ACTA ODONTOLOGICA SCANDINAVICA
2021, VOL. 79, NO. 7, 499–505
https://doi.org/10.1080/00016357.2021.1896031

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ORIGINAL ARTICLE

Knowledge on and treatment practices of erosive tooth wear among Finnish dentists

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ABSTRACT

Objectives: To investigate Finnish dentists' knowledge on and means of recording, detecting 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 by e-mail to 3664 Finnish dentists. 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 of ETW. Use of carbonated beverages (84.3%), energy drinks (57.0%), and reflux disease (53.1%) were reported to be probable causes. 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 Finnish dentists who participated in this survey are able to detect and/or diagnose erosive tooth wear, but there is variation in recording it. The differences in treatment decisions between general dentists and specialized dentists seem to be moderate. The treatment practices for ETW are not established and further research to create clinical guidelines seems to be needed.

ARTICLE HISTORY
Received 5 November 2020
Revised 31 January 2021
Accepted 7 February 2021

KEYWORDS
Erosive tooth wear; dental erosion; decision-making; questionnaire

Introduction

Dental erosion, defined as chemical loss of mineralized tooth substance caused by the exposure to acids not derived from oral bacteria, is the primary aetiological factor for erosive tooth wear (ETW) [1]. The interest in erosive tooth wear (ETW) has been increasing in recent years both in research and among clinicians [2–4]. Epidemiologic studies suggest an increasing prevalence and severity of ETW among children and adolescents [5,6]. However, literature suggests that among clinical dental practitioners, there appears to be a need for enhancing awareness and knowledge about ETW and how to deal with it [7–10]. A large proportion of dentists are reported to advise their patients about ETW only occasionally or rarely [11,12]. 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 [13]. A study conducted among Norwegian public dental practitioners [7] 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 priority and early, preventive treatment is lacking. Similarly, a study conducted among Yemeni dentists and dental students [14] 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 [15].

No data are available on the experiences, knowledge of diagnosis and choice of treatment options on ETW among Finnish dentists. Therefore, the aim of the study was to perform a survey among dental practitioners in Finland asking about their experiences, awareness, diagnostic measures and

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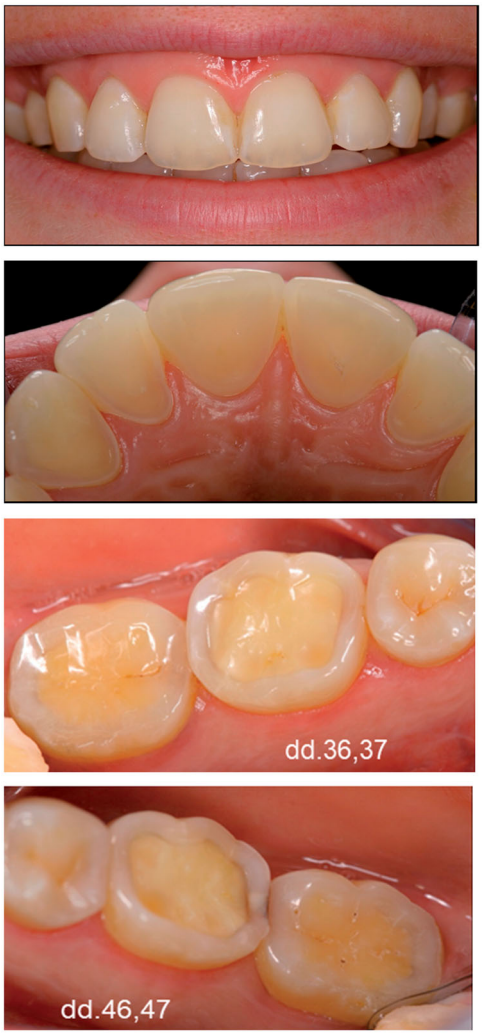

Figure 1. A 28-year old female, who has had an eating disorder and vomiting as a teenager, but now has no symptoms.

treatment options for ETW. Specifically, the aim was to evaluate if there were differences in treatment decisions between general and specialized dentists. This is of interest, since specialized dentist have longer education and they are expected to have treated more complicated ETW patients, at least during their specialization time in hospital [16]. The hypothesis was that Finnish dentists record, detect and diagnose ETW not using specific criteria. Additionally, general dentists were expected to make less invasive treatment decisions than dentist specialized in cariology or prosthodontics.

Materials and methods

Participants

The invitation to participate in the study and a Webropol-based questionnaire, originally developed by Mulic et al. [7], 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 ($N = 3664$). The invitation was sent by e-mail in April 2018, and all those invited received two reminders at one-month intervals. The survey was closed at the beginning of June 2018. Sample size calculation was not done since all Finnish Dental Society members were invited to participate.

Questionnaire

The questionnaire was used previously in similar studies in Norway in 2012 [7] and in Iceland in 2018 [8]. 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 were made to the questionnaire. 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 [7].

Patient case

A 28-year-old female who has had an eating disorder and vomiting as a teenager but has no symptoms any longer (Figure 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 beverage preferences* (2) *give guidance on tooth brushing technique and habits, (3) recommend rinsing with fluoride, (4) recommend rinsing with chlorhexidine*, (5) *recommend using 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*

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)

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. The majority (75%) 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).

The results indicated that almost all ($n = 798$, 98.0%) respondents recorded ETW in patient files. As regards working experience, no difference was found ($p > 0.05$). However, only 4.1% ($n = 33$) used a specific scoring system, 26.7% ($n = 217$) used a two-graded scoring system (enamel-dentine), while 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 candy (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 were found between the practice locations ($p > 0.05$).

Patient case

The majority of the respondents (85.3%, $n = 694$) would have advised the patient about good dietary and beverage preferences, and (69.2%, $n = 563$) would have recommended the use of additional fluoride products. Two thirds (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 specialised dentists. Additionally, the proportion of 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 3 (the upper central incisor) and Table 4 (the 1st lower molar).

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.

	<10 yrs *n* (%)	≥10 yrs *n* (%)	*p*	General dentists *n* (%)	Cariology *n* (%)	Prosthodontics *n* (%)	Other specialty *n* (%)	*p*
Found the cause for ETW ($n = 810$)[a]			0.147					0.731
Usually	136 (67.3)	388 (64.0)		436 (64.5)	21 (84.0)	21 (60.0)	46 (62.2)	
Occasionally	58 (28.7)	203 (33.4)		220 (32.5)	4 (16.0)	14 (31.4)	23 (31.1)	
Seldom	8 (4.0)	17 (2.8)		20 (3.0)	0 (0.0)	0 (0.0)	5 (6.8)	
Assessed patient's dietary history ($n = 799$)[a]			0.064					0.287
Usually	168 (84.0)	478 (80.0)		543 (81.2)	23 (95.8)	26 (74.3)	54 (76.1)	
Occasionally	29 (14.5)	115 (19.2)		120 (17.9)	1 (0.4)	9 (25.7)	14 (19.7)	
Seldom	3 (1.5)	6 (1.0)		6 (0.9)	0 (0.0)	0 (0.0)	3 (4.2)	
Evaluated saliva secretion rate ($n = 809$)[a]			<0.001					0.001
Usually	3 (1.5)	12 (2.0)		5 (0.7)	7 (28.0)	0 (0.0)	3 (4.2)	
Occasionally	19 (9.4)	130 (21.4)		106 (15.7)	14 (56.0)	15 (2.9)	14 (19.4)	
Seldom	180 (74.2)	465 (75.1)		566 (83.6)	4 (16.0)	20 (57.1)	55 (76.4)	
Used clinical photographs ($n = 808$)[a]			<0.001					0.490
Usually	6 (3.0)	28 (4.6)		18 (2.2)	3 (12.0)	2 (10.0)	11 (14.9)	
Occasionally	74 (36.6)	233 (38.4)		226 (33.5)	17 (68.0)	27 (77.1)	37 (50.0)	
Seldom	122 (60.4)	345 (57.0)		430 (64.0)	5 (20.0)	6 (17.1)	26 (35.1)	
Made casts ($n = 808$)[a]			<0.001					<0.001
Usually	2 (1.0)	10 (1.7)		1 (0.1)	2 (10.0)	3 (8.6)	6 (8.2)	
Occasionally	31 (15.3)	183 (0.5)		147 (21.8)	18 (72.0)	21 (60.0)	28 (37.8)	
Seldom	169 (83.7)	413 (68.2)		526 (78.0)	5 (20.0)	11 (31.4)	40 (54.1)	

[a]*n* is indicating the number of answered respondents.

Table 3. The dentists' general treatment choices for upper central incisor.

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 laminate/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)

n=the number of dentists responding to each question, multiple choices were allowed.

Table 4. The dentists' general treatment choices for lower 1st molar.

Treatment decisions $n = 814$	Cariology $n = 25$ (%)	Prosthodontics $n = 35$ (%)	Other specialty $n = 76$ (%)	General dentists $n = 678$ (%)
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)

n=the number of dentists responding to each question, multiple choices were allowed.

Discussion

The Finnish dentists who participated in this study were aware of ETW. Practically all the dentists reported recording ETW findings in patient files; however, the criteria of the scoring system and the options to treat ETW varied between participants. Thus, the first hypothesis of Finnish dentists recording and diagnosing ETW not using specific criteria turned out to be true. Interestingly, one third of the participating dentists felt unconfident about finding the cause for ETW. As a whole, the treatment practices between specialised and general dentists were surprisingly similar and our second hypothesis was abandoned.

Encouragingly, nearly all of the respondents recorded ETW in the patient files, which is in line with questionnaire-based surveys implemented in Norway [7] and in Iceland [8]. However, in Finland, the use of a specific ETW scoring system was only occasional. The reason might be that the most commonly used electronical patient record software in Finland does not support the use of any detailed scoring system. For the follow-up of ETW patients and for research purposes, it is, however, essential to use classified criteria to record ETW as an established pattern. Over the years, a number of different indices have been created to record ETW [17,18], particularly to describe the loss of hard tissue. The Basic Erosive Wear Examination (BEWE) links classification and grading of erosive lesions with clinical management [19]. Implementation of an easy-to-use index such as BEWE into patient records would be beneficial; this would serve clinicians in the evaluation and follow-up of ETW. Opposite to the findings of O'Toole et al. [9], respondents' working experience had no association with the recording practices.

In the present study, the Finnish dentists with more than ten years' work experience reported detecting ETW more often now than 10–15 years ago, which is in line with recent studies [4,6,20]. 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 [8,21]. Two thirds of the respondents reported finding the cause for ETW, the most common reported causes being the use of carbonated beverages, including soft and energy drinks, and reflux disease. Several studies have shown the association between ETW and acidic beverage consumption among adolescents [5,12,22–24] and only recently, Skalsky-Jarkander et al. [25] showed that consumption of soft drinks several times a week is significantly more prevalent among individuals with ETW than among those without erosion. Since the consumption of acidic beverages in Finland has increased during the last decade [26] it can be assumed that prevalence of ETW might be increasing in the future.

According to the literature, gastro-esophageal reflux-disease (GERD) has been suggested as the most important intrinsic risk factor for ETW [27,28]. This was also proposed by the respondents of this study and is supported by a recent Finnish study, where symptoms of GERD were strongly correlated with severe ETW [29]. 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%) [7,8]. Daily intake of fruit and fruit juices has been reported to be a common causative factor for ETW [30,31]; here, this was assumed by half of the respondents.

As a whole, the respondents seem to be fairly up-to-date with detecting, diagnosing and documenting ETW. However, the documentation related to clinical photographs and study casts as well as measuring saliva secretion can be considered insufficient. As many as 80% of the respondents never measured the saliva secretion rate. The corresponding rates in the Icelandic and Norwegian surveys were 65 and 73% [7,8]. However, in this study, cariologists measured the saliva secretion rate much more often than other dentists; 28% usually and 56% occasionally. Since saliva is one of the most important protective factors in the ETW process [32,33], it is good to know the saliva secretion rate when aetiological elements are evaluated [34].

The participants assessed patient's dietary history in most cases (81%), whereas the respective figure is 45% in Norway and 50% in Iceland. Especially cariologists found it necessary to assess the patient's dietary habits (96%). This is encouraging since lifestyle factors such as a diet containing a lot fruit and berries, soft and energy drinks and fruit juices seems to be the main exogenous cause of ETW among children and adolescents and seems to have considerable significance in the development of ETW [25,35,36]. The majority of the respondents found it important to advise ETW patients about healthy drinking and eating habits as well as the use of fluoride products. 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 and 50% [3,37]. Advice on brushing techniques was considered important, although the scientific evidence concerning this is vague.

When asking about treatment decisions in the given patient case, the differences between general dentists and specialized dentists were not as obvious as hypothesized. In the case of the central incisor, the general dentists seemed to trust local fluoride treatment more often than their specialized colleagues. Furthermore, the cariologists chose to use bonding material for surface protection more often than general dentists or other specialists. Unexpectedly, the treatment choices for the 1st lower molar did not vary as much as in the case of the upper incisor. The Consensus Report of the European Federation of Conservative Dentistry – Erosive tooth wear, published in 2015 by Carvalho et al., categorized the management of ETW into preventive and 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 aesthetics 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 [32], yet less invasive direct procedures are recommended, especially for younger patients [38].

To our knowledge, this is the first study to evaluate this topic in Finland. The participation rate was quite low; however, it was in line with other recent questionnaire surveys carried out among dentists in Finland [39,40] and clearly higher than in the international study on clinicians' awareness of ETW [10]. Additionally, it is suggested that more attention should be devoted to assessments of bias and less to specific response rate thresholds [41]. However, it should be kept in mind that those who responded might be more motivated and interested to record ETW than those who did not participate in the study. More than 800 Finnish dentists answered the survey and despite the participation rate, some tentative and cautious conclusions may be drawn since the mean age, location and work experience of the participants were in line with those among dentists in Finland as a whole [42]. Additionally, the number of specialized dentists among the respondents was small and the proportion of specialists was in accordance with the proportion of all specialists among Finnish dentists [42]. Indeed, this study enables analysis of the differences between general and specialized dentist considering treatment and documentation as well as knowledge of ETW.

Conclusion

This study suggests that the Finnish dentists who participated in this survey are able to detect and diagnose ETW, but there is variation in recording it. The differences in

practices between general and specialized dentists seem not to be remarkable. Based on these results, the authors suggest current care guidelines on ETW in order to facilitate diagnosis, recording and decision-making for clinicians.

Acknowledgements

The authors thank all the Finnish dentists who participated in the study. The pre-print DOI:10.21203/rs.3.rs-17206/v1 is acknowledged.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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