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Terminology of Erosive Tooth Wear: Consensus Report of a Workshop Organized by the ORCA and the Cariology Research Group of the IADR

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Abstract
Our understanding of erosive tooth wear and its contributing factors has evolved considerably over the last decades. New terms have been continuously introduced, which frequently describe the same aspects of this condition, whereas other terms are being used inappropriately. This has led to unnecessary confusion and miscommunication between patients, professionals, and researchers. A group of 15 experts, selected by the European Organization for Caries Research (ORCA) and the Cariology Research Group of the International Association for Dental Research (IADR), participated in a 2-day workshop to define the most commonly used terms in erosive tooth wear. A modified Delphi method was utilized to reach consensus. At least 80% agreement was achieved for all terms discussed and their definitions related to clinical conditions and processes, basic concepts, diagnosis, risk, and prevention and management of erosive tooth wear. Use of the terms agreed on will provide a better understanding of erosive tooth wear and intends to enable improved communication on this topic.

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Introduction

Over the last decades, the topic of acid-related tooth destruction has been increasingly researched and reported more frequently in the literature. A simple PubMed search with the terms "dental erosion OR erosive tooth wear OR tooth erosion" revealed nearly 4,000 hits, showing the general interest in this area. The major problem in this literature is that the terminology has evolved with variations in the meaning of a single term, and sometimes different terms are used to describe the same condition. Therefore, this paper defines the most commonly used terms related to erosive tooth wear and its management. Use of a common terminology will facilitate less ambiguous communication between researchers, clinicians, and their patients. It will also enable better documentation and interpretation of research findings and clinical observations.

Methods

The European Organization for Caries Research (ORCA) and the Cariology Research Group of the International Association for Dental Research (CRG-IADR) organized a consensus workshop on terminology related to erosive tooth wear and dental caries that was held in Frankfurt, Germany, from February 6 to 7 in 2019. Two groups of experts were selected, one for caries and one for erosive tooth wear. This article refers only to the results from the erosive tooth wear group.

Fifteen experts were selected by the executive boards of both organizations to participate in the erosive tooth wear section of the workshop, with N.S. and F.L. appointed as chairs. A draft document containing the most commonly used terms and their proposed definitions was prepared by N.S. and F.L. Prior to the workshop, this document was circulated to the experts who independently decided on the appropriateness and accuracy of the provided statements. All individual feedback was collected and combined into one document by N.S. and F.L., which was then shared among workshop participants. New terms and their definitions brought forward by the experts were also included in this document.

A modified Delphi process was used to establish the most commonly used terms and their definitions. The nominal group method was then used to reach consensus on each definition. Consensus with the final definitions or statements was ascertained by anonymous voting. Each term and its definition were voted on separately. An agreement of at least 80% was needed to confirm the definition and/or statement for each term. The reached agreement in percent is given after each term in parentheses.

The terms and their definitions are presented in the following categories: clinical conditions and processes, basic concepts, diagnosis, risk, and prevention and management of erosive tooth wear. In addition to some of the definitions, further explanations are given in italics. In these cases, the percentage of agreement also refers to these additional explanations. For this paper, the term "mineralized tooth substance" refers to dental enamel, dentine, and cementum.

Terms and Definitions

1. Clinical Conditions and Processes

Conditions

- Tooth wear (100%): The cumulative surface loss of mineralized tooth substance due to physical or chemophysical processes (dental erosion, attrition, abrasion). *Tooth wear is not considered to be the result of dental caries, resorption, or trauma.*
- Erosive tooth wear (100%): Erosive tooth wear is tooth wear with dental erosion as the primary etiological factor.

Processes

- Dental erosion (100%): Dental erosion is the chemical loss of mineralized tooth substance caused by the exposure to acids not derived from oral bacteria.
- Dental attrition (100%): Dental attrition is the physical loss of mineralized tooth substance caused by tooth-to-tooth contact.
- Dental abrasion (100%): Dental abrasion is the physical loss of mineralized tooth substance caused by objects other than teeth.

Discouraged Terms

- Demastication (100%): The term demastication is discouraged and will not be defined in this publication.
- Abfraction (100%): The term abfraction is discouraged and will not be defined in this publication. The level of evidence currently available is too weak to justify it as a separate process.
- Acid erosion/acidic erosion (93%): The terms acid erosion and acidic erosion have the same meaning as dental erosion, are discouraged, and will not be defined in this publication.
- Tooth surface loss (100%): The term tooth surface loss has been used to describe tooth wear. Its use is discouraged in the clinical situation and will be defined in the context of research outcome measures.

2. Basic Concepts

- Erosive challenge (100%): Exposure to an acid, which may lead to an erosive demineralization.
- Erosive demineralization (100%): Loss of tooth mineral caused by exposure to acids resulting in an erosive lesion.
- Resistance to dental erosion (100%): The capability of the mineralized tooth substance to withstand an erosive challenge.

- Protection against dental erosion (100%): Any measure which increases the resistance of the mineralized tooth substance to dental erosion, prevents exposure to or limits the effect of an erosive challenge.
- Remineralization (87%): Recovery of the original mineral phase of the tooth substance after demineralization. *There is insufficient evidence that remineralization in dental erosion occurs; however, surface deposition of mineral may be possible.*
- Erosive potential/erosivity (100%): The capability to cause dental erosion. *The erosive potential of a substance depends on several factors, such as its pH and buffering properties, calcium and phosphate contents (degree of saturation), fluoride content, and temperature. Whether the erosive potential translates into dental erosion depends on host factors and exposure conditions.*
- Buffering properties (100%): Buffering properties of an aqueous solution are a measure of resistance to pH change and can be represented by:
  - Titratable acidity: the amount of base, given in mmol/l, needed to raise the pH to a defined level (normally 7.0).
  - Buffering capacity: the buffering at the pH of the investigated solution. It can be assessed from the slope of the titration curve at the solution pH.
- Abrasive potential/abrasivity (100%): The capability to cause dental abrasion.
- Endogenous/intrinsic acids (87%): Acids from the gastric juice.
- Exogenous/extrinsic acids (93%): Acids from external sources, such as the diet, environment and/or drugs.
- Laboratory terms (93%):
  - Sound tooth surface: A tooth surface without any recognizable defect.
  - Initial (early) erosive lesion: A lesion with mineral loss without surface loss.
  - Advanced erosive lesion: A lesion with mineral loss together with surface loss.

Discouraged Terms

- Corrosive wear, bio-corrosion (100%): The terms corrosive wear and bio-corrosion are discouraged and will not be defined in this publication.

3. Diagnosis

- Diagnosis of erosive tooth wear integrates findings from the patient history, assessment of risk factors and an oral examination (100%).
- Typical early signs of erosive tooth wear include defects that are shallow; they mostly affect the smooth surfaces and the area coronal to the cemento-enamel junction with an intact band at the gingival margin. On the occlusal surfaces, cupping and flattening of the surface can be found. As erosive tooth wear progresses, the dentine color becomes more visible and restorations may protrude from the surrounding dental hard tissue. Finally, the teeth can have a melted appearance losing the morphology of sound teeth (93%).
- Physiological tooth wear (87%): Some degree of tooth wear expected over a lifetime. The rate of progression varies between individuals and not all tooth wear needs treatment.
- Pathological tooth wear (93%): Tooth wear can be defined as pathological if it is beyond the physiological level relative to the individual's age and interferes with the self-perception of well-being.
- Classification (100%):
  - Mild erosive tooth wear (BEWE 1): Initial loss of surface texture.
  - Moderate erosive tooth wear (BEWE 2): Distinct defect: hard tissue loss involving less than 50% of the surface area.
  - Severe erosive tooth wear (BEWE 3): Hard tissue loss involving more than 50% of the surface area.

  Moderate and severe levels may involve dentine exposure.
- Distribution of erosive tooth wear (87%):
  - Localized erosive tooth wear is restricted to a few teeth.
  - Generalized erosive tooth wear involves most of the teeth.

Discouraged Term

- Activity of erosive tooth wear (100%): As activity refers to disease, this term is discouraged and will not be defined in this publication.

4. Risk

- Erosive tooth wear risk (87%): The probability that erosive tooth wear will occur within a defined period of time or at a certain age.
- Risk factor/predisposing factor for erosive tooth wear (100%): A risk factor or predisposing factor is any aspect of personal lifestyle, habit, or behavior, medical condition, environmental exposure, or an inborn or inherited characteristic, which is evidentially associated with an increased probability to develop erosive tooth wear. Risk factors are a part of the causal chain or expose the individual to the causal chain.

- Variable/modifiable risk factor (93%): The risk factor can be modified by an intervention, which in turn can reduce the likelihood to develop erosive tooth wear.
- Risk marker/risk indicator (100%): An attribute or exposure that is associated with an increased probability of developing erosive tooth wear, but not thought to be a part of the causal chain (e.g., some evidence showing that erosive tooth wear in the primary dentition is a risk marker for erosive tooth wear in the permanent dentition).
- Risk assessment for erosive tooth wear (100%): Risk assessment comprises the qualitative and quantitative estimation of the likelihood of developing erosive tooth wear. It uses clinical, epidemiologic, environmental, and other relevant data. Screening for erosive tooth wear is the first step of risk assessment – if indicated, the next steps would be:
  - Risk factor identification and characterization
  - Exposure assessment
  - Risk estimation (combining the above to quantify risk level)
- Risk management of erosive tooth wear (100%): Risk management includes various steps to reduce the level of risk, which are (a) risk evaluation; (b) exposure control; and (c) risk monitoring. In case of erosive tooth wear, it comprises the analysis of which type of wear leads to the hard tissue loss, reduction of acid exposure and exposure to physical forces, and the control whether recommendations are sustainably realized in daily practice.

5. Prevention and Management of Erosive Tooth Wear

- Management is the complete scope of care and self-care including diagnosis, risk assessment, prevention (primary, secondary, tertiary), and monitoring of erosive tooth wear (100%).
- Prevention of erosive tooth wear:
  - Primary Prevention (93%): Primary prevention involves general/nonpersonalized advice about risk factors and can include population-based measures to prevent erosive tooth wear.
  - Secondary Prevention (100%): Following diagnosis, secondary prevention involves nonrestorative treatment of erosive tooth wear, including personalized advice, and, when appropriate, liaison with other healthcare professionals.
  - Tertiary Prevention (80%): In addition to secondary prevention, restorative treatment strategies may be considered in tertiary prevention.
- Erosive tooth wear monitoring (100%): Regular assessment of erosive tooth wear status tailored to the patient's needs.

Conclusions

The consensus workshop participants recommend to continuously review the discussed terminology every 5 years or sooner if new terms arise that require clarification.

The attached references were considered by the workshop participants in the selections of the discussed terms and their definitions.

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Disclosure Statement

The authors declare that they have no conflicts of interest.

Author Contributions

N.S. and F.L. wrote the first draft of the manuscript. All authors contributed equally to the success of the workshop and the final version of the manuscript.

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