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Dentine Hypersensitivity and Dentine Exposure in Arab Patient Populations

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Abstract:

Background: Dentine hypersensitivity is a frequent oral complaint that is usually associated with several factors including diet and oral hygiene practices. Objective: The aim of this study was to assess the prevalence, severity and correlates of dentine hypersensitivity and dentine exposure related risk indicators in a sample from six Arab countries. Methods: A multinational cross-sectional study was conducted on a sample of 2924 participants, attending dental practices, aged 18-35 years old from six Arab countries. Trained examiners assessed dentine hypersensitivity using the Schiff scale and scored the tooth with the highest value in each sextant. Participants were asked to complete a questionnaire that assessed the frequency of drinking and eating acidic foods and their oral health habits. Results: Overall, the Schiff score 1 was found in 938 (32.6%), score 2 in 613 (21%) and score 3 in 274 (9%) of the participants. There was variation between countries with Saudi Arabia (13.9%) and Oman (15%) having the highest prevalence of hypersensitivity and Kuwait (2.2) and Jordan the lowest (4.8%). Participants who experienced toothache and difficulty eating *Once a day* were significantly more likely to have Schiff score 2 or 3 (OR:2.51, 95% CI: 1.54-2.87; OR:1.34, 95%CI:1.04-1.73; respectively). Furthermore, drinking soft drinks *once a day* was also significantly associated with dentine exposure (OR: 1.4, 95% CI: 1.19, 1.65).

Conclusion: In this cross sectional study, dentine sensitivity and exposure were common in Arab patient populations.

Running title: Correlates of dentine hypersensitivity in Arab populations

Background

Dentine hypersensitivity is an oral condition that is characterized by a transient pain typically in response to chemical, thermal or tactile stimuli that cannot be explained arising from another causative agent.¹⁻³ It is generally accepted to be a diagnosis of exclusion, but is a common clinical finding with estimates ranging from 2.8 to 98%,⁴ and this range is probably explained by the varying measures to record the condition.⁵⁻⁷ The condition is also recognized to vary in intensity with many responders admitting to symptoms, but they may not be currently experiencing. The Schiff scale⁵ is a partially quantitative measure using 4 scores from 0 (no pain) to 3 (intense pain) and is reported to be reasonably reproducible. But the scoring is in real time and does not account for the variation in symptoms which is a characteristic of the condition. Personal reporting through questionnaires or Visual Analogue Scale (VAS) also varies between participants and on the same participant at different times.² All give some indication of the severity but as the condition undergoes periods of activity and inactivity the output may change over time.³

Recently an investigation of tooth wear was conducted across six Arab countries.⁷ Results showed that tooth wear was an almost universal experience with 99% showing signs of erosive tooth wear with 40.7% showing evidence of severe wear present in at least one tooth in a sextant.

In a similar designed study conducted in 7 European countries in 2014 on 3187 adults, aged 18-35 years old, 56.8% scored 1 or higher on the Schiff scale⁸. Although the tooth wear study and the hypersensitivity studies^{9,10} report on a relatively small population considering the size of the countries involved, it gave an understanding of the experience of those participants involved and this could, with reservations, give an estimate for the region as a whole.

The aim of this cross sectional study was to investigate the frequency and correlates of dentine hypersensitivity in a sample of patients attending dental practices across six Arab countries.

Materials and Methods

This cross-sectional study implemented in six Arab countries (United Arab Emirates, Oman, Jordan, Egypt, Saudi Arabia and Kuwait) was conducted between February 2016 and December 2017. The tooth wear findings have been reported elsewhere and the authors present the results of the dentine hypersensitivity and dentine exposure using the same participants.⁷ In brief, the study population comprised of healthy Arab males and females between the ages of 18-35 years old, attending public and private dental practices in the six countries. The exclusion criteria were the presence of fixed orthodontic appliances or an inability to understand the Arabic language. The study was approved by the Research Ethics Committee at the University of Sharjah and the appropriate ethics committees in each of the participating country. All subjects provided written informed consent for use of their data and were willing to answer the questionnaire.

Following screening, consenting participants who met the inclusion criteria underwent an examination under good lighting by trained examiners. Each participant completed a self-administered questionnaire including data on lifestyle, dietary behavior and perception of dentine hypersensitivity. The Schiff scale ⁴ was applied on each sextant and the tooth surface with the highest value was recorded. All eligible teeth (apart from wisdom) were subjected to a cold stimulation from a 1 second application of air from a triple air dental syringe at 60 (± 5) psi and operating at room temperature from a distance of approximately 1cm from the tooth. The examiner recorded the response as score 0 indicating *no response*, 1= *the subject responds to stimulus but does not request discontinuation of stimulus*, 2= *Subject responds to stimulus and requests discontinuation or moves from stimulus* and 3= *Subject responds to air stimulus, considers stimulus to be painful, and requests discontinuation of the stimulus*. Dentine exposure was also assessed for each tooth as either absent (coded as 0) or present (coded as 1). All

participating dentists were given training which included a half-day session with an experienced examiner (SBA). All questionnaires and clinical forms were sent to the PI (MA) for data entry, cleaning and analysis.

Statistical Analysis

Quality control procedures included a review of each questionnaire and clinical form. In addition, double data entry procedure was adopted to correct typographic errors. Co-investigators in each site also kept records of problems that occurred during data collection and any doubt was discussed and solved with the principal investigator.

Data were analysed using SPSS (version 24, Chicago, USA) on the individual level. Descriptive statistics and frequencies of categorical variables and mean (Standard deviation) for continuous variables were reported. For each participant the highest Schiff score was identified as well as dentine exposure. Chi-square tests were used to analyse the relationship between independent variables (demographic, dietary and oral care factors) and the Schiff score, for which Schiff score 0 or 1 would indicate no hypersensitivity and scores 2 or 3 would indicate that the participant had hypersensitivity, as well as, the association with dentine exposure (0: Absent, exposure, 1: Present). Additional logistic regression analysis with backward elimination was used to estimate the odds ratio and 95% confidence intervals for the statistically significant factors association with hypersensitivity and dentine exposure. To address potential bias created from missing data, multiple imputation was applied to outcome variables. This statistical technique was designed to reduce bias that can occur from missing data by allowing participants with incomplete data to be included in the analyses. In this approach, a model was posited for the association between missing values and recorded values and used to generate several replicate “completed” data sets, containing imputed values in place of the missing values. Estimates of the parameters of interest in each completed data set, with their variance, are then pooled using multiple imputation rules¹¹. Five separate imputation samples were generated. Statistical significant levels were set at $p < 0.05$.

Results

Table 1 shows that there was a total of 2924 adults recruited from six Arab countries with a total of 1400 males and 1524 females with a mean age of 26.8 years (SD:4.8). Overall, there were 78,755 teeth examined. In this study, 1099 (37.6%) participants had Schiff score “0”, 938 (32.6%) had a score of “1”, score “2” was observed in 613 (21%) of the participants and “3” in 274 (9%) of the participants. There was variation in the results between countries with Oman the highest percentage of Schiff score 2 and 3 (N=146 (34.8%) and N=63 (15%), respectively) and Kuwait the lowest (N= 973 (18%)). In addition, more than 50% of the participants from Oman and Saudi Arabia had dentine exposure (N=245 (58.8%) and N=236 (55.7%); respectively). Table 2 shows the chi-square results between hypersensitivity and dentine exposure, according to the independent variables. Schiff scores 2 and 3 were positively associated with high school education, being a male, experiencing gastroesophageal reflux once a day, toothache and difficulty eating ($p<0.05$). Dentine exposure was significantly associated with brushing teeth three time or more per day (Table 2), drinking soft drinks, isotonic drinks, drinking fruit and vegetable juices, as well as, eating cheese once a day ($p<0.05$). A significant association was also observed between participants’ perception of sensitive teeth and Schiff scores (Table 3). In which, a significantly higher proportion of participants ($p<0.05$) who experienced sensitive teeth *once a day* due to cold air and drinks, hot water and eating sweets had a Schiff score of “2” or “3”.

Table 4 shows the results of the multivariate logistic regression analysis using backward elimination for the association between Schiff 2 or 3 and oral health habits, dietary habits and demographic factors, the independent variables in the study. Due to difference between countries these associations were adjusted for country of the participants. In this model increase in age (OR: 1.04, 95% CI: 1.01,1.07); experiencing toothache *once a day* because of problems with teeth or gums (OR: 2.51, 95% CI: 1.54,2.87), difficulties eating once a day (OR:1.34, 95% CI:1.04,1.73) were all positively associated with hypersensitivity. Furthermore, participants who had dentine exposure reported more difficulties eating and feeling tense once a day compared to those who

did not have dentine exposure ($p < 0.05$). Dentine exposure was also associated with less frequency of brushing teeth (OR:0.77, 95% CI: 0.63,0.95).

Discussion

In this study, based on patients attending general dental practices across six Arab countries, we observed a relatively high levels of dentine hypersensitivity (30%) and dentine exposure (45.5%). However, the reported levels of hypersensitivity and dentine exposure quite varied between countries, with Oman having the highest of both hypersensitivity (49.8%) and dentine exposure (59.8%). These data emphasize the importance of dentine hypersensitivity in Arab populations in which a Schiff score of 2 or 3 is approximately twice that reported in Europe⁸ using a similar protocol. This finding has impact for the health authorities in the region and others involved with the management of hypersensitivity.

The reason for the difference between Europe and Arab countries in hypersensitivity is almost certainly complex. In neither study can the results be interpreted for the regions as a whole, but they give some estimate for the prevalence across different countries.

Consistent with previous studies^{9,12-16} both hypersensitivity and dentine exposure were positively associated with age. This is likely due to the cumulative exposure to risk factors that are associated with these conditions⁹. In this cohort, 41% consumed food more than three times per day, 44% consumed acidic fruit and 32% soft drinks more than *once a day*. However, similar to a previous study in China¹³ the multivariate analysis showed no association between hypersensitivity and acidic foods and fruit juices. These unexpected findings that contradicts previous studies^{10,16} could be attributed to the multifactorial etiology of dentine hypersensitivity, as well as, the unique characteristics of studied populations in which the contribution of oral health and dietary habits as well as, sociodemographic factors suggest specific risk factors in each studied population.^{12,13} To the contrary, consumption of soft drinks *once a day*, was significantly associated with dentine exposure. These findings are in line with the reported results of the meta-

analysis by Li et al,¹⁷ in which the authors reported that soft drinks showed the highest statistically significant odds ratio (2.41) for the development of dental erosion. Nevertheless, the lack of consensus about the effect of acidic foods, juices and soft drinks on teeth maybe due to the contents of these products and their ability to cause loss of enamel and dentine that leads to hypersensitivity.^{18,19} For example, Zimmer et al¹⁸ demonstrated that some soft drinks can significantly affect teeth more than others, but because of the difficulties of asking participants to recall the exact type of acidic drinks they consume, collecting such data maybe challenging. However, identification of the most damaging soft drinks and other acidic juices may assist dentists when counselling their patients on alternative drinks to the ones that cause most damage to the teeth.

Our findings that brushing teeth more than *twice per day* was not associated with hypersensitivity and negatively correlated with dentine exposure were unexpected and in contrast to previous suggestions.^{2,13,20-22} For example, Que et al¹³, reported that participants in their study who brushed their teeth more than twice per day were significantly more likely to have dentine hypersensitivity (OR:2.76; p<0.05) West et al² argued that the abrasive effects of tooth brushing alone on enamel or dentine is not important, however, the abrasion effect of some toothpastes on dentine are more damaging. The assumption that good oral hygiene practices (i.e frequent tooth brushing) would be associated with increase hypersensitivity should be further explored in clinical studies taking into account the timing of brushing²² and type of toothpaste used.²⁰

Although the risk factors associated with hypersensitivity has been established in many studies, its impact on daily living is much less understood.²³⁻²⁶ Consistent with previous research,²³ our findings that both hypersensitivity and dentine exposure are associated with difficulties eating, feeling tense and experience pain more frequently than those without these conditions, highlight the relevance to the patients and could have a significant psychological impact on everyday living.²³⁻²⁵ For example, Beks et al²⁴ showed that among a group of patients who sought treatment for dentine hypersensitivity, the impact of this condition on oral health related quality of life was similar to that reported by patients who suffer from TMJ disorders. This emphasize that, although

oral pain maybe experienced in different forms, its impact may on quality of life cannot be overlooked, especially by oral health care professionals who may underestimate its effect on patients' lives.²⁵ Additional studies could be conducted to further explore the possible undesirable changes in diet and oral hygiene practices that may also occur as a result of hypersensitivity.

A limitation of this is that the dental examinations were conducted by multiple examiners in general dental practices across different countries. There will be variation in testing. But to limit this, training was performed using experienced researchers and reproducibility testing on the erosive tooth wear gave Kappa scores between 0.81 to 0.84⁸. For tooth wear this result indicates good reproducibility and therefore the confidence in the results are encouraging. It is also not possible to assess reproducibility of sensitivity as the responders change their perceptions once the stimuli are repeated. But given the outcome from the tooth wear the variation in sensitivity is real.

The attendance pattern of patients from the six countries varied, therefore, a formal analysis of prevalence of hypersensitivity is not possible. Nevertheless, the data obtained from this cross sectional study are suggestive that, of those attending a dental practice, hypersensitivity and dentine exposure are common.

To conclude, dentine hypersensitivity and dentine exposure are oral health concerns in Arab populations, in addition to the strong correlation with age and soft drinks, it appears to have an additional negative impact on patients' quality of life.

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Table 1: Overall prevalence of hypersensitivity* and dentine exposure** in study population

Country	Total	Male/Female N (%)	Age Mean (SD)	Schiff 0 N (%)	Schiff 1 N (%)	Schiff 2 N (%)	Schiff 3 N (%)	DE 0 N (%)	DE 1 N (%)
All	2924	1399(48)/1525 (52)	26.8 (4.5)	1099 (37.6)	938 (32.4)	613 (21)	274 (9)	1595 (54.5)	1329 (45.5)
UAE	481	255 (53)/226 (47)	27.3 (5.4)	221 (45.9)	112 (23.3)	88 (18.3)	60 (12.5)	301 (62.6)	180 (37.4)
Kuwait	406	140 (35)/265 (65)	26.3 (3.5)	217 (53.4)	116 (28.6)	64 (15.8)	9 (2.2)	256 (63.1)	150 (36.9)
Oman	420	293 (69)/127 (30)	26.7 (4.2)	69 (16.4)	142 (33.8)	146 (34.8)	63 (15)	173 (41.2)	247 (58.8)
Egypt	793	320 (41)/473 (59)	27.1 (4.6)	285 (35.9)	286 (36.1)	158 (19.9)	64 (8.1)	458 (57.8)	335 (42.2)
Jordan	400	156 (39)/244 (61)	25.7 (4.5)	162 (40.5)	153 (38.3)	66 (16.4)	19 (4.8)	219 (54.8)	181 (45.3)
Saudi Arabia	424	235 (55)/189 (45)	27.2 (5.1)	145 (34.2)	129 (30.4)	91 (21.5)	59 (13.9)	188 (44.3)	236 (55.7)

*Measured by Schiff Scale: a “0”subject does not respond to air stimulus. “1”subject responds to air stimulus but does not request discontinuation of stimulus,“2”subject responds to air stimulus requests discontinuation or moves from stimulus, “3” subject responds to air stimulus, considers stimulus to be painful, and requests discontinuation of stimulus

** Dentine exposure: DE: “0” no dentine exposure. DE: “1” dentine exposure

Table 2: The Association between hypersensitivity and sociodemographic factors and potential independent correlates of hypersensitivity^a and dentine exposure^c

Variables	Total N=2924	Schiff (0,1) ^b N=2037	Schiff (2,3) ^b N=887	DE 0 N=1595	DE 1 N=1329
Sex					
Male	1400	963 (47.2)	437 (49.4) ^d	727 (45.6)	673 (50.6)
Female	1524	1074 (52.8)	450 (50.6)	868 (54.4)	656 (49.4)
Education					
School	920	594 (29.2)	326 (36.7) ^d	471 (29.5)	449 (33.8)
University	2004	1443 (70.8)	561 (63.3)	1124 (70.5)	880 (66.2)
Frequency of tooth brushing					
3 times or more per day	522	381 (18.5)	141 (15.6)	318 (19.9)	204 (84.7)
Less than 3 times per day	2402	1656 (81.5)	746 (84.4)	1277 (80.1)	1125 (15.3)
Gastroesophageal Reflux					
Once a day	162	97 (5)	65 (7) ^d	79 (5.0)	83 (6.2)
Once a week/once a month/Never	2762	1940 (95)	822 (93)	1516 (95)	1246 (93.8)
Experience toothache					
Once a day	432	229 (11)	203 (23) ^d	194 (12.2)	238 (17.9) ^d
Once a week/once a month/never	2492	1808 (89)	684 (77)	1401 (87.8)	1091 (82.1)
Vomiting					
Once a day	55	34 (2)	21 (2)	25 (1.6)	30 (2.3)
Once a week/once a month/never	2869	2003 (98)	866 (98)	1570 (98.4)	1299 (97.7)
Difficulty eating					
Once a day	412	241 (11.8)	171 (19.3) ^d	176 (11.0)	236 (17.8)
Once a week/once a month/never	2512	1796 (88.2)	716 (80.7)	1419 (89.0)	1093 (82.2)
Eating occasions					
3 times per day	1726	1216 (58)	510 (57.5)	949 (59.5)	777 (58.5)
4-6 times per day	1036	721 (35)	315 (35.5)	558 (35.0)	478 (36.0)
> 6 times per day	162	100 (7)	62 (7)	88 (5.5)	74 (5.5)
Eating fruits					
Once a day	1285	890 (43.8)	395 (44.4)	689 (44.8)	596 (53.7)
Once a week/once a month/Never	1639	1147 (56.2)	492 (55.6)	906 (56.7)	733 (46.8)
Drinking fruit and vegetables juice					
Once a day	1161	799 (39)	362 (41)	604 (37.9)	557 (41.9)
Once a week/once a month/never	1763	1238 (61)	525 (59)	991 (62.1)	772 (58.1)
Isotonic drinks					
Once a day	176	120 (6)	56 (6)	97 (13.9)	79 (7.1)
Once a week/a month/never	2748	1917 (94)	831 (94)	1498 (86.1)	1250 (92.9)
Soft drinks					
Once a day	942	639 (31)	303 (34)	450 (28.2)	492 (37.0) ^d
Once a week/once a month/never	1982	1398 (69)	584 (66)	1145 (71.8)	837 (63.0)
Cheese					
Once a day	1809	1269 (63)	540 (61)	947 (41.9)	862 (47.6)
Once a week/once a month/never	1115	768 (37)	347 (39)	648 (58.1)	467 (52.4)

^a based on chi-square test

“0”subject does not respond to air stimulus. “1”subject responds to air stimulus but does not request discontinuation of stimulus, “2”subject responds to air stimulus requests discontinuation or moves from stimulus, “3” subject responds to air stimulus, considers stimulus to be painful, and requests discontinuation of stimulus.

^d p<0.01.

Table 3: Association between perception of sensitive teeth and hypersensitivity scores

Variable	Total	Schiff (0,1)	Schiff (2,3)
Cold weather (air)			
Once a day	351	177 (30.3)	174 (37.8)*
Once a week/once a month/never	695	407 (69.7)	288 (62.2)
Touch			
Once a day	213	119 (21)	94 (21.5)
Once a week/once a month/never	792	448 (79)	344 (78.5)
Hot water			
Once a day	214	107 (18.8)	107 (24.4)*
Once a week/once a month/never	793	462 (81.2)	331 (75.6)
Sweet			
Once a day	417	214 (35.8)	203 (43.2)*
Once a week/once a month/never	651	384 (64.2)	267 (56.8)
Cold drink			
Once a day	524	265 (43)	259 (53.2)*
Once a week/once a month/never	579	351 (57)	228 (46.8)
While brushing			
Once a day	442	157 (26.2)	149 (34)
Once a week/once a month/never	731	442 (73.3)	289 (66)

*P<0.01 based on chi-square test

Table 4: Logistic regression analysis^a of factors associated with Dentine Exposure^b

Variable	Odds Ratio	95% CI	P-value
Age	1.04	1.01,1.07	0.002
Tooth ache Once a day Less than once a day ^c	1.24	0.98,1.56	0.09
Difficulty eating Once a day Less than once a day ^c	1.45	1.12,1.87	0.02
Feeling tense Once a day Less than once a day ^c	1.46	1.14,1.87	0.03
Vegetables juices Once a day Once a week/once a month/never	1.15	0.97,1.35	0.21
Soft drinks Once a day Once a week/once a month/never	1.4	1.19,1.65	0.001
Cheese Once a day Once a week/once a month/never	1.27	1.08,1.49	0.01
Brush 3 times or more per day Less than 3 times per day	0.77	0.63,0.95	0.002

^a Adjusted for country

^b dependent variable Dentine exposure (yes vs no)

^c Reference category

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