Dentures: the growing patient population and challenges for the dental profession

Non-Carious Tooth Surface Loss and the BEWE

Professor Paul Brunton talks about tooth surface loss and the use of the Basic Erosive Wear Examination in General Dental Practice
About the Author

Professor Paul Brunton
PhD, MSc BChD FDS RCS Rest Dent (Edin) FGDP (UK) RCS (Eng) FDS RCS (Eng)

Paul Brunton is Professor of Restorative Dentistry at the University of Leeds School of Dentistry. The team at Leeds have always had an interest in the diagnosis, prevention and management of non-carious tooth surface loss and have published regularly in this field. This article reflects on the BEWE and its use by practitioners in the overall management of tooth wear.

The Restorative Dentistry Team

Ahmed Alhilou
Specialty Registrar in Restorative Dentistry BChD, MFDS RCS (Ed), MSc ClinDent (Rest)

Hannah P Beddis
Specialty Registrar in Restorative Dentistry BChD (Hons), MJDF RCS (Eng)

David W. Seymour
Specialty Registrar in Restorative Dentistry BChD, MFDS RCS (Ed), MSc ClinDent (Rest)

Abstract

Non-carious tooth surface loss (NCTSL) is considered to be of increasing concern to general dental practitioners. Recent studies have shown that there has been an increase in the prevalence of patients aged 18-35 presenting with NCTSL within Western Europe. It is vital to correctly identify the causes and appreciate the severity of NCTSL in order to successfully manage patients presenting with the condition. Historically, a number of indices have been developed to aid the clinician in recording the severity of NCTSL, however, none have been widely used in general practice, most likely due to their complexities. The Basic Erosive Wear Examination (BEWE) is a relatively new index which aims to provide a simple, repeatable system appropriate to screen and record NCTSL of multi-factorial aetiology in general dental practice. This article aims to describe the use of the BEWE and discuss its applicability within general practice.

Introduction

Non-carious tooth surface loss (NCTSL) is a generic term that is used to describe the loss of dental hard tissues from causes not related to dental caries, trauma or developmental disorders. NCTSL is a physiological process that occurs as part of the aging process, causing loss of enamel between 28-30µm per annum. However, patients regularly present to the general dental practitioner with NCTSL that is disproportionate to the presenting age which is therefore considered to be pathological. This can have a significant effect on a patient’s quality of life with patients complaining of symptoms which include pain, discomfort, and unsatisfactory aesthetic appearance and reduced masticatory efficiency.

NCTSL is considered to be a growing concern amongst general dental practitioners. A recent systematic review which examined 186 studies showed that there has been an increase in the prevalence of severe tooth wear in the adult population from 3% at the age of 20 to 17% at the age of 70. A recent observational cross-sectional study by Bartlett et al found that 29% of 3187 European adults aged 18-35 exhibited NCTSL. Interestingly, the study revealed a variation amongst countries with the largest amount of NCTSL found in the United Kingdom.

Causes of NCTSL

Dental professionals generally classify the cause of NCTSL into one of four groups. NCTSL is often multifactorial in origin and could be due to one, or more likely a combination of the following: 3 5 6 7 8

- **Attrition**: Caused by tooth-to-tooth friction. Occlusal and incisal attrition can occur during function and parafunction, although wear becomes most severe during bruxism, which can lead to advanced and often rapid wear of the dentition.

- **Abfraction**: A consequence of eccentric forces on the natural dentition, which are theorised to cause tooth fatigue, flexure and deformation via biomechanical loading of the tooth structure. Cusp flexure causes stress at the cervical region which leads to loss of the overlying tooth structure, typically forming wedge-shaped lesions with sharp line angles.

- **Erosion**: Caused by chemical or electrochemical action other than bacteria (Fig. 1a-b). The sources can be:
  - **Endogenous**: Regurgitation, which is either voluntary (e.g. Anorexia Nervosa or Bulimia Nervosa) or involuntary (e.g. gastro-oesophageal reflux disease) produces a unique pattern of enamel loss. The erosion pattern is most marked on the palatal surfaces of maxillary teeth. The enamel appears thin and translucent. Depressions or concavities occur at the cervical areas.
Tooth Surface Loss
the Basic Erosive Wear Examination in General Dental Practice

Figures 1a, 1b: A patient presenting with severe NCTSL primarily due to erosion. Note that tooth surface loss is significant on the palatal surfaces of maxillary teeth and occlusal surfaces of the upper and lower posterior dentition. The enamel appears thin and translucent whilst concavities are present at the cervical areas. These clinical findings are consistent with patients suffering from GORD. The BEWE scores are 3/3/3 in the upper arch and 3/2/3 in the lower arch, with a cumulative score of 17: high risk.

Figures 2a, 2b: patient presenting with relatively mild NCTSL has a BEWE score 2/2/1 in the upper arch and 1/2/0 in the lower arch, resulting in a summative score of 8. This score would identify the patient as being a low risk patient and therefore would guide the clinician to instigate preventative measures.

Figures 3a-3c: patient presenting with localised NCTSL with attrition being the primary aetiological factor. This patient has a BEWE score of 0/3/0 in both upper and lower arches. This would result in a summative score of 6, which would identify the patient as being a low risk patient. This is contrary to the true clinical picture in view of the loss of clinical crown height, particularly affecting the UR2.

• Exogenous: any substance that has a critical pH of less than 5.5 is considered to be erosive and can potentially cause tooth surface loss, e.g. carbonated soft drinks or citrus fruits.

Erosion is the most common type of NCTSL found in the adult European population, which may be due to the fact that the population in Europe are retaining more natural teeth with age, together with changing lifestyles and social pressures.

Assessment of NCTSL
The successful management of patients presenting with NCTSL is multifaceted; it is vital to have a correct diagnosis and appreciation of the severity of the NCTSL in order to correctly manage the condition. Dentists often use the subjective terms ‘mild,’ ‘moderate’ and ‘severe’ to describe NCTSL, with obvious inherent difficulties in interpretation and comparison. The use of these terms does not allow monitoring of progression of TSL with any accuracy. A number of indices have been devised to assist the clinician in recording NCTSL, however, none have been used in general dental practice. The most popular index is the Tooth Wear Index (TWI), devised in 1984 by Smith and Knight, which is used primarily in epidemiological studies. The TWI relies on the ability of the clinician to
scores of 2-3. A comparison of three tooth BEWE scores of ≥1, and around a third have approximately half of the population have in the general population found that 10 research and general dental practice. The appropriate for use in epidemiological aims to provide a simple, repeatable system et al, first described in 2008 by Bartlett et al, the Basic Erosive Wear Examination (BEWE), has been adopted more by clinicians. The Basic Erosive Wear Examination (BEWE), aims to provide a simple, repeatable system appropriate for use in epidemiological research and general dental practice. The BEWE is a partial scoring system for the severity of NCTSL, with similarities to the Basic Periodontal Examination (BPE). Unlike other NCTSL indices, the BEWE describes NCTSL in terms of the surface area affected rather than the depth of the lesion in terms of dentine or pulpal exposure. All teeth are examined, and the worst affected tooth in each sextant is scored on a 4-point scale according to the severity of wear (Table 1). The sextant scores can be annotated in a similar manner to the BPE. The sum of these scores is calculated: this score is used to classify the patient’s risk level for NCTSL. A guide for clinical management is given according to this risk (Table 2) (Figs 1-3).

Management strategies include identification of risk factors, preventive treatment and restorative management. The BEWE also gives guidance as to the frequency of repeat scoring: higher risk patients should be scored more often. It is important to note that the BEWE is used for all forms of NCTSL, not only erosive NCTSL as the title suggests.

The BEWE has been advocated for use in dental public health research and epidemiology. A cross-sectional study in the general population found that approximately half of the population have BEWE scores of ≥1, and around a third have scores of 2-3. A comparison of three tooth wear indices found the BEWE was simple and convenient to use, although it appeared to underestimate the severity of the NCTSL indicated by the other indices: the BEWE scores found that 80.1% had cumulative scores of 0-1, whilst the other indices found that 22.7-24.3% of subjects had severe erosive lesions into dentine.

A study of 164 patients in general dental practice compared the BEWE to the TWI. A BEWE score of 3 (moderate-severe wear) had a sensitivity of 48.6% and specificity of 96.1% in relation to TWI score 3, and 90.9% and 91.5% respectively in comparison to TWI score 4. On assessment of study models, moderate inter- and intra-examiner agreement was recorded ($k_{	ext{MC}}=0.43$ and 0.57 respectively). In contrast, Mulic (2010) found higher values for interexaminer and intraexaminer agreement for the BEWE: $k_{	ext{MC}}=0.69$ and 0.78 respectively for examination of photographs and $k_{	ext{MC}}=0.73$ and 0.92 for clinical examination.

The BEWE can be applied retrospectively to existing studies to allow better comparison between studies using different indices. Holbrook et al (2014) retrospectively applied the BEWE to a large community-based sample of 2251 patients and to a group of patients referred to secondary care, with similarly significant results to the original studies. The use or retrospective application of the BEWE to large samples can give an idea of the needs for prevention and treatment in a population from a public health viewpoint. This can lead to better targeting of resources to at-risk groups. Forecasting likely treatment needs with regards to NCTSL could also be useful for dental insurance or other treatment cost plans.

### Table 1: BEWE Criteria for scoring TSL

<table>
<thead>
<tr>
<th>BEWE score</th>
<th>Clinical appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No surface loss</td>
</tr>
<tr>
<td>1</td>
<td>Initial loss of enamel surface texture</td>
</tr>
<tr>
<td>2</td>
<td>Distinct defect, hard tissue loss &lt;50% of the surface area</td>
</tr>
<tr>
<td>3</td>
<td>Hard tissue loss &gt; 50% of the surface area</td>
</tr>
</tbody>
</table>

### Table 2: Risk/complexity levels as calculated by BEWE and guide for management

<table>
<thead>
<tr>
<th>Risk/complexity level</th>
<th>Sum of BEWE scores from all sextants</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>≤2</td>
<td>Routine maintenance and observation Repeat at 3-year intervals</td>
</tr>
<tr>
<td>Low</td>
<td>3-8</td>
<td>Oral hygiene and dietary assessment, and advice, routine maintenance and observation Repeat at 2-year intervals</td>
</tr>
<tr>
<td>Medium</td>
<td>9-13</td>
<td>Oral hygiene and dietary assessment, and advice, identify the main aetiological factor(s) for tissue loss and develop strategies to eliminate respective impacts Consider fluoridation measures or other strategies to increase the resistance of tooth surfaces Ideally, avoid the placement of restorations and monitor erosive wear with study casts, photographs, or silicone impressions Repeat at 6–12-month intervals</td>
</tr>
<tr>
<td>High</td>
<td>≥14</td>
<td>Oral hygiene and dietary assessment, and advice, identify the main aetiological factor(s) for tissue loss and develop strategies to eliminate respective impacts Consider fluoridation measures or other strategies to increase the resistance of tooth surfaces Ideally, avoid restorations and monitor tooth wear with study casts, photographs, or silicone impressions Especially in cases of severe progression consider special care that may involve restorations Repeat at 6–12-month intervals</td>
</tr>
</tbody>
</table>
The use of the BEWE in general practice

It is important to appreciate that BEWE has its limitations as a tool in the management of patients presenting with NCTSL notably it should not be used as a screening tool and as such it is not equivalent to the Basic Periodontal Examination (BPE). In contrast, the widely used BPE successfully screens a population for periodontal disease and consequently provides the clinician guidance on basic treatment need. It fails, however, to provide a diagnosis or act as a monitoring tool.

Nonetheless, the BEWE is a simple and easy to use sextant-based tool that aids the clinician in identifying the severity of NCTSL once NCTSL has been diagnosed. However, the term ‘erosive wear’ may be confusing as it implies exclusively to erosive NCTSL only. As stated above, NCTSL is frequently multifactorial and often has more than one aetiological factor.

The guide to clinical management is a little contentious; the management strategies presented in the table advocate similar strategies for individuals considered to be at medium and high risk except for “special cases.” The BEWE appears to recommend avoidance of restorations except following referral to specialist care that may involve restorations. The guide to clinical management is a little contentious; the management strategies presented in the table advocate similar strategies for individuals considered to be at medium and high risk except for “special cases.” The BEWE appears to recommend avoidance of restorations except following referral to specialist care that may involve restorations. The guide to clinical management is a little contentious; the management strategies presented in the table advocate similar strategies for individuals considered to be at medium and high risk except for “special cases.” The BEWE appears to recommend avoidance of restorations except following referral to specialist care that may involve restorations. The guide to clinical management is a little contentious; the management strategies presented in the table advocate similar strategies for individuals considered to be at medium and high risk except for “special cases.” The BEWE appears to recommend avoidance of restorations except following referral to specialist care that may involve restorations. The guide to clinical management is a little contentious; the management strategies presented in the table advocate similar strategies for individuals considered to be at medium and high risk except for “special cases.” The BEWE appears to recommend avoidance of restorations except following referral to specialist care that may involve restorations. The guide to clinical management is a little contentious; the management strategies presented in the table advocate similar strategies for individuals considered to be at medium and high risk except for “special cases.” The BEWE appears to recommend avoidance of restorations except following referral to specialist care that may involve restorations.

It is in the authors’ opinion that this might not be in the patient’s best interest as intervention in the majority of cases would be required to improve speech, function and aesthetics. (Fig. 3a-c)

Conclusion

The BEWE is a simple and easy to use index for screening and recording NCTSL of multifactorial aetiology in general dental practice. The tool shares some conceptual similarities to the widely used BPE score, so is likely to be acceptable to the general dental practitioner. However, the recommendations for patient management may be seen as overly simplistic and fail to take into account patient factors such as the presence of symptoms or a patient driven aesthetic concern.

It is clear that despite its limitations the BEWE is a useful adjunct to practitioners in the management of NCTSL and its use in general dental practice is recommended.

References