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Tooth Wear Prevalence and Associated Risk Factors Among a Small Portuguese Community: A Retrospective Study

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Abstract: Background/Objectives: This study aims to study the prevalence of tooth wear (TW) in a sample of patients seeking the Screening and Urgency appointment at Egas Moniz Dental Clinic (EMDC) and correlate TW with risk factors. **Methods:** The database created with the collected information was used for descriptive and inferential statistical analysis. Data from 2266 patients, collected between 2021 and 2023, was analyzed for the presence of tooth wear, its different types and its correlation with risk factors. **Results:** The prevalence of dental wear was found to be 54.7%, with attrition (24.1%) being the most prevalent lesion, and erosion (2.7%) the least prevalent. Concerning risk predictors for tooth wear, age, decreased DVO, antacids, mastigation difficulties, drugs and use of mouthwash were positively associated. **Conclusions:** It was concluded that TW is prevalent and increases with age, underscoring the necessity for timely and accurate diagnosis to minimise its progression. Additionally, it is crucial to conduct a thorough evaluation of the risk factors involved, to implement effective preventive measures and treatment strategies.

Keywords: tooth wear; grading index scales; risk factors; prevalence

1. Introduction

Tooth wear (TW) is a multifactorial condition described as the progressive loss of dental hard tissues [1,2]. Due to its multifactorial aetiology, TW can manifest in many ways and can be difficult to diagnose and to manage [2]. It occurs mainly through three specific processes: abrasion, attrition, and erosion. A fourth wear-related process, abfraction, was postulated to potentiate wear by abrasion and/or erosion, although this term has been recently discouraged as the level of evidence regarding this was considered to be week by the current evidence to justify it as a separate process [1,3], also the term "non-carious cervical lesion" (NCCL) is a more appropriate designation to describe abrasion lesions [4].

It is important to prevent or reduce the destruction of tooth wear by the early identification of TW lesions, grade its severity, diagnose the likely cause or causes and monitoring this condition [5]. The most recent consensus statement on the management of severe tooth wear states that priority should be given to early detection of (severe) tooth wear and to identify the underlying etiology [6,7].

Global prevalence of tooth wear was evaluated in recent multi-centered studies throughout Europe, Arabia and China reporting a range from 29% to 60% [8-10]. The variation in data reflects different methods used to quantify TW and difference in ages [11]. Also, TW is becoming a relevant oral health issue among young adults, as cross-sectional studies revealed that it occurs at a young age [12,13]. To date in the Portuguese community, very few data provided a comprehensive assessment on TW prevalence. Addressing risk factors, only two studies were found regarding dental

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erosion in patients with alcoholic habits and vomiting behavior (anorexia nervosa and bulimia nervosa) [14,15].

This study aims at investigating the prevalence and related risk factors concerning TW in a population attending a Portuguese university dental clinic and contribute to the development of effective strategies for its management and prevention.

2. Materials and Methods

2.1. Study Design, Eligibility Criteria and Sampling

This observational Cross-Sectional study was conducted at Egas Moniz Dental Clinic (EMDC), at Egas Moniz School of Health and Science University (Almada, Portugal), from April 2021 to November 2023, and approved by the Egas Moniz Ethics Committee (1349/2021). Patients seeking treatment at the Screening and emergency appointment at EMDC, were invited to voluntarily and anonymously participate in the study. To be included, patients had to be able to understand and sign the informed consent form, be 18 years of age or older and have a complete filled tooth wear index at the appointment.

2.2. Data Collection

Patients were positioned in a dental chair under the examination light source, and the observations took place using a dental mirror, air syringe and cotton rolls. The data was collected through a Screening form, filled with the patient's information, medication, oral hygiene habits, alcohol and drugs use, diet and clinical observations, and was conducted by 4th and 5th year dental students, who were supervised by experienced dentists.

2.3. Variables

The presence or absence of erosion, attrition and NCCL and the combinations of different wear types (erosion and/or attrition and/or NCCL) were the clinical outcome variables. Predictor variables were Age, Gender, Bronchodilators, Antacids, Mastication difficulties, Dry mouth, Consumption of alcohol, Drugs use, Consumption of beverages, Consumption of fresh fruits, Tooth brushing frequency, Mouthwash and Esthetic complaints.

2.4. Statistical Analysis

Data analysis was performed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA). Descriptive and inferential statistics methodologies were applied.

Further, logistic regression analysis was used to model the relationship between TW and several risk indicators. Multivariate models were constructed for each of the outcome clinical variables (abrasion, attrition, erosion and presence of non-carious cervical lesions), via a stepwise procedure. Only predictor variables showing a significance $p \leq 0.05$ in the univariate model were included in the multivariate logistic regression procedure. The contribution of each variable to the model was evaluated by Wald statistics. Interactions were also analyzed for all tested variables. A final reduced model for each of the considered clinical outcome was obtained, based on the significant predictor variable categories. Odds Ratio (OR) along with correspondent 95% Confidence Intervals (95% CI) were calculated for both univariate (crude OR) and multivariate analyses (adjusted OR). The level of statistical significance was set at 5%.

3. Results

3.1. Patients Characteritics

The research sample consisted of 2266 patients who attended the Screening and Emergency appointment at EMDC and were considered eligible for inclusion in this study (Table 3). 936 patients

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were males with a mean age of 42.85 years (± 19.7 years) and 1330 were females with a mean age of 42.52 (± 19.6 years).

3.2. Tooth Wear Prevelance

Regarding the different forms of TW, males presented a higher prevalence of TW (58,3%) in both individual and combined lesions (Table 1). Attrition (26% and 22,85% in male and female gender, respectively) was considered the most prevalent TW lesion (Table 1). The least prevalent was Erosion (2,6% and 2,85% for male and female gender, respectively). In the combined lesions, the most common was Attrition and NCCL (12,3% and 9% for males and females, respectively), with Erosion + NCCL being the least common for males (1,6%) and Erosion + Attrition + NCCL for the females (0,8%). In both genders, 1026 patients did not present any type of tooth wear (45,3%).

Table 1. Prevalence of the different types of Tooth Wear: Erosion, Attrition and NCCL (Noncarious cervical lesions) and combinations.

Tooth Wear	Erosion	Attrition	NCCL	Erosion + Attrition + NCCL	Erosion + Attrition	Erosion + NCCL	Attrition + NCCL	No Wear	Total
Male n (%)	24 (2.6)	243 (26)	103 (11)	21 (2.2)	24 (2.6)	15 (1.6)	115 (12.3)	391 (41.7)	936 (100)
Female n (%)	38 (2.85)	304 (22.85)	159 (12)	21 (1.6)	28 (2.1)	25 (1.9)	120 (9)	635 (47.7)	1330 (100)

3.3. Risk Factors

The most common risk factor was the use of mouthwash (39,2% in both males and females) (Table 2). Decreased DVO (22,2% in males and 22,9% in females) and mastication difficulties (16,6% in males and 21,3% in females) also showed high levels of commonness in the population studied.

The risk factors least encountered were the consumption of sodas (0,3% in males and 0,1% in females), Sjögren's Syndrome (0,1% in males and 0,5% in females) and the intake of antacids (1% in males and 0,9% in females).

Table 2. Prevalence of the different risk factors evaluated.

Risk Factors	Male n (%)	Female n (%)
Sjögren's Syndrome	1 (0,1)	6 (0,5)
Bronchodilator	16 (1,7).	22 (1,7)
Antacids	9 (1).	12 (0,9)
Alcohol intake	140 (15)	57 (4,3)
Narcotics	50 (5,3)	18 (1,4)
Fruits (2-3 times a day)	9 (1)	29 (2,2)
Soda (2-3 times a day)	3 (0,3)	1 (0,1)
Brushing (+3 times a day)	37 (4)	61 (4,6)
Mouthwash	367 (39,2)	586 (39,2)
Listerine	222 (23,7)	303 (22,8)
Mastigation difficulties	155 (16,6)	283 (21,3)
Ashamed to smile	95 (10,1)	231 (17,4)
Frequent dry mouth	89 (9,5)	176 (13,2)
Decreased DVO	208 (22,2)	304 (22,9)

* DVO – Dimension of Vertical Occlusion.

All factors measured were tested for association with the prevalence of different types of TW using multivariate analysis, and only those found to be significant are presented in Table 3.

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Table 3. Results of the multivariate logistic regression analysis for factors associated with TW types.

Type of lesion	Associated risk factor(s)
Erosion	No risk factor was positively associated
Attrition	Age (OR=1.01)
NCCL	Age (OR=1.01)
Erosion + Attrition + NCCL	Age (OR=1.05); Decreased DVO (OR=2.16)
Erosion + Attrition	Age (OR= 1.03); Antacids (OR= 7.07); Mastigation difficulties (OR= 1.87)
Erosion + NCCL	Age (OR= 1.03)
Attrition + NCCL	Age (OR= 1.05); Drugs (OR= 2.38); Mouthwash (OR= 1.47); Female gender (OR= 0.70)

* NCCL – Non-carious cervical lesion; DVO – Dimension of Vertical Occlusion.

4. Discussion

The primary objective of this study was to evaluate the occurrence of TW among individuals attending the Screening and Emergency consultation at EMDC. Overall, the prevalence of TW was 54,7%, with attrition (24,1%) being the most prevalent, similar to results seen in studies such as Al-Ani [16], Hedge et al. [17] and Hemmings et al [18], followed by NCCL (11,6%) and Erosion (2,7%) considering individual lesions.

Dental hard tissues loss, resulting in TW, is a matter of growing significance; this is particularly true as people live longer and are able to maintain their natural teeth into old age [8,19,20]. TW can be caused by a range of factors, including chemical, biological, behavioral, medications, gastrointestinal problems, and acid regurgitation [8,19].

Documenting a comprehensive history for the primary complaint, finding the etiology is important in order to manage the associated risk factors, preventing further structure loss and allowing monitoring of the associated symptoms [21]. Of the risk factors documented, mouthwash (42.1%) was a popular element included in the patient's oral hygiene habits. Nonetheless, its abuse can cause dental erosion, one of the most reported side effects, not only because of the pH, but also due to its viscosity [22]. Factors such as decreased VDO (22.6%), mastication difficulties (19.3%) and frequent dry mouth (11.7%) also displayed moderate prevalence percentages. Additional to the primary objective, we aimed to explore any potential associations between TW and various risk factors.

Concerning risk predictors in individual TW lesions, none were positively associated with erosion. Age was common for attrition and NCCL (OR = 1.01 equally). For the association erosion + attrition + NCCL, age (OR = 1.05) and decreased DVO (OR = 2.16) were significantly associated. For erosion + attrition, age (OR = 1.03), antacids (OR = 7.07) and mastigation difficulties (OR = 1.87) were significant. Considering erosion + NCCL only age (OR = 1.03) was positively established. Regarding attrition + NCCL, age (OR = 1.05), narcotics (OR = 2.38), mouthwash (OR = 1.47) and female gender (OR = 0.7) were associated.

In accordance with this investigation, age has demonstrated itself to be a common significant result when associated with TW, seen in works such as Shrestha & Rajbhandari [23], Sun et al. [24], Van 't Spijker et al. [9], Wei et al. [25]. Considering gender, Wei et al. [25] and Zhang et al. [26] concluded that there was no distinction in prevalence between gender. Nevertheless, our results indicate a higher prevalence of TW in male gender (58.2%). Despite this, our multivariable analyses did not reveal a positive association between TW and gender, only when considering the association of Attrition and NCCL, where female gender revealed a lower risk (OR = 0.7). Also, our study observed no correlation between tooth wear and how often individuals brush their teeth, which is

 doi:10.20944/preprints202502.0651.v1

consistent with the findings of Sadaf et al. [27], and Bartlett et al. [28]. On the other hand, research by Wei et al. [25] demonstrated a significant correlation between these variables.

Among patients who frequently consume acidic foods and soft drinks, this investigation found no increase in TW similar to the findings in studies conducted on Chinese adults [25]. In contrast, research conducted in China, Poland, and Europe demonstrated a significant association between frequent consumption of these items and increased TW [25,28,29].

Concerning the interaction of Attrition + NCCL with drug use there were substantial findings. This might be explained by the presence of bruxism as a result of drug-induced hyperactivity [30,31]. According to Donaldson & Goodchild [30]; Shetty et al., [31], erosion is also common in cases of substance abuse, however, this doesn't go in line with our results.

Intrinsic acid from conditions such as GERD, anorexia, and bulimia can also lead to erosive TW, as demonstrated by other studies [24,25,28,29]; this was not supported by the results found in the present study. Interestingly, the intake of antacids (OR = 7.07) was proven significant when correlated with the combined lesion of Erosion and Attrition, which leads us to think that some patients may exhibit signs of erosion due to other pathologies treated with such medication, rather than GERD, or that GERD was not correctly diagnosed.

In this study, the frequent sensation of dry mouth was not significantly linked to tooth wear caused by erosion. This finding differs from the results of Sun et al. [24] and Zwier et al. [32], who found that low salivary flow is a major risk factor for tooth wear. Both studies highlighted the vital role of saliva in maintaining oral health, particularly in protecting teeth from erosion by neutralizing acids and supporting enamel repair [24,32]. The lack of correlation between the sensation of dry mouth and TW found in the present study, might reflect the subjectivity of this risk factor, emphasizing the need for effectively measuring saliva parameters.

This research is a retrospective study, which comes with certain limitations. For instance, there may be incomplete information about exposure to causal agents. Additionally, since the data was collected through screening questions administered by students rather than trained and calibrated researchers, there is a higher potential for errors. Another challenge is the difficulty in differentiating between erosion, attrition, and abrasion, as these conditions frequently coexist and overlap, making clear distinctions hard to establish.

Nevertheless, given the lack of clinical studies on TW and associated risk factors in large populations, this study might give some insight on the planning of more controlled clinical trials on this topic and contribute to the development of prevention and monitoring strategies.

5. Conclusions

The prevalence of TW reported in this study was 54.7%, being attrition the most common lesion (24.1%) and erosion the least (2.7%).

Several risk factors were associated with TW, in both individually or combined lesions, with age present in several as a statistically significant risk factor.

Further studies should be conducted to delve deeper into the reasons behind the findings and to formulate less ambiguous questions for better understanding of patients. This study underscores the need for implementing validated questionnaires and observer calibration.

Additional prospective studies could confirm the consistency of these results.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data supporting the reported results are confidential and cannot be shared publicly due to privacy and ethical restrictions. However, interested researchers may request access by contacting the corresponding author via email. Access will be granted at the discretion of the authors and in accordance with applicable regulations.

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Abbreviations

The following abbreviations are used in this manuscript:

TW	Tooth wear
NCCL	Non-carious cervical lesion
DVO	Dimension of Vertical Occlusion
EMDC	Egas Moniz Dental Clinic
GERD	Gastroesophageal reflux disease

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