Self-Reports of Pain-Related Awakenings in Persistent Orofacial Pain Patients

Rafael Benoliel, BDS, LDS, RCS
Professor and Chairman
Department of Oral Medicine
The Faculty of Dentistry
Hebrew University—Hadassah
Jerusalem, Israel

Eli Eliav, DMD, PhD
Professor and Interim Chairman
Department of Diagnostic Sciences
Director, Division of Orofacial Pain
Susan and Robert Carmel Endowed Chair in Algesiology
UMDNJ, New Jersey Dental School
Newark, New Jersey

Yair Sharav, DMD, MS
Professor Emeritus
Department of Oral Medicine
The Faculty of Dentistry
Hebrew University—Hadassah
Jerusalem, Israel

Correspondence to:
Prof Rafael Benoliel
Department of Oral Medicine
The Faculty of Dentistry
Hebrew University—Hadassah, POB 12272
Jerusalem, Israel
Fax: (9722) 6447919
Email: benoliel@cc.huji.ac.il

Aims: *To assess whether pain-related awakenings occur with persistent orofacial pain conditions and whether it is related to pain severity.* ***Methods:*** *Reports of pain-related awakening were prospectively collected at initial interview, prior to treatment, during a 24-month period from 328 patients with orofacial pain. The pain conditions were diagnosed according to the International Headache Society, the American Academy of Orofacial Pain, and the Research Diagnostic Criteria for Temporomandibular Disorders.* ***Results:*** *Pain-related awakening was significantly correlated to pain intensity (odds ratio [OR] 1.5, 95% confidence intervals [CI] 1.3–1.8;* P < *.001), the total muscle tenderness score (OR 1.1, 95% CI 1.01–1.14;* P = *.03), and the presence of lacrimation (OR 4.6, 95% CI 1.7–12.3;* P = *.002) but not to the clinical diagnosis. Two groups of patients were specifically examined; patients with masticatory myofascial pain (MMP) and patients with classical trigeminal neuralgia (CTN). Twenty-eight of the 120 MMP patients (23.3%) reported pain-related awakening and this was associated with a high muscle tenderness score (OR 1.13, 95% CI 1.01–1.3;* P = *.02) and unilaterality of pain (OR 3.9, 95% CI 1.2–12.3;* P = *.02). Seven of the 31 patients with CTN (22.6%) reported pain-related awakenings. Continuous background pain was the most significant parameter associated with awakening (OR 26, 95% CI 1.1–594;* P < *.05).* ***Conclusion:*** *Persistent orofacial pain often induced pain-related awakening and this was significantly associated with pain intensity.* J OROFAC PAIN 2009;23:330–338

Key words: myofascial pain, sleep, trigeminal neuralgia

In general, pain that wakens the patient from sleep is considered rare.[1] When pain-related awakening does occur, it is usually related to some forms of primary neurovascular headaches, such as cluster headache, or to tooth, visceral, neck, and back pain.[1–5] Thus, the question whether a specific headache or facial pain wakens the patient from sleep is clinically relevant and should be part of the standard history.

Why awakenings are specifically related to particular headaches is a complex matter that probably involves a number of mechanisms that may not be directly related to the pain,[6,7] although particularly severe pain may itself wake up the patient.[8–10] Such an association has been described for acute, dental pain.[11] Additionally, self-reported pain intensity often correlates with pain-related awakening in chronic pain syndromes.[12,13] Thus, a reciprocal relationship between pain and sleep has been proposed such that pain interferes with sleep and poor sleep is associated with increases in pain experience both in the short and long term.[14,15]

The aims of this study were therefore to investigate whether pain-related awakenings occur in patients with persistent orofacial pain conditions and whether the awakenings are related to specific diagnoses and/or pain severity. The authors were specifically interested in documenting the presence of pain-related awakening in orofacial pain patients at baseline (prior to treatment). Possible correlations with demographic parameters and pain features associated with awakening were also explored.

Materials and Methods

Data collection was performed at the Orofacial Pain Clinic at the Faculty of Dentistry, Hadassah—The Hebrew University, Jerusalem, between 09.00 and 13.00 in the day. All consecutive patients (n = 328, mean age 43.8 ± 17.7 years, 107 males [32.6%] and 221 females [67.4%]) visiting the clinic between 2005 and 2007 (2-year period) were interviewed in Hebrew at the first visit before medications were prescribed. The resultant data, including a standard pain history, were recorded on an intake form.

Patients were asked to rate pain duration, quality, and average pain intensity over the previous week. Attack duration is often reported by patients as a time range. In these cases, duration was approximated to the range midpoint, eg, for a patient stating that pain lasted 1 to 2 minutes, a value of 1.5 minutes was recorded. Pain quality was assessed by asking the patients to choose one or more of the following descriptive terms: electrical, stabbing, throbbing, pressure, burning, or any combination of the five terms. These five arbitrary terms are in routine use in the Orofacial Pain Clinic to provide rapid assessment of pain quality. Pain intensity was rated by a verbal pain scale (VPS) where 0 is no pain and 10 represents the worst imaginable pain. Pain that began following a clear traumatic event was defined as "posttraumatic" and as "primary" in the absence of a traumatic onset. Trauma was divided into macrotrauma (road traffic accidents and altercations) and dental surgery trauma (invasive or prolonged interventions).

Patients were also asked whether the pain specifically wakes them from sleep via a standardized question: "Does your pain wake you from sleep?" Answers to this question were carefully interpreted so as to ensure that the patient was reporting awakening specifically related to pain. This approach excluded, for example, random awakenings (to drink water or for micturition) where the patient reported that pain was coincidentally present but had not been the reason for awakening. Thus, rates of pain-related awakening were based on verbal self-reports. There were no reported concomitant environmental or other events (criminal, military, etc) that could interfere with sleep during the study period.

Clinical Examination

The masticatory apparatus (temporomandibular joints and masticatory muscles) and neck muscles were examined for sensitivity to palpation. The following muscles were examined bilaterally: masseter, temporalis, medial pterygoid, lateral pterygoid, suboccipital group (as one), sternocleidomastoid, and trapezius. Muscle palpation was performed with about 4 kg[16] of digital pressure (previous examiner calibration). Tenderness to palpation was graded on an ordinal scale: 0 (no pain), 1 (mild), 2 (moderate), and 3 (severe),[17–20] and the individual scores summated to give the total tenderness score (muscle tenderness score) for each patient.[17–20] The muscle tenderness score, also known as the total tenderness score in the literature, is commonly used in headache practice for the assessment of pericranial muscle tenderness and adds valuable information beyond the number of involved muscles.

Dental radiographs were obtained as needed. Imaging of the brain and brainstem was routinely performed in all cases of classical trigeminal neuralgia or in other pain conditions when pathology was suspected.

Inclusion Criteria and Pain Diagnosis

Inclusion criteria comprised a complaint of persistent facial pain, which may also involve the head. "Persistent" refers to pain that was present for a minimum period of 3 months. For all diagnoses, pain that was present on 15 or more days per month was classified as "daily" and, if it occurred < 15 days per month, as "episodic."

Headache and facial pain such as migraine (M), paroxysmal hemicrania (PH), and persistent idiopathic facial pain (PIFP) were diagnosed by means of the criteria published by the International Headache Society (IHS).[21] The term persistent idiopathic facial pain (PIFP), that has replaced that of atypical facial pain, was employed for daily pain according to IHS criteria, usually in cases that were undiagnosable as other entities. Painful temporomandibular disorders (TMD) were diagnosed according to the criteria published by the American Academy of Orofacial Pain[22] and the Research Diagnostic Criteria for Temporomandibular

Table 1 Diagnoses and Accompanying Features for the Entire Study Population (n = 306)

Diagnosis	Gender M	Gender F	Waken n (%)	Onset age (y)	Onset (mo)	VPS	Muscle tenderness score	Lacrimation n (%)	Daily Pain n (% of total)	Daily pattern and awakenings n (% w/in diagnosis)
BMS	1	5	3 (50.0)	67.1 ± 8.6	21.0 ± 14.1	7.3 ± 2.1	1.00 ± 2.0	-	6 (100)	3 (50)
M	2	3	3 (60.0)	27.1 ± 11.5	23.2 ± 24.4	9.6 ± 0.8	5.80 ± 5.3	1 (20)	-	-
MMP	31	89	28 (23.3)	37.6 ± 16.8	30.0 ± 66.0	7.1 ± 2.0	6.80 ± 3.8	-	108 (90)	27 (25)
TMD	3	5	3 (37.5)	34.8 ±11.0	29.6 ± 35.0	7.8 ± 3.1	3.19 ± 4.4	-	8 (100)	3 (37.5)
TMJ	7	20	5 (18.9)	30.3 ± 15.6	12.4 ± 17.0	6.0 ± 1.9	1.00 ± 1.6	-	21 (77)	4 (19)
NVOP	7	16	11 (47.8)	39.0 ± 13.7	32.1 ± 43.3	8.3 ± 1.4	2.30 ± 3.3	8 (34.8)	16 (69.6)	8 (50)
PH	4	2	3 (50)	41.5 ± 16.9	25.5 ± 25.8	7.9 ± 1.4	1.33 ± 2.3	6 (100)	5 (83.3)	3 (60)
PIFP	15	19	8 (23.5)	43.1 ± 16.7	28.6 ± 37.3	7.6 ± 2.3	2.50 ± 3.9	-	34 (100)	8 (23.5)
PTN	16	30	19 (41.3)	46.5 ± 15.0	34.1 ± 50.4	7.9 ± 2.0	3.50 ± 5.1	2 (4.3)	38 (82.6)	16 (44.4)
CTN	14	17	7 (22.6)	57.0 ± 13.2	35.6 ± 52.9	8.9 ± 1.2	1.38 ± 2.6	7 (22.6)	31 (100)	7 (22.6)

Waken = number and percentage of patients with pain-related awakenings; onset = time from pain onset to definitive diagnosis at the clinic; lacrimation = number and percentage of patients reporting ipsilateral tearing during pain attacks; daily pain = number and percentage of patients with pain occurring on > 15 days per month; daily pattern and awakenings = number and percentage of cases with a daily pattern and awakenings. Means ± 1 SD. For abbreviations of diagnoses, see text.

Disorders.[23] TMD include masticatory myofascial pain (MMP) and painful disorders of the temporomandibular joint (TMJ). Pain caused by regional trauma and accompanied by clear sensory dysfunction was defined as "posttraumatic trigeminal neuropathy" (PTN),[24,25] essentially similar to IHS code 13.18.1; anesthesia dolorosa. Additionally, the term "facial migraine" or "neurovascular orofacial pain" (NVOP) was used for facial pain with migrainous features in the second and/or the third divisions of the trigeminal nerve.[26–29] Atypical presentations of classical trigeminal neuralgia (CTN) are not defined by the IHS but are widely accepted as representing CTN and were therefore included.[30,31] Some CTN patients complained of a very prolonged or constant, chronic background pain in addition to the typical paroxysms of pain, and this was recorded.[30,31] Burning mouth syndrome (BMS) was diagnosed according to accepted criteria.[21,22] Diagnoses were confirmed by both senior authors (RB, YS). The study was approved by the institutional review board and informed consent was obtained from all participating patients.

Statistical Analyses

Data were analyzed with SPSS (version 16 for Windows) with two-tailed α for significance set at .05. Factors were initially examined with univariate analyses. Associations between nominal variables were analyzed with a Pearson's Chi square (χ^2). The association between diagnosis and awakening was analyzed by means of a logistic regression analysis in order to obtain individual *P* values and an odds ratio (OR) for specific diagnoses.

A multivariate model (backward stepwise logistic regression) was employed to study the effects of selected parameters on the presence of pain-related awakening. Only parameters that were significant in the univariate analysis were included in the regression. The OR is reported with its 95% confidence intervals (CI). The Hosmer and Lemeshow Test was used to analyze the model's goodness of fit; this test requires significance values greater than .05 to confirm that the regression model's estimates fit the data at an acceptable level, and increasing *P* values indicate better models.

Results

Diagnoses

Rare diagnoses included post-herpetic neuralgia, cardiac referred pain, cervicogenic headache, hemodyalisis-related headache, glossopharyngeal neuralgia, neuropathic pain secondary to multiple connective tissue disease, and pain secondary to salivary gland disorder (all n = 1, total = 7). Groups with few patients included rhinosinusitis (n = 3) and chronic dental pathology (n = 3). Mixed diagnoses included posttraumatic neuropathy with regional myofascial pain or tension-type headache (n = 5), or with neurovascular pain (M or NVOP, n = 2) and myofascial pain and migraine or NVOP (n = 2). All these patients (n = 22) were excluded so that the final group consisted of 306 patients. The specific diagnoses observed in these 306 patients are shown in Table 1. Due to low numbers, patients suffering from TMJ disorders such as disc displacements with (n = 9) or without (n = 9)

Table 2 OR with 95% CI for Pain Awakening from Sleep for the Single Diagnoses (Relative to Painful TMJ Disorders Which is Therefore the Reference Parameter)

Diagnosis (n)	*P*	OR	95% CI
BMS (6)	.12	4.4	0.7–28.6
M (5)	.07	6.6	0.9–50.5
MMP (120)	.60	1.4	0.5–3.9
NVOP (23)	.03*	4.0*	1.1–14.4*
PH (6)	.10	4.4	0.7–28.6
PIFP (34)	.60	1.4	0.4–4.7
PTN (46)	.03*	3.6*	1.2–11.4*
TMD (8)	.30	2.6	0.5–14.8
TMJ (27)	Reference parameter		
CTN (31)	.70	1.3	0.4–4.6

* = significant OR was observed for NVOP and for PTN.

Table 3 Factors Affecting the Presence of Pain-Related Awakenings According to the Univariate Analysis and the Logistic Regression Analysis in the Whole Patient Sample

	Univariate analysis			Logistic regression analysis	
Parameter	*df*	χ^2/t	*P*	*P*	OR (95% CI)
VPS (t)	1	–5.4	< .001	< .001	1.5 (1.3–1.8)
Lacrimation (χ^2)	1	11.8	.001	.002	4.6 (1.7–12.3)
Muscle tenderness score (t)	1	–2.4	.02	.03	1.1 (1.01–1.14)
Diagnosis	9	17.68*	.04	Not included, see Table 2	

The multivariate regression model included pain intensity, lacrimation, and muscle tenderness score that were all associated with significant OR. *df* = degrees of freedom; t = unpaired *t*-test value; * = Wald value for regression.

reduction or osteoarthritis (n = 9) resulting in isolated joint pain were grouped together and classified as "TMJ." For the same reason painful disorders of the TMJ (disc displacement with reduction [n = 6] and osteoarthritis [n = 2]) with comorbid myofascial pain were classified as "TMD."

Out of the 306 patients, 136 (44.4%) reported a posttraumatic pain onset, some form of dental surgery in 60 and macrotrauma in 76. More specifically, in the posttraumatic trigeminal neuropathy group (n = 46), pain onset was associated with dental surgery in 38 patients and macrotrauma in 8.

Pain-Related Awakenings

Almost one-third of the patients (29.8%) complained of being regularly woken up from sleep by pain. This was relatively common across all diagnoses particularly in patients suffering from M (60%), BMS (50%), and NVOP (47.8%) (Table 1). Age, onset age, time to diagnosis, gender, daily versus episodic pattern, as well as pain quality, did not differ significantly between patients with or without pain-related awakenings ($P > .05$).

Patients with pain-related awakenings reported significantly higher pain intensity than those without (VPS: 8.6 ± 1.6 versus 7.2 ± 2, t = –5.4, $P < .001$). Logistic regression analysis showed significant associations between diagnoses and pain-related awakenings (Wald = 17.62, $df = 9$, $P = .04$). This was the case for NVOP and PTN ($P = .03$ for both; Table 2). Patients with these diagnoses were about four times more likely to be woken up from sleep than those without NVOP and PTN ($P < .05$, Table 2). As far as symptoms, lacrimation was significantly associated with pain-related awakenings ($\chi^2 = 11.8$, $df = 1$, $P < .001$; Table 3). In addition, patients with pain-related awakenings had a significantly higher mean muscle tenderness score (5.2 ± 5.0 versus 3.9 ± 4.1, t = –2.4, $P = .02$) but not more tender muscles (2.8 ± 2.3 [median = 3] versus 2.4 ± 2.1 [median 2], t = –1.7, $P = .09$) than patients without.

Table 4 Factors Affecting the Presence of Pain-Related Awakenings According to the Univariate and Logistic Regression Analysis for the MMP patients (n = 120)

	Univariate analysis			Logistic regression analysis	
Parameter	*df*	χ^2/t	*P*	*P*	OR (95% CI)
VPS (t)	1	–2.4	.02	.09	1.3 (0.9–1.7)
Muscle tenderness score (t)	1	-2.5	.01	.02	1.13 (1.01–1.3)
Unilaterality (χ^2)	1	4.8	.03	.02	3.9 (1.2–12.3)

Significant OR was observed with unilateral pain and with increased muscle tenderness score in the multivariate regression model. For abbreviations, see Table 3.

In the final step, backward stepwise logistic regression (13 missing values) retained pain severity (OR 1.5, 95% CI: 1.3–1.8, $P < .001$), lacrimation (OR 4.6, 95% CI: 1.7–12.3, $P = .002$), and the muscle tenderness score (OR 1.1, 95% CI: 1.01–1.14, $P = .03$; Table 3). The Hosmer and Lemeshow Test revealed a good fit of the model ($\chi^2 = 4.3$, $df = 8$, $P = .8$).

Groups Selected for Further Analysis

Two diagnostic entities, MMP and CTN, were further analyzed because they had a sufficient number of patients for analysis, the patient populations were homogeneous, and clinically they are not usually associated with pain-related awakenings. In contrast, the association between neurovascular headaches (paroxysmal hemicrania, M, NVOP) and awakening is well documented. Unfortunately, the BMS group was too small and the remaining patient groups were too heterogeneous for statistical analysis.

MMP Patients. There were 120 patients (31 were males and 89 females) with MMP with a mean onset age of 37.6 ± 16.8 years (range 14 to 76 years). The majority (n = 108) had persistent, daily pain, while the minority suffered episodic pain (n = 12). Pain intensity was moderate to severe (7.1 ± 2).

Fifty-seven (47.5%) MMP patients associated pain onset with a traumatic event (12 with prolonged or invasive dental treatment and 45 with macrotrauma). Unilateral pain was reported by 73 patients (61%) and was more common in cases classified as "primary" (71%) than in cases with a history of trauma (49%, $\chi^2 = 6.3$, $df = 1$, $P = .012$). Pain intensity did not vary between patients with unilateral (7.2 ± 1.9) or bilateral pain (7.0 ± 2.2, $P > .05$) or between posttraumatic and "primary" MMP (7.2 ± 1.9 versus 7.1 ± 2.1, $P > .05$).

Pain-related awakening was found in 23.3% of the patients. Age, onset age, time to diagnosis, gender, and pain pattern did not differ significantly between patients with pain-related awakenings and those without. MMP patients with pain-related awakenings reported significantly more severe pain and a higher muscle tenderness score (VPS 7.9 ± 1.6 versus 6.9 ± 2; t = –2.4, $P = .02$; muscle tenderness score 8.4 ± 4.3 versus 6.3 ± 3.6; t = –2.5, $P = .013$) but not more tender muscles (4.4 ± 1.6, median 4 versus 3.9 ± 1.7, median 3; t = –1.4, $P = .17$) than patients without awakening. The percentage of patients with pain-related awakenings did not differ significantly between patients with "primary" and posttraumatic MMP (19% versus 28%, $P > .05$). On the other hand, the proportion of patients with unilateral MMP who reported pain-related awakenings was significantly higher than in patients with bilateral pain (30% versus 13%, $\chi^2 = 4.8$, $df = 1$, $P = .03$). This occurred in spite of the fact that there was no difference between VPS in patients with unilateral or bilateral pain (7.2 ± 1.9 versus 7.0 ± 2; t = 0.5, $P = .6$) nor in muscle tenderness score (unilateral 6.5 ± 3, bilateral 7.3 ± 4; t = –1.0, $P = .3$).

The final step (nine missing values) of the backward stepwise logistic regression analysis showed a significant increase in the chance for awakening (OR 1.13, 95% CI 1.01–1.3, $P = .02$) for every one-point increase in the muscle tenderness score (see Table 4). There was a nearly 4 times increase in the chance for awakening in patients with unilateral pain versus those with bilateral pain (OR = 3.9, 95% CI 1.2–12.3, $P = .02$). The OR for reported pain severity was 1.3 but was non-significant (95% CI 0.9–1.7, $P = .09$). The Hosmer and Lemeshow Test revealed a good fit of the model ($\chi^2 = 3.8$, $df = 8$, $P = .88$).

Table 5 Factors Affecting the Presence of Pain-Related Awakenings According to the Univariate and Logistic Regression Analysis for the CTN patients (n = 31)

	Univariate analysis			Logistic regression analysis	
Parameter	*df*	χ^2/t	*P*	*P*	OR (95% CI)
Background pain (χ^2)	1	7.9	.005	.04	26 (1.1–594)
VPS (t)	1	–2.4	.02	.1	25 (0.4–1419)
Lacrimation (χ^2)	1	6.18	.013	.1	11.5 (0.6–213)

Constant background pain was associated with a significant OR in the multivariate regression model. For abbrevoations, see Table 3.

CTN Patients. Out of the 31 CTN patients (mean age of onset 59.6 ± 13, range 35 to 82 years), 14 were males (48.4%) and 17 females (51.6%). A history of pain triggering by touch within trigeminal dermatomes was reported by 25 patients (80.6%), in addition to frequent spontaneous attacks. The other 6 patients reported spontaneous pain attacks with uncertain trigger zones. The pain was located intraorally in 32.3% of the patients (n = 10; 6 lower jaw, 4 upper jaw), in the mandible in 29% (n = 9), in the maxilla in 12.9% (n = 4), and in both jaws in 25.8% (n = 8). Patients suffered attacks nearly every day (mean 27.5 ± 2.4, range 15 to 28 days per month). In all cases the typical paroxysmal attacks lasted for 2 minutes or less with an overall mean duration of 1.4 ± 0.42 minutes and mean reported pain intensity of 8.9 ± 1.2 (range 6 to 10).

Seven patients (22.6%) reported that pain woke them from sleep and these patients did not differ in gender, pain onset, attack duration, or frequency from those without awakening. Patients with pain-related awakening reported significantly more severe pain than patients without (9.9 ± 0.3 versus 8.7 ± 1.3; t = –2.4, *df* = 1, *P* = .02). The nine patients (29%) with a constant or dull and long-lasting background pain with paroxysms of short-lasting pain reported pain-related awakening significantly more often than those without (55.6% versus 9.1%, χ^2 = 7.9, *df* = 1, *P* = .005) although the attacks were not more severe (9.6 ± 0.5 versus 8.6 ± 1.4, *P* = .07).

Pain-related awakening was reported by 50% of patients with no clear trigger zones and by 16% with trigger zones (χ^2; *P* = .07). Also pain severity did not differ among the two groups (9.0 ± 1.2 versus 8.8 ± 1.4, *P* = .69).

Ipsilateral lacrimation was reported by seven patients (22.6%) who also reported pain-related awakening significantly more often (57.1%) than those without lacrimation (12.5%, χ^2 = 6.18, *df* = 1, *P* = .013). No statistically significant difference was observed between the pain intensity (9.5 ± 0.8 versus 8.8 ± 1.3) and the pain duration among the patients with lacrimation and those without (*P* = .17).

The final model (no missing values) of the backward stepwise logistic regression analysis included the presence of atypical constant background pain (OR 26, 95% CI 1.1–594, *P* = .04), severity (OR 25, 95% CI 0.4–1419, *P* = .1) and lacrimation (OR 11.5, 95% CI 0.6–213, *P* = .1) (Table 5). The Hosmer and Lemeshow Goodness-of-Fit Test revealed that this was an acceptable model (χ^2 = 1.113, *df* = 6, *P* = . 98).

Discussion

The present study clearly showed that pain-related awakening is quite common in patients with persistent orofacial pain conditions, occurring in about one third of all patients. In the total patient population, the risk of pain-related awakening increased by 1.5 times for each point increase in pain severity. This finding seems reliable and clinically relevant as it was unveiled in a relatively large population sample. Additionally, the final statistical model retained lacrimation and the muscle tenderness score, thus confirming that orofacial pain-related awakenings were associated with pain severity but refuting the hypothesis that awakenings could also be associated with a particular diagnosis. Nonetheless, the fact that pain awakening was related to lacrimation, a sign typical of neurovascular headaches, suggests that this group of disorders could have emerged as significant if the study would have been conducted in a larger sample of neurovascular headache patients. This hypothesis is supported by the results of the univariate analysis that showed

that the diagnosis of NVOP was significantly associated to awakening.

While pain intensity clearly correlated with pain-related awakening, the mean pain intensity reported by patients not woken from sleep was by no means "mild." Indeed similar pain intensities are usually associated with pain-related awakening in the presence of other pain conditions such as acute dental[11] or neurovascular pain.[5,26,29,32] Thus, it seems clear that pain severity increases the chances for awakening, but it does not totally explain the awakenings, particularly in relation to the individual diagnoses. Of course, awakening may have other causes. Hypothetically, triggering of nocturnal pain could be more frequent in CTN patients with clear trigger zones that may be inadvertently activated, as has recently been reported.[33] However, in this study a clear trigger mechanism was more frequent in CTN patients without awakening than in those with awakening. This may alternatively suggest that spontaneous, not mechanically triggered, pain attacks may be more important for pain-related awakenings in CTN patients. Awakening may also be due to painful movement of the head and neck in patients with musculoskeletal disorders. Both in the overall sample and in the MMP patients, the muscle tenderness score was significantly associated with pain-related awakening. Thus, as has been previously suggested,[1] movements of the craniocervical complex during sleep may activate pain and induce awakening in MMP patients.

Patients with MMP often report poor sleep,[34] but they very rarely report awakenings.[35] Yet, in the present study almost a quarter of MMP patients reported pain-related awakenings though in most clinical aspects they resembled patients in other studies (pain location, degree of muscle tenderness). However, pain intensity was higher than usually reported by myofascial pain patients in other studies.[35,36] Additionally, awakenings were associated in the MMP patients with a high muscle tenderness score. This, together with the higher pain intensity, may explain the fact that the patients of this study reported more awakenings than those of a previous one.[35]

Trauma-associated onset did not significantly increase the number of MMP patients reporting pain-related awakenings. The presence of posttraumatic stress disorder (PTSD) was not assessed in this study. This disorder is very common in patients with orofacial injury[37] and comorbidity between PTSD and chronic pain is well documented.[38,39] PTSD patients often suffer from sleep disorders and have frequent sleep arousals.[40] The fact that patients with trauma-associated onset of MMP did not wake up more frequently than those without may suggest that this group of patients did not suffer from PTSD.

Unilateral MMP was not more severe than bilateral pain. Thus, it is unclear why patients with unilateral pain reported significantly more pain-related awakenings. Moreover, unilateral MMP was more common in primary MMP, reducing the importance of the possible effects of trauma. However, this finding suggests the need to examine the relationship between primary-MMP and sleep disturbances more carefully as has been done for fibromyalgia patients.

Based on patient reports, interviews, or the recorded use of hypnotics, sleep-related pain episodes have been reported in 11% to 83% of CTN patients[33,41–45] and the rate of CTN-associated pain-related awakening recorded in this study falls within this range. The reasons for the high variation reported in the literature may be related to methodological differences and to different characteristics of the investigated patient populations. Atypical cases of trigeminal neuralgia accompanied by background pain have been previously reported in 25% to 30% of patients.[30,31,46] In this study, pain-related awakening was significantly more frequent in CTN patients with atypical background pain, but in these patients pain intensity was not higher than in patients without awakenings. This suggests that background pain may be the most important factor in pain-related awakenings in this patient group. This is an important finding as pain-related awakening is not typically associated with the diagnostic process in CTN.

It is known that the pain threshold varies during the night with a possible threshold decrease between midnight and 2 AM.[1] Thus, this may be a particularly sensitive time period for awakenings in patients with orofacial pain conditions so that the awakening time should be assessed in future studies.

Study Limitations

The study certainly suffers several limitations. First, the study design did not allow the authors to unequivocally infer on the causal relationship between sleep and pain syndromes. Second, depression, anxiety, physical fitness, and cognitive rumination are factors that are often strongly associated with awakening or poor sleep,[6] but these dimensions were not assessed in this study. Therefore, it cannot be excluded that these conditions may have been present and affected the rates

of awakening. Third, the collected data are based on patient's self-reports, the way in which pain histories and data are normally collected. This does, however, introduce another source of error due to memory bias. Because of the absence of sleep questionnaires and sleep laboratory data, it cannot be excluded that patients could have experienced awakening due to other comorbidities and felt pain at that time.

Conclusions

Persistent orofacial pain often induced pain-related awakenings and these were significantly associated with pain intensity. In addition, pain-related awakening was observed in pain conditions usually not associated with this phenomenon, such as MMP and CTN. In MMP patients, pain-related awakenings were significantly related to the level of muscle tenderness and unilateral pain, but less to pain intensity. In CTN patients it was primarily associated with constant background pain.

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