How dentists diagnose and treat erosive tooth wear in Finland? – A questionnaire survey

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Research article

Keywords: Erosive tooth wear, Dental Erosion, Diagnosing, Dentists

Posted Date: March 13th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-17206/v1>

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Abstract

Objectives To investigate Finnish dentists' knowledge on and means of recording and diagnosing erosive tooth wear (ETW). Treatment options and possible differences in treatment decisions between general and specialized dentists were also evaluated. **Materials and Methods** An electronic questionnaire was sent to 3,664 Finnish dentists by e-mail. Respondents' gender, age, work experience, field of specialty, and practice location were requested. The questionnaire also included a patient case where the dentists were asked about their choice of treatment. Statistical analyses were performed using means, proportions, and cross tabulations.

Results Response rate was 24% (n=866). Almost all respondents (98.0%) recorded ETW in patient files, but only 4.1% used a detailed scoring system. Of the respondents, 64.4% usually found the cause for ETW. Probable causes were reported to be use of carbonated beverages (84.3%), energy drinks (57.0%), and reflux disease (53.1%). The majority of the respondents (80.9%) usually assessed patient's dietary history while 1.9% evaluated saliva secretion rate. When asked about treatment decisions of ETW patients the differences between general dentists and specialized dentists were not as obvious as hypothesized. **Conclusions** This study suggests that the dentists in Finland are relatively up-to-date regarding clinical recording and diagnosis of ETW. However, they do not feel they have enough competence in detecting the cause of ETW. Differences in treatment decisions between general dentists and specialized dentists seem to be moderate. **Clinical Relevance** The treatment practices for ETW are not established and further research to create clinical guidelines seems to be needed. **Key words** Erosive tooth wear, Dental Erosion, Diagnosing, Dentists

Background

The interest in erosive tooth wear (ETW) has been increasing in recent years both in research and among clinicians [1, 2, 3]. This may be due to epidemiologic studies that suggest an increasing prevalence and severity of ETW among children and adolescents [4, 5]. The studies are challenging to compare since there is no universally accepted index for diagnosing ETW and the diagnostic criteria for ETW vary between studies. However, there is a consensus that ETW is challenging to diagnose, especially in its early stages [6, 7]. Along with diagnostic challenges and the need for a universal index comes also the need for universal guidelines for the implementation of non-operative as well as operative strategies to prevent, arrest and treat EWT.

Not much data is available on how clinical dental practitioners record, diagnose and treat ETW [8, 9]. When it comes to advising patients about the condition, a large proportion of dentists are reported to advise their patients about ETW only occasionally or rarely [10, 11]. Of the 1,686 12-year-old children included in that study, less than 10% could recall their dentist mentioning the condition. Similar results were reported in China where 71% of the 520 participants had never heard about dental erosion and 53% could not tell the difference between dental erosion and dental caries [12]. A study conducted among Norwegian public dental practitioners [8] suggests that Norwegian dentists are relatively up-to-date

regarding the clinical recording, diagnosis and treatment of ETW. However, dietary and salivary analyses are not given a priority and early, preventive treatment is lacking. Similarly, a study conducted among Yemeni dentists and dental students [13] suggests that in-depth knowledge about causative factors, diagnosis and preventive methods of ETW was absent among half of the respondents, and approaches to early diagnosis were insufficient. Additionally, a Brazilian study reported that awareness about ETW was poor among dental students, faculty members and patients [14]. In brief, literature suggests that there appears to be a need for enhancing awareness and knowledge about ETW and how to deal with it.

No data on the experiences, knowledge of diagnosis and choice of treatment options on ETW among Finnish dentists are available. Therefore, the aim of the study was to perform a survey among dental practitioners in Finland asking about their experiences, awareness, diagnostic measures and treatment options for ETW. Specifically, the aim was to evaluate if there were differences in treatment decisions between general and specialized dentists. The hypothesis was that Finnish dentists record and diagnose ETW not using specific criteria. The general dentists were expected to make less invasive treatment decisions than the dentists specialized in cariology or prosthodontics.

Methods

Participants:

The invitation to participate in the study and a Webropol-based questionnaire, originally developed by Mulic et al. (2012), was sent to Finnish dentists who were members of the Finnish Dental Society Apollonia and whose e-mail address was available in the registers of Apollonia (N = 3,664). The invitation was sent by e-mail in April 2018, and all those invited received two reminders at one-month interval. The survey was closed at the beginning of June 2018.

Questionnaire:

The questionnaire was used previously in similar studies in Norway in 2012 [8] and in Iceland in 2018 [9]. The original questionnaire was translated into English by a Norwegian research group, and the English version was translated into Finnish by two of the authors (TT, VA). The questionnaire consisted of questions on respondents' gender, age, work experience (< 10 yrs/≥10 yrs), and practice location (province). Because of the differences between the practices in Finland and Norway, some minor modifications to the questionnaire were made. In addition to the original questionnaire, dentists were asked whether they were general practitioners or specializing/specialized dentists. The options for the field of specialty were Cariology and Endodontics, Prosthodontics and Stomatognathic physiology, Periodontology, Orthodontics, Pedodontics, Oral surgery, Radiology and Pathology, Dental Public Health and some other specialty. For the analyses, field of specialty was categorized as 1) cariology, 2) prosthodontics and stomatognathic physiology, 3) other specialties, and 4) general dentists. The reason for this grouping was that in Finland, dentists who are specialists in cariology or prosthodontics mainly carry out the most difficult restorative treatments for ETW patients. Additionally, the location was categorized according to University hospital districts (South/North/East/West/Central Finland). For the

analyses of the treatment decisions in the patient case, options restoring with glass ionomer cement, composite filling material and compomer were combined as restorative filling.

The questionnaire also included a patient case where the dentists were asked to record their choice of treatment. For the patient case, a brief patient history as well as clinical photographs were provided [8].

Patient case

28-year old female who has had an eating disorder and vomiting as a teenager but is now healthy. (Fig. 1)

The respondents were asked what kind of information and advice they would give to this patient. The options were 1) give information about healthy dietary and drinking habits, 2) give guidance on tooth brushing technique and habits, 3) recommend rinsing with fluoride, 4) recommend rinsing with chlorhexidine, 5) recommend using of fluoride tablets, and 6) recommend using specific toothpaste. The respondents were also asked whether they would refer the patient to another dentist, to a specialist, or to a central or university hospital. They were also asked how they would treat the upper central incisor and lower 1st molar of the patient. The options were 1) no treatment, 2) local treatment with fluoride solution, 3) applying bonding material, or 4) applying flow composite, 5) restoring with glass ionomer cement, or 6) restoring with composite filling material, or 7) restoring with compomer, or 8) restoring with ceramic laminate/facet/inlay/onlay, or 9) restoring with crown.

Statistical analyses

Descriptive analyses were performed using means, frequencies and proportions. Cross tabulation was used to analyze the association between finding the cause for ETW as well as between decisions to refer the patient and work experience, practice location and field of specialty. Considering the patient case, the association between treatment decisions and field of specialty was analyzed using cross tabulation. Chi-squared test was used to investigate the statistical difference between the groups. P-values < 0.05 were considered statistically significant. All analyses were performed using SPSS version 25.0 (Statistical Package for the Social Sciences; SPSS Inc., Chicago, Ill., USA) and MedCalc version 19.1.

Ethical considerations

Participation was voluntary and no compensation was given to the respondents. Anonymity was ensured by Webropol. According to Finnish legislation, ethical approval was not needed.

Results

Of the total 3,664 invited dentists, 866 responded (response rate 24%). Of the respondents, 702 were general dentists and 164 specialized or specializing dentists. The respondents' age ranged between 25 and 78 years (mean 47.8, SD 11.9; median 51.0). Participants represented all university hospital districts in Finland. Majority of the respondents had at least ten years of work experience. Those who stated that

they did not normally work with patients having ETW and were not willing to take part in the survey (n = 52) were excluded from the statistical analyses (Table 1).

Results indicated that almost all (n=798, 98.0%) respondents recorded ETW in patient files. However, only 4.1% (n=33) of them used a detailed scoring system while 26.7% (n=217) used a two-graded scoring system (enamel-dentine) and 61.5% (n=501) did not use any detailed scoring at all. More than half of the respondents (n=418, 51.4%) registered affected surfaces, 15.4% (n=125) registered affected teeth, and 3.4% (n=28) registered ETW at patient level. Altogether 29.1% (n=237) reported that they registered ETW in some other way, e.g. in words.

Of the respondents, 64.4% reported usually finding the cause for ETW. No significant differences in relation to work experience and field of specialty were found (Table 2). The use of carbonated beverages (84.3%), the use of energy drinks (57.0%), reflux (53.1%), the use of juices (49.2%), sport drinks (44.8%), and sour food and candies (35.5%) were reported as the most probable causes.

When diagnosing ETW, the majority of the respondents, 80.9% (n=646), usually assessed the patient's dietary history and 1.9% (n=15) evaluated saliva secretion rate. For the documentation of ETW, 42.2% (n=341) of the dentists used clinical photographs at least occasionally while 57.8% (n=467) never did. One third, 27.0% (n=226), made casts for monitoring the lesion at least occasionally, whereas 72.0% (n=582) never did. In the use of clinical photographs and casts, no significant differences were found in relation to work experience and field of specialty (Table 2).

Of those dentists who had been working more than ten years (n=608), 79.3% reported discovering ETW more often now than 10–15 years ago, while 5.7% did not report any differences. Considering the restorative treatment of erosive lesions, the majority of the respondents (76.4%, n=617) reported treating the patients by themselves, while 7.4% (n=76) reported that they referred the patients to another colleague or specialist and 1.0% (n=8) reported referring the patients to a central or university hospital. No significant differences between the practice location were found ($p>0.05$).

Patient case

The majority of the respondents (85.3%, n=694) would have advised the patient about good dietary and drinking habits, and (69.2%, n=563) would have recommended the use of additional fluoride products. Two thirds of the dentists (62.4%, n=508) would have given advice on tooth brushing.

The treatment decisions were different according to the field of specialty. When treating the central incisor, the general dentists used local treatment with fluoride products more often than specialized dentists. Additionally, the proportion of those respondents who chose restoration with fillings was the lowest among general dentists ($p<0.05$). In the case of the 1st lower molar the differences between the treatment decisions were minor compared to the central incisor. The dentists' most common treatment

choices and types of restorative materials are seen in Table 3a (the upper central incisor) and 3b (the 1st lower molar).

Discussion

In Finland, dentists seem to be aware of ETW. Practically all the dentists reported recording ETW findings in patient files; however, the criteria and the scoring system are not established. Interestingly, one third of the dentists felt unconfident about finding the cause for ETW. As a whole, the treatment practices between specialized and general dentists are surprisingly similar. Among general as well as specialized dentists, the options to treat ETW patients are not established.

Encouragingly, nearly all of the respondents record ETW in the patient files, which is in line with questionnaire-based surveys following the same pattern implemented in Norway [8] and in Iceland [9]. However, in Finland, the use of a specific scoring system is rare. For the follow-up of ETW patients and for research purposes, it is essential to have classified criteria to record ETW as an established pattern. Over the years, a number of different indicators have been created to record ETW [15, 16], particularly to describe the loss of hard tissue. The Basic Erosive Wear Examination (BEWE) links classification and grading erosive lesions with clinical management [17]. An easy-to-use index to evaluate ETW (e.g. BEWE) should be implemented into all patient status records; this would serve clinicians with the evaluation and follow-up of ETW.

In the present study, the Finnish dentists with more than ten years' work experience reported discovering ETW more often now than 10–15 years ago, which is in line with recent studies [5, 2, 3]. Due to the increased prevalence and better understanding of the condition, ETW has gained more interest in recent years, although more systematic and follow-up studies are needed [18, 9].

In the present study, two thirds of the respondents reported finding the cause for ETW, the most common reported causes being the use of carbonated beverages, including energy drinks, and reflux disease. Several international studies have shown the association between ETW and acidic beverage consumption among adolescents [11, 19, 20, 4, 21]. Recently, Skalsky-Jarkander et al. [22] showed that consumption of soft drinks several times a week is significantly more prevalent in individuals with ETW than in those who have no erosion. The consumption of acidic beverages in Finland has increased during the last decade [23] and it can be expected that the prevalence of ETW might be even higher in the future. According to the literature, gastro-esophageal reflux-disease (GERD) has been suggested as the most important intrinsic risk indicator for ETW [24, 25]. This was also proposed by the respondents of this study. However, in a recent Finnish study, GERD was not strongly associated with ETW [26]. Compared with Icelandic colleagues, the reported percentage for reflux disease was similar (54%), but surprisingly, Norwegian dentists considered the condition to be a more uncommon cause (8%) [8, 9]. Daily intake of fruit and fruit juices has been reported to be a common causative factor for ETW [27, 28]; here, this was assumed by half of the respondents.

As a whole, the respondents seem to be fairly up-to-date with diagnosing and documenting ETW. However, the documentation related to clinical photographs, study casts and saliva secretion can be considered insufficient. Here, as much as 80% of the respondents never measure the saliva secretion rate. The corresponding rates in the Icelandic and Norwegian surveys were 65% and 73% [8, 9]. However, cariologists in Finland seem to measure the saliva secretion rate of the ETW patients much more often than other dentists; 28% usually and 56% occasionally. It is known that ETW has a multifactorial background, saliva being the most affecting biological factor in the progress of ETW [29, 30]. Therefore, it is essential to know the saliva secretion rate when etiological elements are evaluated [31].

The Finnish dentists tend to assess patient's dietary history in most cases (81%), whereas the respective figure is 45% in Norway and 50% in Iceland. Especially cariologists in Finland find it necessary to assess the patient's dietary habits (96%). This is encouraging because behavioral factors such as drinking and eating habits are important etiological factors in the pathogenesis of ETW [32, 33]. Lifestyle factors such as a diet containing a lot of fruit and berries, soft and energy drinks and fruit juices seem to be the main exogenous causes of ETW among children and adolescents and seem to have considerable significance in the development of ETW [22].

The majority of the respondents find it important to advise ETW patients about healthy drinking and eating habits along with the use of fluoride products. Furthermore, advice on brushing techniques is seen to be important, although the scientific evidence concerning this is vague. The recommendation on fluoride use can be considered as an important preventive treatment against ETW, since several studies have shown the anti-erosive effect of fluorides containing stannous fluoride. The reduction of ETW has been shown to be between 18 to 50% [34, 35].

When asking about treatment decisions in the given patient case, the differences between general dentists and specialized dentists were not as obvious as hypothesized. However, there was some variation in the answers. In the case of the central incisor, the general dentists seem to trust local fluoride treatment more often than their specialized colleagues. This was not true in the case of the 1st lower molar. The cariologists chose to use bonding material for surface protection more often than general dentists or other specialists. The prosthodontists believe in ceramic material as they chose to treat the upper incisor with a ceramic restoration more often than others. Unexpectedly, the treatment choices for the 1st lower molar did not vary as much as in the case of the upper incisor. The only detected treatment choice which differed slightly from the others was the use of restoration with composite/glass-ionomer filling by the cariologists. This is quite understandable since cariologists are very familiar with restoring the teeth with composite material. The Consensus Report of the European Federation of Conservative Dentistry – Erosive tooth wear published in 2015 by Carvalho et al. categorized the management of erosive tooth wear into a preventive and a restorative management. The preventive management of ETW should be implemented to reduce or stop progression of the erosive lesions. With restorative management, the objective is to reduce and stop progression and symptoms of advanced ETW lesions and to restore the esthetics and function of the erosive teeth. The least invasive therapy always comes first into consideration. In recent years, less invasive restorative techniques with composite have been

developed. There is still no clear guideline for restorative treatment of erosive damage [29], yet less invasive direct procedures are recommended, especially for younger patients [36].

Even though the low participation rate can be considered as a limitation of this study and no strong conclusions can be drawn, the participants sufficiently represent Finnish dentists. In our study, the mean age and work experience of the participants are in line with those of the dentists in Finland [37]. Additionally, the respondents work in all parts of Finland. The number of specialized dentists among the respondents was minor; however, the proportion of specialists in this study is in accordance with the proportion of specialists among Finnish dentists (Finnish Dental Association). It can be assumed that the respondents of this survey are those who work with patients having ETW or are somehow interested in the subject. In this study, the answers are based on respondents' point of view. No information of the non-respondents is available and that can be seen as a limitation.

Knowledge of erosive tooth wear among dentists in general has increased. This is mostly due to the increased prevalence of ETW, which has been demonstrated by several international studies. Even though Finnish dentists seem to know the principal diagnosis and management strategies with the ETW patient, internationally standardized current guidelines are needed in order to make decision-making easier for the clinicians. This could be a distinct aim for further studies. To our knowledge, this is the first study to evaluate the topic in Finland.

Conclusion

This study suggests that the Finnish dentists who participated in this survey were relatively up-to-date regarding the clinical recording and diagnosing of ETW. The treatment practices for ETW are not established and further research to create clinical guidelines seems to be needed.

Abbreviations

ETW (Erosive Tooth Wear)

BEWE (Basic Erosive Wear Examination)

GERD (Gastro-Esophageal Reflux-Disease)

Declarations

Ethics approval and consent to participate

According to the Finnish legislation, ethical approval was not needed (Laki lääketieteellisestä tutkimuksesta, <http://www.finlex.fi/fi/laki/ajantasa/1999/19990488>). The respondents gave their consent by completing the electronic questionnaire. Participation was voluntary and no compensation

was given to the respondents. No personal data was gathered, and anonymity of the respondents was ensured.

Consent for publication

The written consent for publication of the clinical photographs was obtained before the Norwegian study by one of the authors (AM) [8]. This consent covered also further studies using the same questionnaire [9], including this particular study.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was received for the study.

Authors' contributions

TT, VKA, AM and SK designed the study. HV, HK, TT, MLL, VA and VKA analyzed the data and drafted the manuscript. All authors read and approved the final manuscript.

Acknowledgements

The authors thank all the Finnish dentists who participated in the study.

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Tables

Table 1. Descriptive statistics of the respondents.

		All respondents	The respondents who normally treat patients with ETW
		N=866 (%)	N=814 (%)
Gender	male	195 (22.5)	185 (22.7)
	female	671 (77.5)	629 (77.3)
Work experience	<10 yrs	202 (23.3)	202 (24.8)
	≥10 yrs	664 (76.7)	608 (74.7)
	missing value	0 (0.0)	4 (0.5)
Field of specialty	cariology	27 (3.1)	25 (3.1)
	prosthodontics	36 (4.2)	35 (4.3)
	other specialties	101 (11.6)	76 (9.3)
	general dentist	702 (81.1)	678 (83.3)
Location	South	320 (36.9)	297 (36.5)
	North	150 (17.4)	145 (17.8)
	West	139 (16.1)	136 (16.7)
	Central	125 (14.4)	115 (14.1)
	East	132 (15.2)	121 (14.9)

Table 2. The numbers and proportions of the respondents for finding the cause of ETW in relation to work experience and the field of specialty.

n is indicating to number of answered respondents

Table 3a. The dentists' general treatment choices for upper central incisor (n=the number of dentists responding to each question, multiple choices were allowed).

Table 3b. The dentists' general treatment choices for lower 1st molar (n=the number of dentists responding to each question, multiple choices were allowed).

Figures

	<10 yrs n (%)	≥10 yrs Cariology n (%)	General dentists n (%)	Prosthodontics Other specialty n (%)	p
Found the cause for ETW (n=810)¶					0.147
					0.731
Usually	136 (67.3)	388 (64.0) 21 (84.0)	436 (64.5)	21 (60.0) 46 (62.2)	
Occasionally	58 (28.7)	203 (33.4) 4 (16.0)	220 (32.5)	14 (31.4) 23 (31.1)	
Seldom	8 (4.0)	17 (2.8) 0 (0.0)	20 (3.0)	0 (0.0) 5 (6.8)	
Assessed patient's dietary history (n=799)¶					0.064
					0.287
Usually	168 (84.0)	478 (80.0) 23 (95.8)	543 (81.2)	26 (74.3) 54 (76.1)	
Occasionally	29 (14.5)	115 (19.2) 1 (0.4)	120 (17.9)	9 (25.7) 14 (19.7)	
Seldom	3 (1.5)	6 (1.0) 0 (0.0)	6 (0.9)	0 (0.0) 3 (4.2)	
Evaluated saliva secretion rate (n=809)¶					< 0.001
					0.001
Usually	3 (1.5)	12 (2.0) 7 (28.0)	5 (0.7)	0 (0.0) 3 (4.2)	
Occasionally	19 (9.4)	130 (21.4) 14 (56.0)	106 (15.7)	15 (2.9) 14 (19.4)	
Seldom	180 (74.2)	465 (75.1) 4 (16.0)	566 (83.6)	20 (57.1) 55 (76.4)	
Used clinical photographs (n=808)¶					< 0.001
					0.490
Usually	6 (3.0)	28 (4.6) 3 (12.0)	18 (2.2)	2 (10.0) 11 (14.9)	
Occasionally	74 (36.6)	233 (38.4) 17 (68.0)	226 (33.5)	27 (77.1) 37 (50.0)	
Seldom	122 (60.4)	345 (57.0) 5 (20.0)	430 (64.0)	6 (17.1) 26 (35.1)	

Made casts		<0.001			<0.001	
(n=808)□						
Usually	2 (1.0)	10 (1.7) 2 (10.0)	1 (0.1)		3 (8.6) 6 (8.2)	
Occasionally	31 (15.3)	183 (0.5) 18 (72.0)	147 (21.8)		21 (60.0) 28 (37.8)	
Seldom	169 (83.7)	413 (68.2) 5 (20.0)	526 (78.0)		11 (31.4) 40 (54.1)	
Treatment decisions n=814		Cariology n=25 (%)	Prosthodontics n=35 (%)	Other specialty n=76 (%)	General dentists n=678 (%)	
No treatment		6 (24.0)	7 (20.0)	14 (18.4)	180 (26.5)	
Local treatment with fluoride products		11 (44.0)	14 (40.0)	24 (31.6)	353 (52.1)	
Surface protection with bonding material		4 (16.7)	0 (0.0)	7 (9.2)	23 (3.4)	
Surface protection with flow composite		2 (8.0)	2 (5.7)	7 (9.2)	62 (9.1)	
Restoration with filling (composite/glass ionomer)		7 (31.8)	12 (34.3)	19 (41.3)	148 (18.2)	
Restoration with ceramic lamine/facet/inlay/onlay		1 (4.0)	14 (40.0)	12 (15.8)	86 (12.7)	
Restoration with crown		1 (4.0)	1 (2.9)	7 (9.2)	52 (7.7)	

Treatment decisions n=814	Cariology	Prosthodontics	Other specialty	General dentists
	n=25 (%)	n=35 (%)	n=76 (%)	n=678 (%)
No treatment	2 (8.0)	6 (18.8)	6 (7.9)	77 (11.4)
Local treatment with fluoride products	9 (36.0)	11 (31.4)	20 (43.5)	278 (41.0)
Surface protection with bonding material	0 (0.0)	1 (2.9)	5 (4.3)	11 (1.6)
Surface protection with flow composite	4 (16.0)	3 (8.6)	11 (23.9)	63 (9.7)
Restoration with filling (composite/glass ionomer)	13 (52.0)	13 (37.1)	22 (28.9)	294 (43.4)
Restoration with ceramic laminate/facet/inlay/onlay	2 (8.0)	14 (11.4)	9 (11.8)	70 (10.3)
Restoration with crown	4 (16.0)	8 (22.9)	21 (27.6)	194 (29.9)

Figure 1

A 28-year old female, who has had an eating disorder and vomiting as a teenager, but is now healthy.