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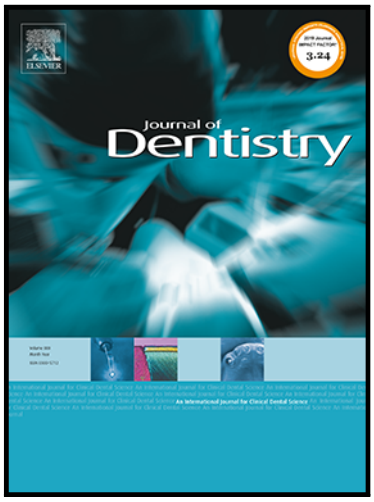

Dentine hypersensitivity and associations with self-reported oral health and quality of life data in seven European countries

Nicola X West , Robert G Newcombe , Bettina Alonso , Ana Araoz , Raluca Cosgarea , Jonathan Creeth , Sinéad Daly , Maria Davies , Joana Dias , Ricardo Faria-Almeida , Stefano Gennai , Filippo Graziani , Louise Griffith , Mairead Harding , David Herrera , Nikki Hellin , Søren Jepsen , Berta Legido , María Rioboo , Maria Prosper , Joon Seong , Alexandra Staehli , Anton Sculean

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Dentine hypersensitivity and associations with self-reported oral health and quality of life data in seven European countries.

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SHORT TITLE: Clinical and Self-reported dentine hypersensitivity in Europe.

KEY WORDS: dentine hypersensitivity, Schiff scale, quality of life, erosive tooth wear, recession

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All authors contributed towards the conceptualisation, methodology, project, administration, formal analysis of the study and reviewing & editing of the manuscript. All authors have read and agreed to the published version of the manuscript.

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Abstract

Objectives: To examine clinically-assessed dentine hypersensitivity and its associations with self-reported oral health and quality of life data.

Methods: A cross-sectional, observational, epidemiological study in healthy adults in seven European countries was undertaken. Participants underwent a clinical oral examination which assessed dentine hypersensitivity (DH) using an evaporative air stimulus with clinician reported Schiff scale and participant reported binary (yes/no) scores, gingival recession (GR), erosive tooth wear (ETW). Participants also completed a questionnaire on oral health, DH and lived experience.

Results: A total of 3,551 participants completed the study, the mean age was 44.0 years (standard deviation 17.4), 56.4% were females, and 29.1% had ≥1 site with Schiff 2/3. DH was more common buccally than lingually ($p<0.001$). Binary DH 'no' corresponded closely to Schiff 0 and 'yes' to 2/3. Schiff 2/3 was associated ($p<0.001$) with ETW, and with GR buccally. GR and the coronal and root ETW cervical location code was most commonly associated with Schiff 2/3 ($p<0.001$). DH was most common in lower incisors (participant self-reported and clinician reported Schiff 2/3). DH toothpaste use was significantly higher in participants with a clinical DH Schiff 2/3 and binary DH positive ($p<0.001$). DH participant pain intensity was rated as important by 37.5% and as very important by 14.9%.

Conclusions: DH is a common dental pain condition, with DH, GR and ETW particularly associated with the cervical buccal tooth aspect. For over half the participants, pain was very important/important to their lived experience.

Clinical significance: DH is not a legitimised dental pain condition. This perception needs to change from both oral healthcare and public perspectives. Data demonstrated high DH prevalence at different tooth sites with good correlation between examiner, participant reporting and quality of life measures, with a strong DH impact on lived experience.

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INTRODUCTION

Dentine hypersensitivity (DH) is a ubiquitous dental pain condition, affecting 50% of the global adult dentate population [1-3].

DH emanates from stimulation of crown and/or root dentine, by a naturally occurring stimulus, particularly cold food/drink or windy weather, in a healthy, permanent tooth in a healthy periodontium [4]. DH is characterised by its rapid onset, intense, sharp sensation and is transient in nature, resolving shortly afterwards [5]. DH is diagnosed by exclusion of other conditions with similar pain symptoms, and cannot be ascribed to any other form of dental defect and/or disease [6]. DH negatively affects people's lived experience through impacting everyday activities, such as eating, drinking, talking, and social interaction, nevertheless patients do not feel they can discuss it with their dentist [7]. DH can, therefore, have a negative effect on quality of life [8].

DH is highly prevalent, peaking in the 38–47 age group [1], with the current literature supporting a rise in prevalence in young adults in Europe, China and Nigeria [1, 3, 9], and more worryingly in adolescence [10-13]. With increased life expectancy, and individuals retaining their vital teeth with complete functionality for longer, due to caries and periodontal diseases prevention and treatment, condition burden is likely to increase.

Although many associated risk factors have been identified for DH, in particular erosive tooth wear (ETW) due mainly to the acidic diet of an otherwise healthy lifestyle [14-17], and oral hygiene habits, such as traumatic toothbrushing, contributing to soft tissue gingival recession (GR) [18-24], the condition is undoubtedly of multifactorial causation and is still to be fully elucidated.

Whilst DH pain is transient, only present for the duration of the stimulation and for up to 2-5 minutes following stimulus cessation [25], it can be debilitating. Recently there has been wide consideration of the psycho-social impacts of DH on everyday life, people affected by DH reporting substantial impacts [8, 26]. The World Health Organization [27] defines oral health as the state of the mouth, teeth and orofacial structures that enables individuals to perform essential functions, such as eating, breathing and speaking, and encompasses psychosocial dimensions, such as self-confidence, well-being and the ability to socialize and work without pain, discomfort and

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embarrassment. Oral health is necessary for quality of life [28], and there is good evidence that highly prevalent oral conditions, such as DH and its aetiological associated risk factors, have considerable negative effects on day-to-day living. Further, there is evidence that a change of dietary habits and oral hygiene regimens, including application and brushing of toothpaste, can help prevent or alleviate DH pain [29, 30]. Systematic reviews have confirmed a negative effect of DH on oral health-related quality of life (OHRQoL) that can be reversed with treatment [31-34]. Lived experience data is important to capture when assessing DH, to better understand the condition, associated risk factors and management. To date, large multicentre epidemiological DH studies with clinically diagnosed DH, as defined by a number of outcome measures in combination with self-reported DH in healthy adults, are lacking.

This paper aims to further explore the relationship between the clinically diagnosed and self-reported DH data from 3,551 participants from seven European countries extending the findings published previously ([1] to elucidate further associated risk factor characteristics, supported by an in-depth examination of the clinical data. It will aim to give greater understanding into the importance of the participants' perspective, presenting their self-reported oral health, lifestyle, dietary and oral hygiene habits and quality of life data, in seven European countries. If we can better understand DH sufferers' habits and how they rate the physical and emotional experience as well as quality, intensity, duration and triggers of their DH pain, we can better understand the condition and implement superior management strategies.

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METHODS

The methods used for the present study have been described in detail in West et al [1]. Those central to the data presented in this manuscript are summarised here. Briefly, the study was a cross-sectional, observational, epidemiological, multi-centre study, across seven European countries (Germany, Ireland, Italy, Portugal, Spain, Switzerland, UK), in adult participants aged 18 or over. All study documents were translated from English into the respective languages, and back-translated to confirm accuracy, for the participating countries. Participants who provided written informed consent and fulfilled the inclusion and exclusion criteria completed a questionnaire (Supplementary data Appendix 1), followed by a standardised clinical examination (Supplementary data

Appendix 2, data collection forms). The study was approved by an appropriate research ethics committee in each participating nation and conducted according to good clinical practice guidelines.

Recruitment

Participants were individuals attending scheduled appointments in general dental practices, and in clinics at university hospitals and dental schools. Individuals who gave informed consent were assessed for study eligibility. Only adults with a minimum of 10 teeth, excluding teeth with crowns or bridges, who were not undergoing orthodontic treatment or pregnant, who did not require antibiotic cover for dental treatment, or suffer from bleeding disorders, and who had not used analgesic drugs within the preceding 24 hours, were recruited.

Study assessments

Enrolled participants completed a questionnaire about their oral health (Appendix 1) which included 10 questions focussed on DH, including the impact this had on OHRQoL, from the shorted Dentine Hypersensitivity Experience Questionnaire (DHEQ) [26, 35, 36] validated questionnaire (Appendix 1). A clinical examination was then undertaken, buccal and lingual/palatal sites of all teeth and gingival units in both dental arches, except third molars, were examined by trained, calibrated study dentists [1].

Eligible teeth were assessed for DH and the related issues of ETW, cervical localisation code (CLC) which identifies distinct tooth wear (DTW) (a step or scooped out defect) and GR. Each eligible tooth was assessed for DH by a one-second cold air blast at the cervical margin with adjacent teeth shielded, using an examiner-reported Schiff scores: 0 = subject does not respond to sensitivity, 1 = subject responds to stimulus but does not request discontinuation of stimulus, 2 = subject responds to stimulus and requests discontinuation or moves from stimulus, 3 = subject responds to air stimulus, considers stimulus to be painful, and requests discontinuation of the stimulus [37]. Volunteer-reported clinical stimulus DH pain index (yes/no) was also recorded. ETW was assessed using the Basic Erosive Wear Examination (BEWE): 0 = no erosive wear, 1 = early tooth loss, 2 = hard tissue surface loss <50%, 3 = hard tissue surface loss >50% (Bartlett et al 2008)[38]. CLC was assessed using the categorical scale: A = no GR, and no DTW on crown in cervical region, B = no GR, and DTW on crown in cervical region, C = GR with

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or without DTW on root in cervical region and no DTW on crown in cervical region, D = GR with DTW on root in cervical region, and DTW on crown in cervical region [39]. GR was measured as the greatest recession in mm [cemento-enamel junction (CEJ) to the gingival margin] [40]. Dental exclusions for BEWE/DH/CLC, in addition to the general exclusions, were teeth with caries, restorations in the proximity of CEJ and, in addition for DH, teeth that had been endodontically treated.

Sample size calculation

It was planned to recruit approximately 700 participants from each of the seven countries, with approximately 70 males and 70 females for each of the age strata 18-27, 28-37, 38-47, 48-57, ≥58 per country. In a previous European study, the overall proportion of participants with clinically elicited DH measured by Schiff score at one or more sites was 42% [24]. Considering a DH risk indicator with a prevalence of approximately 25%, a study size of 4,900 would detect an odds ratio (OR) of 1.20 with a power of 80% at the conventional two-sided 5% alpha level, equivalent to a difference of between 45.4% and 40.9% sensitivity in the two groups.

Statistical analysis

Analyses in the present report are at participant level, using whole mouth measures which summarise the site level data, and at site level. Participant level analyses used the generalised Mann-Whitney measure U/mn [41, 42], a non-parametric relative effect size measure to quantify the degree of separation between two frequency distributions. Chi-square analyses, including paired McNemar test, were also used.

In analyses at site level (Table 2), differences in prevalence of Schiff 2/3 between sites with and without ETW or GR were stratified by 35 strata defined by country and age in six groups, 18-27, 28-37, 38-47, 48-57, 58-67 and 68+. Bootstrap p-values and confidence intervals (CI) for differences were calculated to allow for within-participant clustering.

RESULTS

Participant numbers, demographics and study timelines have been published in detail previously. In summary, 3,551 participants were recruited from seven European countries. Participants were more commonly female (56.4%), the overall mean body

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mass index (BMI) was 24.5, 73.9% lived in urban areas, with employment most commonly indicated as non-manual (38.7%) [1].

The prevalence of clinically-diagnosed DH at the overall participant level in each country, together with its relationship with ETW, GR and bleeding on probing (BOP), has been published in the first report arising from this study [1]. Clinically-evaluated DH data at the participant level, not previously reported, as well as data at tooth site level are presented here.

Clinically-assessed dentine hypersensitivity (DH) and associated factors

DH as measured by maximum Schiff score on buccal and lingual/palatal surfaces is shown in Figure 1.

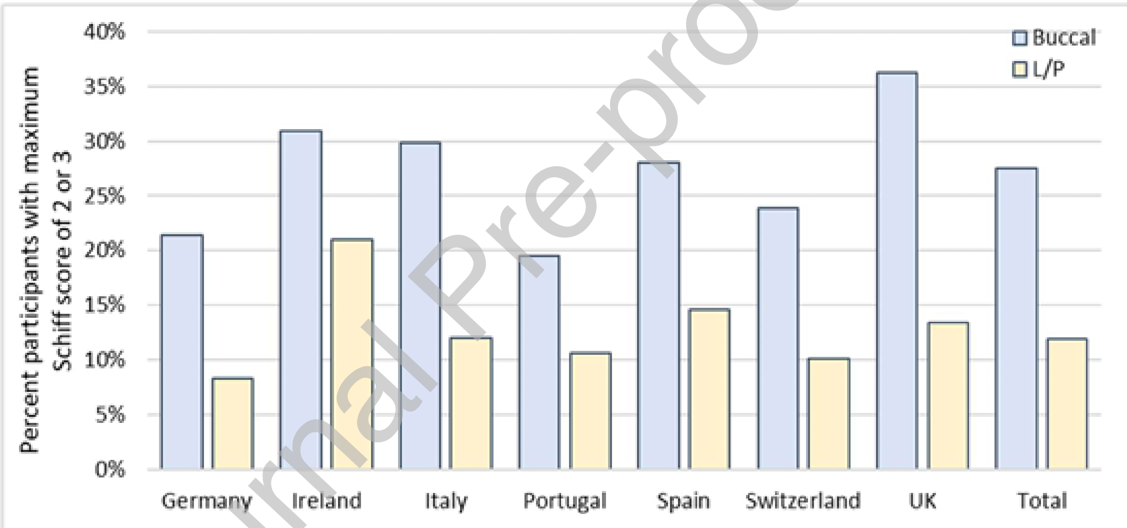

Figure 1. Maximum Schiff scores of 2/3 compared to 0/1 at buccal and lingual/palatal (L/P) surfaces.

Whilst there was heterogeneity between the countries, for all countries maximum Schiff scores of 2 or 3 were more common on buccal cervical surfaces, as compared to lingual/palatal surfaces, a difference that was statistically significant (p<0.001), both overall and also in each country. 96.6% of participants with a maximum Schiff score or 2 or 3 reported sensitivity to an air blast, at one or more sites. The corresponding percentages for those with maximum scores 0 and 1 were 4.1% and 47.6%, respectively, the latter indicating great ambiguity in relation to a score of 1.

For 540 participants studied by a single examiner with a known, identical, consistent approach to charting DH, the first tooth exposed to air blast (always tooth 17 in this sub-series) yielded a Schiff score of 1 in 49.2% of cases. This was considerably more than for any other tooth, in particular contralateral tooth 27 (26.1%, $p<0.001$).

The association between clinical DH as measured by Schiff score and CLC is shown in Table 1.

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Table 1. Cross tabulation of Schiff score and cervical localisation code (CLC per tooth/tooth site.

		Schiff score				
		0	1	2	3	2 or 3
CLC Both surfaces	A no GR, no coronal DTW	72.8%	25.4%	1.6%	0.2%	1.7%
	B no GR, distinct coronal DTW	71.5%	25.5%	2.5%	0.4%	3.0%
	C GR, no coronal DTW	56.5%	37.6%	5.3%	0.7%	6.0%
	D GR + coronal + root DTW	61.6%	28.5%	8.0%	1.9%	9.9%
CLC Buccal	A no GR, no coronal DTW	68.7%	28.7%	2.3%	0.3%	2.6%
	B no GR, distinct coronal DTW	67.1%	28.6%	3.7%	0.6%	4.3%
	C GR, no coronal DTW	52.6%	40.0%	6.5%	0.9%	7.4%
	D GR + coronal + root DTW	59.0%	30.6%	8.4%	2.0%	10.4%
CLC Lingual/ palatal	A no GR, no coronal DTW	75.9%	23.0%	1.0%	0.1%	1.1%
	B no GR, distinct coronal DTW	75.5%	22.7%	1.5%	0.3%	1.8%
	C GR, no coronal DTW	62.6%	33.7%	3.3%	0.4%	3.7%
	D GR + coronal + root DTW	71.1%	21.1%	6.3%	1.6%	7.8%

DTW = distinct tooth wear, GR = gingival recession

Sites coded CLC-D, indicating both GR, coronal and root DTW, were most commonly associated with DH (Schiff 2/3). Sites coded CLC-C were shown to have 2.1 times more DH (Schiff 2 or 3) than sites coded CLC-B, while the difference in DH between CLC-A and CLC-B was smaller, CLC-B sites having 1.61 times more DH than sites coded CLC-A. In the absence of coronal DTW, GR was more often associated with DH buccally, than it was lingual/palatally.

Table 2 shows tooth site level associations between DH, ETW and GR.

Table 2. The association of Schiff 2/3 and erosive tooth wear (ETW), assessed by the Basic Erosive Wear Examination (BEWE), or gingival recession (GR), on buccal surfaces.

Buccal		% Schiff sites 2 or 3 for:	Adjusted difference	95% confidence interval	p-value
BEWE	Positive 2 or 3	2379 / 31303 (7.6%)	4.2%	2.9% to 5.5%	p<0.001
	Negative 0 or 1	1886 / 53796 (3.5%)			
GR	Positive (1mm+)	2708 / 34432 (7.9%)	4.6%	3.8% to 5.3%	p<0.001
	Negative (0mm)	1456 / 49911 (2.9%)			

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Palatal/lingual		% Schiff sites 2 or 3 for:	Adjusted difference	95% confidence interval	p-value
BEWE	Positive 2 or 3	698 / 23620 (3.0%)	2.2%	0.4% to 4.0%	p=0.02
	Negative 0 or 1	865 / 60559 (1.4%)			
GR	Positive (1mm+)	718 / 18296 (3.9%)	2.7%	1.2% to 4.3%	p<0.001
	Negative (0mm)	796 / 65264 (1.2%)			

Differences in proportions with Schiff score 2/3 were adjusted for confounding with country and age group by stratification, with bootstrapping for non-independence. Both ETW and GR were significantly associated with DH. No clear relationship at site level of DH to probing depth or bleeding was found.

Clinically-assessed dentine hypersensitivity and questionnaire variables

Many of the associations between clinical DH and questionnaire variables were reported in West et al [1]. Dominant hand analysis, however, was not included in the earlier publication and it demonstrated that there was no statistically significant association between the participants dominant hand and maximum Schiff score on the teeth, on the corresponding side of the mouth for buccal or for lingual/palatal sites. However, when data were split by toothbrush type (manual versus powered), a positive association between dominant hand and the mean maximum Schiff score on the teeth on the corresponding side of the mouth brushed first, approached significance on buccal surfaces for manual brushers (difference in mean maximum Schiff dominant hand – non-dominant hand, +0.03 with 95% CI [-0.001; +0.06]).

Also not reported previously is the association between clinical DH and dry mouth or bad breath. DH was significantly positively associated with both conditions (Table 3), all these differences being statistically significant ($p<0.001$).

Table 3. Mean maximum Schiff and % binary dentine hypersensitivity (DH) (yes/no), association with bad breath and dry mouth.

DH measure	Condition	Yes	No	Don't know	U/mn	95% CI Lower limit	95% CI Upper limit	P-value
Mean max Schiff	Dry mouth	1.26	1.08	1.23	0.559	0.531	0.587	<0.001
	Bad breath	1.18	1.04	N/A	0.549	0.529	0.567	<0.001
	Dry mouth	14.09	8.20	10.34	0.579	0.550	0.608	<0.001

% binary DH	Bad breath	10.16	7.98	N/A	0.534	0.515	0.553	<0.001

U/mn, Generalised Mann-Whitney measure; CI, confidence interval; N/A, not applicable.

All participants were asked about their use of DH treatments. Overall, 27.1% participants reported using a DH toothpaste, but 10.9% participants did not know if the toothpaste they used was formulated for DH. More females used DH toothpaste than males (30.4% versus 22.8%, p<0.001) and more men were unsure if the toothpaste they used was a DH toothpaste than women (15.6% versus 7.3%, p<0.001).

Mean age differed significantly between the three groups (DH toothpaste, non-DH toothpaste, unsure), ranging from 42.2 years in non-DH toothpaste, to 49.4 years in users of a DH toothpaste (p<0.001).

The association between DH treatments and clinically diagnosed DH is shown in Table 4.

Table 4. Association between use of dentine hypersensitivity (DH) treatments and clinically-assessed DH.

		Mean by use of DH toothpaste		Compare 'Yes' vs 'No' groups			
		Yes	No	U/mn	Lower	Upper	P-value
Max Schiff	All sites	1.31	1.03	0.587	0.565	0.608	<0.001
	Buccal	1.27	1.00	0.585	0.563	0.606	<0.001
	Palatal/lingual	0.81	0.60	0.574	0.552	0.595	<0.001
% binary DH	All sites	12.86	7.50	0.600	0.579	0.622	<0.001
	Buccal	17.31	10.39	0.598	0.577	0.619	<0.001
	Palatal/lingual	8.41	4.57	0.576	0.554	0.597	<0.001
		Mean by professional advice		Compare 'Yes' vs 'No' groups			
		Yes	No	U/mn	Lower	Upper	P-value
Max Schiff	All sites	1.56	1.51	0.520	0.490	0.550	0.189
	Buccal	1.52	1.48	0.515	0.485	0.546	0.321
	Palatal/lingual	0.94	0.94	0.501	0.471	0.532	0.931
% binary DH	All sites	17.21	14.65	0.537	0.506	0.567	0.017
	Buccal	22.73	20.29	0.534	0.504	0.564	0.027
	Palatal/lingual	11.71	8.96	0.528	0.497	0.558	0.073

U/mn, Generalised Mann-Whitney Measure; Lower, lower limit of the 95% confidence interval; Upper, upper limit of the 95% confidence interval.

The use of a DH toothpaste was significantly associated with clinically-diagnosed DH (maximum Schiff score and participant confirmation of DH following an air blast).

Receiving advice from a dentist about DH treatments was more common in those with clinically-diagnosed DH, and the association was borderline for DH confirmed by participants following an air blast.

Associations between clinically-diagnosed and self-reported dentine hypersensitivity

Overall, 40.6% of participants reported suffering from sensitive teeth, 51.4% confirmed DH in response to an air-blast (yes/no) and 29.0% had a maximum Schiff score of 2 or 3 [1].

At the participant level, clinically-diagnosed DH was substantially associated with self-reported DH, as measured by Schiff or participant response to an air-blast (Table 5). However the agreement was not perfect.

Table 5. The association between self-reported and clinically-diagnosed dentine hypersensitivity (DH)

	Mean % sites max Schiff by SR-DH		Compare 'Yes' vs 'No' groups			
	Yes	No	U/mn	Lower	Upper	p-value
All sites	1.54	0.82	0.729	0.712	0.746	<0.001
Buccal	1.50	0.79	0.727	0.710	0.744	<0.001
Palatal/lingual	0.94	0.48	0.663	0.645	0.681	<0.001
	Mean % sites binary DH by SR-DH		Compare 'Yes' vs 'No' groups			
	Yes	No	U/mn	Lower	Upper	p-value
All sites	15.88	4.51	0.733	0.715	0.749	<0.001
Buccal	21.40	6.22	0.733	0.715	0.749	<0.001
Palatal/lingual	10.35	2.80	0.644	0.626	0.662	<0.001

U/mn, Generalised Mann-Whitney measure; Lower, lower limit of the 95% confidence interval; Upper, upper limit of the 95% confidence interval; max, maximum.

At site level, clinically-diagnosed DH was found at 8.8% (14,901/169,709) of buccal or palatal sites following an air-blast and 3.4% (5,806/169,709) scored Schiff 2 or 3. Separately, participants self-reported DH, which teeth were sensitive on a mouth map, and in total 5,519 teeth, were identified as sensitive. On average, participants who self-reported DH indicated four sensitive teeth.

The distribution of the sites identified as Schiff 2/3 and the frequency each tooth was self-reported DH as sensitive, from the mouth map data, are shown in Figure 2A-C. The pattern is parallel in both arches, with a main peak in first incisors and a subsidiary peak in first molars.

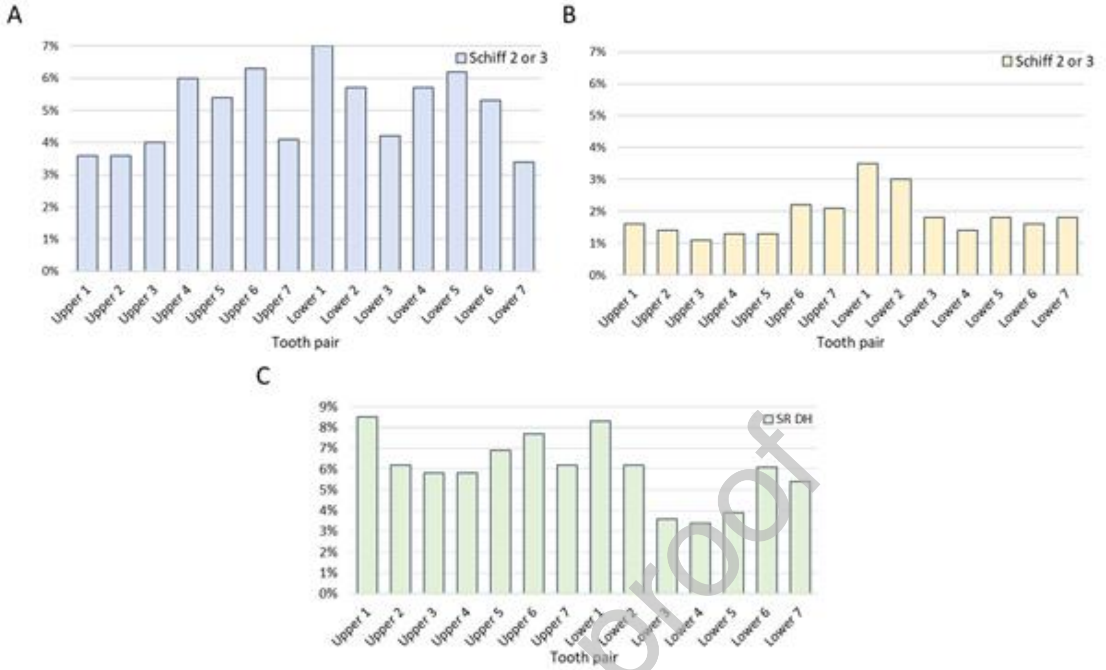

Figure 2. Distribution of dentine hypersensitivity (DH) data 7-7 expressed as a % of the number of participants who had that tooth scored. A, Schiff 2/3 buccal sites; B, Schiff 2/3 lingual/palatal sites; C, S self-reported DH (SR DH) by tooth as identified by participants on a questionnaire mouth map.

The tooth level agreement of self-reported DH with clinically determined DH is shown in Table 6, both across all tooth positions and for four zones of the mouth.

Table 6. Agreement of self-reported dentine hypersensitivity (SR-DH) teeth with clinically determined DH [Schiff and binary dentine hypersensitivity (DH] sites.

	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Across 28 teeth				
SR-DH vs Schiff	30.7%	86.6%	21.4%	91.3%
SR-DH vs binary DH	25.4%	88.0%	40.3%	78.8%
Upper anteriors (13-23)				
SR-DH vs Schiff	37.7%	83.1%	16.6%	93.7%
SR-DH vs binary DH	30.8%	84.7%	34.5%	82.4%
Upper posteriors (17-14 & 24-27)				
SR-DH vs Schiff	32.1%	86.5%	23.5%	90.8%
SR-DH vs binary DH	25.7%	87.9%	42.2%	77.5%
Lower anteriors (43-33)				
SR-DH vs Schiff	33.6%	86.0%	25.1%	90.3%
SR-DH vs binary DH	29.9%	88.6%	48.8%	77.7%

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	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Lower posteriors (47-44 & 34-37)				
SR-DH vs Schiff	21.7%	90.2%	20.4%	90.8%
SR-DH vs binary DH	16.7%	90.6%	35.0%	78.2%

Self-reported DH accurately reports teeth in areas in the mouth that are not sensitive, specificity and negative predictive value are high for both Schiff score and DH in response to an air-blast; but it is not accurate at reporting which tooth is sensitive in a specific area, sensitivity is low for both clinically-assessed DH measures, especially for lower posterior teeth and positive predictive value is very low for Schiff, especially for upper anteriors.

Characteristics of self-reported dentine hypersensitivity

As previously reported, variation in self-reported DH was evident across the seven countries, with the percentage of participants confirming they were DH sufferers ranging from 30.9% of participants in Ireland to 50.4% participants in the UK [1]. Self-reported DH was more common in females (904/1,995; 45.3%) than in males (533/1544; 34.5%) (p<0.001), and the mean age of those with self-reported DH was 45.5, as compared to 42.9 in those who confirmed they did not suffer from DH (p<0.001). Similar to clinical measures of DH, the proportion who self-reported DH increased with age initially and then decreased steadily in older adults. However, self-reported DH was most prevalent in a slightly older age group than clinically determined DH; 48-57 as compared to 38-47.

Participants with self-reported DH were asked a series of additional questions about their DH, summary statistics of participant responses by country and overall are shown in Table 7.

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Table 7. Self-reported dentine hypersensitivity (DH) characteristics

	Germany	Ireland	Italy	Portugal	Spain	Switzerland	UK	Total
Suffer DH*								
n	704	181	614	350	377	529	785	3540
Yes (n)	231	56	298	128	140	188	396	1437
Yes (%)	32.8%	30.9%	48.5%	36.6%	37.1%	35.5%	50.4%	40.6%
Length of time suffered from DH								
n	223	56	293	128	140	181	396	1417
< 1 year	8.1%	5.4%	15.0%	8.6%	9.3%	3.3%	8.6%	9.1%
1-2 years	12.6%	10.7%	15.4%	7.8%	12.1%	9.9%	11.9%	12.1%
> 2 years	57.4%	60.7%	41.3%	72.7%	57.9%	67.4%	64.1%	58.8%
Don't know	22.0%	23.2%	28.3%	10.9%	20.7%	19.3%	15.4%	20.0%
Triggers reported								
n	231	56	298	128	140	188	396	1437
Hot food/drink	12.6%	23.2%	16.1%	23.4%	20.7%	18.1%	16.9%	17.4%
Cold food/drink	75.3%	89.3%	82.6%	91.4%	97.1%	71.8%	89.6%	84.4%
Sweet food/drink	29.0%	32.1%	18.8%	26.6%	18.6%	20.7%	34.6%	26.2%
Ambient cold air	44.2%	37.5%	27.9%	50.0%	35.0%	39.9%	34.8%	37.0%
Tactile	16.0%	10.7%	19.5%	25.8%	15.0%	16.0%	11.6%	16.1%
Toothbrushing	25.5%	12.5%	20.5%	39.1%	23.6%	16.5%	19.4%	22.1%
Number of triggers								
n	231	56	298	128	140	188	396	1437
0	4.3%	0.0%	2.0%	1.6%	1.4%	9.6%	1.8%	3.1%
1	32.0%	46.4%	44.6%	28.1%	34.3%	30.3%	31.8%	34.8%
2	34.6%	21.4%	30.9%	23.4%	37.1%	38.3%	38.1%	34.0%
3	19.5%	16.1%	14.8%	16.4%	12.1%	13.3%	18.7%	16.4%
4	6.1%	12.5%	4.7%	22.7%	10.7%	6.9%	5.3%	7.9%
5	2.2%	3.6%	2.3%	5.5%	3.6%	1.1%	4.0%	3.1%
6	1.3%	0.0%	0.7%	2.3%	0.7%	0.5%	0.3%	0.8%
mean (Standard deviation)	2.03 (1.16)	2.05 (1.21)	1.85 (1.08)	2.56 (1.41)	2.10 (1.18)	1.83 (1.12)	2.07 (1.09)	2.03 (1.16)
Importance of the intensity of DH pain								
n	224	54	294	127	139	179	395	1412
Not important	11.2%	3.7%	7.5%	3.1%	5.8%	11.2%	10.6%	8.7%
Little importance	45.1%	25.9%	26.2%	17.3%	31.7%	53.1%	40.8%	36.4%
Some importance	32.6%	51.9%	42.5%	42.5%	46.0%	23.5%	36.5%	37.5%
Very important	8.0%	18.5%	21.1%	35.4%	15.1%	7.3%	10.6%	14.9%
Don't know	3.1%	0.0%	2.7%	1.6%	1.4%	5.0%	1.5%	2.4%
Degree of DH pain (none 0 – 10 worst imaginable)								
n	222	55	291	126	139	173	396	1402
mean (SD)	3.19 (2.03)	4.16 (1.78)	4.99 (2.43)	5.17 (2.18)	5.25 (2.34)	3.38 (1.99)	3.83 (1.97)	4.19 (2.23)

	Germany	Ireland	Italy	Portugal	Spain	Switzerland	UK	Total
Impact of DH pain on daily life (none 0 – 10 worst imaginable)								
n	221	55	289	127	140	178	395	1405
mean	1.94	2.76	3.96	3.83	3.41	2.23	2.29	2.84
(SD)	(2.15)	(2.26)	(2.87)	(3.01)	(2.47)	(2.02)	(2.07)	(2.53)
QoL (8-item DH related: 0 least – 100 greatest impact of DH on QoL)								
n	220	55	285	128	139	163	388	1378
mean	31.9	49.5	52.2	48.8	51.7	32.0	47.3	44.7
(SD)	(19.9)	(23.7)	(22.3)	(22.3)	(23.1)	(20.1)	(18.7)	(22.3)

*Published previously, but included here for completeness [1]. QoL, quality of life.

Across all countries, DH had most commonly been suffered for more than 2 years and cold food/drink was the most common trigger; participants most frequently reported one DH trigger (Ireland, Italy, Portugal) or two DH triggers (Germany, Spain, Switzerland, UK). The proportion of manual brushers was significantly higher in those who identified toothbrushing as a trigger than those who do not (55.1% versus 47.3%; $p = 0.016$).

Overall, DH pain intensity was most often reported as being of some importance (37.5% participants), while 14.9% of participants rated it as very important. DH pain importance varied considerably across the countries. More than 50% of participants in Germany, Switzerland and the UK rated their DH pain intensity as of little importance or not important to them. By contrast, 35.4% of participants in Portugal and 21.1% participants in Italy rated their DH pain intensity as very important. Similarly, the mean degree (how painful) and impact of DH pain on daily life was lowest in Switzerland, Germany and the UK and highest in Portugal, Spain and Italy. Country differences in the combined score for the 8 items that comprised the quality of life (QoL) question followed a similar pattern with the exception of UK participants who rated the impact of DH on their QoL relatively highly.

There was a similar age profile for the self-reported DH characteristics as there was for self-reported DH, each being most frequently reported in the 38-45 or 48-57 age groups. Two characteristics that did not fit this pattern were the identification of cold food/drink as a trigger which was extremely common in all age groups, only tailing off in those aged 68 or over to just below 80% of participants in this group, and duration of suffering DH which plateaued at around 80% after age 38 (Figure 3).

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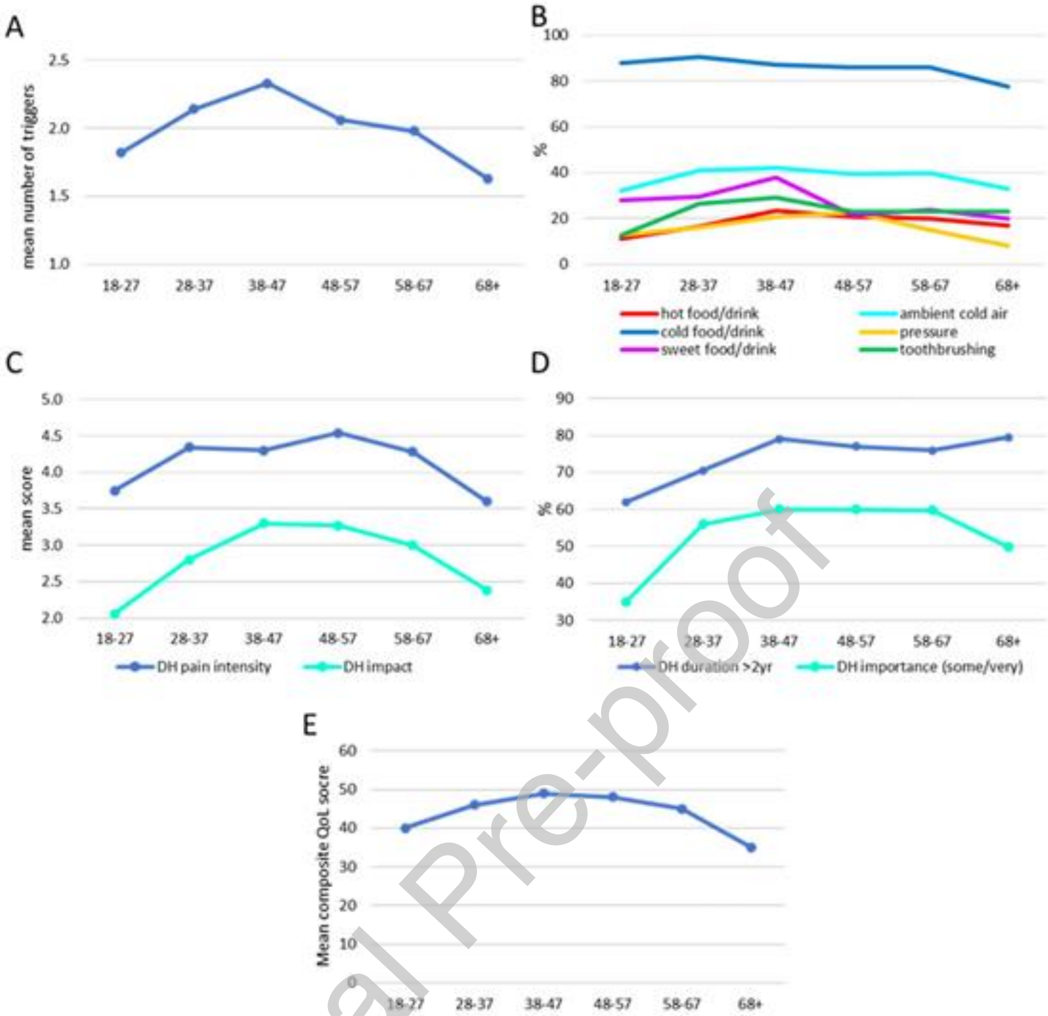

Figure 3. Dentine hypersensitivity (DH) characteristics by age. The mean number of triggers (A), the percentage of participants responding to each trigger (B), the mean DH pain intensity and impact scores (C), the percentage of participants suffering from DH for more than 2 years and rating their DH as of come importance/very important (D), the mean composite quality of life (QoL) score (E).

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DH characteristics were analysed by gender. There was no difference in the overall scores for the degree of DH pain or its impact on daily life between males and females. However, all triggers, apart from touch, were more commonly reported by women than men, and gender specific statistically significant differences were observed for sweet food/drink ($p = 0.042$) and ambient cold air ($p = 0.021$). The length of time that DH had been suffered was similar in males and females, but significantly more females than males indicated their DH pain intensity was of some importance or very important to them (U/mn = 0.460, p=0.01). QoL scores were generally higher (worse) in females than males, with the composite score and several individual items being significantly higher in women than in men (Table 8). Men only scored higher than women for one QoL item: 'Having sensations in my teeth makes me feel as though I am unhealthy', but the difference was not statistically significant.

Table: 8. Quality of life (QoL) scores, gender differences (taken from short Dentine Hypersensitivity Experience Questionnaire - DHEQ)

Test Result Variable(s)	U/mn	P-value	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Composite Score	0.462	0.018	0.430	0.493
Less pleasure eat/drink	0.474	0.105	0.442	0.506
Problems-Ice cream	0.452	0.003	0.420	0.484
Change eat some food	0.489	0.475	0.457	0.520
Care -Breathe Cold	0.470	0.062	0.439	0.501
Avoid teeth with foods	0.466	0.035	0.435	0.498
Dentistry painful	0.454	0.004	0.423	0.485
Sensations annoying	0.468	0.047	0.436	0.500
Sensations unhealthy	0.507	0.659	0.475	0.539

U/mn, Generalised Mann-Whitney measure

Associations between self-reported dentine hypersensitivity characteristic and other clinical conditions

There were no significant associations between a maximum clinical BEWE score of 2 or 3 and self-reported DH characteristics. By contrast, significant positive associations were seen between some DH characteristics and degree of gingival recession (GR) (Table 9).

Table 9. Self-reported dentine hypersensitivity (DH) characteristics and their association with gingival recession (GR).

		n	Mean	Contrast	U/mn	Lower	Upper	P-value
Degree of DH pain (none 0 – 10 worst imaginable)								
Max GR	0	101	4.50	3+ vs 0	0.471	0.413	0.530	0.339
	1-2mm	410	3.92	3+ vs 1-2	0.540	0.506	0.573	0.022
	3mm+	880	4.28					
Impact of DH pain on daily life (none 0 – 10 worst imaginable)								
Max GR	0	101	2.92	3+ vs 0	0.505	0.446	0.564	0.872
	1-2mm	409	2.44	3+ vs 1-2	0.560	0.527	0.594	<0.001
	3mm+	884	3.01					
How long suffered from DH (% over 2 years)								
Max GR	0	77	66.2%					
	1mm+	1047	74.0%	0 vs 1+	0.535	0.468	0.600	0.306

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		n	Mean	Contrast	U/mn	Lower	Upper	P-value
	0-2mm	392	65.6%					
	3mm+	732	77.7%	0-2 vs 3+	0.562	0.527	0.597	<0.001
Importance of the intensity of DH pain (% some or very important)								
Max GR	0	97	56.7%					
	1mm+	1270	53.5%	0 vs 1+	0.468	0.410	0.528	0.296
	0-2mm	500	47.4%					
	3mm+	867	57.4%	0-2 vs 3+	0.550	0.518	0.581	0.002

U/mn, Generalised Mann-Whitney measure; Lower, lower limit of the 95% confidence interval; Upper, upper limit of the 95% confidence interval; Max, maximum.

Participants with maximum GR of 1-2 mm had significantly lower scores for the degree of their DH pain and the impact of DH pain on daily life, as compared to those with 3 mm or more GR. Significant positive associations were also seen between those with GR of 3 mm or more, and the length of time DH had been suffered and the importance of the DH pain. There were no associations between specific triggers of DH or the number of triggers of DH and GR.

Associations between self-reported QoL items and maximum clinical GR or maximum BEWE score of 2 or 3 are shown in Table 10.

Table 10. Self-reported dentine hypersensitivity (DH) quality of life (QoL) items and their association with maximum Basic Erosive Wear Examination (BEWE) scores of 0/1 or 2/3 and any gingival recession (GR).

	BEWE 2/3 v BEWE 0/1				GR 0 versus any GR			
	U/mn	Lower	Upper	p value	U/mn	Lower	Upper	p value
Combined score	0.496	0.460	0.532	0.839	0.470	0.415	0.526	0.318
Less pleasure eat/drink	0.484	0.447	0.522	0.408	0.426	0.371	0.481	0.012*
Problems-ice cream	0.483	0.445	0.521	0.372	0.443	0.381	0.505	0.055
Change eat some food	0.461	0.423	0.499	0.041*	0.453	0.397	0.509	0.113
Care-breathe cold	0.489	0.452	0.527	0.578	0.455	0.394	0.516	0.127
Avoid teeth with foods	0.458	0.421	0.495	0.029*	0.469	0.410	0.528	0.295
Dentistry painful	0.588	0.551	0.625	<0.001*	0.591	0.533	0.649	0.002*
Sensations annoying	0.482	0.444	0.520	0.341	0.457	0.398	0.516	0.143

Sensations unhealthy	0.526	0.490	0.563	0.166	0.538	0.480	0.596	0.196

*Statistically significant differences. U/mn, Generalised Mann-Whitney measure; Lower, lower limit of the 95% confidence interval; Upper, upper limit of the 95% confidence interval.

Finding dentistry painful was positively strongly significantly associated with both any recession (GR 1 mm or more) and a maximum BEWE score of 2 or 3. The other significant associations were inverse, avoiding sensitive teeth when eating certain foods and changing foods that are eaten were associated with a maximum BEWE score of 0 or 1, while having less pleasure in each or drinking was associate with having no GR.

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DISCUSSION

In this European dataset, based on 3,551 participants from seven European countries, DH prevalence was high, with marked variation across countries and age groups. Overall, 29.0 % of participants had a clinician-reported DH Schiff score of 2 or 3, 51.4% self-reported DH in response to an air-blast, and 40.6 % of participants self-reported DH when completing the questionnaire. These three measures of DH had a significant agreement and broadly similar pattern of age distribution [1].

Site-level data for dentine hypersensitivity

When reviewing the site level data in this dataset, DH Schiff score of 2 or 3 for buccal cervical DH was more frequent than lingual cervical DH (p<0.001) in all seven European countries, most markedly in the UK. Overall data demonstrated almost twice as frequent buccal DH than lingual DH. Although there is ample literature on the prevalence of buccal and lingual recession [43, 44], most studies focus on only buccal/labial GR association with DH. This is most likely due to ease of access for the clinician in DH clinical studies, patient identification of sites and frequency of lesions, rather than lack of its presence. Demirci and co-workers [15] commented on buccal and lingual DH in a clinical study with three DH assessments: tactile stimulus with verbal rating score, air blast with visual analogue scale (VAS), and self-reported questionnaire study, with 1,210 patients. Results showed DH buccal surface prevalence of 86.3% with air and tactile stimuli, compared to 53.7% lingual DH, the same site distribution trend as in the present report.

In explanation of why there is more buccal recession than lingual, Cone Beam Computed Tomography and surgical clinical experience frequently demonstrate the buccal root surface has minimal bone coverage, either due to natural bone morphology or orthodontic expansion of the arch [45]. Once GR occurs, for example, due to combinations of thin gingival phenotype accompanied by traumatic toothbrushing, cementum will quickly be lost resulting in exposed dentine [43, 46, 47]. Whilst traumatic toothbrushing may be a contributing factor to the development and progression of this multifactorial condition, evidence to prove this association is largely circumstantial [48].

In contrast, palatally/lingually there is good bone coverage of the palatal/ lingual root surface unless the tooth is malpositioned or due to extensive bone loss (e.g., in periodontitis) [43, 45]. In general, palatal/lingual gingival phenotype is thick, as opposed to the buccal/labial phenotype which can be thin or thick at any site [49]. Gingival phenotype is often not recorded in DH studies and indeed this has been raised a study limitation [50]. Gingival phenotype was recorded at buccal and palatal/lingual sites of all scoreable teeth in the present study, and the participants fell into one of three groups: having no thin sites, having all thin sites and having a mixture of thick and thin sites [1]; further details will be published in a future manuscript.

Buccally tooth site level associations between clinical DH, ETW and GR were associated with a Schiff score of 2 or 3, as compared with a tooth score of 0 or 1. This has been demonstrated in previous studies for overall and buccal aspects [15, 24, 50], and this finding although unsurprising gives a deeper delve into the condition.

Assessment of dentine hypersensitivity

Overall, 75.9 % of participants in this study had a Schiff score of 1 or higher on at least one tooth, indicative of DH, with 29.0 % having a Schiff score of 2 or 3 [1]. The Schiff Air Sensitivity [37], an examiner-based ordinal index scored immediately following application of the evaporative (air) stimulus scale, focuses on a combination of specific, observable, physical, behavioural and verbal responses from the participant, which may facilitate discrimination. It is interesting to consider whether Schiff 1 should be regarded as DH or not. Historically, DH clinical product evaluation studies [37, 51] utilised a Schiff score of 1 (*Subject responds to air stimulus but does not request* *discontinuation of stimulus*), as a measure of DH. Subsequently clinical evaluation studies moved to only Schiff 2 and 3 (2, *Subject responds to air stimulus and requests discontinuation or moves from stimulus*; 3, *Subject responds to stimulus, considers stimulus to be painful, and requests discontinuation of the stimulus*) as outcome measures [52-54]. Results from the present study confirm that Schiff 2/3 and 0 overall agree with the binary "yes/no" participant response on stimulation of the corresponding buccal or lingual cervical site. Further, evidence for dichotomising the Schiff scale for recording DH pain at 0/1 and 2/3 is confirmed when comparing self-reported "Yes" to DH with Schiff, there being significant agreement for all sites, buccal and lingual. In contrast, a Schiff score of 1 was only associated with a "yes" response half of the time. The analyses present a picture of far-from-perfect agreement between our various variables relating to sensitivity when considering Schiff score 1 as DH pain, possibly reflecting participants with a low pain threshold and the range of discomfort characterised by the condition, from mild to severe. The authors suggest a Schiff score of 1 has value and is worth capturing in epidemiological studies for the reasons indicated in this paper. However, for product evaluation studies, a Schiff 2/3 would be an advisable and more predictive cut off score.

In 2020, the International Association for the Study of Pain (IASP) revised the definition of pain to "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage," [55] . Pain is always subjective, each individual learning the application of the word through experiences related to injury in early life [55] and it may not be directly proportional to the severity of the stimulus, with for example anticipation of a painful experience influencing brain activity [56]. Participant anticipation of pain was demonstrated in this study with a single examiner with a known, identical, consistent approach to charting DH. The first tooth exposed to an air-blast yielded a Schiff score of 1 more often than any other tooth. The phenomena observed can be partially explained by looking to the mutual contribution of conditioning and expectancy mechanisms [57]. When evaluating DH for diagnosis, this needs to an intrinsic part of the process.

There is also complexity when identifying the characteristics and triggers of the condition due to the heterogeneous study methodology, making direct comparative findings more difficult to interpret both in product evaluation studies and

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epidemiological studies. Clinical studies evaluate the condition with objective stimuli, most commonly a cold air blast or tactile Yeaple probe [5]; and patient responses such as binary "yes/no" pain, self-reported participant VAS, verbal descriptors which are subjective and/or objective clinician measurement such as Schiff score following applied stimuli [5]. Other study designs rely on surveys with questionnaires [58] and more sophisticated tools to capture the impact of interventions on OHRQoL completed by the participant [26, 59]. Some studies combine both clinical evaluation and short supporting questionnaires [24], objective scoring methods involving provoking sensitivity yielding much clearer conclusions than subjective ones [60]. Other studies include individuals having tooth sensitivity that does not fit the DH definition, such as those whose sensitivity is due to vital tooth bleaching [61], or molar-incisor hypomineralisation (MIH) [62], a developmental, qualitative enamel defect [63].

As part of the preparation of this study a new cervical localisation code was devised, validated and published [39], to particularly assess tooth wear as well as GR at the amelocemental junction (ACJ) where the majority of DH arises. Other indices, such as BEWE [38] or the one proposed by Cairo et al [64], do not differentiate crown and root tooth wear and GR at the cervical margin. Not unexpectedly, the sites exhibiting DTW and GR on the crown and root surface (code D) were most commonly correlated with DH, confirming the strong association of the location of the condition at the ACJ, where the enamel coverage of crown dentine is thinnest and where GR often occurs [65]. Peer reviewed literature documents strong associations between DH and non-carious cervical lesions (NCCL) and with the individual's lifestyle and habits [66]. Code A would not be expected to be associated with DH as per the definition, dentine is not exposed. For this population only GR exposing dentine gave more DH discomfort than only coronal tooth wear, because dentine is not always exposed with coronal tooth wear [67], and due to size of the coronal and root dentine tubules and age and trauma related pulpal changes [68].

Dentine hypersensitivity and associated factors

The association between DH and toothbrushing was explored in this study. Oral hygiene habits, such as overzealous toothbrushing with toothpaste more than once a day and for >2 minutes, are known to be associated with DH [69, 70], and lower levels of BOP, reflecting DH as a healthy lifestyle condition [1, 71]. Supporting oral health awareness and best practice for DH sufferers was evidenced by Katirci et al [50], who identified negative correlations between DH and the number of missing teeth index, and the Decayed, Missing, and Filled Teeth (DMFT) index. The combination of traumatic abrasive toothbrushing [40, 72], highly abrasive toothpaste [73], heavy toothbrushing forces (>3 N) [74], high frequency of daily toothbrushing >2 times [24], and length of toothbrushing cycle time [17, 69] are all components thought to contribute to cervical abrasions.

Toothbrushing dominant hand relationship to DH lesion site is frequently discussed and debated, but associations are difficult to determine [24]. The toothbrushing cycle is not an even distribution of brushing across all tooth surfaces [75]. The first tooth brushed has considerably more toothbrushing exposure than the last sites, these often being referred to as the upper non-dominant buccal premolar region and the dominant side lower molar lingual region respectively [76]. No significant association between the participants dominant hand and DH score, on the corresponding side of the mouth for buccal or for lingual/palatal sites, was shown in this study. However, when data were split by toothbrush type, manual versus powered toothbrush, there was a positive association between dominant hand and buccal DH on the corresponding side of the mouth for manual brushers, suggesting manual toothbrushing may be associated with DH. This is possibly due to increased force that can be applied with a manual brush [77] and the different toothbrush and toothbrushing characteristics displayed by manual or powered tooth brush (e.g., brushing action, movement, filament stiffness, toothpaste abrasivity) [17, 78]. The horizontal scrub technique, most commonly used with a manual toothbrush, may promote cervical abrasions [72], and hard-bristled manual brushes may produce more tooth surface loss than softer bristles with the same average force [79]. Indeed, in the present study, a powered toothbrush has been shown to be protective against ETW and DH [1].

A recent study [80] evaluated changes in tactile sensitivity, thermal sensitivity, and surface plaque within a population experiencing DH, using a powered toothbrush with a sensitive brush head, compared to a manual toothbrush. Both toothbrush types reduced the symptoms of sensitivity, when used twice daily with anti-sensitive toothpaste for 4 weeks. Other studies on powered brushes showed dental biofilm and gingivitis reduction, with no soft and hard tissue damage, attributed to the lower brushing forces [77, 81, 82]. Previous epidemiological studies have not always found an advantage to using powered toothbrushes when looking for associations with DH and these conditions, a powered toothbrush being significantly associated with increased ETW [14], but no association with DH has been observed [14].

This study found a significant association between DH and dry mouth and bad breath. A possible explanation, being ETW associated with DH increases the risk of gastroesophageal reflux [14], which has strong associations with patients suffering from salivary impairment [83], resulting in dry mouth. Some participants used an anti-sensitising toothpaste but this was variable (use of a DH toothpaste) was, however, significantly associated with clinical DH. Seeking professional advice from a dentist about DH treatments was more common in those with clinically-diagnosed DH, but the association was borderline for DH confirmed by participants following an air blast. In explanation of these two findings, if guidance of regular twice daily toothbrushing with anti-sensitivity toothpaste use is not followed, the pain of DH is not likely to improve. From patient testimonial, this is often found to be the case, due, in the main, to financial economics of anti-sensitivity toothpastes being more expensive than conventional toothpastes. The anti-sensitivity toothpastes were possibly only partially relieved their symptoms.

Dentine hypersensitivity experience by participants

In this study, participants were asked to point to their hypersensitive teeth on a mouth map and this was correlated with the clinical findings. Incisor teeth were the most sensitive self-reported teeth and Schiff 2/3 scores closely aligned with this. In previous research, premolars closely followed by incisors, were cited as teeth most commonly afflicted [69, 84-88]. In other investigations, incisors and canines were the most impacted teeth [13, 18-20, 23, 89-91], matching the authors findings. Ramlogan et al [92] also showed the highest numbers of teeth with DH were the lower anterior for both the buccal and lingual/palatal aspects. Incisors have thinner enamel than the other teeth, studies showing incisor enamel ranges from 0.60-0.84 mm, whereas premolar enamel is typically thicker, ≥1.0mm [93]. The anterior section of the mouth also has a higher density of nerve endings than the back of the mouth, possibly contributing to more heightened awareness of sensations in that region and importance for the individual [94].

DH had most commonly been suffered for more than 2 years and cold food/drink was the most strikingly common trigger reported, concordant with multiple previous studies [15, 21, 95-99]. Gillam et al [100] reported 90% of individuals experience pain to cold stimuli, with a tactile stimulus affecting up to 10% of individual sufferers [101, 102]. Cold seems to the most potent stimulus to induce pain from DH [103-105]. Most hypersensitive teeth respond to cold, this sensation being the typical response to A delta fibre action, fast, sharp and transient [104].

DH triggers were more commonly reported by women than men, and gender specific significant differences were observed for sweet food/drink and a cold air. The length of time that DH had been suffered was similar in males and females, but significantly more females indicated their DH pain intensity was of some importance or very important to them, QoL scores were worse in females than males. DH has now been shown to be substantially more common in females than in males [1, 3, 9], a finding that is similar to previous DH studies globally [18, 22, 50, 106, 107]. This also reflects pain study results across the medical field, showing similar gender bias, this being attributed to cultural, behavioural and social attitudes [12, 14, 108] . In addition, self-perceptions have greater impact on females than men [109], who tend to overreport sensitivity to their underlying medical illnesses [110]. Further, it has been shown that females were more motivated to receive treatment for DH than males, achieving superior plaque control from an early age [69].

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Significant positive associations were seen between self-reported DH pain and degree of GR, 1-2 mm being less painful than ≥3 mm. Significant positive associations were also seen between those with GR of ≥3 mm and the length of time DH had been suffered and the importance of the DH pain. These findings need further work for elucidation. Finding dentistry painful was positively and strongly significantly associated with both any recession and BEWE 2 or 3, as might be expected when stimulating the teeth with the high prevalence of GR and ETW. Previous studies in adults have indicated dietary acid as a risk factor for both ETW [17, 111] and ETW with DH [17, 112], with a significant relation between the timing of acidic intake and dental treatment [17].

Limitations of the present work should be acknowledged, including that the initially desired sample size was not achieved, and the heterogeneity in recruitment and patient characteristics among research centres/countries. As described in the primary publication of this data [1], the main reason for this was the Covid19 pandemic which impacted data collection, requiring changes to planned research centres and participant recruitment targets.

Within the limitations of the present study, it can be concluded that DH is a common dental pain condition, with DH, GR and ETW particularly associated with the cervical buccal tooth aspect. For over half the participants, pain was very important or important to their lived experience. DH sufferers are affected by the symptoms to an extent that it interferes with daily activities, but until recently clinical assessment of DH for diagnosis and treatment outcome has relied solely on the intensity aspect of pain following dentine stimulation, these pain scales not reflecting the new concept of health defined by the WHO. Self-reported assessments are increasingly used in dentistry to capture the psychosocial experiences, for example of pain, discomfort and malfunctioning, supplementing clinical indicators [113]. Insight from wider sociological and psychological work suggests changing the perception of dentine hypersensitivity could help patients manage this common oral complaint and also help strengthen the dentist-patient relationship.

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Declaration of interests

☐ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☒ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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