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Prevalence of painful temporomandibular disorders, awake bruxism and sleep bruxism among patients with severe post-traumatic stress disorder

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Abstract

Background: Post-traumatic stress disorder (PTSD) is associated with painful temporomandibular disorder (TMD) and may be part of the aetiology of awake bruxism (AB) and sleep bruxism (SB). Investigating the associations between PTSD symptoms on the one hand, and painful TMD, AB and SB on the other, can help tailoring treatment to the needs of this patient group.

Objectives: The aim of this study was to investigate the associations between PTSD symptoms and painful TMD, AB and SB among patients with PTSD, focusing on prevalence, symptom severity and the influence of trauma history on the presence of painful TMD, AB and SB.

Methods: Individuals ($N = 673$) attending a specialised PTSD clinic were assessed (pre-treatment) for painful TMD (TMD pain screener), AB and SB (Oral Behaviours Checklist), PTSD symptoms (Clinician-Administered PTSD Scale) and type of traumatic events (Life Events Checklist).

Results: Painful TMD, AB and SB were more prevalent among patients with PTSD (28.4%, 48.3% and 40.1%, respectively) than in the general population (8.0%, 31.0% and 15.3%, respectively; all p's $< .001$). PTSD symptom severity was found to be significantly, but poorly, associated with the severity of painful TMD ($r_s = .126$, $p = .001$), AB ($r_s = .155$, $p < .001$) and SB ($r_s = .084$, $p = .029$). Patients who had been exposed to sexual assault were more likely to report AB than patients who had not. Similarly, exposure to physical violence was associated with increased odds for SB.

Conclusion: Patients with severe PTSD are more likely to experience painful TMD, AB or SB, whereas type of traumatic event can be of influence. These findings can contribute to selecting appropriate treatment modalities when treating patients with painful TMD, AB and SB.

KEYWORDS
awake bruxism, orofacial pain, post-traumatic stress disorder, sleep bruxism, stress disorders, temporomandibular disorders

1 | BACKGROUND

Painful temporomandibular disorders (TMDs) and bruxism are rather common—and to some extent related—conditions in the orofacial area. TMDs are described as 'a group of musculoskeletal and neuromuscular conditions that involve the TMJs, the masticatory muscles, and all associated tissues, and they have been identified as a major cause of nondental pain in the orofacial region. TMDs represent clusters of related disorders in the masticatory system with many common symptoms. The most frequent presenting symptom is pain, usually localized in the muscles of mastication or the preauricular area'.[1] Bruxism during wakefulness is considered to be a different behaviour as compared to bruxism during sleep, and as such separate definitions for awake bruxism (AB) and sleep bruxism (SB) have been formulated: 'Sleep bruxism is a masticatory muscle activity during sleep that is characterised as rhythmic (phasic) or nonrhythmic (tonic) and is not a movement disorder or a sleep disorder in otherwise healthy individuals. Awake bruxism is a masticatory muscle activity during wakefulness that is characterised by repetitive or sustained tooth contact and/or by bracing or thrusting of the mandible and is not a movement disorder in otherwise healthy individuals'.[2] Painful TMD, AB and SB are all likely to be multifactorial, with psychosocial factors playing an important role.[3,4] The estimated prevalence of painful TMD for the Netherlands varies between 7.2% and 8.0%.[5] The estimated prevalence for bruxism ranges from 22% to 31% for AB and from 9.3% to 15.3% for SB.[6] In a recent study in the Netherlands, the prevalence of AB and SB was 5.0% and 16.5%, respectively.[7]

A psychosocial factor of interest in the aetiology of painful TMD is post-traumatic stress disorder (PTSD).[3,8–13] PTSD is a mental health condition in which a person, after the confrontation with a serious threatening event (i.e. actual or threatened death, serious injury or sexual violence), develops intrusive memories of the event, avoidance behaviour, negative alterations in cognition and mood, and alterations in arousal and reactivity for a month or more.[14] Chronic painful TMD and PTSD are known to coincide more frequently than would be expected based on the epidemiology of either condition in the general population.[9,11,13] The estimated prevalence of PTSD among individuals with painful TMD ranges from 15.0%[11] to 24.0%,[15] or even to 31.0% when partial and lifetime PTSD diagnoses are included.[13] PTSD symptoms have also been found to be positively associated with TMD incidence.[3] In addition, one might expect that the severity of PTSD symptoms would be associated with the severity of painful TMD; however, this has not, to our knowledge, been investigated as yet.

Painful TMD and bruxism are often considered to be related conditions.[16–18] Thus, if painful TMD and PTSD are found to be associated, bruxism may be associated with PTSD as well. Nevertheless, while some studies have been conducted that aimed to examine the association between PTSD and painful TMD, hardly any research has been carried out to investigate the association between PTSD and either AB or SB. In one small study, grinding habits were reported to occur more frequently in patients with PTSD than in those without PTSD.[12] Some case studies describe PTSD and bruxism as co-occurring conditions, suggesting that PTSD may be a (rare) cause of bruxism.[19–21]

Trauma history, the type of traumatic event to which the person has been exposed, may have a clinically relevant influence on chronic pain.[22] It has been suggested that the type of trauma a person has been exposed to would have a specific influence on pain location, illness behaviour, mood, treatment adherence and pain chronicity.[22] The relationship between PTSD and painful TMD raises the question as to whether trauma history affects the presence of painful TMD in patients with PTSD. Some clinicians suggest that having been exposed to sexual abuse is a cause of, or an aggravating influence on, painful TMD.[23,24] However, the results of the few studies that examined the relationship between trauma exposure and painful TMD have been inconclusive, with some finding evidence that emotional rather than physical and/or sexual abuse constitutes a risk factor for painful TMD,[25] and others concluding that exposure to physical, rather than sexual, abuse is associated with painful TMD.[22] In a study investigating pain locations after self-reported rape, a 3.7 times increased risk for jaw/face pain was found. However, after adjusting for pain in other locations (pelvic pain, lower back pain and headache), this association proved no longer significant.[26]

Given the multifactorial aetiology of painful TMD, we now know that TMD treatment should be multidisciplinary.[27] However, more specific knowledge about psychosocial influences on painful TMD, may contribute to selecting treatment modalities.[27] The same is recommended for AB and SB, if there is a need for treatment.[28] The present study can help clarify the role of psychological trauma in the aetiology of painful TMD, AB and SB, which in future could assist oral health professionals in choosing appropriate treatment modalities, such as including referral for trauma-focused PTSD treatment in their treatment plan. If PTSD is part of the aetiology of painful TMD, AB or SB, treatment may be unlikely to succeed if the PTSD is not addressed.

Therefore, the purpose of the present study was to determine the relationship between PTSD symptoms on the one hand and painful TMD, AB and SB on the other. A secondary aim was to explore the association between trauma history, type of traumatic events patients have been exposed to and the presence of painful TMD, AB and SB.

Research into the association between PTSD and painful TMD has thus far mostly focused on PTSD among patients with painful TMD. When looking at painful TMD in patients with PTSD, samples were small, PTSD was not assessed adequately, or all patients with PTSD were war veterans.[9–13,15,29] Thus, with the exception of one study assessing the association between PTSD and painful TMD, research into the prevalence of painful TMD among patients with PTSD compared with the prevalence of painful TMD in the general population appears to be lacking.[8] Neither the prevalence of PTSD among patients with AB or SB, nor the prevalence of AB or SB among patients with PTSD has, to our knowledge, been studied before. Given the literature on the comorbidity between PTSD and painful TMD, we hypothesised that the prevalence of

painful TMD would be higher in a sample of patients with PTSD than in the general population (H1a). Although there is little information available on the comorbidity between PTSD and bruxism, based on the importance of psychosocial factors in the aetiology of bruxism, and its relationship with painful TMD, we hypothesised that both the prevalence of AB (H1b) and that of SB (H1c) would be higher in a sample of patients with PTSD than in the general population. We also hypothesised that among patients with PTSD, the severity of PTSD symptoms would be positively associated with the severity of painful TMD (H2a), the severity of AB (H2b) and the severity of SB (H2c). In case (one of) the abovementioned hypotheses would be confirmed, we were specifically interested in the question as to whether the exposure to certain types of traumatic events would be associated with the presence of painful TMD, AB or SB.

2 | METHOD

2.1 | Participants

Participants in this study were referred by their general practitioner, psychologist or psychiatrist to the Dutch psychotrauma expertise centre (PSYTREC, Bilthoven, the Netherlands) for treatment of severe PTSD. PSYTREC provides an intensive treatment programme that has been developed to treat patients suffering from severe PTSD. Participants were included between September 2019 and July 2020. Inclusion criteria for this study were the same as the criteria for starting treatment at PSYTREC: aged 18 years and older, having a diagnosis of PTSD according to the *Diagnostic and statistical manual of mental disorders—5*[14] as established with the Clinician-Administered PTSD Scale (CAPS-5),[30,31] having sufficient knowledge of the Dutch language to complete the assessments, and no recent suicide attempts (within the past 3 months). All patients receiving treatment at the centre were instructed to complete all assessments as part of the routine procedure. Only patients consenting to the use of their data for research purposes were included in this study.

2.2 | Procedure

During intake sessions, PTSD was diagnosed by a trained clinical psychologist using the CAPS-5. After assuring eligibility for the intensive trauma-focused treatment, patients were informed about the study and asked to sign an informed consent form for use of their data for scientific research. During the intake procedure, patients completed questionnaires to assess baseline variables, including painful TMD, bruxism and type of traumatic event.

The questionnaires that were used in this study were part of a larger set of questionnaires used for research at PSYTREC. This set was considered by the Medical Ethical Review Committee of VU University Medical Centre (registered with the US Office for Human Research Protections [OHRP] as IRB00002991, FWA number FWA00017598) not to fall under the provisions of the Medical Research Involving Human Subjects Act.

2.3 | Instruments

PTSD was assessed using the Dutch version of the CAPS-5.[30,31] The CAPS-5 is a 20-item questionnaire that is administered during a clinical interview by a trained professional. The instrument provides ratings of the 20 DSM-V-based PTSD symptoms, using 5-point scales for intensity (0 = 'absent' to 4 = 'extreme') and frequency (0 = 'never' to 4 = 'almost daily'). The total CAPS-5 severity score ranging from zero to 80.[30,31] Psychometric evaluation has shown the Dutch version of the CAPS-5 to possess a high internal consistency and reliability.[30] The CAPS is considered to be the gold standard for PTSD assessment.[32] Suicidal risk was assessed with the Dutch version of the Mini International Neuropsychiatric Interview (MINI).[33] The MINI is a reliable and well-validated structured diagnostic interview to establish DSM-IV diagnoses.[34] Suicidal risk was categorised as 'no risk', 'low risk', 'moderate risk' and 'high risk'.

Painful TMD was assessed using the six-item version of the Dutch translation of the TMD pain screener, long version.[35,36] The first item is scored 0–2 ($a = 0$, $b = 1$, $c = 2$), and the other items are scored as $a = 0$, $b = 1$. The maximum sum score for the long version is seven points. Patients scoring three or higher on the TMD pain screener are classified as suffering from painful TMD.[35,36] Psychometric evaluation has shown the TMD pain screener to possess excellent content validity, reliability, sensitivity and specificity.[35] The overall reliability of the Dutch version of the TMD pain screener was also qualified as excellent, with a mean ICC of 0.76. The level of sensitivity for this version was also excellent (90.8%), but it had a relatively low level of specificity (52.4%).[36]

For both AB and SB, an abbreviated six-item version of the Dutch translation of the Oral Behaviors Checklist (OBC) was used.[37,38] Test–retest reliability of the Dutch OBC was shown to be excellent, and the concurrent validity is good.[37] The five items about AB are scored on a 5-point scale (1 = 'none of the time' to 5 = 'all of the time'). The questionnaire contains one item about SB. On this item, patients score SB on a five-point scale (1 = 'none of the time', 2 = 'less than 1 night per month', 3 = '1 to 3 nights per month', 4 = '1 to 3 nights a week', 5 = '4 to 7 nights a week'). As no cut-off scores for the OBC have been established, and to prevent over-estimation of AB and SB, a conservative cut-off was chosen. Only in patients reporting frequent bruxism, bruxism was considered to be present. Thus, prevalence rates of AB and SB were established based on patients scoring a four or higher on any of the five questions about AB or on the SB question, respectively.

Lifetime exposure to past traumatic events was indexed using the Dutch translation of the Life Events Checklist for DSM-5 (LEC-5).[39,40] The LEC-5 is a 19-item self-report measure adapted from the original Life Events Checklist (LEC) to comply with the DSM-5.[14] The

original LEC showed adequate psychometric properties.[41] The version of the LEC-5 that was used for this study contained 18 items, each asking about a specific type of trauma, and a 19th item referring to 'any other very stressful event or experience'. For each item, patients can indicate whether or not they had been exposed this type of event. Exposure to an event includes both that patients experienced it themselves, and that they witnessed it. Patients who indicate that they have been exposed to a particular event are also asked how old they were when they did, and how often they have been exposed to this type of event. No scores are calculated. For the present study, each type of traumatic event that was identified was included in the analyses.

2.4 | Data analysis

2.4.1 | The prevalence of painful TMD, AB and SB compared with the general population

The first hypothesis, that the prevalence of painful TMD would be higher in a sample of patients with PTSD than in the general population (H1a), was tested using a binomial test to compare the percentage of patients who scored positive for painful TMD to the prevalence of painful TMD in the general population in the Netherlands (8.0%).[5] The hypotheses that the prevalence of AB (H1b) and that of SB (H1c) would be higher in a sample of patients with PTSD than in the general population were also tested using a binomial test. The prevalence of AB and that of SB were compared with the values reported in qualitatively adequate studies using self-report measures like in the present study. Of those studies, the ones reporting the highest prevalence were used.[6,7] Thus, the percentages of patients with AB (H1b) and with SB (H1c) in our sample were compared with the population prevalence reported by Jensen et al. (15.0%[42]) and Winocur et al. (31.0%[43]), respectively.

2.4.2 | The association between the severity of PTSD symptoms and of painful TMD, AB and SB

In order to examine whether, among patients with PTSD, the severity of painful TMD would be associated with the severity of PTSD symptoms (H2a), sum scores on the CAPS-5 were correlated with sum scores on the TMD pain screener using Spearman's test for correlations. Similarly, the sum scores of the five OBC questions about AB, and the score on the SB question of the OBC were both correlated to the total score on the CAPS-5 using Spearman's test for correlations, to test the hypotheses that the severity of both AB (H2b) and SB (H2c) would be associated with the severity of PTSD symptoms. Besides the significance of the correlations, the strength of the correlations was presented, with an r_s of .00–.29 being considered as 'poor', of .30–.49 as 'fair', of .60–.79 as 'moderately strong' and of .80–1.0 as 'very strong'.[44]

2.4.3 | Type of traumatic event and the presence of painful TMD, AB and SB

Finally, the question as to whether exposure to a certain type of traumatic event would be associated with the presence of painful TMD, AB or SB was addressed using odds ratios. Odds ratios were calculated for each type of traumatic event that was identified using the LEC-5, provided that 15 or more patients reported having experienced the specific type of traumatic event. To select all relevant types of events for multiple regression analysis, a 90% confidence interval was used. Multiple logistic regression analyses were then conducted to further investigate the role of type of traumatic event as predictor variable for each of painful TMD, AB and SB as a dependent variable. First, all types of traumatic events in which univariate analyses were significantly associated with the odds of painful TMD, AB or SB were included as independent variables in a multiple logistic regression. Next, a multiple logistic regression analysis was performed, adjusting for possible confounders. Gender, age, PTSD symptom severity (if a correlation was found with painful TMD [H2a]), AB and SB were considered as possible confounding factors when modelling painful TMD.[16] When modelling AB, gender, age, PTSD symptom severity (if a correlation was found with AB [H2b]), painful TMD and SB were considered as possible confounding factors.[4] Similarly, gender, age, PTSD symptom severity (if a correlation was found with SB [H2c]), painful TMD and AB were taken into account as possible confounding factors when modelling SB.[4]

Third, for each model, the traumatic event with the highest p-value was removed, until all remaining traumatic events showed a significant association with the dependent variable ($p < .05$). Possible confounders were retained in the adjusted multiple logistic regression model, regardless of their p-value. Nagelkerke's R^2 was obtained as an estimation of the total variance explained by the variables included in the models. All statistical analyses were performed using IBM SPSS statistics for Windows (version 27), with alpha-level set at .05.

3 | RESULTS

3.1 | Descriptives

A total of 673 patients were included (see Figure 1 for participant flow). In this sample, significantly more women (n = 365; 54.0%) than men (n = 308; 46.0%) were present ($X^2[1] = 4.8$, $p = .028$). In addition, the average age for women (M = 37.4, SD = 12.1) was significantly lower than for men (M = 40.9, SD = 12.8) ($t[671] = -3.6$, $p < .001$). The sample consisted of patients suffering from severe PTSD as reflected by high CAPS-5 severity scores (M = 41.9, SD = 7.6), high rates of sexual (76.2%) and physical assault (90.9%), and elevated suicide risk (32.7%). Almost all patients (n = 667, 99.1%) reported having been exposed to multiple traumatic events. In addition, most patients (n = 654, 97.2%) reported having been exposed to multiple types of traumatic events. The mean number

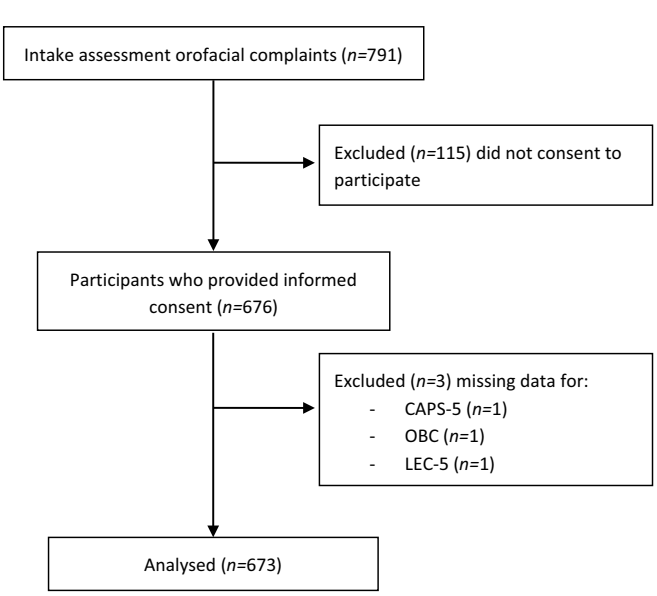

FIGURE 1 Flow diagram of patient inclusion

of types of events experienced was 5.5 (SD = 2.6). The types of events included in the questionnaire and the number of patients reporting each type of event as part of their trauma history are reported in Table 1.

3.2 | Prevalence of painful TMD, AB and SB (H1a-c) compared with the general population

Painful TMD was reported by 191 patients (28.4%), 325 patients (48.3%) screened positive for AB, and SB was reported by 270 patients (40.1%). Painful TMD, AB and SB were reported significantly more often than in the general population (8.0%,[5] 31.0%[43] and 15.3%,[42] respectively; Table 2).

3.3 | Severity of PTSD symptoms and severity of painful TMD, AB and SB (H2a-c)

The severity of painful TMD (r_s = .126, p = .001), AB (r_s = .155, p < .001) and SB (r_s = .084, p = .029) showed significant, albeit poor, correlations with the severity of PTSD symptoms.

3.4 | Type of traumatic event experienced and presence of painful TMD, AB and SB

3.4.1 | Type of trauma and painful TMD

Some types of traumatic events were found to be specifically associated with the presence of painful TMD. Both in univariate analysis and in the unadjusted multiple logistic regression model, exposure to sexual assault and sudden accidental death was found to be associated with increased odds for painful TMD, while odds for painful TMD were decreased in those reporting they experienced captivity or witnessed sudden violent death (Table 3). In the final model for painful TMD, when adjusting for possible confounders (gender, age, PTSD severity, AB and SB), only the experience of captivity was retained in the model, with decreased odds of painful TMD within this sample of patients with PTSD.

TABLE 1 Types of traumatic events and number of patients reporting exposure to each event (N = 673)

Traumatic event experienced[a]	*n* (%)
1. Natural disaster	66 (9.8)
2. Fire or explosion	151 (22.4)
3. Transportation accident	328 (48.7)
4. Serious accident at work, home, or during recreational activity	158 (23.5)
5. Exposure to toxic substance	41 (6.1)
6. Physical assault	612 (90.9)
7. Assault with a weapon	346 (51.4)
8. Sexual assault	513 (76.2)
9. Other unwanted or uncomfortable sexual experience	228 (33.9)
10. Combat or exposure to a war-zone	39 (5.8)
11. Captivity	93 (13.8)
12. Life-threatening illness or injury	212 (31.5)
13. Severe human suffering	213 (31.6)
14. Sudden violent death	211 (31.4)
15. Sudden accidental death	190 (28.2)
16. Serious injury, harm, or death you caused to someone else	65 (9.7)
17. Ritual abuse or satanic abuse	19 (2.8)
18. Torture	48 (7.1)
19. Any other very stressful event or experience	157 (23.3)

[a]Traumatic events as assessed with questions 1–19 of the Life Events Checklist for DSM-5 (LEC-5).[39,40]

	Painful TMD	p	Awake bruxism	p	Sleep bruxism	p
General population	8.0%[5]	<.001[a]	31.0%[43]	<.001[a]	15.3%[42]	<.001[a]
Individuals with PTSD	28.4%		48.3%		40.1%	

[a]Binomial test.

TABLE 2 Prevalence of painful TMD, awake bruxism and sleep bruxism among individuals with PTSD ($N = 673$), as compared to the general population

TABLE 3 Univariate analyses and multiple logistic regression models presenting the association between the type of traumatic events experienced and the presence of painful TMD ($N = 673$)

	Univariate analyses		Multiple regression model (*Nagelkerke's* $R^2 = 0.04$)		*p*-to-exit	Adjusted multiple regression model[a] (*Nagelkerke's* $R^2 = 0.36$)	
Traumatic event experienced	**OR**	**90% CI**	**OR**	**95% CI**		**OR[a]**	**95% CI**
1. Natural disaster	1.40	0.89–2.19					
2. Fire or explosion	1.29	0.93–1.79					
3. Transportation accident	0.91	0.69–1.21					
4. Serious accident at work, home, or during recreational activity	1.09	0.79–1.52					
5. Exposure to toxic substance	0.70	0.37–1.32					
6. Physical assault	1.13	0.68–1.86					
7. Assault with a weapon	0.99	0.75–1.32					
8. Sexual assault	1.49	1.05–2.12*	1.59	1.04–2.42**	.89		
9. Other unwanted or uncomfortable sexual experience	1.23	0.91–1.6					
10. Combat or exposure to a war-zone	0.86	0.46–1.61					
11 Captivity	0.57	0.36–0.89*	0.56	0.32-0.98**		0.53	0.29–0.98**
12. Life-threatening illness or injury	1.22	0.90–1.64					
13. Severe human suffering	1.02	0.75–1.38					
14. Sudden violent death	0.68	0.50–0.93*	0.67	0.46-0.99**	.41		
15. Sudden accidental death	1.38	1.01–1.87*	1.54	1.06-2.24**	.13		
16. Serious injury, harm, or death you caused to someone else	1.05	0.65–1.68					
17. Ritual abuse or satanic abuse	1.87	0.86–4.07					
18. Torture	0.56	0.30–1.05					
19. Any other very stressful event or experience	0.86	0.62–1.21					

[a]Model adjusted for gender, age, PTSD severity, awake bruxism and sleep bruxism.

*$p < .10$.; **$p < .05$.

3.4.2 | Type of trauma and AB

AB was predicted by both sexual assault and other unwanted or uncomfortable sexual experiences in univariate analysis (Table 4). In the unadjusted multiple logistic regression model, only sexual assault was found to be associated with increased odds of AB. Sexual assault remained a significant predictor of AB in the final adjusted multiple logistic regression model (adjusting for gender, age, PTSD severity, painful TMD and SB).

3.4.3 | Type of trauma and SB

In univariate analysis, odds for SB were increased in patients reporting physical assault, life-threatening illness or injury, and exposure to any other stressful event or experience, and decreased in those patients that had witnessed sudden violent death, or caused serious injury, harm, or death to someone else (Table 5). In the unadjusted multiple logistic regression model, experiencing physical assault, and witnessing sudden violent death, remained significantly associated

TABLE 4 Univariate analyses and multiple logistic regression models presenting the association between the type of events experienced and the presence of awake bruxism ($N = 673$)

	Univariate analyses		Multiple regression model (Nagelkerke's $R^2 = 0.04$)		*p*-to-exit	Adjusted multiple regression model[a] (Nagelkerke's $R^2 = 0.39$)	
Traumatic event experienced	**OR**	**90% CI**	**OR**	**95% CI**		**OR**	**95% CI**
1. Natural disaster	0.94	0.62–1.45					
2. Fire or explosion	0.85	0.62–1.15					
3. Transportation accident	1.17	0.91–1.51					
4. Serious accident at work, home, or during recreational activity	1.02	0.76–1.38					
5. Exposure to toxic substance	0.60	0.35–1.04					
6. Physical assault	1.20	0.77–1.86					
7. Assault with a weapon	0.91	0.70–1.17					
8. Sexual assault	2.20	1.61–3.00*	2.13	1.46–3.10**		2.26	1.44–3.56**
9. Other unwanted or uncomfortable sexual experience	1.34	1.02–1.75*	1.21	0.87–1.68	.58		
10. Combat or exposure to a war-zone	0.65	0.37–1.14					
11 Captivity	0.86	0.60–1.25					
12. Life-threatening illness or injury	1.14	0.86–1.49					
13. Severe human suffering	1.18	0.90–1.56					
14. Sudden violent death	0.83	0.63–1.09					
15. Sudden accidental death	1.27	0.96–1.69					
16. Serious injury, harm, or death you caused to someone else	0.85	0.55–1.31					
17. Ritual abuse or satanic abuse	1.49	0.69–3.23					
18. Torture	0.82	0.50–1.35					
19. Any other very stressful event or experience	1.23	0.91–1.66					

[a]Model adjusted for gender, age, PTSD severity, painful TMD and sleep bruxism.
*$p < .10$.; **$p < .05$.

with SB. In the final adjusted multiple logistic regression model (adjusting for gender, age, PTSD severity, painful TMD and AB), SB was predicted by exposure to physical assault (increased odds for SB) and witnessing sudden violent death (decreased odds for SB).

4 | DISCUSSION

With the present study, we aimed to determine the relationship between PTSD symptoms on the one hand and painful TMD, AB and SB on the other. The results showed that the prevalence of painful TMD, AB and SB was significantly higher among patients with PTSD than in the general population (H1a-c), and that the severity of PTSD symptoms and the severity of painful TMD, AB and SB were significantly, and positively, associated (H2a-c). Finally, we found that within this sample of severely traumatised individuals, some specific types of trauma exposure were associated with increased odds of either painful TMD, AB or SB.

Our findings regarding the higher prevalence of painful TMD and PTSD in the present sample are in line with earlier research showing that chronic painful TMD and PTSD coincide more frequently than would be expected based on the prevalence of either condition in the general population.[9,11,13] We found that the same holds true for both AB and SB in that both were found to be more prevalent among patients with PTSD than in the general population. Previous studies into PTSD and AB or SB are scarce, but are in line with the present results.[12,19–21] We hypothesised that the severity of PTSD symptoms would be associated with the severity of painful TMD, AB and SB (H2a-c). To our knowledge, the association between PTSD severity and the severity of painful TMD, AB and SB had not been studied before. Our findings are in support of our hypotheses, albeit the strength of these correlations was poor, and therefore, this finding is unlikely to be clinically relevant.

TABLE 5 Univariate analyses and multiple logistic regression models presenting the association between the type of events experienced and the presence of sleep bruxism ($N = 673$)

	Univariate analyses		Multiple regression model (Nagelkerke's $R^2 = 0.04$)		*p*-to-exit	Adjusted multiple regression model[a] (Nagelkerke's $R^2 = 0.34$)	
Traumatic event experienced	**OR**	**90% CI**	**OR**	**95% CI**		**OR**	**95% CI**
1. Natural disaster	1.27	0.83–1.96					
2. Fire or explosion	0.91	0.67–1.25					
3. Transportation accident	0.99	0.76–1.28					
4. Serious accident at work, home or during recreational activity	1.25	0.93–1.0					
5. Exposure to toxic substance	0.95	0.55–1.64					
6. Physical assault	1.82	1.12–2.97*	1.88	1.04–3.38**		2.06	1.04–4.08**
7. Assault with a weapon	0.93	0.72–1.21					
8. Sexual assault	1.33	0.98–1.81					
9. Other unwanted or uncomfortable sexual experience	1.20	0.91–1.57					
10. Combat or exposure to a war-zone	0.57	0.31–1.04					
11 Captivity	0.89	0.61–1.29					
12. Life-threatening illness or injury	1.40	1.07–1.85*	1.40	1.00–1.96	.11		
13. Severe human suffering	0.99	0.75–1.30					
14. Sudden violent death	0.63	0.47–0.84*	0.62	0.44–0.89**		0.65	0.44–0.97**
15. Sudden accidental death	1.12	0.84–1.49					
16. Serious injury, harm, or death you caused to someone else	0.59	0.37–0.94*	0.69	0.39–1.22	.13		
17. Ritual abuse or satanic abuse	0.52	0.22–1.25					
18. Torture	0.81	0.48–1.35					
19. Any other very stressful event or experience	1.36	1.01–1.84*	1.32	0.92–1.91	.06		

[a]Model adjusted for gender, age, PTSD severity, painful TMD and awake bruxism.

*$p < .10$.; **$p < .05$.

Finally, we explored the association between types of traumatic events patients had been exposed to and the presence of painful TMD, AB or SB. It had been suggested previously that trauma history, in terms of exposure to specific types of traumatic events, would be related to painful TMD, AB or SB, but research into this topic is limited and inconclusive.[22–26] In the present study, exposure to specific types of traumatic events was specifically associated with painful TMD, AB and SB. However, which type of traumatic event specifically was of influence, differed between painful TMD, AB and SB. Sexual abuse has been suggested to be specifically associated with painful TMD, AB and SB.[23,24] In both univariate and multivariate analyses, sexual abuse was indeed found to be associated with, and showing increased odds for, AB, but not for painful TMD or SB. For AB, the association with sexual abuse was retained after adjusting for confounders. For painful TMD, after adjusting for confounders, only captivity was retained in the model, showing decreased odds for painful TMD. As for SB, after adjusting for possible confounders, physical assault and sudden violent death were retained in the model, with physical assault showing increased odds and sudden violent death showing decreased odds for SB. Although exposure to these traumatic events was significantly associated with painful TMD, AB and SB after adjusting for confounders, the odds ratios were small and may still be coincidence.

For now, considering the different outcomes for painful TMD, AB and SB, the lack of underlying theory about how specific types of trauma exposure may influence painful TMD, AB and SB, and the fact that this was the first study that examined the relationship between these variables, these results need to be interpreted with caution. Before the possible implications of these outcomes are discussed further, the results should first be replicated.

It should be noted that this study was the first in its kind to address these specific research questions in a relatively large cohort of

patients with PTSD who were diagnosed using the CAPS-5, the gold standard when it comes to diagnosing PTSD. Yet, the study also had some limitations. A major limitation is the fact that painful TMD, AB and SB were assessed with brief self-report questionnaires, as such we need to be careful when interpreting the results. As we were addressing questions that had not been subject of much, or any, research before, burdening patients that came for PTSD treatment with a clinical examination, let alone with daytime and night-time measurements of their oral behaviours, was considered inappropriate. However, now that we did for the first time address these subjects, the present results do warrant further studies using clinical and instrumental assessments of painful TMD, AB and SB. Last but not least, the results of the present study may not generalise to the entire population of patients with PTSD, because this study involved patients with severe PTSD who had, up to the referral to the PTSD clinic, been treatment-resistant. Generalisation is also hampered by the fact that we conducted the study among a convenience sample of patients presenting for treatment at a PTSD clinic, compared our data with earlier studies rather than using a (randomly selected) control group and did not match respondents for age and gender. Also, the instruments we used were not exactly the same as those used in the studies we compared our data to. We did, however, compare to studies that measured painful TMD, AB and SB using brief screening instruments resembling our questionnaires.

5 | CONCLUSION

In conclusion, we found painful TMD, AB and SB were more prevalent among patients with severe PTSD and that the severity of painful TMD, AB and SB was associated with the severity of the PTSD symptoms. We also showed that in order to understand the nature of the relationship between PTSD and painful TMD, AB and SB, the trauma history of patients with painful TMD, AB and SB may need to be taken into account. The present results suggest that oral health professionals may need to enquire about traumatic life events and PTSD symptoms, and, if applicable, include trauma-focused treatment in the treatment plan, when treating patients with painful TMD, AB, or SB.

AUTHOR CONTRIBUTIONS

All authors are fully accountable for the text and agree with the submission. Wendy Knibbe contributed to the conceptualisation, formal analysis, investigation, methodology and writing—original draft. Frank Lobbezoo contributed to the conceptualisation, investigation, methodology, and writing—review and editing. Eline M. Voorendonk was involved in writing—review and editing. Corine M. Visscher and Ad de Jongh contributed to the conceptualisation, formal analysis, investigation, methodology and writing—review and editing.

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CONFLICT OF INTEREST

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PEER REVIEW

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author [Wendy Knibbe; w.knibbe@acta.nl]. The data are not publicly available due to information that could compromise the privacy of research participants.

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