamel caries are diagnosed as "disease = treatment" ; while CO, *i.e.* surface enamel demineralization, "diagnosed as" to "considered". However, in order to avoid inadvertently detecting "disease", the ICDAS criteria classifies findings from observation in greater detail on the assumption that many cases of C1 are caries that have stopped progressing or are sound teeth that are merely colored. In addition, CO is also divided into multiple subcategories based on risk. The intention is not to declare "observation", but to proactively pursue "treatment". This "treatment" does not consist of drilling or filling, but remineralization through care. The goal is to restore the tooth without drilling. Specific forms of effective care include the following: improving dietary habits to reduce or avoid intake of sweets and other foods that cause caries; appropriate oral prophylaxis (including the use of dental floss, an interdental brush, or other supplementary prophylactic instruments) ; application of fluoride (use of fluoride tooth-surface coating, fluoride mouth-rinsing, or dentifrices containing fluoride) ; and improving the quality and quantity of "liquid enamel", *i.e.* saliva (chewing sugarless gum and developing a habit of chewing food thoroughly).

3. Examination methods recommended by the ICDAS

1) Selection of examination site and tooth surface cleaning/drying

The first step is to select the examination site (by tooth versus by tooth surface). When examining at the tooth surface level, it is necessary to decide on the examination site for a single tooth surface. If the surface in question is the occlusal surface of a molar, the examination site is divided into mesial and distal fissures. If the surface in question is the buccal and lingual surface of a molar, the examination site is divided into the fissure and the cervical region. Once the examination site is decided, it is mechanically cleaned by the operator in order to remove coloring, plaque, and calculi. When doing so, the operator records the attachment site of dental plaque in order

to assess postoperative caries activity. Next, the tooth surface is dried with air (5 seconds) and is then examined with the naked eye; the results of the examination are coded with a two-digit number.

2) Method for recording the results of an examination

When coding the examination results, the ten digits are recorded on the basis of ICDAS classifications for restoration, pit and fissure sealant, or missing teeth, while the single digit is coded according to the ICDAS classifications of enamel caries[3].

(i) ICDAS classifications of restoration, pit and fissure sealant, or missing tooth (tens digit)

Code 0 : Unrestored
Code 1 : Pit and fissure sealant (fissures only partially covered)
Code 2 : Pit and fissure sealant (all fissures covered)
Code 3 : Restoration (crown coloring)
Code 4 : Amalgam restoration
Code 5 : Stainless steel crown
Code 6 : Porcelain crown, gold crown, full or partial metal crown, or veneer crown
Code 7 : Fracture or desorption of restorations
Code 8 : Temporary restoration
Code 9 : Any of the following
96 : Defect of enamel surface
97 : Missing tooth because of dental caries
98 : Tooth missing for other reasons
99 : Unerupted tooth

(ii) ICDAS classifications of enamel caries (single digit)

Code 0 : Sound

*No evidence of caries (either no change or questionable change in enamel translucency after air-drying for 5 seconds)

*The tooth surface is considered sound even if it demonstrates enamel hypoplasia or other developmental defects, fluorosis, tooth wear, or extrinsic/intrinsic stains.

*For a tooth surface with multiple stained fissures, if an identical condition is observed in other pits and fissures, and this condition is consistent with non-cariogenic lifestyle habits (such as frequent tea drinking), the examiner assesses the tooth surface as normal.

Code 1 : First visual change in enamel

*Observed only after air-drying for 5 seconds, or localized in small pits and fissures

Code 2 : Distinct change in enamel

Code 3 : Localized breakdown of enamel

*No gross clinical signs indicative of progression to dentin

Code 4 : Shadow from dentin
Code 5 : Distinct carious cavity with visible dentin
Code 6 : Extensive distinct carious cavity with visible dentin

3) Assessment of caries activity

On the basis of the diagnostic criteria described by Nyvad *et al*[4], caries activity is assessed according to visual changes, palpation, and attachment of dental plaque. The ICDAS is not a system for determining the suitability of treatment in a manner as follows : "if the assessment is Code 3, there will be no drilling ; but if the assessment is Code 4, there will be drilling and filling". The decision of whether to conduct a follow-up examination or to perform a procedure for treatment must take into consideration, not only findings for the affected tooth, but also individual background factors such as various caries risk test results, lifestyle habits, home care, and the use of fluoride.

(i) Assessment of coronal caries activity

①Lesions with high caries activity

Code 1-3 : Detected as obvious white spots or as yellowish white spots. On palpation, roughness is felt on the surface. Sites where dental plaque easily attaches, such as small pits and fissures, the tooth cervix, and the contact surface, are detected easily.
Code 4 : All Code 4 lesions have high caries activity.
Code 5-6 : On palpation, roughness and softening can be detected on the cavity floor and cavity wall.

②Lesions with low caries activity

Code 1-3 : White spots have a brownish or blackish tone. On palpation, the surface is smooth; on the smooth surface, the lesions are observed at a site away from the tooth cervix.
Code 5-6 : On palpation, the cavity floor and cavity wall are hard and smooth.

(ii) Assessment of root surface caries activity

For coding 1-2 lesions detected on root surfaces, caries activity is assessed as "stopped" or "high", on the basis of factors such as the shape of the tooth surface, its hardness, and visual examination.

Conclusion

The considerable decrease in dental caries among young people has created a situation in which many general dentists, regardless of whether they wish to do so, will be forced to shift the core of their clinical practice from dental treatment to routine dental checkups, *i.e.* health promotion that incorporates preventive dentistry. In this type of clinical practice, the ICDAS can be incredibly useful as a tool not only in providing an explanation of brushing instructions to the patients, as well as in performing saliva tests and other caries tests.

In order for the ICDAS to be used widely by clinical dentists in clinical practice, several issues must be resolved, such as the education of students and dental professionals, awareness among patients, and assessment of the payment system for dental services.

Lastly, we would like to introduce literature that should be useful for understanding the ICDAS[5-7]. We humbly, but enthusiastically, recommend this literature to anyone who is interested.

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