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Prevalence of gingival recession and study of associated related factors in young UK adults

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Key words: gingival recession, dentine hypersensitivity, pain, erosive tooth wear, periodontal probing depth, bleeding on probing

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Prevalence of gingival recession and study of associated related factors in young adults in the UK

ABSTRACT

Objectives: Prevalence of gingival recession (GR) and associations with dentine hypersensitivity (DH), erosive toothwear (BEWE), gingival bleeding (BOP) and periodontal pocketing (PPD) in young European adults.

Materials and Methods: This is a secondary analysis using data collected from 350 UK participants enrolled in a European cross sectional study of 3187 young adults. GR, BOP, PPD, DH (participant and clinician assessment) and BEWE were recorded. A questionnaire assessed demographics, oral hygiene and lifestyle habits.

Results: 349 participants completed the study. GR, BOP and PPD showed the same pattern of distribution, prevalence increasing from incisors to molars in upper and lower arches for buccal and palatal scores. Every participant exhibited recession affecting at least 1 tooth, 42% having a maximum recession of 4-8mm. There was a significant and linear association demonstrating an increase in maximum recession with age. DH and BEWE produced a similar pattern to buccal periodontal indices, the premolars being most affected. Maximum recession correlated significantly with maximum DH (participant and Schiff), PPD, BOP, BEWE (scores of 2/3), BMI ($\geq 25 kg/m^2$) and unsystematic brushing motion. 94% of the study population exhibited some BOP at one or more sites. 5% of the population had periodontal pocketing ≥4mm, 46% had DH and 80% BEWE 2/3.

Conclusion: Widespread recession and gingivitis with minimal periodontal disease was observed. Every participant exhibited at least one tooth with recession. Many teeth did not exhibit DH despite prevalent recession and severe erosive toothwear. Recession correlates to a number of oral and lifestyle variables.

Clinical Significance: Recession in young adults is multifactorial and highly prevalent. It can result in DH and consequential increase in demand for treatment relating to both pain and aesthetics. Further research is needed to understand the underlying aetiology to prevent recession occurring.

INTRODUCTION

Gingival recession is defined as the exposure of the root surface due to migration of the gingival margin apical to the amelo-cemental junction (ACJ). Recession affects a significant proportion of the population according to the systematic review of Heasman et al [1]. Chrysanthakopoulos [2] reported a prevalence of 64%, with higher [3, 4] and lower percentages documented in the literature [5, 6]. Consequences of recession include dentine hypersensitivity and cervical tooth wear, affecting quality of life due to regular pain episodes, poor aesthetics and ultimately loss of function. The prevalence of gingival recession is high in populations with high [7-11] as well as low standards of oral hygiene [4, 8, 12, 13].

The presence of gingival recession in the population has generally been associated with poor oral hygiene, periodontal disease and its management [13], resulting in increased loss of attachment. The overall prevalence of periodontitis, however, is generally low in a young population. In UK cohort data collected by the World Health Organisation in 2005, 97% of 15-19 year olds had no evidence of periodontal disease. This figure fell to 25% in those aged 35-44 [14]. Kassebaum et al [15] meanwhile found the prevalence of severe periodontitis increased gradually with age, showing a steep increase between the third and fourth decades of life that was driven by a peak in incidence at around 38 years old.

Whilst periodontal disease may not be a common problem in the young, gingivitis is very common and indeed regarded as a necessary pre-requisite for the subsequent development of periodontitis [16, 17]. Hugoson and Jordan [18] showed that 68% and 69% of Swedish individuals in their 20s and 30s respectively were diagnosed as having gingivitis. Assessment of gingivitis and its severity in the population, by visual observation and bleeding on probing, is therefore of value with regards to the risk of future periodontal disease and subsequent recession.

Gingival recession tends to increase with age [3, 10] and due to increased life expectancy and retention of natural teeth, is likely to rise in the future. With a modest reduction in periodontal support, gingival recession of ≤3mm accompanies aging and may be considered physiologic [19]. However, age does not determine gingival recession that occurs in individuals not susceptible to periodontitis and with good standards of oral hygiene. It is thought that recession of healthy gingivae could be a consequence of multiple other factors. These include repeated use of low level insult to a vulnerable area with a thin gingival phenotype and areas with a lack of keratinised mucosa [20], the first tooth brushed in the mouth, the duration and frequency of tooth brushing, toothbrush bristle shape and type, traumatic tooth brushing [21, 22], tooth position or teeth not well supported in the bony alveolar

housing amongst others [23]. Indeed the development of recession in otherwise healthy gingivae could be considered to be multifactorial. With these concepts in mind, short-term longitudinal tooth brushing studies of manual and power brushing have demonstrated gingival trauma [24-27], suggesting brushing is implicated in gingival recession. However, more recent work [7] failed to show this association. A meta-analysis [1] failed to support or refute the association between tooth brushing and non-inflammatory gingival recession.

As well as being unsightly, gingival recession exposes root cementum to the oral environment where it is rapidly denuded. Once dentine is exposed it may then become sensitive on stimulation in an acidic environment [21] with pain characterised as sharp, transient and arresting. Epidemiological, clinical studies and case reports have associated tooth sites of high predilection for recession with confirmatory dentine hypersensitivity pain scores and low plaque scores [11, 21]. Dentine hypersensitivity is an unpleasant condition which can affect eating and drinking, and in sufferers sensitive to tactile stimuli, result in pain when toothbrushing [28]. It has been demonstrated that dentine hypersensitivity has a negative impact on quality of life [29], furthermore, if toothbrushing is significantly disturbed, oral hygiene may be affected. This highlights the need for further research into gingival recession to identify factors that are associated with it and may be causal.

Non carious cervical lesions (NCCLs) at the cervical margin of the tooth have also been linked to gingival recession, and in some cases, dentine hypersensitivity [30]. In a recent study [31] gingival recession was associated with the presence of NCCLs, 52% of teeth having an exposed CEJ demonstrating a step consistent with an NCCL. NCCLs generally occur on buccal or labial surfaces of teeth along the gingival margin, with erosive toothwear and tooth brushing in an acid environment suggested as aetiological agents for these lesions [32]. Indeed, in the parent study of dentine hypersensitivity prevalence and associated factors [33] there was a strong progressive relationship between dentine hypersensitivity, erosive tooth wear and gingival recession in individuals with a periodontium not exhibiting periodontal disease. Olley et al [34] recently demonstrated that 93% of cervical erosive tooth wear cases have dentine hypersensitivity, supporting previous data that 85% of patients with tooth wear will present with some degree of sensitivity [35]. Whilst tooth brushing method and frequency in an acid oral environment have been implicated in the development of NCCLs, the available data is conflicting [1, 36]. The relationship between gingival recession, abrasive and/or erosive tooth wear and dentine sensitivity is therefore complex and as yet, not fully understood.

The nature of the relationship between gingival recession, gingivitis, periodontal probing depth, tooth wear and dentine hypersensitivity needs to be better understood, not least because risk factors for

one condition, such as overzealous tooth brushing may be of positive benefit to another. The lack of consistent evidence for the causal effect of some of the risk factors identified for gingival recession, together with the impact these conditions have on health, highlights the need for more research into the disease and its causes.

In 2010 a study designed to evaluate the prevalence of tooth wear, dentine hypersensitivity and gingival recession, together with their associated risk factors was undertaken in adults aged 18-35 in Europe with prevalence of both tooth wear and dentine hypersensitivity shown to be high at 29% and 42% respectively [30, 33]. Tooth wear was associated with exposure to both intrinsic and dietary acids, energy drinks, rural residence, snoring, power toothbrush use, dentine hypersensitivity, sleeping medications and smoking. The current publication analyses data from the UK to assess the pattern of gingival recession in young adults aged 18-35 and associations and risk factors with dentine hypersensitivity, erosive tooth wear, gingival bleeding and periodontal probing depths.

METHODS

Study design and methodology

This study was an observational, cross-sectional epidemiological study carried out in a young-adult population attending general dental practice for a routine dental examination. NHS Research Ethics Committee approval was obtained, participant oral and written consent gained, with the study conducted to Good Clinical Practice guidelines as laid down by the Declaration of Helsinki and its later amendments. The data reported was part of a larger study called the European Study in Non Carious Cervical Lesions and Dentine Hypersensitivity.

Clinical Examination

Sequential patients of either gender were approached to participate. Recruitment took place from June to October 2011. Consenting volunteers who satisfied protocol inclusion and exclusion criteria were enrolled to the study. Participants were required to be aged 18 to 35 years old, in good health and able and willing to comply with study criteria. Patients with fewer than 5 teeth, having an orthodontic appliance, needing antibiotics for dental treatment or who had undergone local oral anaesthesia were excluded. Patients with bleeding disorders or who were on anticoagulants were also excluded as bleeding on probing scores would have been affected adversely [37]. Similarly, patients who were on pain medication or who had had oral anaesthesia in the last 24 hours were excluded so that dentine hypersensitivity scores were not compromised. Enrolled patients were allocated sequential study numbers used on all study documentation to preserve anonymity.

Patients enrolled onto the study were first asked to complete a self-administered questionnaire [figure 1] to determine demographics and general oral hygiene practices. The questionnaire was designed to identify habits as risk factors for poor oral hygiene and subsequent periodontal disease, including BMI which if high, can reflect a tendency for snacking and an unbalanced diet, dentine hypersensitivity and/or tooth wear. Following completion, the patients were provided with a clinical examination that assessed periodontal indicators, tooth wear and dentine hypersensitivity. Third molars were excluded from all assessments to avoid issues such as partial eruption and second molars were also excluded from dentine hypersensitivity assessments due to access. For consistency and to avoid inter examiner variability, a single trained dental investigator performed all clinical examinations at 15 sites across the South West of the UK.

For buccal and palatal/lingual tooth surfaces, gingival recession and periodontal pocket depth in mm, and presence or absence of gingival bleeding were assessed with a periodontal probe. Buccal and palatal/lingual tooth wear was assessed using the Basic Erosive Wear Examination (BEWE) [38], where 0 = no erosive wear, 1 = early tooth loss, 2 = surface loss <50%, 3 wear with tissue loss > 50% of the surface, together with the localisation of the lesion. Dentine hypersensitivity was assessed for buccal surfaces of teeth from incisors to first molars in each quadrant. Areas of exposed dentine were subjected to cold air stimulation from a 1 second application of air at 60 (±5) psi at 19°C (±5°C) from approximately 10 mm, with adjacent teeth shielded. The dental investigator discreetly recorded the patient's response to the stimulus according to the 1994 Schiff ordinal scale [39] (0= Participant does not respond to sensitivity, 1= Participant responds to stimulus but does not request discontinuation of stimulus, 2= Participant responds to stimulus and requests discontinuation or moves from stimulus, 3= Participant responds to air stimulus, considers stimulus to be painful, and requests discontinuation of the stimulus). The patient was then asked whether the stimulus provoked dentine hypersensitivity or not. Both the practitioner and patient reported dentine hypersensitivity assessments before moving on to the next tooth.

Statistical Analysis

The frequency distributions of the clinical scoring variables across the buccal and palatal/lingual surfaces of the teeth in both arches were determined.

At the patient level clinical scoring variables considered for analysis were: the number of sites with BEWE 2 or 3, number of sites with bleeding; and across all sites in the mouth: the maximum probing depth, recession score and dentine hypersensitivity elicited and Schiff scores. Associations between

variables were determined using Spearman's Rank correlation. Associations between the clinical periodontal variable maximum recession score and risk factors for the oral conditions examined in this study were determined using linear ANOVA, with the extent to which certain risk factors might be secondary to others determined using multiple linear regression models.

RESULTS

350 participants were recruited and all participants completed the study. One participant with incomplete data was excluded from the study analysis. Demographic information for study participants is shown in Table 1. The numbers of patients living rurally, in small/mid-size towns and in metropolitan areas were very similar. More females than males took part in the study (221 vs 128). Over half the participants were students, with the majority of the remaining participants being white collar workers.

Table 2 shows the distribution of the maximum recession score across both dental arches. All participants had recession at one or more sites. 58.4% of them had a maximum recession score between 1mm and 3mm, the remaining 41.6% of participants between 4mm and 8mm.

Figures 2 and 3 show frequency distributions of the clinical scoring variables on buccal and palatal/lingual surfaces. Dentine hypersensitivity (DH) scores (elicited pain and Schiff) were only recorded on the buccal surface. Gingival recession, bleeding on probing and periodontal pocket depth assessments showed a similar pattern of distribution, with a more or less steady increase in prevalence from the incisors to the second molar in both dental arches on both tooth surfaces. However, for recession, severity scores were greater buccally, whereas scores for bleeding on probing and pocket depth assessments were higher on lingual/palatal surfaces. For both dentist and self-assessed sensitivity in the maxillary arch sensitivity was observed on first premolars. In contrast, in the lower arch incisors were the most sensitive. The Schiff sensitivity determined by the clinician mirrored and strongly correlated to the DH reported by the patient ($p<0.001$). Tooth wear as determined by BEWE peaked at upper second molars in the maxillary arch, but in the mandibular arch premolars had the highest scores. BEWE scores on palatal/lingual sites are much lower and do not show the same pattern as the periodontal conditions. The highest overall prevalence occurred on the incisors, but severity of wear was greater for posterior teeth.

Correlations between clinical study variables at the patient level are shown in Table 3. The three periodontal indices: maximum gingival recession, number of sites with bleeding on probing and maximum periodontal pocket depth, correlated significantly with one another. In addition, the maximum recession score across all sites also correlated significantly with maximum Schiff score across all sites and the number of sites scoring BEWE 2 or 3. Maximum Schiff score and the number of sites scoring BEWE 2 or 3 were also significantly correlated.

Results for maximum recession by maximum Schiff (clinician rated 0 to 3 scale) and a binary variable of elicited DH, indicating whether any of the 24 teeth had elicited sensitivity as assessed by the patient, were highly significantly correlated ($p<0.001$).

The risk factors that demonstrated significant relationships with maximum recession depth are shown in Table 4. There was significant linear association of increasing maximum recession depth with age. Males and those living in rural areas experienced significantly greater maximum recession scores than females and those living in urban areas, respectively. When considering education status and occupation, there was strong evidence of significant differences between the groups in each category. Students were shown to have lower maximum recession depths than those who had completed their education and manual workers had the highest. Similarly, significant differences between brushing motion were detected between groups, with those using an undefined 'various motion' exhibiting the greatest maximum recession. For BMI there was a highly significant trend across the 4 weight/height categories. There was some evidence of an association between having orthodontic treatment, and never smoking and lower maximum recession. However, the differences between groups only just reached significance. No significant associations with maximum recession were found for frequency of brushing, interval between breakfast and tooth brushing, dominant hand, type of toothbrush, frequency of exposure to intrinsic or extrinsic acids, frequency of snoring, taking sleeping medication, exercise, chewing gum or consumption of dairy produce, or frequency of use of fluoride products.

DISCUSSION

The current study analyses associations and risk factors of gingival recession with dentine hypersensitivity, erosive tooth wear, gingival bleeding and periodontal probing depths in order to better understand this complex condition. The indices chosen for erosion and dentine hypersensitivity were Schiff [39] and BEWE [38], respectively. Alternative indices to record erosive wear are generally modified versions of earlier indices [40], for example the Visual Erosive Dental Exam is a modification

of the index of Lussi [41] and include the need for visual diagnosis of exposed dentine which is difficult [40]. Alternative indices using to measure dentine hypersensitivity also exist, using different sensitivity triggers and can be time consuming requiring the set up and careful calibration of equipment, the Yeaple probe for measuring response to tactile stimulation [42]. By contrast the indices used in this study provide a measure of the severity of their respective conditions, but are straightforward to use and suitable for accurate data collection in a busy dental practice.

A significant positive correlation was demonstrated between gingival recession, gingival bleeding and periodontal probing depth. A similar pattern of distribution for gingival bleeding and periodontal probing depth was observed, with an increase in prevalence from the incisors to the second molar affecting both dental arches on both tooth surfaces. Periodontal probing depths of 4mm and above demonstrating true attachment loss and the presence of periodontitis, closely mirrors bleeding on probing with a marked increase in disease activity on the molars, both buccally and lingually. Conversely, the incisor and premolar regions show a very healthy periodontium, with minimal bleeding on probing, and hence no gingivitis and no true periodontal pockets. This may suggest an association with oral hygiene practices, with the anterior teeth and surfaces being cleaned more effectively than the posterior ones. This hypothesis is supported by previous data from Prasad et al [43] and Sreenivasan and Prasad [44] who demonstrated that many more anterior surfaces were free of plaque than posterior regions. Correspondingly, results from epidemiological studies indicate that posterior sites are more prone to gingival inflammation and periodontal disease [45]. Löe et al [46] demonstrated conclusively that good plaque control is essential for the prevention of gingivitis and gingivitis is known to be a prerequisite for periodontitis.

The distribution of recession was a common finding on all types of tooth both buccally and palatally, being particularly prevalent at premolars and molars. The majority of recession defects appeared to be in healthy mouths with no periodontal disease, as evidenced by the majority of bleeding on probing scores of 20% or below and periodontal probing depths of less than 4mm [47]. This suggests oral hygiene practices play a role in the aetiology of recession with good oral hygiene being influential throughout the mouth at the majority of sites in this cohort and suboptimal oral hygiene contributing to recession in areas of periodontal disease with higher bleeding on probing scores and periodontal pocketing equal of greater than 4mm.

Interestingly, when Galinsky [48] examined uninstructed natural tendencies for toothbrushing it was demonstrated that participants generally started brushing buccally using the quadrant sequence of: upper left, upper right, lower right, lower left. Further, it has also been documented that brushing becomes haphazard towards the end of the brushing session [49]. Thus, since the teeth at the back of

the mouth have been shown to be less well brushed than those in the anterior portion [43, 44] the maxillary canines and premolars may be expected to receive the most focussed brushing. The significance is that these sites are prone to dentine exposure as a result of either toothwear or gingival recession or both, all of which can lead to dentine hypersensitivity. In support, West et al [33] have shown a strong, progressive relationship between erosive toothwear, gingival recession and DH.

Olley et al [34] demonstrated that toothwear, resulting in dentine exposure, is one of the causes of DH. This study confirmed a correlation between toothwear and DH. Interestingly, both toothwear and DH also correlated significantly with gingival recession, but not the other periodontal indices recorded. In addition, DH (both patient reported and Schiff score) and toothwear demonstrated a similar pattern to gingival recession on the buccal surfaces of teeth in the maxillary arch, although maximum sensitivity and toothwear scores were observed on the upper and lower first premolars as opposed to the molars. This pattern of DH has been previously documented [50] where the upper premolars and canines were observed to be the most sensitive. However, in contrast to the present study, Addy et al [50] demonstrated that gingival recession was most prevalent on upper premolars and canines, rather than the molars. One possible explanation may be the fact that only participants with DH were recruited for the study [50] and patients of all ages were included. Further, erosive toothwear appears to play a significant role in contributing to cervical DH today particularly in young populations, whereas twenty years ago the majority of DH was thought to be due to recession.

The present study was unusual in that it compared buccal and palatal/lingual surfaces. It was observed that severity of recession, and in particular toothwear, was greater on buccal surfaces. In contrast, increased periodontal probing depths and bleeding scores on probing were more prevalent on lingual/palatal surfaces. These findings may also be a consequence of brushing habits. Individuals brush for an average of 55 seconds, spend 90% of that time on the buccal aspect compared to the palatal/lingual surfaces and contact the buccal surfaces first [51, 52]. This is supported by data drawn from epidemiological studies, clinical studies and case reports where tooth sites with the greatest exposure to tooth cleaning exhibited a predilection for recession and lowest scores for plaque [11, 53]. Similarly, erosive toothwear is thought to be greater on a particular tooth due to the wear being localised with the effects of tooth brushing [21].

This study clearly demonstrates that gingival recession is prevalent amongst the young 18-35 adult population in the UK, with all participants having at least one tooth exhibiting clinically detectable gingival recession. This study confirms previous findings [10, 11, 54] of a significant positive correlation of gingival recession with age. Overall, the participants in this study presented with high standards of oral hygiene evidenced by the low periodontal probing depths and bleeding on probing indices and

exercised better oral hygiene practices in the anterior regions of the mouth, than the posterior ones. This suggests that the majority of the recession observed may be considered to be 'healthy recession' [21]. This is a condition affecting healthy and well-educated individuals who are overzealous with their oral hygiene practices and who consume a healthy erosive diet. Similar high prevalence figures for recession have been obtained in recent epidemiological studies examining gingival recession in young adults with good oral health, with figures for gingival recession of 85% and 64% in Spain and Greece, respectively [2, 55]. Although prevalence of recession was high in young adults in the present study, students had the lowest and manual workers the highest levels of recession, data that is in contrast to the study by Chrysanthakopoulos et al [2] which found greater recession with higher educational levels. If one accepts Lamsters et al [19] conclusions that healthy recession is 0-3mm, 42% of this study's population has pathological recession with the majority having a healthy periodontium. However, this group of individuals is young, 18-35 years of age, and one could argue that recession should be no greater than 2mm hence 83% have pathological recession with the majority having a healthy periodontium.

Tooth brushing trauma has long been considered a precipitating factor for the initiation and progression of non-inflammatory localised gingival recession [53]. The study presented shows no significant difference between manual or power toothbrushes. Furthermore, data examining maximum gingival recession corresponds well with a recent longitudinal study [7] which demonstrated similar effects for both brush types on gingival recession after 35 months. However, Dorfer et al [7] detected significant differences in patterns of toothbrushing with haphazard motions associated with significantly more gingival recession than structured toothbrushing patterns. These findings contrast with a previous study [56] which demonstrated that a horizontal scrubbing motion was significantly associated with gingival recession. Tezel et al [56] additionally demonstrated significant associations between the frequency and duration of toothbrushing with gingival recession, which were not observed in the current study. The discrepancy between the 2 studies may be due to differences in the participant populations as Tezel et al [56] recruited from a periodontal clinic rather than general dental practice, despite the fact that those with active periodontal disease were excluded from the study. Overall, the current study findings reflect those of a recent review which concluded that evidence to support the association between toothbrushing and recession remains inconclusive [1].

The current study also confirmed geographic differences in that males and those living in rural areas had significantly greater maximum recession scores than females and those living in urban areas. Similar findings regarding the distribution of gingival recession by gender have been found in a previous study of young adults although the difference was not significant [2]. In contrast, Kozlowska et al [57] demonstrated greater recession in females than males. It was suggested that this could be

attributed to the fact that females are more motivated with regard to oral hygiene practices and, thus, brush their teeth more frequently than males [58] although as indicated above, conclusive evidence to support the association between toothbrushing and recession is lacking. It should also be remembered that gingival recession may be a consequence of poor oral hygiene. The highest recession scores in the current study were seen on the posterior teeth, where the surfaces are less likely to be cleaned well. The finding that males had significantly greater maximum recession scores than females may reflect that males tend to be less consistent with their brushing. This finding is in line with data from the adult dental health survey (2009) which showed that males were less likely to have excellent oral health and periodontally healthy sextants than females [59].

Interestingly, no significant associations with maximum recession were found for interval between breakfast and tooth brushing, frequency of exposure to intrinsic or extrinsic acids, frequency of snoring, taking sleeping medication, exercise, chewing gum, consumption of dairy produce or frequency of use of fluoride products. These phenomena are difficult to explain and although they have been documented elsewhere, this would suggest a complex multifactorial aetiology to recession, erosive toothwear and DH. Further investigation is warranted.

The study did produce some evidence of an association between never smoking and lower maximum recession. However, differences between groups only just reached significance, a result that concurs with other studies. The majority of the participants were nonsmokers, similarly no strong conclusions could be drawn from BMI.

In conclusion, the rates of recession in young adults recorded in this study were high but in line with other recent studies highlighting the extent of this problem. While recession correlated with bleeding on probing and periodontal probing depth, it also correlated with toothwear and dentine hypersensitivity suggesting that the effects on the posterior teeth was caused by poor oral hygiene, while anteriorly the recession is more likely to be that described as healthy recession caused by good oral hygiene. These conflicting causes of recession may explain why toothbrushing does not significantly correlate with recession.

We conjecture that a lack of toothbrushing is the likely causal factor posteriorly and excess toothbrushing for anterior recession. It is highly likely that there is a fine balance between excellent oral hygiene from tooth brushing and traumatic damage from tooth brushing to the hard and soft tissues, with the host susceptibility playing a substantial role in determining degree of recession. Further studies that monitor toothbrushing frequency, intensity and location in the mouth in relation to recession and other oral factors would be appropriate.

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Table 1. Demographic Characteristics of Study participants

	N
Age	
18 to 23	175
24 to 29	98
30 to 35	76
Gender	
Male	128
Female	221
Residence	
Rural	108
Small/middling towns	121
Metropolitan	120
Education*	
16-19	38
20+	124
Still studying	186
Occupation	
Self employed	14
Manager	43
Other white collar	73
Manual worker	15
House person	14
Student	187

*age at which participant left full time education, those aged 16-19 not continuing education after school, those aged 21+ being graduates.

Table 2. Maximum recession scores of study participants

Maximum Recession score (any tooth) (mm)	Number of participants with this maximum score	Percent of participants with this maximum score
1	2	0.6
2	57	16.3
3	145	41.5
4	92	26.4
5	36	10.3
6	9	2.6
7	7	2.0
8	1	0.3

Table 3 Spearman rank correlations between clinical conditions.

	Correlation coefficient	P value
Maximum recession vs Number of sites with BEWE score 2 or 3	0.48	<0.001
Maximum recession vs Maximum Probing Depth	0.402	<0.001
Maximum recession vs Number of sites with bleeding	0.145	0.007
Maximum recession vs Maximum Schiff score	0.204	<0.001
Maximum Probing Depth vs Number of sites with bleeding	0.414	<0.001
Maximum Probing Depth vs Number of sites with BEWE score 2 or 3	-0.041	0.446
Maximum Probing Depth vs Maximum Schiff score	0.074	0.166
Number of sites with bleeding vs Number of sites with BEWE score 2 or 3	-0.091	0.089
Number of sites with bleeding vs Maximum Schiff score	-0.016	0.763
Number of sites with BEWE score 2 or 3 vs Maximum Schiff score	0.194	<0.001

Table 4 Questionnaire variables significantly associated with maximum recession score

Variable*	N	Mean maximum recession score	SD	P-value**
Age				<0.001
18 to 23	175	3.09	0.83	
24 to 29	98	3.67	0.98	
30 to 35	76	4.07	1.52	
Gender				0.004
Male	128	3.70	1.19	
Female	221	3.33	1.07	
Residence				<0.001
Rural	108	3.89	1.29	
Small/middling towns	121	3.31	1.01	
Metropolitan	120	3.24	0.98	
Education***				<0.001
16-19	38	3.71	1.35	
20+	124	3.86	1.25	
Still studying	186	3.15	0.88	
Occupation				<0.001
Self employed	14	3.64	1.15	
Manager	43	3.95	1.19	
Other white collar	73	3.79	1.18	
Manual worker	15	4.40	1.64	
House person	14	3.21	1.63	
Student	187	3.18	0.87	
Brush motion				0.005
Various	126	3.76	1.22	
Horizontal	42	3.36	1.03	
Vertical	17	3.35	1.11	
Circular	149	3.28	1.07	
BMI				0.002
Up to 18.5	16	3.25	0.93	
18.51 to 25	232	3.33	1.04	
25.01 to 30	72	3.88	1.28	
Above 30	19	3.63	1.21	
Smoking				0.015
Often	25	3.56	1.39	
Occasionally	25	4.04	1.02	
Rarely	31	3.77	1.36	
Never	257	3.36	1.06	
Orthodontic treatment				0.031
Yes	114	3.28	0.93	
No	228	3.56	1.20	

*Age and gender are risk factors, while the other variables shown are risk indicators

**p value as determined by linear ANOVA indicates significant trend (age, degree of urbanisation, degree of education, BMI, degree of tobacco consumption), or significant differences between categories and max recession score.

***age at which participant left full time education, those aged 16-19 not continuing education after school, those aged 21+ being graduates.

13 June 2018

Special Euro Oral Health

Non Carious Cervical Lesions (NCCL) and Dentine Hypersensitivity Questionnaire

QB1. How many times per day do you brush your teeth? Please enter frequency, *(e.g. "2"= twice a day)* ☐

QB2. Which kind of toothbrush do you use frequently? *(Please tick one box only)*

None ☐ Manual toothbrush ☐ Electric toothbrush ☐

QB3. Which motions do you use while brushing your teeth? *(Please tick one box only)*

Various motions ☐ Horizontal motion (= "back and forth" movement) ☐

Vertical motion (="up and down" movement) ☐ Circular motion ☐ Don't know/Not sure ☐

QB4. How often do you brush your teeth? *(One answer per line)*

		Often	Occasionally	Rarely	Never	Don't know
1	Before your breakfast					
2	After your breakfast					
3	After lunch					
4	After dinner					

QB5. How long do you wait before brushing teeth after having your breakfast? *(please indicate estimated average)*

Number of minutes ☐☐

QB6. Are you left-handed or right-handed? *(Please tick one box only)* left-handed ☐ right-handed ☐

QB7. How often during the past 12 months have you..? *(One answer per line)*

		Often	Occasionally	Rarely	Never	Don't know
1	Experienced toothache due to sensitive teeth					
2	Suffered from heartburn/reflux/regurgitation					
3	Suffered from repeated vomiting					
4	Experienced difficulties with eating food due to mouth or teeth problems					
5	Felt embarrassed because of the appearance of your teeth					
6	Felt tense because of teeth or mouth problems					
7	Avoided conversation because of the appearance of your teeth or dentures					

QB8. Do you consider yourself as currently suffering from sensitive teeth?

Yes ☐ No ☐ Don't Know / Not sure ☐

If "Yes", please answer QB9, QB10 and QB11; If "No" or "Don't know/Not sure", please go directly to QB12

QB9. When does the pain from sensitive teeth occur? *(One answer per line)*

		Often	Occasionally	Rarely	Never	Don't know
1	While brushing teeth					
2	Cold Weather (air)					
3	Touch					
4	Hot water					
5	Sweet					
6	Cold (drinks, ice ...)					
7	Other					

QB10.How long have you been suffering from sensitive teeth?

Less than a year ☐ 1 to 2 years ☐ 2 to 5 years ☐ 5 or more years ☐ Never ☐ Don't know ☐

QB11. How would you evaluate the pain intensity of your sensitive teeth? *(Please tick one box only)*

Not important ☐ Little importance ☐ Some importance ☐ Important ☐ Very important ☐ Don't know ☐

QB12. How often do you? *(One answer per line)*

		Often	Occasionally	Rarely	Never	Don't know
1	Snore					
2	Take sleeping medication/antidepressants?					
3	Smoke cigarettes					
4	Chew gum					
5	Have acidic foods (i.e. fruit, fruit juice...)					

QB13. How many eating/drinking occasions do you have per day even in small quantities? Number of times: ☐☐

QB14. How often do you eat or drink of the following, even in small quantities? *(One answer per line)*

		Often	Occasionally	Rarely	Never	Don't know
1	Fresh fruit e.g. lemon, orange, apple, pear, grapes, mango, etc.					
2	Fruit and vegetable juice e.g. orange, apple, grape, pineapple, carrot, multivitamin, etc.					
3	Isotonic drinks/Energy drinks e.g. Isostar, Powerade, Perform, Red-bull, Red Horse, etc.					
4	Softdrinks i.e Cola beverages, Sprite, Lemonade, Fanta, Iced tea, etc.					
5	Cheese, yoghurts, other dairy products					

If at least one of the "often" cases is filled, please go to QB15. If not, please go to directly Q16

QB15. If "*often*" is filled, please can you be precise for each item "*how often do you eat or drink of the following, even in small quantities*"

		more than 3 times per day	2-3 times per day	once per day	less than once per day but at least once per week	Less than once per week	Don't know
1	Fresh fruit e.g. lemon, orange, apple, pear, grapes, mango, etc.						
2	Fruit and vegetable juice e.g. orange, apple, grape, pineapple, carrot, multivitamin, etc.						
3	Isotonic drinks/Energy drinks e.g. Isostar, Powerade, Perform, Red-bull, Red Horse, etc.						
4	Softdrinks i.e Cola beverages, Sprite, Lemonade, Fanta, Iced tea, etc.						
5	Cheese, yoghurts, other dairy products						

QB16. When did you last visit a dentist about your teeth, dentures or gums? *(Please tick one box only)*

Less than 1 year ago ☐ 1 to less than 2 years ago ☐ 2 to less than 5 years ago ☐ 5 or more years ago ☐

Never ☐ Don't know ☐

QB17. How many times in the past 12 months have you seen a dentist? ☐☐

QB18. What was the reason for your last visit to the dentist? *(Please tick one box only)*

Check-up, examination or cleaning ☐ Routine treatment ☐ Emergency treatment ☐

QB19. How tall are you (in cm)? ☐☐☐

QB20. How much do you weigh (in kg)? ☐☐☐

QB21. How often do you exercise or play sport? *(Please tick one box only)*

5 times a week or more ☐ 3 to 4 times a week ☐ 1 to 2 times a week ☐ 1 to 3 times a month ☐

Less often ☐ Never ☐ Don't know ☐

QB22. Did you wear an orthodontic appliance? Yes ☐ No ☐

QB23. Do you use a toothpaste containing fluoride? Yes ☐ No ☐ Don't know / Not sure ☐

QB24. Do you use fluoride in any other way than toothpaste? Yes ☐ No ☐ Don't know / Not sure ☐

Country code ☐ GDP ☐☐ ID ☐☐☐

Figure 1 Questionnaire completed by participants

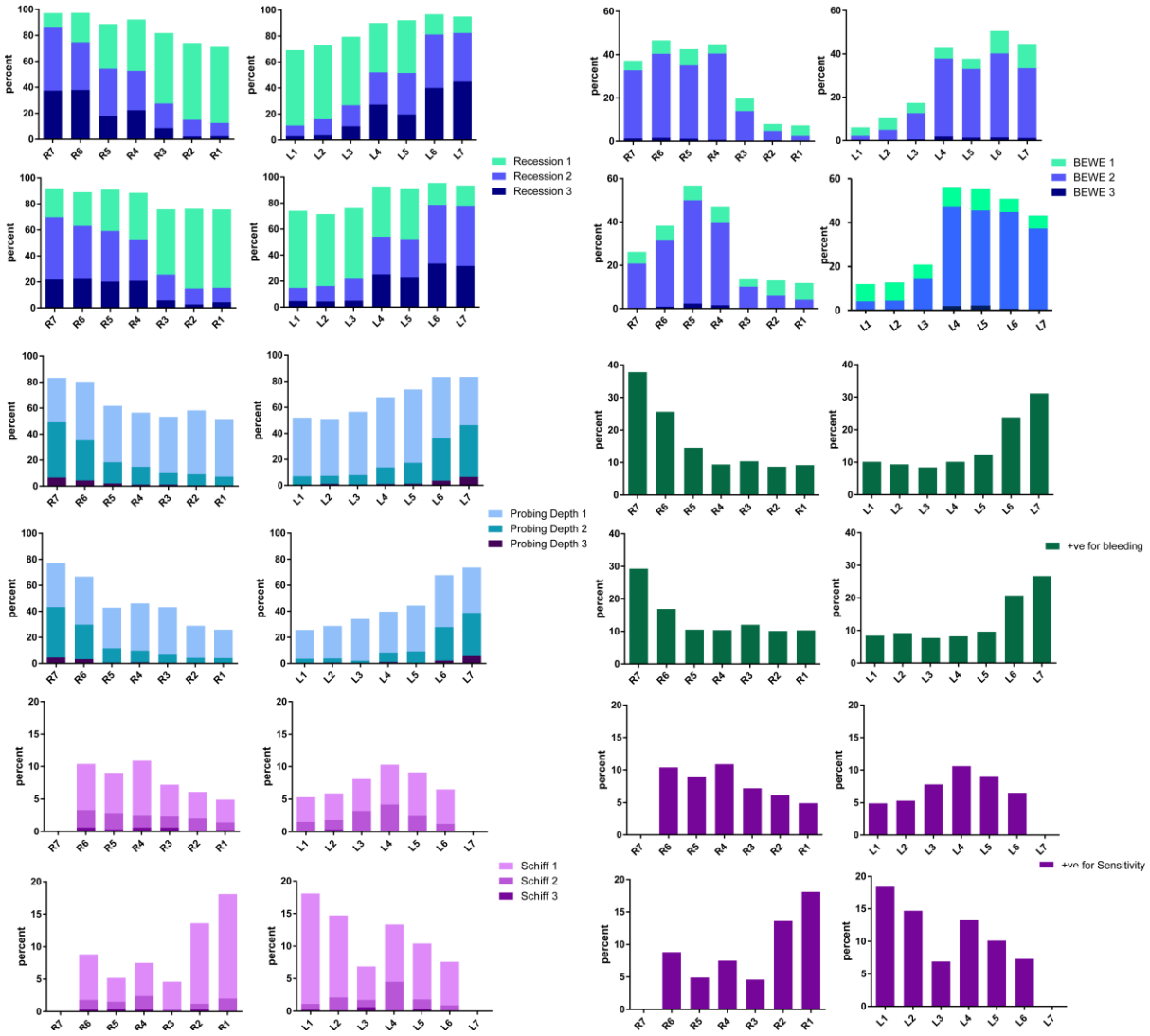

Figure 2 Frequency distributions of periodontal conditions on buccal surfaces.

Probing Depth score, 1 = 0-2 mm, 2 = 3mm, 3 = ≥4mm

Recession score, 1=1-2mm, 2=3 mm, 3=≥4mm

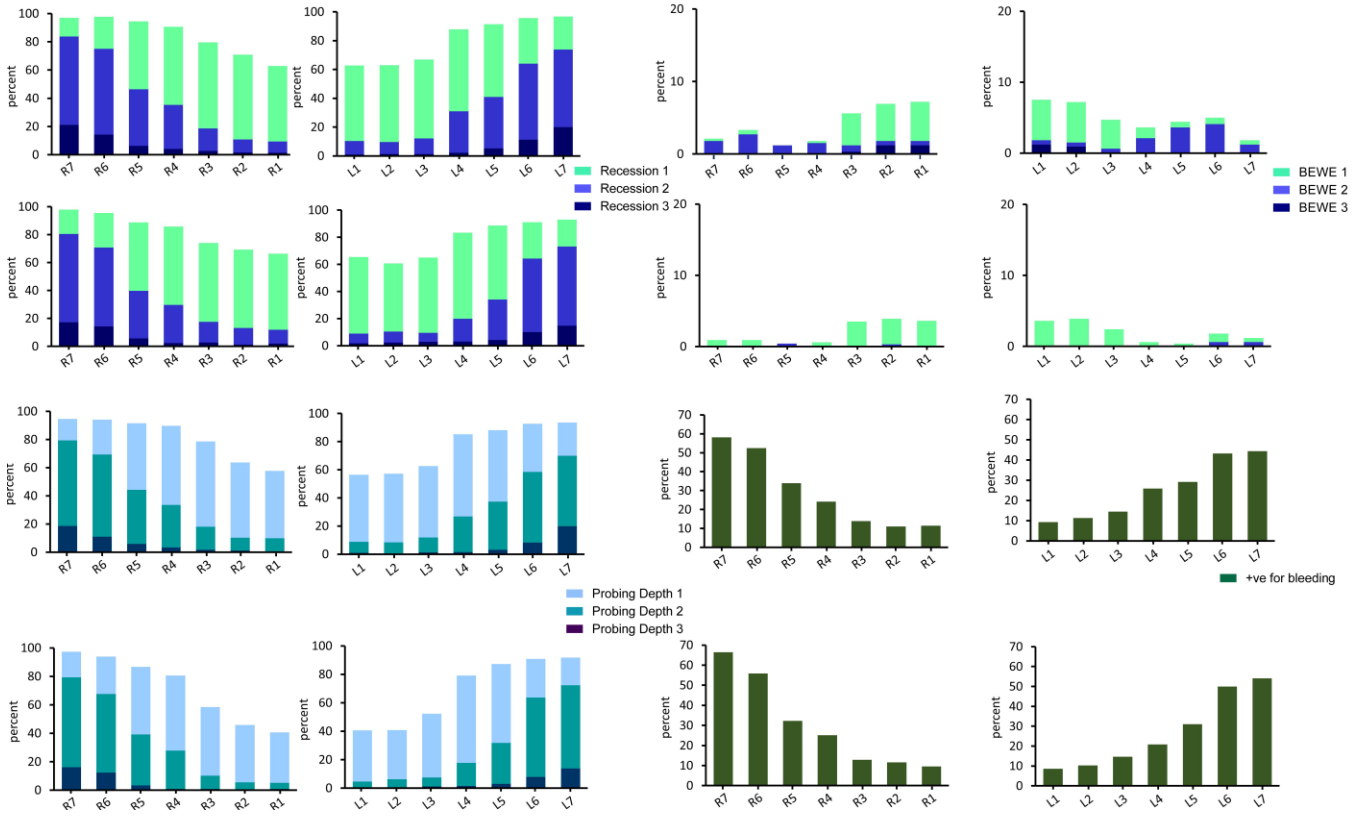

Figure 3 Frequency distributions of tooth wear and dentine hypersensitivity on palatal surfaces.

Probing Depth score, 1 = 0-2 mm, 2 = 3mm, 3 = ≥4mm

Recession score, 1=1-2mm, 2=3mm, 3=≥4mm