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Associations between body dysmorphic disorder (BDD) with the dental health component of the index of orthodontic treatment need (IOTN-DHC) and other BDD risk factors in orthodontic patients: A preliminary study

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Objective: Body dysmorphic disorder (BDD) is a form of obsessive-compulsive disorder that may be negatively associated with the self-image. It might be associated with orthodontic treatment demand and outcome, and therefore is important. Thus, this study was conducted. **Methods:** The Yale-Brown Obsessive-Compulsive Scale modified for Body Dysmorphic Disorder (BDD-YBOCS) questionnaire was used in 699 orthodontic patients above 12 years of age (222 males, 477 females), at seven clinics in two cities (2020–2021). BDD diagnosis and severity were calculated based on the first 3 items and all 12 items of the questionnaire. The dental health component of the index of orthodontic treatment need (IOTN-DHC) was assessed by orthodontists. Multivariable and bivariable statistical analyses were performed on ordinal and dichotomized BDD diagnoses to assess potentially associated factors (IOTN-DHC, age, sex, marital status, education level, and previous orthodontic consultation) (α = 0.05). **Results:** IOTN-DHC scores 1–5 were seen in 13.0%, 39.9%, 29.8%, 12.4%, and 4.9% of patients. Age/sex/marital status/education were not associated with IOTN-DHC (p > 0.05). Based on 3-item questionnaire, 17.02% of patients had BDD (14.02% mild). Based on 12-item questionnaire, 2.86% had BDD. BDD was more prevalent or severer in females, married patients, patients with a previous history of orthodontic consultation, and patients with milder IOTN-DHCs (p < 0.05). **Conclusions:** IOTN-DHC was negatively/slightly associated with BDD in orthodontic patients. Being female and married may increase BDD risk.

Key words: Body dysmorphic disorder, Dental health component of the index of orthodontic treatment need (IOTN-DHC), Psychology, Orthodontic index

INTRODUCTION

Decision making in orthodontics might be influenced more by demand than need.[1] Patients' satisfaction by function and esthetics should be always considered.[1,2] Therefore, psychological factors are a part of orthodontics.[3]

Beauty and oral health play a major role in quality of life, self-confidence, social relationships, emotional health, focus in learning, and work success.[4-7] Recently, the number of patients seeking orthodontic treatment to improve their appearance and quality of life has increased[4-6,8] as orthodontic treatment improves self-confidence and reduces anxiety in social situations.[9,10] Therefore, body image is becoming more important in orthodontics.[8]

Body image can sometimes be disrupted: body dysmorphic disorder (BDD), also known as dysmorphic syndrome, dysmorphophobia, or body dysmorphia, is a psychological disorder classified under obsessive-compulsive disorder (OCD) and related disorders, in which a person becomes overly concerned about a defect in their physical characteristics (body image).[11-14] People with BDD have persistent concerns about one or more defects in their appearance, such as minor flaws that are not visible to others.[11-13] Their concerns about their appearance lead to a wide range of mental actions or behaviors, including comparing themselves to others, looking in the mirror, or camouflaging their perceived flaws.[14,15] BDD can coexist with several other psychiatric disorders, including major depressive disorder, anxiety disorders, and OCD.[16]

BDD can be a chronic disorder that lasts for years if left untreated.[17] In most of these patients, concerns about appearance are concentrated on the head and face.[18] Because patients do not understand the true nature of their problem, they often seek non-psychiatric and cosmetic treatments.[18] Dentistry is among such cosmetic fields: mostly, dentists might be asked by BDD patients for tooth whitening, jaw surgery, and braces while orthodontic concerns might be tooth size, upper and lower midlines, rotations, and spacing.[8,19] Most BDD patients who receive regular dental or orthodontic treatments are dissatisfied with the results and frequently seek out other dentists and orthodontists.[8] Therefore, psychological evaluation and expectations of patients seeking orthodontic treatment is an important and therefore vital part of the overall evaluation.[8]

The prevalence of BDD might be about 0.7% to 2.4% in the general population.[20] However, BDD can be more prevalent in some clinical settings, especially in cosmetic treatments (e.g., 9% to 12% in dermatology settings and 3% to 53% in cosmetic surgery settings).[8,20,21] In orthodontic settings, there is not enough evidence in this regard, as there are only 3 studies on BDD,[8,12,18] two of which had sample sizes of 40 and 270 patients only,[12,18]

and all of them had used only the first 3 items of the BDD questionnaire (out of the 12-item questionnaire) for BDD diagnosis.[8,18] The prevalence of BDD in orthodontic patients was reported to be 7.5%,[12] 5.5%,[18] and 5.2%.[8]

Moreover, there is no study on the associations between BDD diagnosis or BDD severity and orthodontic treatment need. Orthodontic treatment need can be assessed by an orthodontist based on departures from the standardized norm (such as the index of orthodontic treatment need [IOTN][3,22]) or be self-perceived by the patient (which is the case in BDD patients). In this regard, the assessment of correlations between these normative and self-perceived aspects has obvious service-related implications, since the treatment need is commonly determined by clinical examination.[3,22]

This study was conducted because there was no study on the associations between orthodontic treatment need with BDD diagnosis or BDD severity. Our aim was to examine the associations across the dental health component of IOTN (IOTN-DHC), BDD, age, sex, and other potentially associated factors. The null hypotheses were the lack of any associations between any of the variables (IOTN-DHC, BDD, age, sex, level of education, and marital status). The main aim was to examine if there was any association between BDD and IOTN-DHC.

MATERIALS AND METHODS

This multicenter, epidemiological, and analytical cross-sectional study was performed on orthodonticpatients visiting seven private orthodontic clinics in two cities, Babol and Sari, Iran, during 2020–2021. The inclusion criterion was orthodontic patients over 12 years of age willing to participate in the study. The exclusion criteria were patients with any history of previous orthodontic treatment, patients with skeletal abnormalities, craniofacial syndromes, cleft lip and palate, and skeletal malocclusions requiring orthosurgical treatment and also illiterate people and those who were unable or unwilling to fill out the questionnaire. The protocol was first approved by the Research Ethics Committee of Mazandaran University of Medical Sciences before beginning the study (Ethics Code: IR.MAZUMS.REC.1399.8791). Initially, the purpose of the study and its steps were completely explained to all participants (and/or their parents) by a final year dental student, and patients were assured that their information would remain confidential. All patients and/or their parents filled out and signed written consents.

Data collection

Demographic information of patients (age, sex, level of education, and marital status) as well as history of previous orthodontic consultations[8,19] were recorded.

To assess the severity of the malocclusion, the IOTN-

DHC was examined clinically under the light of a dental unit, by an experienced orthodontist at each office (a total of 7 orthodontists). The score 1 indicated no treatment need; 2 meant mild treatment need; the score 3 specified a moderate need; the score 4 indicated a severe need; and 5 meant a definite need for treatment.[3,4,23]

The questionnaire used in this study was a translation of the English questionnaire, which had high validity and reproducibility for Persian-language participants.[24] The self-report version of the Yale-Brown Obsessive-Compulsive Scale modified for Body Dysmorphic Disorder (BDD-YBOCS) questionnaire consisted of 12 questions designed for body deformity and used in a variety of anomalies.[25] This questionnaire was about (1) obsessive thoughts (questions 1 to 5) and (2) compulsive behaviors (questions 6 to 10). There were also two additional questions about avoidance (question 11) and insight (question 12). The items 1 to 12 were respectively "(1) time preoccupied with thoughts, (2) interference due to thoughts, (3) distress due to thoughts, (4) resistance against thoughts, (5) control over thoughts, (6) time spent in behaviors, (7) interference due to behaviors, (8) distress due to behaviors, (9) resistance against behaviors, (10) control over behaviors, (11) insight, and (12) avoidance".[26] Respondents indicated their agreement with selecting each of the responses on the Likert scale: (0) strongly disagree, (1) disagree, (2) have no opinion, (3) agree, and (4) strongly agree.

Studies on the reliability and validity of the Yale-Brown BDD-YBOCS obsessive-compulsive disorder questionnaire show that this tool is suitable for measuring BDD symptoms. Phillips et al.[25] reported that reliability of the retest type was appropriate in the one-week period (r = 0.88). Cronbach's alpha coefficient for internal consistency was 0.80, which indicates the high internal consistency of this scale. Diagnostic validity was appropriate compared to the Brief Psychiatric Rating Scale. In addition, this tool can assess the improvement of symptoms after treatment. Although there is no cut-off point for BDD diagnosis, it has been suggested that a score equal to or above 20 be determined for BDD diagnosis.[25,27-30]

It is suggested by Phillips[31] that the first three questions are related to the diagnostic criteria of BDD and the rest of the questions focus on determining the severity of symptoms. According to them, the sum of the first 3 questions might to some extent reflect the overall score of the 12 questions. According to them, a score of 3 on the first three items indicate the absence of BDD, a score of 4–5 on the first three items indicated mild BDD, a score of 6 on the first three items indicated mild-to-moderate BDD, a score of 7 on the first three items indicated moderate BDD, a score of 8 on the first three items meant moderate-to-severe BDD, a score of 9 on the first three items meant severe BDD, 10 on the first three items indicated severe to extremely severe BDD, and 11 indicated extremely severe BDD, respectively.[8,25,31] It is suggested that the score of 5 on the first three questions might be roughly equivalent to a 20 on the full version, a 6 on the first three items might be roughly equivalent to a 24, a 7 on the first three items might be similar to a 28, an 8 on the first three items to a 32, a 9 on the first three items to a 36, a 10 on the first three items to a 40, an 11 on the first three items to a 44, and a 12 on the first three items to a 48 (the highest possible score).[25,31] The scores of the 12 questions were added and a total score equal to or above 20 was a definite indication of BDD.[25,31]

Many studies have used merely this 3-item BDD diagnosis system (only the first 3 items) for diagnosis and determining the prevalence of BDD.[8,18] Because of this, we used both methods of BDD diagnosis in this study (i.e., using all the 12 items and also using only the first 3 items).

Statistical analyses

Descriptive statistics were calculated. The prevalence rates of BDD based on the full BDD questionnaire and its first 3 items were calculated separately. The sexes and BDD-positive and BDD-negative patients were compared in terms of age, marital status, history of previous orthodontic visit, IOTN, and BDD scores using unpaired t-test, chi-squared, Fisher exact, and Mann–Whitney U tests. Spearman correlation coefficient was used to estimate correlations among the variables. A multiple linear regression was used to assess the effects of IOTN, sex, age, marriage status, and education level on the overall BDD score (the sum of 12 items and that of the first 3 items). The effects of these variables on BDD-positive and BDD-negative diagnosis were also assessed using a multiple binary logistic regression. Spearman correlation coefficient was used to evaluate correlations between the 3- and 12-item BDD scores as well as between the dichotomized diagnoses based on the 3- and 12-item BDD questionnaires. The level of significance was set at 0.05 The statistical analyses were performed using SPSS version 25.0 (IBM, Armonk, NY, USA).

RESULTS

Sample

A total of 735 patients were examined during 2020–2021, but 36 of them did not have perfectly completed IOTN or BDD questionnaires resulting in n = 699 included subjects. Only a small part of the sample (n = 54) was consisted of patients under 18 years old (n of subjects at the ages 13: 8, 14: 7, 15: 9, 16: 13, 17: 17). Only 21 and 19 cases were 18 and 19 years old, respectively.

Of the included 699 patients, 477 (68.2%) were female and 222 (31.8%) were male. Also 430 (61.5%) were single and 269 (38.5%) were married. Of females and males, 230 (48.2%) and 39 (17.6%) were married, respectively (Fisher test, $p < 0.001$). Of the subjects, 93 (13.3%), 277 (39.6%), and 329 (47.1%) did not have a high-school diploma, had diploma only, and were university students or graduates, respectively. These numbers were 56, 194, and 227 for females and 37, 83, and 102 for males (chi-square test, $p = 0.196$). Of the females, 77 (16.1%) had a previous history of orthodontic consultation; this was 17 (7.7%) for males (Fisher test, $p = 0.001$). Patients' mean age was 24.72 ± 5.71 years (range: 13–39). It was 24.95 ± 5.73 and 24.23 ± 5.640 for females and males, respectively (t-test, $p = 0.116$).

Orthodontic treatment need

Most patients had a mild or moderate treatment need (IOTN-DHC scores = 2 and 3, Figure 1, Tables 1 and 2). There was no difference between IOTN scores of males and females (Figure 1, Tables 1 and 2). None of the factors: age, sex, marital status, and education level were associated with IOTN-DHC (Table 3). However, a history of previous orthodontic consultation was slightly and negatively associated with IOTN scores.

BDD prevalence and severity

Based on the full BDD questionnaire (all 12 items), it was found that only 2.86% of the assessed orthodontic patients had BDD (2.15% mild + 0.57% mild to moderate + 0.14% moderate, Figure 1). However, based on the 3 first items only, 17.02% of the orthodontic patients had BDD (14.02% mild, 1.72% mild-to-moderate, 0.86% moderate, 0.29% moderate-to-severe, and 0.14% severe-to-extremely severe, Figure 2).

Role of sex in BDD scores

In the case of the BDD questions related to compulsive behavior as well as the last obsessive thought item, there were significant differences between sexes (Tables 1 and 2). According to the Mann–Whitney U test, the sexes differed significantly in terms of the overall BDD score but not when comparing only their sum of the first 3 BDD items (Figures 2 and 3, Table 2). The sexes did not show any significant difference in terms of 'the first 4 BDD items related to obsessive thoughts, and the items related to avoidance and insight' (Tables 1 and 2).

Correlations among all variables

The Spearman correlation coefficient (Table 3) showed a strong significant positive correlation between the total BDD score (all 12 scores) and the BDD score of the 3 first items. Female sex was moderately correlated with higher BDD scores calculated from all 12 items, but not with the BDD score calculated from the first 3 items. Lower IOTN scores were weakly but significantly correlated with higher full-BDD scores and 3-item BDD scores. Married people were significantly but weakly more likely to have full-BDD. A history of previous orthodontic consultation was positively and moderately correlated with higher BDD scores. The existence of such a history was also weakly correlated with lower IOTN scores (Table 3). Age was not correlated with any BDD questions or their sum (Figure 4, Table 3).

Multivariable analyses of factors influencing BDD score

The multiple linear regression (adjusted r square = 0.143, F = 24.35, $p < 0.001$) identified only the 2 variables female sex (rather moderately) and lower IOTN scores (weakly) to be associated with higher full-12-item BDD scores (Table 4). The regression (adjusted r square = 0.025, F = 4.537, $p < 0.001$) also detected only lower IOTN scores to be weakly associated with higher BDD scores calculated from the first 3 items only (Table 4).

Factors associated with binary BDD diagnosis: bivariable analyses

After dichotomizing the sample to BDD-negative and
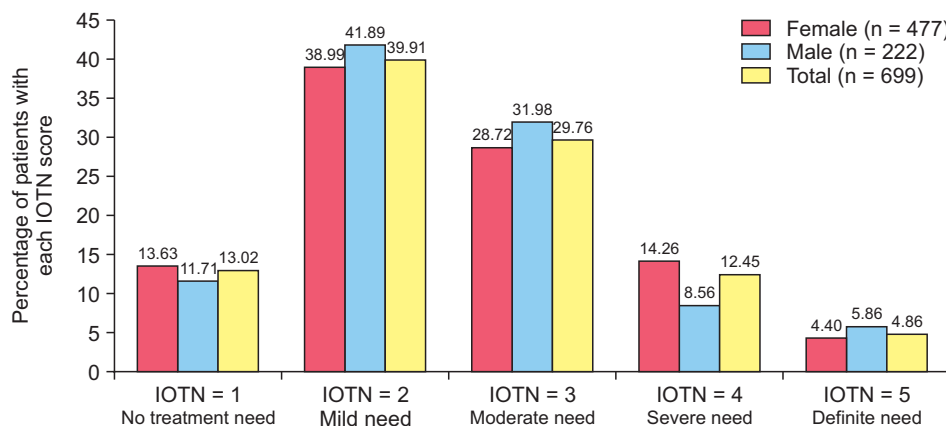
Figure 1. A bar chart showing the percentages of different IOTN scores in females (n = 477), males (n = 222), and the total population (n = 699). IOTN, index of orthodontic treatment need.

Table 1. Net frequency and percentage of the IOTN and BDD scores in females, males, and the total population, as well as statistical comparisons of the sexes

Field	Item	Sex	Net frequency					Percentage					*p*-value
			A	B	C	D	E	A	B	C	D	E	
Treatment need	IOTN	Female	65	186	137	68	21	13.6	39.0	28.7	14.3	4.4	0.207
		Male	26	93	71	19	13	11.7	41.9	32.0	8.6	5.9	
		Total	91	279	208	87	34	13.0	39.9	29.8	12.4	4.9	
Obsessive thoughts	BDD1	Female	5	388	74	9	1	1.0	81.3	15.5	1.9	0.2	0.893
		Male	3	178	38	3	-	1.4	80.2	17.1	1.4	-	
		Total	8	566	112	12	1	1.1	81.0	16.0	1.7	0.1	
	BDD2	Female	193	216	65	2	1	40.5	45.3	13.6	0.4	0.2	0.291
		Male	101	101	20	-	-	45.5	45.5	9.0	-	-	
		Total	294	317	85	2	1	42.1	45.4	12.2	0.3	0.1	
	BDD3	Female	215	227	29	6	-	45.1	47.6	6.1	1.3	-	0.640
		Male	107	103	11	1	-	48.2	46.4	5.0	0.5	-	
		Total	322	330	40	7	-	46.1	47.2	5.7	1.0	-	
	BDD4	Female	5	472	-	-	-	1.0	99.0	-	-	-	0.714*
		Male	3	219	-	-	-	1.4	98.6	-	-	-	
		Total	8	691	-	-	-	1.1	98.9	-	-	-	
	BDD5	Female	38	345	80	14	-	8.0	72.3	16.8	2.9	-	< 0.001
		Male	32	183	7	-	-	14.4	82.4	3.2	-	-	
		Total	70	528	87	14	-	10.0	75.5	12.4	2.0	-	
Compulsive behavior	BDD6	Female	114	285	72	6	-	23.9	59.7	15.1	1.3	-	< 0.001
		Male	195	22	5	-	-	87.8	9.9	2.3	-	-	
		Total	309	307	77	6	-	44.2	43.9	11.0	0.9	-	
	BDD7	Female	171	244	62	-	-	35.8	51.2	13.0	-	-	< 0.001
		Male	216	4	2	-	-	97.3	1.8	0.9	-	-	
		Total	387	248	64	-	-	55.4	35.5	9.2	-	-	
	BDD8	Female	208	201	68	-	-	43.6	42.1	14.3	-	-	< 0.001
		Male	202	16	4	-	-	91.0	7.2	1.8	-	-	
		Total	410	217	72	-	-	58.7	31.0	10.3	-	-	
	BDD9	Female	245	121	79	32	-	51.4	25.4	16.6	6.7	-	< 0.001
		Male	204	13	4	1	-	91.9	5.9	1.8	0.5	-	
		Total	449	134	83	33	-	64.2	19.2	11.9	4.7	-	
	BDD10	Female	180	229	68	-	-	37.7	48.0	14.3	-	-	< 0.001
		Male	166	52	4	-	-	74.8	23.4	1.8	-	-	
		Total	346	281	72	-	-	49.5	40.2	10.3	-	-	
Avoidance	BDD11	Female	447	28	2	-	-	93.7	5.9	0.4	-	-	0.278
		Male	214	8	-	-	-	96.4	3.6	-	-	-	
		Total	661	36	2	-	-	94.6	5.2	0.3	-	-	

BDD-positive groups (on the basis of the 3-item questionnaire used in all previous orthodontic studies), it was found that age was not associated with BDD, but IOTN, sex, and the history of previous orthodontic consultation were associated with BDD (Table 5).

Table 1. Continued

Field	Item	Sex	Net frequency					Percentage					*p*-value
			A	B	C	D	E	A	B	C	D	E	
Insight	BDD12	Female	426	41	10	-	-	89.3	8.6	2.1	-	-	0.081
		Male	209	12	1	-	-	94.1	5.4	0.5	-	-	
		Total	635	53	11	-	-	90.8	7.6	1.6	-	-	

The letters 'A to E' denote the scores "1 to 5" for IOTN and "0 to 4" for BDD questions.
The chi-square used for all analyses except the one marked using an asterisk (BDD4), for which, the Fisher exact test was used.
The items 1 to 12 for BDD were respectively "(1) time preoccupied with thoughts, (2) interference due to thoughts, (3) distress due to thoughts, (4) resistance against thoughts, (5) control over thoughts, (6) time spent in behaviors, (7) interference due to behaviors, (8) distress due to behaviors, (9) resistance against behaviors, (10) control over behaviors, (11) insight, and (12) avoidance".
IOTN, index of orthodontic treatment need; BDD, body dysmorphic disorder.

Table 2. Descriptive and inferential statistics calculated for IOTN and BDD items in females, males, and the total population

Item	Total (n = 699)					Female (n = 477)					Male (n = 222)					*p*-value
	Mean	SD	Min	Max	Med	Mean	SD	Min	Max	Med	Mean	SD	Min	Max	Med	
IOTN	2.56	1.02	1	5	2	2.57	1.03	1	5	2	2.55	1.00	1	5	2	0.786
BDD1	1.19	0.47	0	4	1	1.19	0.47	0	4	1	1.18	0.45	0	3	1	0.889
BDD2	0.71	0.70	0	4	1	0.75	0.72	0	4	1	0.64	0.64	0	2	1	0.080
BDD3	0.62	0.64	0	3	1	0.64	0.66	0	3	1	0.58	0.61	0	3	1	0.341
BDD4	0.99	0.11	0	1	1	0.99	0.10	0	1	1	0.99	0.12	0	1	1	0.726
BDD5	1.06	0.55	0	3	1	1.15	0.59	0	3	1	0.89	0.40	0	2	1	< 0.001
BDD6	0.69	0.70	0	3	1	0.94	0.66	0	3	1	0.14	0.41	0	2	0	< 0.001
BDD7	0.54	0.66	0	2	0	0.77	0.66	0	2	1	0.04	0.23	0	2	0	< 0.001
BDD8	0.52	0.68	0	2	0	0.71	0.70	0	2	1	0.11	0.36	0	2	0	< 0.001
BDD9	0.57	0.88	0	3	0	0.79	0.95	0	3	0	0.11	0.40	0	3	0	< 0.001
BDD10	0.61	0.67	0	2	1	0.77	0.68	0	2	1	0.27	0.48	0	2	0	< 0.001
BDD11	0.06	0.24	0	2	0	0.07	0.27	0	2	0	0.04	0.19	0	1	0	0.143
BDD12	0.11	0.36	0	2	0	0.13	0.39	0	2	0	0.06	0.26	0	2	0	0.036
BDD All	7.65	4.75	0	30	6	8.87	5.00	0	30	8	5.04	2.75	0	18	4	< 0.001
BDD 1-3	2.52	1.29	0	10	2	2.57	1.36	0	10	2	2.40	1.14	0	7	2	0.257

The *p*-values are calculated using the Mann–Whitney *U* test, comparing males and females.
The items 1 to 12 for BDD were respectively "(1) time preoccupied with thoughts, (2) interference due to thoughts, (3) distress due to thoughts, (4) resistance against thoughts, (5) control over thoughts, (6) time spent in behaviors, (7) interference due to behaviors, (8) distress due to behaviors, (9) resistance against behaviors, (10) control over behaviors, (11) insight, and (12) avoidance".
IOTN, index of orthodontic treatment need; BDD, body dysmorphic disorder; BDD All, the BDD score calculated by summing scores of the 12 BDD items; BDD 1-3, the BDD score calculated by summing scores of the first 3 BDD questions; SD, standard deviation; Min, minimum; Max, maximum; Med, median.

Factors associated with binary BDD diagnosis: multivariable analyses

The multiple logistic regression showed that married people and people with lower IOTN scores might have higher odds of having BDD (diagnosed based on the first 3 items only, Table 6). None of the assessed variables was associated with the dichotomized 12-item BDD odds ratio (Table 6).

Correlations between binary BDD diagnoses based on 3-item and 12-item questionnaires

The correlation between BDD diagnoses based on the 3-item and 12-item BDD questionnaires was weak (Spearman Rho = 0.379, *p* < 0.001).

Table 3. Spearman correlation coefficients among the assessed items (n = 699 for each coefficient)

		Age	Sex	Marriage	Education	Visit	IOTN	BDD1	BDD2	BDD3	BDD4	BDD5	BDD6	BDD7	BDD8	BDD9	BDD10	BDD11	BDD12	BDD All	BDD 1-3
Age	Rho		-0.064	0.423	0.434	-0.011	0.034	-0.052	-0.016	0.018	-0.004	0.012	0.030	0.002	0.020	0.016	-0.001	-0.022	-0.061	0.004	-0.020
	p		0.090	<0.001	<0.001	0.763	0.374	0.174	0.667	0.643	0.919	0.742	0.426	0.963	0.589	0.681	0.973	0.557	0.107	0.913	0.590
Sex	Rho	-0.064		-0.293	-0.036	-0.116	-0.010	0.005	-0.066	-0.036	-0.013	-0.220	-0.569	-0.557	-0.439	-0.391	-0.353	-0.055	-0.079	-0.426	-0.043
	p	0.090		<0.001	0.346	0.002	0.787	0.889	0.080	0.341	0.726	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.143	0.036	<0.001	0.257
Marriage	Rho	0.423	-0.293		0.260	0.093	0.037	0.036	0.045	0.017	0.002	0.121	0.206	0.191	0.157	0.142	0.107	0.057	0.066	0.159	0.029
	p	<0.001	<0.001		<0.001	0.014	0.326	0.342	0.239	0.649	0.954	0.001	<0.001	<0.001	<0.001	<0.001	0.005	0.129	0.079	<0.001	0.449
Education	Rho	0.434	-0.036	0.260		-0.009	<0.001	-0.008	-0.010	-0.003	0.003	0.006	0.016	0.034	0.050	0.053	0.002	-0.011	-0.002	0.017	-0.014
	p	<0.001	0.346	<0.001		0.809	0.993	0.832	0.799	0.933	0.946	0.878	0.680	0.366	0.190	0.159	0.962	0.771	0.952	0.658	0.710
Visit	Rho	-0.011	-0.116	0.093	-0.009		-0.100	0.630	0.416	0.406	0.042	0.341	0.416	0.328	0.373	0.351	0.321	0.516	0.605	0.490	0.589
	p	0.763	0.002	0.014	0.809		0.008	<0.001	<0.001	<0.001	0.263	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
IOTN	Rho	0.034	-0.010	0.037	<0.001	-0.100		-0.141	-0.178	-0.078	0.052	-0.053	-0.056	-0.020	-0.019	-0.044	-0.015	-0.053	-0.060	-0.115	-0.245
	p	0.374	0.787	0.326	0.993	0.008		<0.001	<0.001	0.039	0.168	0.159	0.137	0.597	0.613	0.243	0.692	0.164	0.113	0.002	<0.001
BDD1	Rho	-0.052	0.005	0.036	-0.008	0.630	-0.141		0.300	0.217	0.113	0.315	0.336	0.251	0.302	0.301	0.322	0.394	0.485	0.456	0.576
	p	0.174	0.889	0.342	0.832	<0.001	<0.001		<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD2	Rho	-0.016	-0.066	0.045	-0.010	0.416	-0.178	0.300		0.123	0.118	0.338	0.360	0.284	0.345	0.313	0.306	0.291	0.389	0.549	0.761
	p	0.667	0.080	0.239	0.799	<0.001	<0.001	<0.001		0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD3	Rho	0.018	-0.036	0.017	-0.003	0.406	-0.078	0.217	0.123		0.113	0.271	0.274	0.213	0.262	0.235	0.239	0.280	0.353	0.434	0.642
	p	0.643	0.341	0.649	0.933	<0.001	0.039	<0.001	0.001		0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD4	Rho	-0.004	-0.013	0.002	0.003	0.042	0.052	0.113	0.118	0.113		0.170	0.047	0.094	0.016	0.078	0.104	0.026	0.034	0.181	0.192
	p	0.919	0.726	0.954	0.946	0.263	0.168	0.003	0.002	0.003		<0.001	0.219	0.013	0.665	0.039	0.006	0.496	0.367	<0.001	<0.001
BDD5	Rho	0.012	-0.220	0.121	0.006	0.341	-0.053	0.315	0.338	0.271	0.170		0.482	0.470	0.425	0.476	0.422	0.232	0.256	0.592	0.421
	p	0.742	<0.001	0.001	0.878	<0.001	0.159	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD6	Rho	0.030	-0.569	0.206	0.016	0.416	-0.056	0.336	0.360	0.274	0.047	0.482		0.818	0.799	0.697	0.693	0.287	0.354	0.860	0.434
	p	0.426	<0.001	<0.001	0.680	<0.001	0.137	<0.001	<0.001	<0.001	0.219	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD7	Rho	0.002	-0.557	0.191	0.034	0.328	-0.020	0.251	0.284	0.213	0.094	0.470	0.818		0.683	0.753	0.648	0.238	0.270	0.794	0.338
	p	0.963	<0.001	<0.001	0.366	<0.001	0.597	<0.001	<0.001	<0.001	0.013	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD8	Rho	0.020	-0.439	0.157	0.050	0.373	-0.019	0.302	0.345	0.262	0.016	0.425	0.799	0.683		0.789	0.801	0.255	0.341	0.822	0.414
	p	0.589	<0.001	<0.001	0.190	<0.001	0.613	<0.001	<0.001	<0.001	0.665	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BDD9	Rho	0.016	-0.391	0.142	0.053	0.351	-0.044	0.301	0.313	0.235	0.078	0.476	0.697	0.753	0.789		0.786	0.250	0.325	0.802	0.377
	p	0.681	<0.001	<0.001	0.159	<0.001	0.243	<0.001	<0.001	<0.001	0.039	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001

Table 3. Continued

		Age	Sex	Marriage	Education	Visit	IOTN	BDD1	BDD2	BDD3	BDD4	BDD5	BDD6	BDD7	BDD8	BDD9	BDD10	BDD11	BDD12	BDD All	BDD 1-3
BDD10	Rho	−0.001	−0.353	0.107	0.002	0.321	−0.015	0.322	0.306	0.239	0.104	0.422	0.693	0.648	0.801	0.786		0.255	0.312	0.809	0.383
	p	0.973	<0.001	0.005	0.962	<0.001	0.692	<0.001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
BDD11	Rho	−0.022	−0.055	0.057	−0.011	0.516	−0.053	0.394	0.291	0.280	0.026	0.232	0.287	0.238	0.255	0.250	0.255		0.565	0.339	0.374
	p	0.557	0.143	0.129	0.771	<0.001	0.280	<0.001	<0.001	<0.001	0.496	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
BDD12	Rho	−0.061	−0.079	0.066	−0.002	0.605	−0.060	0.485	0.389	0.353	0.034	0.256	0.354	0.270	0.341	0.325	0.312	0.565		0.434	0.491
	p	0.107	0.036	0.079	0.952	<0.001	0.113	<0.001	<0.001	<0.001	0.367	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001
BDD All	Rho	0.004	−0.426	0.159	0.017	0.490	−0.115	0.456	0.549	0.434	0.181	0.592	0.860	0.794	0.822	0.802	0.809	0.339	0.434		0.692
	p	0.913	<0.001	<0.001	0.658	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
BDD 1-3	Rho	−0.020	−0.043	0.029	−0.014	0.589	−0.245	0.576	0.761	0.642	0.192	0.421	0.434	0.338	0.414	0.383	0.374	0.491	0.491	0.692	
	p	0.590	0.257	0.449	0.710	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	

Positive correlations for sex favored males; positive correlations for marital status favored married people; positive correlations for education favored higher ranks; positive correlations for visit (any history of orthodontic consultation) favored the presence of such visits.
The items 1 to 12 for BDD were respectively "(1) time spent preoccupied with thoughts, (2) interference due to thoughts, (3) distress due to thoughts, (4) resistance against thoughts, (5) control over thoughts, (6) time spent in behaviors, (7) interference due to behaviors, (8) distress due to behaviors, (9) resistance against behaviors, (10) control over behaviors, (11) insight, and (12) avoidance".
IOTN, index of orthodontic treatment need; BDD, body dysmorphic disorder; BDD All, the BDD score calculated by summing scores of the 12 BDD items; BDD 1-3, the BDD score calculated by summing scores of the first 3 BDD questions.

DISCUSSION

Overall, there might be a slight (but statistically significant) negative association between BDD and IOTN-DHC; i.e., milder orthodontic cases might be slightly more prone to BDD; or perhaps, patients with BDD tend to attend orthodontic clinics even for milder treatment needs. Future studies are warranted in this regard. Our results in terms of treatment need complied with those of many previous studies.[3,30,32-35] Also similar to some previous studies[3,35] but unlike some others,[1,36] we did not find associations between treatment need with age or sex.

We found that although there was a strong positive correlation between the 3-item and 12-item BDD scores, it was merely about 70%, and that there was a big difference between the results of the two. But more importantly, the correlation between the dichotomized diagnoses based on each of these two BDD questionnaires was quite weak (only 38%). Therefore, we cannot agree much with the suggestion of Phillips[31] regarding the results of the first three questions reflecting those of the whole questionnaire, especially in terms of binary diagnoses (used in many previous studies). Therefore, it might be better to use both diagnosis methods or to devise more comprehensive questionnaires.

Based on all the 12 items, we found that BDD might exist in 2.86% of orthodontic patients, which was slightly greater than the general population[20] but lower than cosmetic patients.[8,20,21] Based on the 3 items of the BDD questionnaire, which had been used by all three studies conducted on BDD in orthodontics, we estimated that 17% of orthodontic patients had BDD. This was much higher than the prevalence rates reported in orthodontic patients of other populations, being 5.2 to 7.5%.[8,12,18] However, it was identical to the prevalence of BDD found in outpatient orthognathic surgery patients (17%).[37] Without more studies on orthodontic patients, it is difficult to understand the reason for the controversy. However, methodological reasons might play a role, as two of these studies had very small or rather small sample sizes, which might have influenced their results. Besides, socio-economic variables of different populations might matter in self-evaluation.[3] Another contributing factor might be the statistical analyses in use. Almost all previous studies had used bivariable statistics, and most of them had dichotomized the cases into BDD-positive and BDD-negative groups. Our research showed that using multivariable statistics as well as using the whole range of BDD scores (instead of binary BDD-positive or -negative diagnoses) might yield different results in some aspects.

In this study, age did not have any influence on BDD scores. There is dispute whether age can influence self-evaluation[3] or cannot.[36] One of the three previous stud-
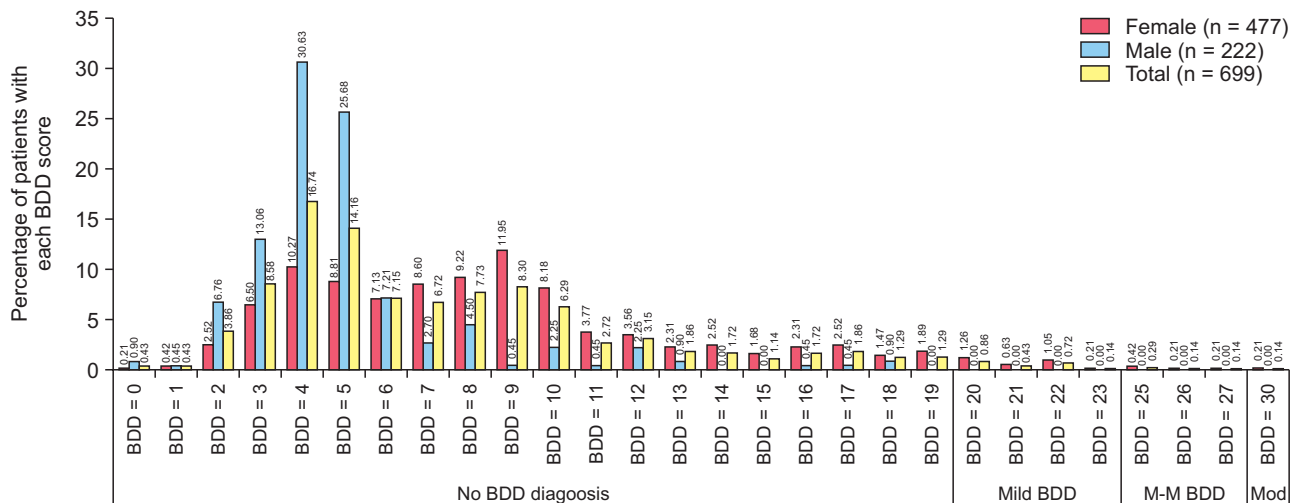
Figure 2. A bar chart showing the percentages of different "overall" BDD scores (calculated by summing up scores of the 12 questions) in females (n = 477), males (n = 222), and the total population (n = 699).
BDD, body dysmorphic disorder; M-M BDD, mild-to-moderate BDD; Mod, moderate BDD.
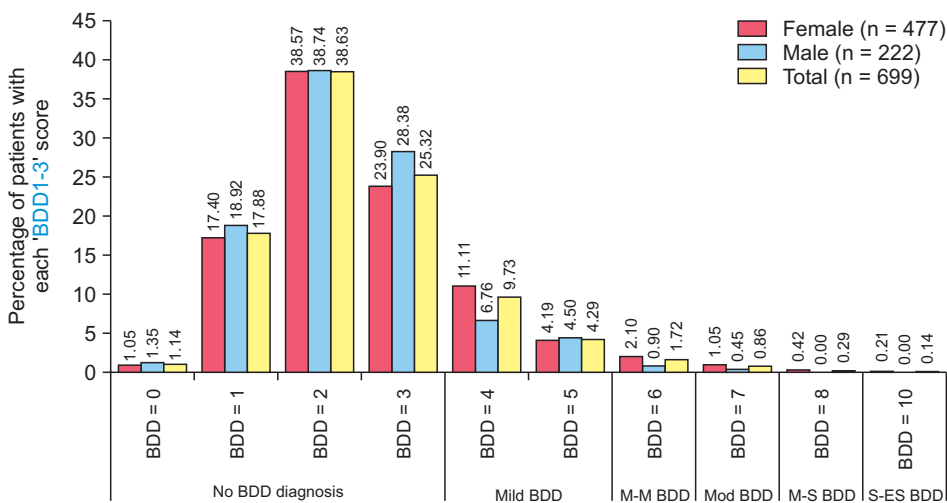
Figure 3. A bar chart showing the percentages of different "3-item" BDD scores (calculated by summing up scores of the first 3 items) in females (n = 477), males (n = 222), and the total population (n = 699).
BDD, body dysmorphic disorder; M-M BDD, mild-to-moderate BDD; Mod BDD, moderate BDD; M-S BDD, moderate to severe BDD; S-ES BDD, severe to extremely severe BDD.
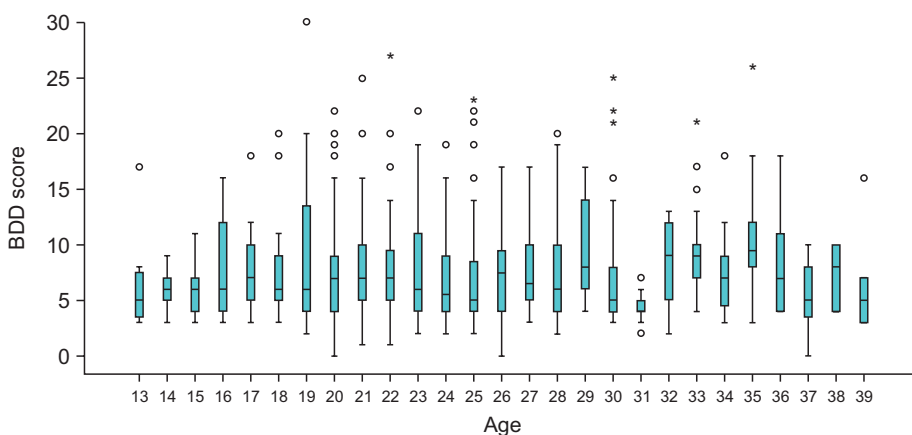
Figure 4. Box plots showing "overall 12-item" BDD scores at each assessed age. Circles and stars respectively mark outliers and extreme values. BDD, body dysmorphic disorder.

Table 4. Results of the multiple linear regressions

DV	IV	B	SE	β	*p*-value
BDD All	(Constant)	10.228	0.901		0.000
	Age	−0.036	0.035	−0.044	0.293
	Sex	−3.675	0.375	−0.360	< 0.001
	IOTN	−0.322	0.163	−0.069	0.050
	Marriage	0.611	0.394	0.063	0.121
	Education	0.033	0.268	0.005	0.901
BDD 1-3	(Constant)	3.260	0.262		0.000
	Age	−0.007	0.010	−0.033	0.456
	Sex	−0.130	0.109	−0.047	0.234
	IOTN	−0.195	0.047	−0.154	< 0.001
	Marriage	0.182	0.114	0.069	0.112
	Education	−0.038	0.078	−0.021	0.621

Positive regression coefficients for sex favored males; positive regression coefficients for marital status favored married people; positive regression coefficients for education favored higher ranks.
DV, dependent variable; IV, independent variable; B, unstandardized coefficient; SE, standard error for B; β, standardized coefficient; BDD, body dysmorphic disorder; BDD All, the BDD score calculated by summing scores of the 12 BDD items; BDD 1-3, the BDD score calculated by summing scores of the first 3 BDD questions; IOTN, index of orthodontic treatment need.

Table 5. Comparing the net frequency (and percentage) of characteristics of cases with or without BDD, calculated based on the first three questions

Variables		BDD 1-3 diagnosis		*p*-value
		No	Yes	
Age		24.84 ± 5.82	24.14 ± 5.13	0.224*
IOTN		2.61 ±1.01	2.34 ± 1.04	0.008*
Sex	Female	386 (80.9)	91 (19.1)	0.040†
	Male	194 (87.4)	28 (12.6)	
Marriage	Single	367 (85.3)	63 (14.7)	0.039†
	Married	213 (79.2)	56 (20.8)	
Education	Student	78 (83.9)	15 (16.1)	0.841‡
	Diploma	227 (81.9)	50 (18.1)	
	Academic	275 (83.6)	54 (16.4)	
Visit	No	577 (95.4)	28 (4.6)	< 0.001†
	Yes	3 (3.2)	91 (96.8)	
IOTN	1	69 (75.8)	22 (24.2)	0.010‡
	2	222 (79.6)	57 (20.4)	
	3	183 (88)	25 (12)	
	4	79 (90.8)	8 (9.2)	
	5	27 (79.4)	7 (20.6)	

Values are presented as mean ± standard deviation or number (%).
BDD, body dysmorphic disorder; BDD 1-3, the BDD score calculated by summing scores of the first 3 BDD questions; IOTN, index of orthodontic treatment need.
*The unpaired *t*-test was performed.
†The Fisher exact test was performed.
‡The chi-square test was performed.

Table 6. The results of the multiple binary logistic regressions

DV	IV	B	SE	*p*-value	OR
BDD All	Sex	−17.844	2,675.542	0.995	0.000
	Marriage	0.763	0.540	0.158	2.144
	Education	−0.151	0.382	0.692	0.860
	Age	−0.044	0.048	0.360	0.957
	IOTN	0.219	0.217	0.312	1.245
	Constant	−2.688	1.270	0.034	0.068
BDD 1-3	Sex	−0.354	0.246	0.150	0.702
	Marriage	0.554	0.241	0.022	1.740
	Education	−0.018	0.166	0.914	0.982
	Age	−0.041	0.023	0.074	0.960
	IOTN	−0.274	0.106	0.010	0.761
	Constant	−0.005	0.567	0.993	0.995

Positive regression coefficients for sex favored males; Positive regression coefficients for marital status favored married people; Positive regression coefficients for education favored higher ranks.
DV, dependent variable; IV, independent variable; B, unstandardized coefficient; SE, standard error for B; OR, odds ratio; BDD, body dysmorphic disorder; BDD All, the BDD score calculated by summing the scores of all the 12 BDD items; BDD 1-3, the BDD score calculated by summing the scores of the first 3 BDD questions; IOTN, index of orthodontic treatment need.

ies on BDD in orthodontic patients showed that age might not be associated with BDD[8]; however, another one showed the opposite.[18] This might be due to various factors such as different included age ranges or different socioeconomic statuses.

In the present study, females had a higher chance of having BDD. This result was similar to that of most previous studies.[17,18,38-41] However, a few studies found greater prevalence in males (especially the recent one in orthodontic patients),[8,37,42] and a few others found no difference between the sexes.[43] Some of such differences might be attributable to referral bias, eligibility criteria, and BDD severity.[12,40,44] Also, as shown in this study, females and males tend to differ mostly in certain areas of the obsessive-compulsive domain and not all of the domains.

The current study showed a higher rate of BDD among married patients compared to single ones, which was in contrast to the results of all previous studies conducted in this regard.[8,12,18,45] Again, several population characteristics might account for the dispute. Furthermore, a history of previous visit was associated with higher BDD odds, which was in line with previous studies.[8,18]

This study might have some limitations. It would be ideal to diagnose BDD based on full psychiatric evaluation by an experienced psychiatrist. Nevertheless, in all studies on screening and epidemiological research, it is not technically possible to conduct this evaluation as it is time-consuming. Therefore, all studies use such validated screening tools.[14] It might be argued that the inclusion of 54 patients younger than 18 might have confounded the results, as according to some personal opinions, such young patients might not have developed realistic self-images yet and thus might show an inflated rate of BDD. However, our findings showed that this is not the case at all and age might not be associated with the BDD scores considerably. Moreover, regardless of young patients' age, their self-image and concerns still matter and should be taken into account while planning the treatment. Finally, the number of such cases was quite small compared to the sample. Another limitation was the lack of the esthetic components of IOTN (IOTN-AC and IOTN-ACE).[3] While the IOTN-DHC is used to determine the nature and severity of a patient's malocclusion, the IOTN-AC/ACE are used to assess the level of dental attractiveness.[3] Although the IOTN-AC/ACE are subjective, they still may be more relevant to appearance. As stated in the introduction section, people with BDD have persistent concerns about one or more defects in their appearance, not necessarily their function or health. Therefore, it would be better if we had included IOTN-AC and IOTN-ACE. This study had advantages over previous studies in terms of its large sample, 12-item BDD diagnosis, multivariable statistics, not limiting itself to dichotomized diagnosis of BDD, and examining the association between 3- and 12-item BDD scores.

CONCLUSIONS

The BDD prevalence in orthodontic patients was 17% and 2.86% based on the 3- and 12-item questionnaires, respectively. It is better to use both, 12- and 3-item diagnosis methods, rather than relying on the 3-item questionnaire only. There was a slight negative link between orthodontic treatment need and BDD. This should be considered when planning for treatment, as some of the patients might be those with milder needs for treatment, but with more severe OCD or BDD traits. Females, married people, and patients with a history of orthodontic consultation might be more likely to have BDD in an orthodontic setting. Future research is warranted to examine the associations across BDD, OCD, IOTN-AC, IOTN-ACE, and IOTN-DHC in orthodontic patients and/or normal population.

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AUTHOR CONTRIBUTIONS

Conceptualization: FS, VR. Data curation: FS, FR, NRK, SD. Formal analysis: VR. Funding acquisition: FS. Methodology: FS, SD, FE, RAN. Project administration: FS, SD. Visualization: VR. Writing–original draft: VR. Writing–review & editing: VR.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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