Research Article

IS DENTAL PHOBIA A BLOOD-INJECTION-INJURY PHOBIA?

C.M.H.H. van Houtem, D.D.S., M.Sc.,[1]* I.H.A. Aartman, Ph.D.,[1] D.I. Boomsma, Professor,[2] L. Ligthart, Ph.D.,[2] C.M. Visscher, Ph.D.,[3] and A. de Jongh, Professor[1,4]

Background: *Dental phobia is part of the Blood-Injection-Injury (B-I-I) phobia subtype of specific phobia within DSM-IV-TR. To investigate the conceptual validity of this classification, the purpose of the present study was to determine the co-occurrence of dental phobia, typical dental (and B-I-I related) fears, vasovagal fainting, and avoidance of dental care.* **Method:** *Data were collected by an online survey in Dutch twin families (n = 11,213).* **Results:** *Individuals with a positive screen of dental phobia (0.4% of the sample) rated typical B-I-I-related stimuli as relatively little anxiety provoking (e.g. of all 28 fears the stimulus "the sight of blood" was ranked lowest). Presence of dental phobia was significantly associated with a history of dizziness or fainting during dental treatment (OR = 3.4; 95% CI: 1.5–8.1), but of the dental phobic individuals only 13.0% reported a history of dizziness or fainting during dental treatment. Presence of dental phobia (OR = 5.0; 95% CI: 2.8–8.8) was found to be associated with avoidance of dental care, but a history of dizziness or fainting during dental treatment was not (OR = 1.0; 95% CI: 0.8–1.2).* **Conclusions:** *The present findings converge to the conclusion that dental phobia should be considered a specific phobia subtype independent of the B-I-I cluster within the DSM classification system. Depression and Anxiety 31:1026–1034, 2014.*

Key words: *specific phobias; dental phobia; blood-injection-injury phobia; DSM*

INTRODUCTION

Specific phobia is an anxiety disorder that represents unreasonable or irrational fear of a specific object or situation.[1] One of the specific phobia subtypes retained in the Diagnostic and Statistical Manual of Mental Disorders (DSM–IV–TR) is Blood-Injection-Injury (B-I-I) phobia, a phobic condition involving an extraordinary fear of blood, injuries, needles, and invasive medical procedures.[2] B-I-I phobia usually starts in childhood,[3] is often familial,[4–7] shows prevalence rates of about 3%,[3,8,9] and is more prevalent in women than in men.[3,10] There are indications that of all specific phobia subtypes B-I-I phobia is most strongly associated with disability.[11]

According to the text of the DSM-IV-TR (p. 446),[2] B-I-I phobia is characterized by a strong vasovagal response, also referred to in the literature as a biphasic response pattern. This response is supposed to consist of an initial acceleration in heart rate and increase in blood pressure, followed by a heart rate deceleration and blood pressure drop leading to an increased likelihood of vasovagal fainting.[2,4,12] It is assumed that about 75%

[1]Department of Social Dentistry and Behavioural Sciences ACTA, University of Amsterdam and VU University Amsterdam, Amsterdam, The Netherlands
[2]Department of Biological Psychology, VU University Amsterdam, Amsterdam, The Netherlands
[3]Department of Oral Kinesiology ACTA, Research Institute MOVE, University of Amsterdam and VU University Amsterdam, Amsterdam, The Netherlands
[4]School of Health Sciences, Salford University, Manchester, United Kingdom

*Correspondence to: Caroline van Houtem, Department of Social Dentistry and Behavioural Sciences ACTA, University of Amsterdam and VU University Amsterdam, Gustav Mahlerlaan 3004, 1081 LA, Amsterdam, The Netherlands. E-mail: c.v.houtem@acta.nl

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of patients afflicted with B-I-I phobia have a history of fainting in phobia-relevant situations.[2]

Dental phobia is a disproportional fear of (invasive) dental procedures, and is currently classified as a specific phobia of the B-I-I subtype within DSM-IV-TR. Regarding the convergent and discriminant validity of this categorization, there are only two factor analytic studies that specifically attempted to determine whether dental fear corresponds to the cluster of fears within the B-I-I subtype of specific phobia. Both studies found support for a classification of fears with a B-I-I or "mutilation" factor comprising fears of injections, injuries, and dental treatment.[8,13] Conversely, a study assessing the relationship between dental anxiety, and either B-I-I anxiety or B-I-I avoidance among dental patients found only weak nonsignificant correlations between these constructs ($r = 0.16$ and –0.02, respectively).[14] Further, a community survey showed that among dentally anxious individuals, only 16% could also be classified as blood-injury fearful.[15] Vice versa, a study among blood and injection phobics showed that less than 20% of them also had a strong fear of the dental situation.[16] The small level of cooccurrence of dental fear in general and typical B-I-I fears seems to challenge the contention that dental fear is a typical B-I-I fear.

The question whether dental phobia is a B-I-I phobia also pertains to onset, phenomenology, and treatment planning. Whereas the origin of dental phobia could easily be explained as the result of associative learning,[14] the origins of fear of blood and injury have been claimed to largely lie in genetic factors.[9,17] Even more striking are the differences in physiological response pattern between dental phobia and B-I-I phobia. Whereas B-I-I phobia is associated with a biphasic response pattern, the cardiac reaction in dental phobics during exposure to phobic stimuli is typically associated with an acceleration of heart rate, which is not followed by a drop in heart rate,[18–22] and fainting.[14,18] Another area in which dental phobia differs from B-I-I phobia is the treatment of both conditions. While in vivo exposure to anxiety provoking stimuli is generally considered to be the most appropriate treatment for specific phobia in general,[23] for B-I-I phobia, when the patient presents with a vasovagal fainting response, the preferred additional treatment is "applied tension" (i.e. artificially increasing the blood pressure by tensing the muscles).[24,25]

Taken together, the findings of studies that investigated the dynamic of dental phobia cast doubt on the empirical basis of the current classification of dental phobia as a "pure" B-I-I phobia within DSM-IV-TR. Yet, in the light of the development of DSM-5, the authors of a recent paper evaluating the current diagnostic criteria for specific phobia, concluded that "*dental phobia shares more similarities than differences with B-I-I phobia*."[26] To further elucidate this issue the purpose of the present study was to investigate the conceptual validity of the DSM classification of dental phobia within the B-I-I phobia subtype of specific phobia. Therefore, the cooccurrence of dental phobia, fear of dental objects and situations (including B-I-I-related stimuli), and a history of vasovagal fainting during dental treatment was investigated. More specifically, based on the current classification of dental phobia as a B-I-I phobia subtype within DSM we expected to find that dental phobics would rate B-I-I-related stimuli equally anxiety provoking as typically dental-related stimuli. Secondly, it was hypothesized that there would be relatively more individuals with a fainting history among dental phobics than among non-dental phobics.

A related issue concerns the contribution of dizziness and fainting to the tendency to avoid situations where fainting might occur (i.e. the dental treatment). For B-I-I phobia it has been claimed that fainting in response to B-I-I stimuli can aggravate avoidance of medical care,[5] which could exacerbate medical conditions and may lead to health threatening situations.[2–4] If dental phobic individuals indeed display a similar distinctive autonomic reaction and a selective propensity to faint as seen in "pure" B-I-I phobics, it is conceivable that this response pattern would evoke a fear of fainting and preclude individuals securing appropriate care with detrimental effects on oral health. Remarkably, however, besides the text of the DSM-IV that states that "*Specific Phobias of the Blood-Injection-Injury Type, may have detrimental effects on dental and physical health, because the individual may avoid obtaining necessary medical care*" (p. 446)[2] and suggestions in this direction,[4,6,24,27] we are not aware of any study supporting such a claim in relation to dental phobia. Therefore, the third aim was to test the hypothesis that fainting would be significantly associated with avoidance of dental care.

METHODS

RESEARCH PARTICIPANTS

This study is part of an ongoing study on lifestyle and personality in twin families registered with the Netherlands Twin Register (NTR).[28] The data are derived from the 9th wave of survey collection in adult participants that was carried out in 2011 and 2012. After obtaining approval from the Medical Ethics Committee of the VU University Medical Center Amsterdam, NTR participants aged 18 years and older were invited to complete the survey ($N = 27{,}892$). At the time of analysis, 11,225 subjects had responded (response rate 40.2%). Twelve participants were excluded because of missing data on family structure ($n = 6$), age ($n = 3$) or because they were younger than 18 years ($n = 3$). The remaining subjects ($n = 11{,}213$ of 5,098 families) had a mean age (±SD) of 44.26 (±15.42) years (age range 18–100 years) with 61.2% being female. Participants were mostly born in the Netherlands (97.4%).

PROCEDURE

Participants were sent a written invitation including a link to the web page where they could log on to a web-based survey with a unique, personal login name, and password. Subjects who had not yet accessed the web-based survey within three months after the first invitation received a written reminder. For participants without internet access, a hard copy version of the survey was available on request. In this study, only data of the web-based survey were used in the analyses ($n = 11{,}213$).

MEASURES

Sociodemographics. The questionnaire included questions about sex and age. Information on country of birth was available for 6,530 individuals and level of education was available for 8,082 individuals based on previous questionnaires.[29]

Presence of Dental Phobia. Presence of dental phobia was assessed using the Phobia Checklist, a screening tool with four questions based on the DSM-IV-TR criteria for specific phobia,[2] developed for the assessment of dental phobia. This instrument has previously been validated and proven to be a valid diagnostic tool for this purpose (sensitivity = 0.95, specificity = 0.99, and an overall hit rate of 97%).[30] The Phobia Checklist contains the following four questions: (i) When I see or undergo dental treatment I feel unreasonable or excessive (= very strong) anxiety; (ii) I try to avoid dental treatment, or else I undergo treatment only with great anxiety; (iii) I see that I am far more anxious of dental treatment than is justified; and (iv) My fear or avoidance of dental treatment is significantly interfering with or restricting my life. Dental phobia was considered present when all four questions were answered in the affirmative.

Severity of Dental Fear. Severity of dental fear was assessed using the Dental Anxiety Scale.[31] Responses are scored from 1 to 5, providing total scores ranging from 4 (not anxious at all) to 20 (extremely anxious). DAS scores of 13 or higher are considered indicative of the presence of a high level of dental fear.[32] Cronbach's alpha of the DAS in the current study was 0.90.

History of Fainting During Dental Treatment. History of dizziness or fainting during dental treatment was assessed with the dichotomous question "*Did you ever feel dizzy or did you ever faint during a dental treatment?*"

Anxiety Provoking Stimuli. The fear provoking nature of 28 stimuli was assessed using the question: "Below you will find examples that you may have experienced at the dentist, oral hygienist, or oral surgeon. Please indicate for each example whether this evokes a fear response?" The stimuli were derived from a questionnaire with 67 potentially anxiety-provoking objects and situations related to the dental setting.[33] In the current study, only the 25 most prevalent anxiety-provoking stimuli were used as items for the questionnaire, which was supplemented with three additional stimuli (i.e. gagging, a sense of vomiting, and fainting). The questionnaire contained the following B-I-I-related stimuli: having surgery, being injured, receiving an injection, and seeing blood. Each of the items were scored on a four point scale, from 1 (not anxiety provoking at all) to 4 (extremely anxiety provoking).

Avoidance of Dental Care. An established way to index regular dental attendance is to assess the proportion of people who visit the dentist at least once a year.[34] Accordingly, those who reported visiting a dentist less than once a year during a 5-year period were classified as having a tendency to avoid dental care. This was scored using two distinct categories (i.e. regular attendance or avoidance of dental care).

STATISTICAL ANALYSES

Descriptive statistics were performed in IBM SPSS Statistics (Version 20). Regression analyses (continuous measures) and logistic regression (categorical measures) were carried out in STATA 12.1 (StataCorp, College Station, Texas, USA) to test whether dental phobia, fainting, and avoidance were related to a selection of variables. STATA's "robust cluster" option was used to account for the non-independence of family members. The strength of the associations between avoidance of dental care on the one hand, and a selection of variables on the other, was estimated by the odds ratio (OR) and 95% confidence intervals. To cross-validate findings based on the relatively small number of strict dental phobics, analyses were partially repeated using a distinction between high and low levels of dental fear based on the DAS. For all statistical analyses, a P-value < 0.05 was considered statistically significant.

RESULTS

SAMPLE CHARACTERISTICS

Sociodemographic characteristics are reported in Table 1 for participants with ($n = 48$, 0.4%) and without a dental phobia, for participants with a history of dizziness or fainting during dental treatment ($n = 472$, 4.3%) or not and for participants who avoided dental care ($n = 2{,}010$, 18.1%) or not. Comparisons between these groups revealed that a gender difference was present for fainting history during dental treatment and for avoidance of dental care.

ANXIETY PROVOKING STIMULI AS INDICATED BY INDIVIDUALS WITH AND WITHOUT DENTAL PHOBIA

Table 2 shows the mean scores of anxiety provoking stimuli as rated by those with and without dental phobia, and the proportion of them rating a specific stimulus as extremely anxiety provoking (score 4). Dental phobics had significantly higher mean scores on all stimuli, including typically B-I-I-related stimuli, than those without dental phobia (all $P < 0.01$). For both dental phobics and nondental phobics the stimulus with the highest mean score was "undergoing root canal treatment" (95% CI 3.45–3.86 and 2.27–2.31, respectively). This stimulus was also most frequently reported as extremely anxiety provoking among both groups (73.9%, and 11.0%, respectively). Among dental phobics, it appeared that typical B-I-I-related stimuli had a relatively low ranking among the 28 fears of dental objects and situations, except the stimulus "having surgery," which was ranked third. Of all 28 stimuli dental phobics rated the B-I-I-related stimulus "seeing blood" as lowest. The results for dental phobia were similar to those for dental fear. Individuals with a high level of dental fear, but without fulfilling all screening criteria of dental phobia ($n = 573$), had significantly higher mean scores on all stimuli than those with a relatively low level of dental fear (all $P < 0.01$). Moreover, regarding the rank order of typical B-I-I-related stimuli, "having surgery" was ranked third, "receiving an injection" 16th, "being injured" 17th, and "seeing blood" 28th.

OVERLAP BETWEEN DENTAL PHOBIA AND A HISTORY OF FAINTING DURING DENTAL TREATMENT

Of the dental phobics, 13.0% ($n = 6$) reported a history of fainting during dental treatment (Fig. 1). Dental phobics were significantly more likely (OR = 3.4; (95% CI: 1.5–8.1) to report a history of fainting than nondental phobics [Wald χ^2 (1) = 7.68; $P < 0.01$]. Of the individuals with a high level of dental fear, but without fulfilling all screening criteria of dental phobia, 17.8% ($n = 101$) reported a history of fainting (Fig. 1). They

TABLE 1. Sociodemographic characteristics of the participants with and without dental phobia, with and without dizziness or fainting during dental treatment, and with and without avoidance of dental care

Variable, % or mean (±SD)	Dental phobia $n = 48$	No dental phobia $n = 11,165$	Wald χ^2 or t	P-value	Dizziness or fainting during dental treatment $n = 472$	No dizziness or fainting during dental treatment $n = 10,588$	Wald χ^2 or t	P-value	Avoidance of dental care $n = 2,010$	No avoidance of dental care $n = 9,114$	Wald χ^2 or t	P-value
Presence												
Overall	0.4%	99.6%			4.3%	95.7%			18.1%	81.9%		
Male	0.3%	99.7%	2.70	0.10	2.8%	97.2%	35.60	<0.01	22.2%	77.8%	80.42	<0.01
Female	0.5%	99.5%			5.2%	94.8%			15.4%	84.6%		
Age												
Overall	48.45 (±15.59)	44.24 (±17.01)	2.01	0.044	42.37 (±17.52)	44.20 (±17.00)	–2.86	<0.01	45.12 (±27.34)	44.01 (±15.99)	2.51	0.012
Male	50.44 (±11.77)	46.26 (±16.29)	1.38	0.17	46.20 (±15.22)	46.12 (±16.29)	0.07	0.94	46.95 (±28.06)	46.07 (±15.64)	1.38	0.17
Female	47.71 (±16.66)	42.94 (±15.55)	1.81	0.070	41.08 (±17.76)	42.96 (±15.63)	–2.51	0.012	43.44 (±25.41)	42.81 (±14.95)	1.07	0.29
Country of birth												
The Netherlands	100%	97.4%	0.84[a]	0.36[a]	98.3%	97.4%	0.82	0.37	97.2%	7.5%	0.24	0.62
Other country	0.0%	2.6%			1.7%	2.6%			2.7%	2.5%		
Education												
Primary-lower vocational	46.2%	19.7%	15.08	<0.01	19.8%	19.6%	0.01	0.93	26.2%	18.3%	42.82	<0.01
Intermediate-higher vocational-university	53.8.0%	80.3%			80.2%	80.4%			63.8%	81.7%		

[a]Test statistic not produced in STATA, but in SPSS.

TABLE 2. Rank order (based on mean score), mean scores (and 95% CI), and the proportion of participants with and without dental phobia who rated the stimulus as extremely anxiety provoking (score 4)

	Dental phobics ($n = 48$)				Nondental phobics ($n = 11,165$)					
Stimulus	Rank order	Mean score (1–4)	95% CI	Proportion of dental phobics rating stimulus as extremely anxiety provoking	Rank order	Mean score (1–4)	95% CI	Proportion of non- dental phobics rating stimulus as extremely anxiety provoking	*t*-value	*P*-value
Undergoing root canal treatment	1	3.65	3.45–3.86	73.9%	1	2.29	2.27–2.31	11.0%	14.53	<0.01
Insufficient anesthetics	2	3.49	3.24–3.74	66.0%	2	2.23	2.21–2.24	8.9%	10.85	<0.01
Dentist drilling your tooth or molar	3	3.37	3.15–3.59	47.8%	8	1.90	1.88–1.92	2.9%	14.14	<0.01
Having surgery[a]	3	3.37	3.11–3.63	56.5%	3	2.16	2.14–2.18	5.7%	9.74	<0.01
Being pushed about roughly/harshly	5	3.35	3.12–3.58	50.0%	6	1.98	1.96–1.99	4.2%	12.73	<0.01
Extraction of tooth or molar	6	3.34	3.09–3.59	52.3%	5	2.12	2.10–2.14	6.4%	10.36	<0.01
Cutting or tearing in soft tissue	7	3.28	3.00–3.55	51.1%	4	2.13	2.12–2.15	5.7%	8.55	<0.01
A dentist in a hurry	8	3.17	2.90–3.44	42.6%	7	1.91	1.89–1.93	3.3%	9.79	<0.01
Feeling helpless	9	3.07	2.78–3.35	39.1%	18	1.66	1.64–1.67	2.1%	10.41	<0.01
Pain	10	3.04	2.78–3.29	37.5%	8	1.90	1.89–1.92	3.4%	8.85	<0.01
Things at the back of your mouth	11	2.98	2.69–3.27	37.0%	12	1.81	1.79–1.82	3.0%	8.39	<0.01
The fact that you don't know what is going to happen	12	2.93	2.64–3.23	34.8%	18	1.66	1.64–1.67	1.3%	8.97	<0.01
Not knowing what's happening in your mouth	13	2.91	2.64–3.18	27.7%	21	1.54	1.53–1.56	1.3%	10.51	<0.01
The sound of the drill	13	2.91	2.64–3.19	30.4%	17	1.68	1.67–1.70	2.0%	9.21	<0.01
Objects in your mouth	15	2.85	2.54–3.15	32.6%	22	1.48	1.47–1.50	1.0%	9.26	<0.01
A cavity in a tooth or molar being filled	16	2.81	2.51–3.12	29.2%	22	1.51	1.50–1.53	1.2%	8.71	<0.01
Receiving an injection[a]	17	2.79	2.43–3.15	40.0%	14	1.78	1.77–1.80	3.1%	5.73	<0.01
Being injured[a]	18	2.76	2.45–3.07	30.4%	13	1.79	1.78–1.81	2.1%	6.41	<0.01
A sense of vomiting	19	2.73	2.38–3.08	39.6%	10	1.85	1.84–1.87	3.6%	5.54	<0.01
Gagging	20	2.72	2.38–3.07	38.3%	15	1.75	1.73–1.77	3.2%	5.83	<0.01
Fainting	20	2.72	2.37–3.08	36.2%	10	1.85	1.84–1.87	5.3%	5.04	<0.01
An unpleasant remark made by de dentist	22	2.67	2.37–2.98	26.1%	20	1.56	1.54–1.57	2.8%	7.56	<0.01
Seeing sharp dental instruments	23	2.61	2.32–2.96	19.6%	25	1.37	1.36–1.39	0.4%	8.87	<0.01
Lack of explanation by the dentist	24	2.60	2.29–2.91	20.0%	16	1.69	1.68–1.71	1.8%	5.96	<0.01
Lying in the dental chair (position)	25	2.52	2.26–2.78	13.0%	27	1.21	1.20–1.22	0.4%	10.09	<0.01
Braces being fixed to your teeth	26	2.39	2.07–2.71	19.6%	24	1.44	1.43–1.46	0.9%	6.00	<0.01
Feeling numb	27	2.15	1.85–2.45	13.0%	27	1.21	1.20–1.21	0.1%	6.42	<0.01
Seeing blood[a]	28	2.04	1.72–2.37	12.8%	26	1.26	1.25–1.27	0.8%	4.91	<0.01

[a] B-I-I-related stimulus.

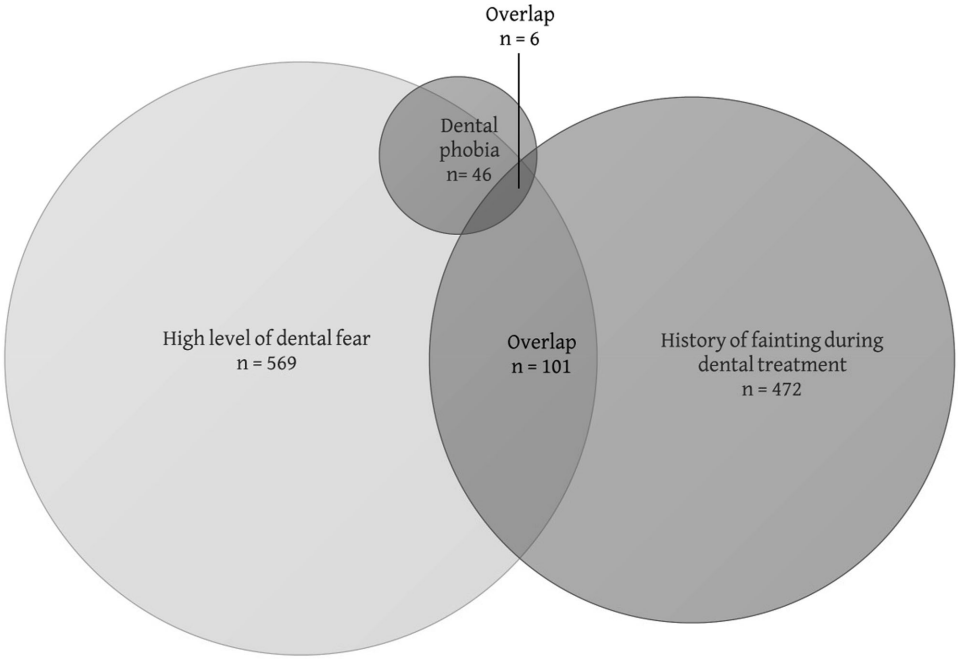

Figure 1. Overlap between dental phobia and a history of fainting during dental treatment and a high level of dental fear and a history of fainting during dental treatment.

were significantly more likely (OR = 6.0; 95% CI: 4.7–7.6) to report a history of fainting than individuals without a high level of dental fear [Wald χ^2 (1) = 204.71; $P < 0.01$].

AVOIDANCE OF DENTAL CARE

Table 3 shows the proportion of participants that reported a tendency to avoid dental care and the associations with other variables. Avoidance of dental care was found to be significantly more likely among dental phobics than among those without dental phobia (OR = 5.0; 95% CI: 2.8–8.8). A similar relationship was found for dental fear (OR = 2.3; 95% CI: 1.9–2.7). However, a history of fainting during dental treatment was not found to be related to avoidance of dental care (OR = 1.0; 95% CI: 0.8–1.2).

DISCUSSION

This is the first study that investigated the cooccurrence of dental phobia, B-I-I-related fears, and vasovagal fainting in a large population-based sample. The results show that dental phobics fear B-I-I-related objects and situations (e.g. seeing blood), although they fear other stimuli present in dental setting (e.g. undergoing root canal treatment) more. These findings are consistent with earlier findings that showed that patients with dental phobia or dental fear demonstrate a high level of fear of multiple stimuli, particularly involving invasive procedures (e.g. root canal treatment procedures and extractions), but not of blood, injury, or injections per se.[14,33,35,36]

Although presence of dental phobia was significantly associated with fainting during dental treatment, only a minor proportion of the dental phobics reported a history of fainting when exposed to their stimulus situation (i.e. a dental treatment). This corroborates previous reports on the small overlap between individuals with high levels of dental fear and fainting,[14,15] and is far less than the percentage of 75% reported in patients with B-I-I phobia according to the DSM-IV-TR.[2] It is also in line with previous studies which showed that none of the dental phobics experienced fainting,[14] and none displayed a biphasic response pattern, when exposed to their phobic stimuli.[18] In previous studies with dental phobics only heart rate acceleration was observed,[20,37,38] a response pattern contrary to the biphasic response pattern, which is described as being the core phenomenon of B-I-I phobia.[2] On the other hand, despite the fact that only a minority of the dental phobics reported a fainting response, they were found to be three times more likely to have experienced such a response during dental treatment than those who did not fulfill the criteria of dental phobia. An explanation for this finding might be that a part of the dental phobics also suffer from a B-I-I-specific phobia subtype, such as blood phobia, apart from their dental phobia.[14,39]

Another important question is whether the alleged biphasic response pattern of dental phobia translates into avoidance of necessary care, and therefore may exert detrimental effects on dental health.[2] It was indeed found that, besides being male and having a low level

TABLE 3. Strength of the associations between the independent variables and avoidance of dental care

	Avoidance of dental care					
Participants	% avoiders	*n*	Wald χ^2	OR	95% CI	*P*-value
Gender						
Female	15.4%	1,052	80.42	0.6	0.6–0.7	<0.01
Male	22.2%	956				
Education						
Intermediate–higher vocational–university	16.3%	1,051	42.82	0.6	0.6–0.7	<0.01
Lower vocational	23.6%	373				
Dental phobia						
Yes	52.1%	25	30.53	5.0	2.8–8.8	<0.01
no	17.9%	1,985				
High level of dental fear						
Yes	30.6%	175	68.05	2.3	1.9–2.7	<0.01
No	16.6%	1,709				
Fainting history during dental treatment						
Yes	18.0%	85	0.030	1.0	0.8–1.2	0.86
No	17.7%	1,869				
Extreme fear of having surgery						
Yes	21.9%	141	8.08	1.3	1.1–1.6	<0.01
No	17.4%	1,773				
Extreme fear of receiving an injection						
Yes	22.5%	81	6.04	1.4	1.1–1.8	0.014
No	17.5%	1,885				
Extreme fear of getting injured						
Yes	21.9%	51	3.07	1.3	1.0–1.8	0.080
No	17.5%	1,789				
Extreme fear of the sight of blood						
Yes	27.2%	25	5.68	1.8	1.1–2.8	0.017
No	17.5%	1,904				
Extreme fear of fainting						
Yes	19.1%	109	0.97	1.1	0.9–1.4	0.33
No	17.5%	1,723				

of education, the presence of dental phobia and its less pathological variant, dental fear, was significantly associated with greater avoidance of dental care. However, the present study failed to find support for the hypothesis that fainting is significantly associated with avoidance of dental care. Thus, dental phobia, and not a vasovagal fainting tendency, seems to be a risk factor of avoidance of proper care, and accordingly, for deteriorating dental health. The present findings are in line with the only other study that examined the relationship between fainting and avoidance of dental care,[40] which showed that fear was an explanatory factor for avoidance of dental treatment, whereas a fainting experience during a dental injection was not.

Some limitations of the study need to be mentioned. Firstly, although the self-report checklist used to identify individuals with dental phobia has been validated against a structured diagnostic interview (i.e. SCID)[41] it is possible that cases were missed. Therefore, it is important to replicate the findings in a large clinical sample. Also, the number of individuals meeting the criteria of dental phobia in the present sample was relatively small (0.4%), and much lower than previously found in a large representative sample of the Dutch population (3.7%).[30] A possible explanation for this difference is that the current study used a written invitation with a request to fill out a web-based survey, which may have provided individuals with dental phobia the opportunity to avoid participating. This is in contrast with the study of Oosterink et al. (2009)[30] that used face-to-face administration to collect data. Given the response rate of 40.2%, we cannot exclude a nonresponse bias related to dental phobia. However, previous studies addressing nonresponse in the Netherlands Twin Registry related to a variety of traits, showed that the effects of nonresponse bias are unlikely to be large.[42] Another explanation for the low prevalence of dental phobia found is the relatively high level of education in this sample[43] since dental fear and dental phobia have been found to be less prevalent in highly educated people than in lower educated people.[44] However, since our results using another operationalization of pathological dental fear (i.e. DAS $\geq$ 13) showed virtually the same results, it is unlikely that this low prevalence of dental phobia limits the conclusions of the present study. Finally, in order to determine whether fainting would be associated with avoidance of dental care, we classified respondents as having a tendency to avoid dental care when they indicated that they visited a dentist less than once a year during the past 5 years. Clearly, there are many more reasons why

people do not visit a dentist on an annual basis than anxiety per se, such as lack of access to care, or financial reasons. However, given the high SES of the sample, such reasons may be less likely. Maybe more relevant to note is that we were not able to tease out clinically relevant or clinically meaningful (i.e. pathological) forms of avoidance.

The results of the present study challenge the current classification of dental phobia as a subtype of B-I-I phobia for several reasons. First, the results show that dental phobics demonstrate fear of multiple stimuli, including the sound of the dental drill, and having insufficient anesthesia, but not of blood, injury, or injections per se.[33,35] The finding that a significant proportion of the dental phobics endorsed having surgery (56%) and receiving injections (40%) as highly anxiety provoking is not a justification for its current classification, but might best be explained as the result of associative learning (i.e. classical conditioning). Many common situations in the dental setting are invasive in its nature (e.g. drilling, anesthetic injections, endodontic treatments, surgical procedures such as surgical removal of wisdom teeth) that could easily elicit pain and, consequently, a fear response. In this way, patients learn to associate previously neutral stimuli (e.g. the dental chair, the sound of the drill, and dental instruments) with the experience of pain by which the dental context becomes a conditioned response to a danger signal that has predictive value in this potentially harmful situation. Secondly, with regard to the vasovagal response pattern of dental phobics, this study showed that only a minority of dental phobics also suffers from a tendency to faint. These findings add to existing evidence against a model in which dental phobia is considered to be part of the B-I-I phobia subtype.[14,15,18–20] It is however not a surprise that dental phobia is in some way related to B-I-I phobia, since B-I-I-related stimuli (e.g. injections or blood) are inevitable aspects of the dental setting. There are many more examples of separate syndromes that appear similar in the dental setting of which the disease processes differ in etiology, including the person with claustrophobia who fears not being able to escape from the dental treatment room. However, having this fear does not imply that this person should be considered as suffering from dental phobia.

Given that dental phobia does not fit in the remaining specific phobia subtypes (i.e. the animal, situational, or natural environment specific phobia subtypes), in the light of recommendations for a next edition of the DSM it may be most appropriate to nosologically classify dental phobia as a specific phobia of the "other category" of specific phobias, a category that already includes other, "oral-related" specific phobia subtypes (e.g. emetophobia and choking phobia).[2]

CONCLUSION

The present findings add to existing evidence, and converge on the conclusion, that dental phobia has to be considered a specific phobia subtype independent of the B-I-I subtype within DSM. Further, dizziness and fainting do not seem to play a role in avoidance of dental care.

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