

# TOOTH WEAR

*A guide for general practice*



In collaboration with:

Professor David Bartlett, King's College London Dental Institute, UK

Professor Marília Afonso Rabelo Buzalaf, Bauru Dental School, University of São Paulo, Brazil

Professor Nicola West, Bristol Dental School, University of Bristol, UK



# AN INTRODUCTION TO TOOTH WEAR

## What is tooth wear?

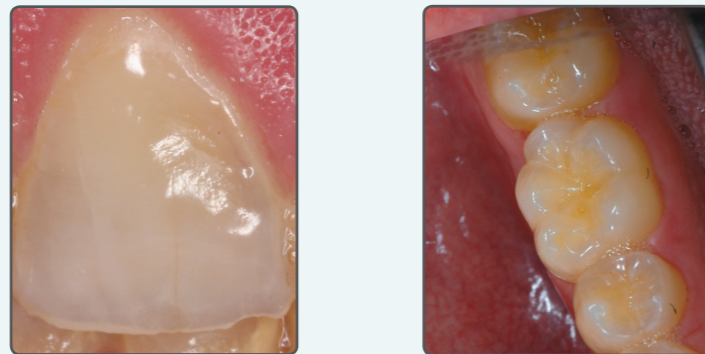
Tooth wear describes the cumulative loss of dental hard tissue due to non-bacterial causes.<sup>1,2</sup> Under normal circumstances, teeth should last a lifetime. While a degree of tooth wear is part of normal aging, a number of chemical and mechanical factors are also implicated.<sup>3</sup> The resulting changes in tooth shape and potential loss of function can have a substantial impact on patients' health and wellbeing.<sup>3</sup>

## What are the clinical implications?

Tooth wear is common and increasing in prevalence.<sup>3</sup> A study of 3,000 adults aged 18–35 years in Europe found that the majority had signs of wear.<sup>4</sup> Severe wear (BEWE score  $\geq 2$ ) affected 54% of those in the UK, 26% in France and 22% in Italy.<sup>4</sup> In Brazil, a smaller scale study reported that 62% of adults had tooth wear, with 12% affected by severe wear.<sup>5</sup> Tooth wear already present in young adults is likely to worsen with age.<sup>4</sup>

Tooth wear is difficult to diagnose in the very early clinical stages. When visible, early signs include subtle changes to the features – particularly noticeable on the upper incisors. These can manifest as loss of the mamelons and smoothing of buccal/facial enamel surfaces. The first molars may show small depressions on the mesio-buccal cusp, which may progress to become more of a ditched lesion.

Early clinical signs of tooth wear, including loss of mamelons and smoothing of buccal/facial surfaces



Gradually, as the condition worsens, changes in the surface features become more noticeable. Eventually dentine is visible. Once this stage has been reached, more profound changes can occur, such as loss of tooth height and a generalised flattening of the teeth. The condition almost invariably involves more than one tooth, but can be limited to the anterior or posterior region. In severe cases, the condition can affect almost all the teeth. Once past the early phase, the damage can be cumulative and irreversible. Once enamel or dentine is lost it cannot be replaced – and ultimately, if untreated, patients may suffer psychological distress, depression and loss of self-esteem.<sup>3</sup>

# A PRIORITY FOR DENTAL PROFESSIONALS

## How have priorities changed?

In recent years, tooth wear has assumed a higher priority among dental professionals.<sup>3</sup> The overall caries rate may have declined, or at least become associated more with at-risk individuals, in many western countries. Erosive tooth wear, on the other hand, has become more of an issue. To complicate this, many of the risk factors associated with progression are considered to represent healthy lifestyles. Fruit and vegetable consumption has been associated with increasing severity of erosive tooth wear; however, the major risk is presented by the frequency of consumption rather than the food itself.<sup>3</sup>

Early identification of people at risk of tooth wear is essential to enable long-term management strategies that prevent progressive, irreversible enamel loss.<sup>3</sup>

## What factors contribute?

Tooth wear is a multifactorial process with both chemical and mechanical causes.<sup>3</sup> Clinical management therefore requires careful and targeted risk assessment to identify causative factors and implement an appropriate prevention strategy.<sup>3,7</sup>

1. **Erosion** refers to enamel softening and dissolution by acid.<sup>3,8</sup> Acid can originate from intrinsic or extrinsic sources.<sup>9</sup> **Extrinsic acids**, such as those from acidic foods and drinks, are a major and increasing source of erosion as populations move towards healthy, albeit erosive, diets.<sup>3,10</sup> Fundamentally, increased risk is associated with frequency of consumption. People choosing acidic fruit in their diets should be aware that snacking throughout the day considerably raises the risk of erosive tooth wear. **Intrinsic acids** include gastric acids from acid reflux or bulimic vomiting. While erosion due to intrinsic acids is less common, it is generally more severe.<sup>11</sup>
2. **Abrasion** is the mechanical removal of hard tissue by foreign bodies introduced into the oral cavity; for example, pens, finger nails, tobacco pipes, toothbrushes and toothpaste.<sup>3,8,12</sup> Abrasion has been associated with toothbrushing but for most people normal tooth brushing is unlikely to lead to tooth wear.<sup>3</sup> However, over-zealous brushing forces can result in wear along the vestibular surfaces of the anterior teeth.<sup>3,13</sup> The level of abrasion on both enamel and dentine increases with brushing force.<sup>14</sup>
3. **Attrition** is the mechanical removal of hard tissue from direct contact between teeth – either natural or restored.<sup>12</sup> An example is bruxism (grinding or clenching), which may affect 30% of people,<sup>15</sup> but often without their awareness.<sup>3</sup>

The Basic Erosive Wear Examination (BEWE)<sup>6</sup> is a four-point scale (0–3) that allows practitioners to assess tooth wear. A BEWE score  $\geq 2$  indicates more severe wear with potential health implications.

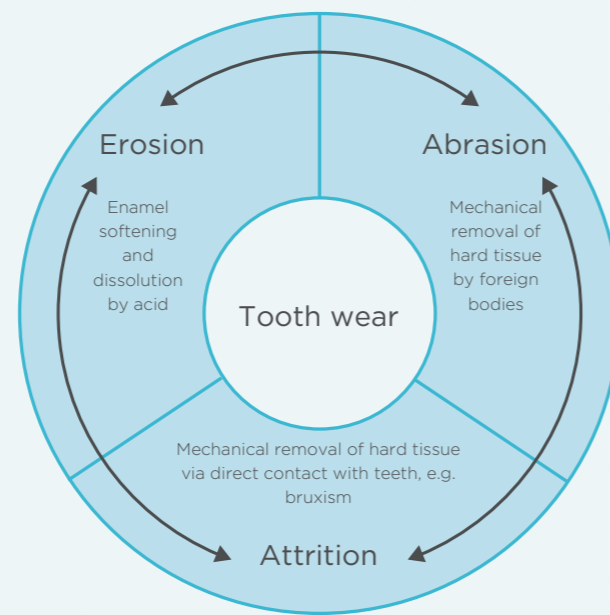


[www.bewe-assist.com](http://www.bewe-assist.com)



# THE MULTIFACTORIAL AETIOLOGY OF TOOTH WEAR

Most clinical cases of tooth wear involve an interaction between erosion, abrasion and attrition, although the role of acid often predominates.<sup>3,12,16</sup> For example, *in situ* data have shown that sound enamel is very hard and tooth brushing effects are negligible.<sup>16</sup> However, when enamel becomes softened by erosion, it becomes more vulnerable to mechanical wear by forces of abrasion or attrition. Just a few brush strokes, or even the tongue, can remove the surface layer of softened enamel.<sup>16</sup> Consequently, patients should be advised to either brush before eating or wait at least 30 minutes after eating before brushing.



The abrasivity of toothpaste is described in terms of its **relative dentine abrasivity (RDA)** or **relative enamel abrasivity (REA)** value.<sup>14</sup>

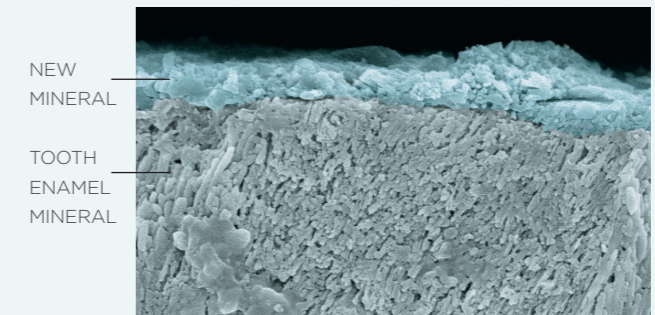
- RDA describes abrasivity on dentine *in vitro* relative to an International Organization for Standardization (ISO) standard value of 100. The ISO maximum limit is 250. Normal toothbrushing with toothpastes that conform to the ISO standard is predicted to cause virtually no wear: an estimated 0.5 mm over 50 years.<sup>16</sup> *In vitro*, wear increases with RDA. However, *in situ*, the pellicle, saliva flow and fluoride may protect against wear and no significant difference in wear has been recorded with RDAs of 90–204.<sup>17</sup>
- REA describes abrasivity on enamel relative to a standard value of 10. The maximum limit is 40.<sup>18</sup> RDA and REA values do not necessarily correlate – low abrasivity on dentine does not always imply low abrasivity on enamel.<sup>14</sup>

# INTRODUCING REGENERATE™ Enamel Science

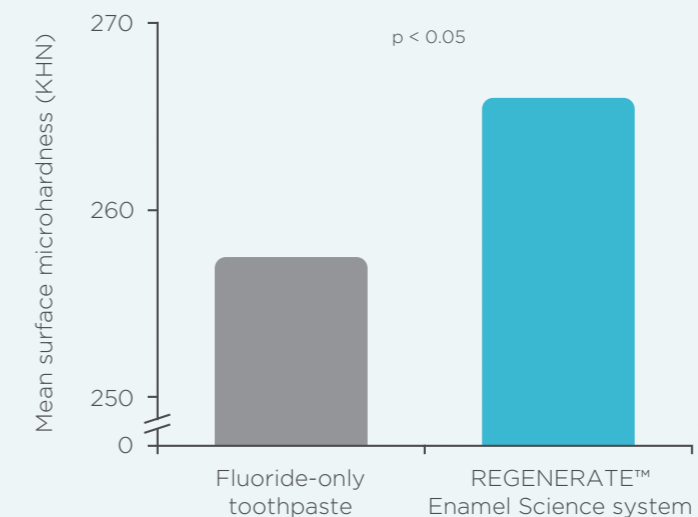
REGENERATE™ Enamel Science with NR-5™ technology, proven to reverse early enamel erosion.\*

The system contains patented† NR-5™ technology, clinically proven to form new hydroxyapatite (HAP) directly onto the enamel surface.<sup>19</sup> Analysis shows the newly-formed HAP has identical structural morphology, chemical composition and crystal symmetry to the underlying enamel mineral.<sup>19</sup>

The REGENERATE™ Enamel Science system consists of an Advanced Toothpaste† for daily brushing and an Advanced Enamel Serum for monthly application on 3 consecutive days. With every use, the NR-5™ ingredients of calcium silicate and sodium phosphate combine to form a fresh supply of enamel minerals, which wrap and integrate onto teeth, regenerating enamel mineral.<sup>19</sup>



Clinically proven superior enamel remineralisation in the mouth<sup>20§</sup>



In an *in situ* study, 3 days' use of the REGENERATE™ Enamel Science Advanced Toothpaste and Advanced Enamel Serum system resulted in superior re-hardening of acid-softened enamel compared with standard fluoride toothpaste.<sup>20</sup>

\* Acts on early invisible stages of enamel erosion. Helps to regenerate enamel by restoring its mineral content and microhardness with regular use. Clinically proven.

† Patents granted and pending.

‡ Contains fluoride at 1450 ppm.

§ Based on an *in situ* test of combined use of Advanced Toothpaste and Advanced Enamel Serum. Effect compared with standard fluoride toothpaste.



## ASK THE EXPERTS

### *When can REGENERATE™ Enamel Science be recommended to prevent erosive tooth wear? Is it for early-stage wear only?*

Re-hardening of acid-softened dental tissue is a preventive strategy that is relevant at any stage in erosive tooth wear.

If a patient's risk assessment shows a high frequency of dietary acid intake, it would be appropriate to recommend products as a preventive measure. Where erosion is clinically visible with a BEWE score of 1, 2 or even 3, a dental professional should recommend a protective product to prevent further damage.

### *Is REGENERATE™ Enamel Science suitable for patients who experience acid reflux, regurgitation or suffer from bulimia?*

Yes, the products are suitable for these patients, and in some cases it may be appropriate to recommend serum usage more frequently than the standard recommendation. Prevention must be in addition to appropriate dental referral to preserve the remaining teeth and medical referral to manage the underlying condition.

### *Would REGENERATE™ Enamel Science be useful in cases of abrasive wear?*

Abrasive wear on its own rarely causes significant damage to sound enamel, but wear progresses when enamel is softened by erosive acids. Therefore, these products are recommended for patients who show a clinical pattern of wear consistent with abrasion. Dietary advice is essential to reduce the frequency of acid food or drink intake, alongside counselling on appropriate methods of oral hygiene.

### *Would REGENERATE™ Enamel Science be useful in cases of bruxism?*

Less is known about the progression of bruxism, but patients with bruxism should benefit from brushing with a fluoride toothpaste; therefore, it might be appropriate to recommend REGENERATE™ Enamel Science to help protect, alongside other physical preventive regimes.

## COLLABORATORS



**Professor David Bartlett** is Head of Prosthodontics and the MClin Dent at Kings College London Dental Institute, UK. David has published over 100 research publications, written 3 books and numerous chapters, and is internationally known for his research on tooth wear and in particular acid erosion. David is an internationally respected specialist in prosthodontics and runs the largest specialty training programmes in prosthodontics in Europe.



**Professor Marília Afonso Rabelo Buzalaf** is Professor of Biochemistry and Cariology at Bauru School of Dentistry, University of São Paulo, Brazil. Her research interests span basic sciences, epidemiology and clinical trials; predominantly focussing on prevention of dental caries and erosion. Marília has published 250 papers and 3 books and has received international accolades for her research, including the 2014 IADR H. Trendley Dean Memorial Award, one of the highest honours bestowed by IADR.



**Professor Nicola West** is Head of Periodontology and Honorary Consultant in Restorative Dentistry at Bristol Dental School, UK, where she also leads the Clinical Trials Unit. Nicola publishes and lectures internationally on her broad range of research and clinical interests, including erosive tooth wear, dentine hypersensitivity and evaluation of oral health care products. Nicola is also a committee member of BSI British Standards and the UK National Standards Body (NSB) that contributes to development of ISO standards in dentistry.



# REGENERATE™ Enamel Science

*For those at risk of tooth wear*



**Advanced Toothpaste**  
*Daily use*



**Advanced Enamel Serum**  
*Monthly use for 3 consecutive days*

## References

1. Carvalho TS, Colon P, Ganss C, et al. Consensus report of the European Federation of Conservative Dentistry: erosive tooth wear-diagnosis and management. Clin Oral Investig 2015; 19:1557-1561; 2. Buzalaf MA, Hannas AR, Kato MT. Saliva and dental erosion. J Appl Oral Sci 2012; 20:493-502; 3. West NX, Joiner A. Enamel mineral loss. J Dent 2014; 42 Suppl 1:S2-11; 4. Bartlett DW, Lussi A, West NX, et al. Prevalence of tooth wear on buccal and lingual surfaces and possible risk factors in young European adults. J Dent 2013; 41:1007-1013; 5. Alves MS, da Silva FA, Araujo SG, et al. Tooth wear in patients submitted to bariatric surgery. Braz Dent J 2012; 23:160-166; 6. Bartlett D, Ganss C, Lussi A. Basic Erosive Wear Examination (BEWE): a new scoring system for scientific and clinical needs. Clin Oral Investig 2008; 12 Suppl 1:S65-S68; 7. Wang X, Lussi A. Assessment and management of dental erosion. Dent Clin North Am 2010; 54:565-578; 8. Magalhaes AC, Wiegand A, Rios D, et al. Insights into preventive measures for dental erosion. J Appl Oral Sci 2009; 17:75-86; 9. Ganss C. Is erosive tooth wear an oral disease? Monogr Oral Sci 2014; 25:16-21; 10. Lussi A, Megert B, Shellis RP, Wang X. Analysis of the erosive effect of different dietary substances and medications. Br J Nutr 2012; 107:252-262; 11. Scheutzel P. Etiology of dental erosion--intrinsic factors. Eur J Oral Sci 1996; 104:178-190; 12. Imfeld T. Dental erosion. Definition, classification and links. Eur J Oral Sci 1996; 104:151-155; 13. Orchardson R, Collins WJ. Clinical features of hypersensitive teeth. Br Dent J 1987; 162:253-256; 14. Wiegand A, Schlueter N. The role of oral hygiene: does toothbrushing harm? Monogr Oral Sci 2014; 25:215-219; 15. Manfredini D, Winocur E, Guarda-Nardini L, et al. Epidemiology of bruxism in adults: a systematic review of the literature. J Orofac Pain 2013; 27:99-110; 16. Shellis RP, Addy M. The interactions between attrition, abrasion and erosion in tooth wear. Monogr Oral Sci 2014; 25:32-45; 17. Joiner A, Schwarz A, Philpotts CJ, et al. The protective nature of pellicle towards toothpaste abrasion on enamel and dentine. J Dent 2008; 36:360-368; 18. Dentistry - Dentifrices - Requirements, test methods and marking (ISO 11609:2010). BSI Standards Publication, 2010. 19. Sun Y, Li X, Deng Y, et al. Mode of action studies on the formation of enamel minerals from a novel toothpaste containing calcium silicate and sodium phosphate salts. J Dent 2014; 42 Suppl 1:S30-S38; 20. Joiner A, Schafer F, Naeeni MM, et al. Remineralisation effect of a dual-phase calcium silicate/phosphate gel combined with calcium silicate/phosphate toothpaste on acid-challenged enamel in situ. J Dent 2014; 42 Suppl 1:S53-S59.