Usefulness Assessment Indices of Non-Carious Dental Defects with Consideration of Aetiological Factors and the Quality Criterion

Much attention is being paid in the current literature to the necessity of raising awareness of the problem of tooth wear. The aim of this paper is to discuss advantages, disadvantages and modifications of currently used tooth wear indices with particular attention drawn to the advantages of their use both in everyday practice and epidemiological research, as well as an attempt to make the choice of a wear index easier and better adjusted for the needs of a single patient or a group of patients. The paper compares index assessment attempts available in the current literature in the context of validity of criteria choices and reliability results. The role of supporting methods is stressed as they facilitate both diagnosis and storing of data on tooth wear, as well as usefulness of indices which comprise therapeutic recommendations (Adv Clin Exp Med 2013, 22, 3, 439–447).

Key words: non-carious defects.

Dynamic development of various branches of dentistry and raising social awareness of the necessity of healthcare and oral hygiene have resulted in the prolongation of the lifespan of natural dentition [1–3]. As patients grow older, problems connected with the wearing of hard dental tissues become more and more severe and, at the same time, less prone to assessment [1, 3–8]. The term “tooth wear” also comprises erosion, attrition, abrasion and, in the case of some sources, also abfraction and demastication [3, 8]. The effect of erosion, which is a loss of hard dental tissues due to chemical factors, without the influence of oral bacteria, is mainly caused by acids of external and internal
Attrition is a loss of tissue or permanent filling surfaces caused by mutual teeth contact, while abrasion is friction caused by a contact with a foreign object which originated outside the oral cavity, such as a tooth brushing, a musical instrument, etc. Abfraction, also called “tooth flexure” plays a significant role in the occurrence of defects in the cervical area of the tooth and is related to the occurrence of occlusion stress. Demastication can be defined as the wear of the occlusal surfaces of teeth caused by chewing hard food and is typical of patients who are on a diet based on, usually hard, non-processed, vegetable food such as grains [6, 9–13]. Those effects usually appear simultaneously in the oral cavity and can influence and intensify one another, which makes a diagnosis of aetiological factors of wear more complex and difficult [2–4, 6, 7, 13]. Another important issue is how to find highly reliable measurement methods which could be used in the assessment of occurrence, degree of advancement or wear progression, both on an individual and population level [2, 14]. The abundance of indices used in the current literature, both aetiological and those which do not take into consideration the causative factors, hinders comparison of results obtained with their use [15].

This paper contains a review of those measurement tools, including both well-established and new indices that are a result of cooperation work conducted by a group of experts in non-carious defects origins. The aim of this paper, besides making doctors more aware of the frequent problem of tooth wear, is to assess the usefulness of those indices for research purposes and, additionally, to stress the importance of their standardization. Advantages, such as simplicity, ability to understand assessment criteria, universality, ability to use those indices for both small and large studied groups, are the reasons why some indices are used more frequently in research and are more often described in the available literature than others [16].

An example of an index close to the so-called “gold standard” is the Smith and Knight Tooth Wear Index (TWI) (Table 1). It can be utilized for both epidemiological study and assessment of wear in the case of an individual patient. It allows dentists to assess the degree of tooth wear for any aetiological cause or also in the case of combined causes. It is most frequently used for adult patients, rarely for children. Tooth Wear Index is a simple, practical measuring tool with a high degree of reliability and clearly defined criteria. It can be used for monitoring progression of wear in time. TWI allows to differentiate “acceptable” wear from “pathological” by setting limits of maximum wear level acceptable for different age group.

<table>
<thead>
<tr>
<th>Value (Wartość)</th>
<th>Surface (Powierzchnia)</th>
<th>Criterion (Kryterium)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>B/L/O/I</td>
<td>no loss of specific enamel features</td>
</tr>
<tr>
<td>0</td>
<td>C</td>
<td>no change of tooth contour</td>
</tr>
<tr>
<td>1</td>
<td>B/L/O/I</td>
<td>loss of specific enamel features</td>
</tr>
<tr>
<td>1</td>
<td>C</td>
<td>minimal change of tooth contour</td>
</tr>
<tr>
<td>2</td>
<td>B/L/O</td>
<td>loss of enamel exposing dentine in less than one third of examined surface</td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>loss of enamel slightly exposing dentine</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>depth of defect &lt; 1 mm</td>
</tr>
<tr>
<td>3</td>
<td>B/L/O</td>
<td>loss of enamel exposing dentine in more than one third of examined surface</td>
</tr>
<tr>
<td>3</td>
<td>I</td>
<td>loss of enamel and significant loss of dentine, without exposure of pulp and secondary dentine</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>depth of defect 1–2 mm</td>
</tr>
<tr>
<td>4</td>
<td>B/L/O</td>
<td>total loss of enamel or exposure of secondary dentine or exposure of pulp</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
<td>exposure of pulp or secondary dentine</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>depth of defect &gt; 2 mm or exposure of pulp or exposure of secondary dentine</td>
</tr>
</tbody>
</table>


(age of 25 or less to aged 66 and older) [3, 5, 8, 10, 14, 16]. Values of some thresholds set by Smith and Knight were criticized by Donachie and Walls who claimed a need to modify them for the elderly population. Some of wear levels classified by Smith and Knight as “pathological” are considered by Donachie and Walls as not even requiring treatment. Another criticized issue was the exclusion of teeth with large fillings from the assessment, while, for example, class V fillings according to Black’s classification may conceal high levels of wear. Faults in the original wear assessment method by Smith and Knight, if applied to the elderly population, are explained by those researchers as a result of too low percentage of that age group being present in the trials, as well as too few patients being included in those trials conducted to create the index [5, 17]. A simplified version of TWI applicable for epidemiological research was suggested by Bardsley, Taylor and Milosevic. They assessed labial and palatal surfaces, incisal margins of 6 upper and 6 lower front teeth, as well as occlusal surfaces of the first molars (Table 2). However, they also excluded large fillings afflicted with caries and those equipped with elements of orthodontic appliances [18]. Fares and Shirodaria created a modification which is more suitable for detection of the early changes. In the original version of TWI, changes in dentine are described by a 3-level scale, yet changes in enamel – only by 1-level scale. Those authors considered that division unsatisfactory and created a 5-level scale (levels 0–4) for enamel changes assessment and a 6-level scale (levels 0–5) for assessment of changes in dentine. That extended version of TWI index achieves very good results of reliability (Kappa 0.88–0.95). Unfortunately, in order to apply that scale in a correct way, excessive training and calibration of researchers is required [19]. Adjustment of TWI for the purposes of epidemiological study which includes both changes of permanent and deciduous dentition was the purpose of modifications made by Salez-Perez et al. They introduced 2 additional codes: 4/e for teeth filled as a result of wear and 9 for teeth that could not be assessed. Digits are used for marking permanent teeth, while deciduous teeth are marked with letters. The system does not recognize the degree of dentine exposure; however, calibration of researchers is much easier [10]. Previously mentioned Donachie and Walls also made an attempt to make the criteria of the original TWI more precise. In order to facilitate recognition of the first three levels of the index, they introduced additional criteria. Moreover, they clarified the term “significant loss of dentine”, which describes level 3. In their description, it is a situation when tissue loss of the incisal margin affects approximately one fourth of the tooth crown length. Another modification by Donachie and Walls is an additional code that facilitates differentiation of exposed secondary dentine from the exposed pulp [17]. TWI was also used by Borcic et al. in their research on the occurrence of cervical non-carious defects. However, their assessment included only one third cervical, vestibular surfaces of upper and lower teeth [8].

Table 2. Simplified TWI criteria of Bardsley, Taylor and Milosevic modification [18]

<table>
<thead>
<tr>
<th>Value (Wartość)</th>
<th>Criterion (Kryterium)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>enamel wear only, no dentine wear</td>
</tr>
<tr>
<td>1</td>
<td>dentine hardly visible or exposed on less than one third of surface</td>
</tr>
<tr>
<td>2</td>
<td>dentine exposed on more than one third of examined surface</td>
</tr>
<tr>
<td>3</td>
<td>pulp or secondary dentine exposed</td>
</tr>
</tbody>
</table>

Table 2. Uproszczone kryteria wskaźnika TWI wg Bardsley, Taylor i Milosevic [18]

Non-aetiological indices are also helpful in estimating wear progression in time. For that purpose, assessment of diagnostic models may be used. An example of such use is an index to evalu-
ate the wear of incisal margins and occlusal surfaces of teeth created by Hopper et al. [21]. The idea of that index is simplicity of use and usefulness in the clinical practice for study of wear conducted on individual patients in order to assess necessity of treatment. Similar criteria were created for incisors, canine teeth and jointly for premolars and molars. Known surface contour of models was assessed by means of a 6-point scale (levels 0–5). The highest level of change was at the same time the assumed value for a given tooth. Disadvantages of the system were lack of calibration and non-extensive training of researchers, as well as lower validity scores in comparison to other indices. Moreover, Hopper et al. conducted their research on a cast created in a 20-year span, while the availability of archive models in comparable time intervals seems to be scarce [21]. Diagnostic casts were also used by Sillness et al. for the assessment of occurrence and degree of advancement of incisal margin wear in a studied group formed from Norwegian dental students. They used the Incisal Wear Index (IWI) to evaluate the wear of incisal margins of maxillary and mandibular front teeth and obtained high scores for reliability. The measurement span of progression in time was after 2, 4 and 6 years. The Incisal Wear Index criteria are as follows: 0 – presence of mammelons on incisal margins, 1 – atrophy of mammelons on incisal margins, 2 – clearly visible, yet smooth wear areas, 3 – loss of tissue with typical groove along the incisal margin [22]. Analogous issues were also the subject of research conducted by Johannson, who focused on the problem of wear on occlusal surfaces. He checked the progression of changes in time on diagnostic casts taken from patients in 6-month intervals and used a scale to measure the progression. A separate scale was used for evaluation of the degree of wear severity. The examination of casts was preceded by calibration and training of researchers. Reliability tests were conducted for every scale and obtained results were highly satisfactory [23–25].

The Johannson’s index is a tool to measure individual cases of wear and is accompanied by a survey on the possible aetiological factors of occlusal wear. The survey includes questions about the time of effect and frequency of occurrence of parafunctions, lifestyle, environmental factors and nutrition habits. In order to assess the progression of changes in time, both models and survey results were obtained. The index excludes largely filled teeth and third molars from evaluation [2].

Among indices that take into consideration aetiology of changes, the most distinct ones are those describing erosion. One of them was created by Lussi [7]. It evaluates the level of erosion by assessing the dentine exposure and comprises both location and morphology of erosive defects. A four-level scale was created for the evaluation of buccolabial surfaces (levels 0–3) and a separate, three-level scale for the assessment of occlusal and palatolabial surfaces (levels 0–2). Largely filled teeth and third molars are excluded from the evaluation. The index is used only for the assessment of erosive defects, with a high emphasis put on their differentiation from wedge defects. The main advantages of this index are ease of use, high scores in “test-retest” research, very high consistency between researchers and particular usefulness in the epidemiological study. Results obtained from measurements conducted with this tool are easily comparable with the results from other sources. Another stressed feature is less problematic, when compared to other indices, differentiation between levels 2 and 3, related to the assessment of a level of dentine exposure as measured against half of the tooth surface area. A disadvantage of the index is its limited usefulness in detection of early changes. Moreover, the criterion of a level of dentine exposure is considered vague by some researchers. Lussi’s index contain the questions related to nutrition and hygienic habits, lifestyle, as well as the general state of patient’s health, e.g. gastric disorders, saliva gland dysfunction, possible radiotherapy and taken medicine [7]. Other essential information included professional risk of being exposed to acids or occurrence of tooth tissue hypersensitivity. Application of Lussi’s index can be accompanied by the use of diagnostic casts and colour photographs. Lussi’s index is a modified version of the index created by Linkossalo and Markkannen [7, 26]. In their research on the influence of the lacto-vegetarian diet on the frequency of occurrence and intensification of erosion, Linkossalo and Markkannen used clinical and radiological research methods but also aetiological examination, models, photographs and saliva samples taken in order to assess its buffer capacity. They created a quality-based index to assess occlusal, labial, buccal and cervical surface areas with the level of intensification of erosive defects measured in a 4-grade scale [26]. The system was used as a base for modification made by Ganss et al. during their research on occurrence of erosion in children and teenagers conducted with the use of models taken for orthodontic purposes. The results were compared with the evaluation of models taken from the same patients after 5 years. The first lower molar was used as an “index tooth” for assessment of the erosion process. Erosive lesions were evaluated separately for buccolabial, palatolabial and occlusal surfaces, in both cases using a 3-level scale. The examination included both deciduous and permanent teeth. Moreover, Ganss et
al. established an Erosion Index (EI). That value is useful in the long-term evaluation of erosion [15]. A modified version of the Lussi’s system was created by Arnadottir et al. for evaluating the influence of the diet and lifestyle on the occurrence of erosion in the case of 15-year-old patients. Arnadottir et al. created the assessment criteria in his 4-level scale separately for front and back teeth. The research was accompanied by both an aetiological survey and sampling of stimulated saliva [24, 27].

The available literature also contains examples of a modification to the TWI introduced in the evaluation of erosion [28]. One of them is the research conducted by Xongi and Valdmanis, which divides erosive defects into three stages: slight, average and severe in order to assess the occurrence of erosion in large populations [29].

Al-Dlagain et al. achieved very high reliability results when using a modified version of the TWI index for assessing the occurrence of erosion in the population of British children [12]. Another tool that can be used for assessing erosion, a tool that detects both early and advanced changes, is the index proposed by Larsen et al. [30]. It takes into account both the location and the level of advancement of changes and can be also used to supervise progression against time. Separate criteria were created for buccolabial, palatolabial and occlusal surfaces, for incisal margins and cervical surfaces of roots. The evaluation of erosive changes is performed in three stages, which comprise clinical examination, photographs of arches in 4 planes and the creation of epoxy resin models. The final assessment of defects is performed on the models with the use of 10 times magnification. If the Black’s class V is present on the surface of a filling together with erosive changes, the score is raised for that surface as the filling could be made because of that erosion. However, crowned teeth are rejected from evaluation, despite the fact that the reason for crowning could be the same as for the direct filling. This is considered to be one of the disadvantages of that index. Consistency results between researchers vary from low to high, depending on the surface being examined. Bardsley criticized the Larsen’s Index as time-consuming and highly complicated in both its quantitative and qualitative criteria [30].

Universality, ease comparing results comparisons with other indices, usefulness in dental erosive research conducted both on the population and individuals – those are the advantages of an index created a few years ago, called BEWE (Basic Erosive Wear Examination) (Table 3). That index is also a guide of therapeutic recommendations for erosive lesions. BEWE is based on the sextant assessment: 17–14; 13–23; 24–27; 47–44; 43–33; 34–37. A 4-point scale is used for evaluating the following surfaces of each tooth: buccolabial, palatolabial and occlusal. Subsequently, within each sextant, the most severely affected surface is chosen and the sum of the scores is calculated forming a cumulative score. The next step is a comparison of the obtained score with the risk level (Table 4). The main advantage of that index is the fact that it does not use the dentine exposure criterion, which is, as contemporary research and literature claim, a highly unreliable one. BEWE is easy to use and calibrate by the researchers. It is a standardized index with high reliability scores. It is recommended that the BEWE examination be repeated on an annual basis, biannually in the case of the risk groups. It may be accompanied by the assessment of colour photographs or diagnostic models [31–33].

Despite the high variety of wear indices in use, none of them has been compliant so far with the full spectrum of requirements of such tool as, among other things, possibly the highest validity and reliability, usefulness in both everyday clinical practice and for research purposes or comparability of results with other indices. The main problem which has been widely discussed and which hinders a comparison of results seems to be the validity of the criteria for each type of wear [16, 22, 25, 31]. Some authors claim it is pointless to use aetiological indices which base their assessment mainly on morphological features of defects. Those features may, for example in the cases of erosion or attrition, have the same clinical characteristics [10, 24, 33]. Due to the fact that the wear process is influenced by many factors, it is extremely difficult to explicitly differentiate the main aetiological factor, particularly in cases of defects that occur on occlusal surfaces or incisal margins [10, 24, 30]. Wear of incisal margins is usually ascribed to attrition [19]; however, it may as well be caused by attrition amplified by coexisting erosion as tooth tissues weakened by the influence of acids are

<table>
<thead>
<tr>
<th>Score (Wartość)</th>
<th>Criteria for grading erosive wear (Kryteria do oceny erozji wg wskaźnika BEWE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>erosive tooth wear</td>
</tr>
<tr>
<td>1</td>
<td>initial loss of surface texture</td>
</tr>
<tr>
<td>2</td>
<td>distinct defect, hard tissue loss &lt; 50% of the surface area, dentine often involved</td>
</tr>
<tr>
<td>3</td>
<td>hard tissue loss ≥ 50% of the surface area, dentine often is involved</td>
</tr>
</tbody>
</table>

Table 3. BEWE Index (Basic Erosive Wear Examination) [31]
Bishop et al. claim that the destructive role of erosion is underestimated, while it may be the main reason of non-carious tissue losses [9]. On the other hand, Bartlett claims that, despite the fact that most European researches blame erosion to be the main factor in the process of wear, in his view the primary cause for progression of that effect seems to be attrition [6]. According to Larsen et al., differentiation of attrition and erosion is so much difficult that it is possible only when epoxy resin models and 10 times magnification are used [30]. Additionally, Eccless states that another problem is the differentiation of erosive and abrasive factors. In his opinion, if there is a significant loss of the hard dental tissues and a dietetic or extrinsic factor has been found in the course of aetiological examination, the diagnosis should lean towards erosion [28]. In order to assess aetiology, the requirements include not only a clinical examination and proper choice of assessment criteria but also a detailed interview of the patient on their general state of health, taken medicine, lifestyle, diet or parafunctions. Measurement of buffer capacity of saliva is also a useful tool of conduct. In some cases, only after several visits and interviews with the patient is the potential cause identified and found as the patient may be embarrassed to talk about his or her uncharacteristic diet habits or, for example, forget about vomiting incidents they had [7, 13, 26–28]. However, Arnadottir at al. did not find a significant relation between lifestyle or diet and the occurrence of erosion in his research conducted on 15-year-old patients from Reykjavik [27]. Another widely discussed issue is the criterion of the level of dentine exposure. Frequent use in epidemiological studies or a significant number of indices that utilize this criterion are mentioned among its advantages, which facilitates easier comparison of results. However, the validity of this criterion is being frequently questioned, as exposure of dentine is not synonymous with significant level of tissue loss. Moreover, visual assessment of optical and colour characteristic of hard dental tissues may be difficult and hardly reliable [24, 32, 34].

One of the main requirements of indices is their standardization, i.e. assessment of the four main parameters such as: validity, reliability, sensitivity and specificity of the measurement tool. Validity is measured on the basis of a comparison with the so-called "gold standard" and assessed if a given index measures what it was created for. Reliability answers the question of the accuracy of a measurement. The percentage of results conformity from two or more researchers who independently examined the trail is a part of the reliability assessment procedure. Moreover, "test-retest" procedures are conducted where a researcher performs the same trial twice in a set interval [16, 33]. The Cohen’s kappa coefficient is most frequently used in the available literature to present assessment of reliability of results. Here, the strength of consistency is described by the following ranges of values: Kappa less or equal 0.2 is weak consistency; Kappa in the range between 0.21 and 0.4 is satisfactory consistency; 0.41–0.6 is moderate consistency; 0.61–0.8 is good consistency; 0.81–1.0 is very good consistency. However, when the kappa coefficient is used, there is no precise evaluation of inconsistency. If there are many categories to be analysed, it is recommended to use the weighted kappa coefficient [34]. Other characteristics of an index that undergo assessment are its sensitivity, i.e. its ability to detect a given feature and specificity, i.e. the ability not to detect a feature if it is absent [16, 33]. High validity, reliability and sensitivity are the most important characteristic of the indices which

### Table 4. Risk levels and therapeutic recommendations according to BEWE index [31]

<table>
<thead>
<tr>
<th>Risk level (Poziom ryzyka)</th>
<th>Cumulative score of all sextants („Suma BEWE”)</th>
<th>Therapeutic management (Wskazania terapeutyczne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>no risk</td>
<td>less then or equal to 2</td>
<td>control and supervision every 3 years</td>
</tr>
<tr>
<td>low</td>
<td>between 3 and 8</td>
<td>assessment of hygienic and dietetic habits of the patient, advice, control and observation every 2 years</td>
</tr>
<tr>
<td>medium</td>
<td>between 9 and 13</td>
<td>assessment of hygienic and dietetic habits of the patient, advice, identification of causes and elimination plan and actions to increase resistance of hard tooth tissues. If it is possible, withhold from making a filling and monitor erosion with use of diagnostic models, photographs. Control every 6 or 12 months</td>
</tr>
<tr>
<td>high</td>
<td>equal to 14 and over</td>
<td>recommendations as above, in case of significant progress of changes, application of filling should be taken into consideration</td>
</tr>
</tbody>
</table>
are used for epidemiological purposes. However, too many stages or levels used in a given index may cause the results to be less reliable [6, 35]. According to Larsen, high reliability scores may be influenced by: a type of assumed assessment criteria, training and calibration of researchers, long enough time of research conduct and use of supporting techniques such as study casts [30]. Casts and colour photographs are diagnostic aids frequently used for assessment of wear or progression of that effect in time. They are also used during training and calibration of examiners.

Analysis of bite-wing radiographs is another useful aid in the assessment of wear [3, 21, 22, 30–32, 35, 36]. The use of diagnostic casts has many advantages and is a permanent, repeatable method which enables good evaluation of all tooth surfaces, especially occlusal ones, as well as the type of bite. Such an examination is not pressed for time and can be conducted in well-lit conditions. However, use of the cast is burdened with no possibility to evaluate optical characteristics of enamel, such as lustre or colour. Moreover, it may be difficult to diagnose early changes or establish the characteristics of wear [15, 21, 35]. As it was mentioned earlier, diagnostic casts are useful for the assessment of progression of the effect in time. Profilometry is generally considered to be the “gold standard” in that kind of assessment [35]. This method is rather used in vitro, as its in vivo application is difficult due to problems with identification of adequate reference points. However, in vitro usage may include epoxy resin models with small linear contraction and acid-proof markers put on the examined surface in order to constitute a reference during tissue loss evaluation. A profilometer is able to detect a loss of as little as several micrometers. Nevertheless, the method is not recommended in wear research conducted on large populations due to its time-consuming nature. On the other hand, it is considered very helpful in the examination of patients from risk groups, such as those who suffer from bulimia. An alternative method to profilometry in the detection of early changes can be, for example, the New Index of Tooth Wear, a modification of the original TWI [19, 37].

Examination time span is yet another issue widely discussed in the available literature. Larsen et al. created an index with comparably extended time span of examination period as they considered this feature to be an advantage and a factor that could increase reliability [30]. However, that index has been extensively criticized by Bardsley, who considers it too time-consuming [25]. On the other hand, Smith and Knight stressed that the average time needed to perform a TWI examination does not exceed 5 minutes, including the time required to clean the tooth surface, while Bardsley, Taylor and Milosevic created a simplified version if this index in order to reduce the examination time even further [3, 18]. In order to save time, shortened versions of indices or systems assessing only chosen parts of dentition are also used in epidemiological research. Therefore, it is necessary to check if examinations of the whole dentition and those using only “index teeth” yield similar values of the Kappa coefficient.

Another controversial issue is the differentiation of “acceptable” and “pathological” wear. Smith and Knight define pathological wear as preventing effective functioning of a tooth, severely deforming its appearance. They also base their differentiation of acceptable and pathological wear on the prognosis whether a given tooth retains its pulp vitality or not. The threshold wear levels for a given age group were established by those researchers on the basis of their own clinical experience. Some of these thresholds were criticized by Donachie and Walls, as mentioned in the first part of this paper. In comparison, Bishop et al. describe pathological wear as of such extend that it is problematic for the patient in terms of aesthetics, function or if it causes dentine hypersensitivity [9]. As the study group gets older, it is becoming more and more difficult to assess the level of wear, as well as to evaluate if it is acceptable or “normal” for a given age or not [6]. The subjective point of view of the evaluator is also important: for a patient, pathological wear may be based on the aesthetic criteria, for a dentist – the occurrence of exposed dentine may be more important. Dugmore and Bartlett claim that despite the general trend to consider wear a process dependent on the age of the patient, severe wear cases are excluded from such evaluations. They examined patients in various age groups and found similar numbers of severe cases of wear in each of them. According to those researchers, the definition of pathological wear should be based on the question of whether the degree of changes qualifies for active preventive treatment or not [11]. Those indices that include therapeutic recommendation may be quite helpful in that assessment. An example of such index is BEWE [31]. On the other hand, Eccless divided his patients with symptoms of erosion into 3 classes and assigned different treatment methods for each of them [28].

A qualitative wear index was created by Oilo et al. [36]. Its main assessment criterion is the decision whether a treatment should be undertaken or not. In their research, patients with symptoms of wear were divided into 5 groups. Three first of them: Romeo, Sierra and Mike, are described as “satisfactory” and therefore require no treatment.
Tango category and Victor group, which comprised the most severe cases of wear, were considered unacceptable. A set of colour photographs to depict subsequent stages of wear can be a helpful model aid in qualification of cases. When a given patient already has the category of wear established, the upper limit of acceptable results which qualify to higher categories is set. The number of teeth present in the oral cavity is used as a factor for setting those thresholds. Age of the patient also plays an important role in assessing the necessity of treatment in each case [36].

Despite the fact that the “gold standard” of the non-carious defect indices has not been yet reached, the usefulness of those measurement tools in various types of research is undeniable. In order to accurately choose an index for a given purpose it is essential to have knowledge of critical opinions in the literature on the available range of indices and the degree of their compliance with the qualitative criteria. Implementation of such wear measurement tools in everyday practice should enable the dentists to recognize potential changes even in their initial stages of advancement, as well as to monitor their progression and to undertake proper therapeutic decisions and subsequent actions.

References
Usefulness Assessment of Non-Carious Dental Defects Indices


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Conflict of interest: None declared

Received: 19.05.2011
Revised: 12.03.2012
Accepted: 13.06.2013