

ORIGINAL ARTICLE

## Perceived orofacial pain and its associations with reported bruxism and insomnia symptoms in media personnel with or without irregular shift work

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### Abstract

A standardized questionnaire was mailed to all employees of the Finnish Broadcasting Company with irregular shift work ( $n = 750$ ) and to an equal number of randomly selected controls in the same company with regular 8-hour daytime work. The aims were to investigate the prevalence and severity of perceived orofacial pain (Research Diagnostic Criteria for Temporomandibular Disorders Axis II) and to analyze whether current orofacial pain was associated with reported bruxism and insomnia symptoms (Diagnostic and Statistical Manual of Mental Disorders–IV and the International Classification of Sleep Disorders Revised). The response rate in the irregular shift-work group was 82.3% (56.6% men) and in the regular daytime-work group 34.3% (46.7% men). Current orofacial pain was found overall in 19.6%, of which 88.3% had experienced the pain over 6 months. All claimed that their pain fluctuated. No subjects with chronic orofacial pain reported disabling pain, and grades III and IV were not found. Insomnia symptoms and frequent bruxism were significantly more prevalent in chronic pain grade II than in lower grades. According to logistic regression, current orofacial pain was significantly positively associated with frequent bruxism ( $p < 0.001$ ), female gender ( $p < 0.001$ ), and disrupted sleep ( $p < 0.01$ ), and significantly negatively associated with age over 45 years ( $p < 0.01$ ). Our results revealed a clear-cut association between perceived orofacial pain and reported bruxism. The association held with both chronic orofacial pain intensity and current pain. Based on the multivariate analyses, it can be concluded that disrupted sleep and bruxism may be concomitantly involved in the development of orofacial pain.

**Key Words:** *Media work, non-patient, pain, RDC/TMD, sleep disorders, tooth grinding*

### Introduction

The prevalence of temporomandibular disorders (TMD) among populations is fairly high, i.e. between 22% and 30% [1,2]. Pain symptoms, of which orofacial pain represents 7–26%, are commonly accepted as the most frequent presenting symptoms of TMD [3–7]. Studies have addressed bruxism as an underlying factor for TMD [8–10], although it has also been suggested that these entities could coexist without having any causal relationship [11]. In a recent study among 1339 media employees, however, a clear-cut association between reported bruxism and stress experience was found [12]. Perceived stress has also

been commonly considered as a causal factor in various sleep disturbances. There is evidence that bruxism appears concomitantly with the transient arousal response, and thus may be a sign of sleep disorder [13–15]. If stress can affect sleep, it would be fair to assume that it could provoke bruxism, which, in turn, could increase the probability of TMD [16–18]. Nevertheless, the relationship between bruxism and orofacial pain in non-patient populations is complex, and it remains poorly understood how these symptoms are linked to other stress-related symptoms or work issues.

Shift work appears to be associated with work-related problems, most of these connected with the

human circadian rhythm [19,20]. Moreover, irregular shift work has been addressed as a cause of sleep disorders and fatigue, and may expose employees to work hazards [21,22]. Currently in the Finnish media industry the production and delivery of radio and TV programs is in transition from analog to digital techniques. Technological changes call for new professions and competence requirements, whereas some existing skills are becoming redundant. The 24-h culture in modern media work may markedly enhance the psychological pressures of work in an already demanding work environment.

A recent longitudinal study among multiprofessional media personnel found that multiple pain symptoms and TMD-related painless symptoms were associated with frequent bruxism [23]. Another study, derived from the present data, revealed an association between bruxism and dissatisfaction with one's workshift schedule [24], the latter suggested to be implicated in work-related stress.

The aims of the present study, performed on media personnel with or without irregular shift work, were first to investigate the prevalence and severity of perceived orofacial pain, and second to analyze whether current orofacial pain was associated with reported bruxism and insomnia symptoms.

## Material and methods

A standardized questionnaire was mailed to all employees of the Finnish Broadcasting Company with irregular shift work ( $n=750$ ) and to an equal number of randomly selected controls in the same company with regular 8-hour daytime work. The work duties of the media personnel included journalism, broadcasting, program production, technical support, and administration.

The overall response rate was 58.3% (53.7% men). The response rate in the irregular shift-work group was 82.3% (56.6% men) and in the regular daytime-work group 34.3% (46.7% men). The mean age of males in shift work was 45.0 (SD 10.6) years and of females 42.6 (SD 10.7) years ( $p<0.001$ ); the corresponding figures for daytime workers were 47.4 (SD 9.7) and 45.5 (SD 10.1) years (NS), respectively [24].

The questionnaire covered demographic items, employment details, general health experience, physical status, insomnia symptoms, psychosocial status, stress, work satisfaction, and performance. For the present study, the data were categorized as follows:

- Demographic data: gender, age.
- Bruxism: self-assessed frequency of tooth-clenching or grinding (never, seldom, sometimes, often, continually) [12,23,24].
- Dissatisfaction with current workshift schedule (irregular shifts versus daytime work).
- Insomnia symptoms (never or less than once a month, less than weekly, 1–2 days per week,

3–5 days per week, daily, or almost every day): difficulties initiating sleep (DIS), disrupted sleep (DS), and early morning awakenings (EMA) according to Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) [25] and the International Classification of Sleep Disorders Revised (ICSD) [26]. An insomnia symptom was considered as present when it occurred on at least three nights/mornings per week. EMA in the irregular work group means that subjects with the symptom woke up before they intended, despite the hour, and had difficulty in getting back to sleep.

- Perceived current orofacial pain (pain in the face, jaw, or preauricular areas, or in the ears) within the previous month and chronic orofacial pain (pain over 6 months) severity according to the RDC/TMD Axis II scores for Graded Chronic Pain [27,28] (Table I).

## Statistical methods

Student's *t*-test was used to compare continuous variables. The chi-square test was used to study associations between categorical variables. A logistic regression model was fitted to analyze the independent effects of the background variables on the probability of current orofacial pain. Independent variables included in the multivariate model were: gender (male=0, female=1), age (<45 yr=0, ≥45 yr=1), irregular shift work (no=0, yes=1), perceived dissatisfaction with current workshift schedule (no=0, yes=1), frequent bruxism (often or continually) (no=0, yes=1), and the presence of studied insomnia symptoms: DIS, DS, EMA (no=0, yes=1). The forced entry method was used, i.e. all selected independent variables were entered in a single step in the regression model.

## Results

Orofacial pain was found overall in 19.6% of the study population. Among those reporting current orofacial pain, 88.3% had experienced the pain over 6 months. They all claimed that the pain characteristically fluctuated; none had continuous pain. According to the RDC/TMD Axis II scores, none of the subjects with chronic orofacial pain reported their pain as disabling, and grades III and IV were not found.

In the bivariate analyses, the severity of perceived chronic orofacial pain was associated with most of the studied variables; Table II shows the prevalence figures and statistical differences for each grade of pain. Insomnia symptoms and frequent bruxism were significantly more prevalent in grade II than in lower grades. Similarly, dissatisfaction with one's workshift schedule was more often seen in grade II, and females reported intense pain significantly more often than males.

Table I. RDC/TMD Axis II scoring criteria after Dworkin and LeResche (1992) [27]

Scoring criteria for grading chronic pain severity			
Characteristic pain intensity is 0 to 100 score derived from: Mean (pain right now, worst pain, average pain) × 10			
Disability score is 0 to 100 score derived from: Mean (daily activities, social activities, work activities) × 10			
Disability points: add the indicated points for disability days and for disability score			
Disability points			
Disability days (0–180)		Disability score (0–100)	
0–6 days	0 points	0–29	0 points
7–14 days	1 point	30–49	1 point
15–30 days	2 points	50–69	2 points
31+ days	3 points	70+	3 points
Classification			
Grade 0:	No TMD pain in previous 6 months		
Grade I: Low intensity	Characteristic pain intensity ≤ 50 and < 3 disability points		
Grade II: High intensity	Characteristic pain intensity > 50 and < 3 disability points		
Grade III: Moderately limiting	3–4 disability points, regardless of characteristic pain intensity		
Grade IV: Severely limiting	5–6 disability points, regardless of characteristic pain intensity		

Table II. Relation of demographic items, frequent bruxism, and insomnia symptoms to orofacial pain. Graded chronic pain severity according to Axis II scoring criteria. Chi-squared test

%	Total <i>n</i> = 874	Grade 0 <i>n</i> = 712	Grade I <i>n</i> = 114	Grade II <i>n</i> = 48	<i>p</i>
Gender (female)	46.3	43.3	57.9	64.6	<0.001
Age > 45 years	41.9	44.2	29.8	35.4	<0.010
Irregular shift work	70.6	69.9	74.6	70.8	0.603
Dissatisfied with work shifts	19.2	16.7	28.9	33.3	<0.001
Frequent bruxism	10.6	6.3	26.2	37.0	<0.001
DIS	16.8	14.7	20.2	39.6	<0.001
DS	43.6	40.9	50.0	68.8	<0.001
EMA	10.3	9.7	9.6	20.8	0.047

DIS: Difficulties initiating sleep; DS: disrupted sleep; EMA: early morning awakenings.

Table III. Regression coefficients ( $\beta$ ) of the studied independent variables and the probability of current orofacial pain. Logistic regression

<i>n</i> = 874	$\beta$	SE	Odds ratio	95% CI	<i>p</i>
Gender (female)	0.71	0.20	2.0	1.4–3.0	<0.001
Age > 45 years	–0.61	0.21	0.5	0.4–0.8	0.004
Irregular shift work	0.10	0.23	1.1	0.7–1.7	0.664
Dissatisfied with work shifts	0.27	0.24	1.3	0.8–2.1	0.247
Frequent bruxism	1.82	0.25	6.2	3.8–10.1	<0.001
DIS	0.34	0.25	1.4	0.9–2.3	0.164
DS	0.67	0.21	2.0	1.3–2.9	<0.001
EMA	–0.13	0.31	0.9	0.5–1.6	0.686
Constant	–2.39	0.27			

DIS: difficulties initiating sleep; DS: disrupted sleep; EMA: early morning awakenings.

According to logistic regression, the probability of current orofacial pain was significantly positively associated with frequent bruxism ( $p < 0.001$ ), female gender ( $p < 0.001$ ), and DS ( $p < 0.01$ ), and significantly negatively associated with age over 45 years ( $p < 0.01$ ). Frequent bruxers were 6.2 times more likely to perceive current orofacial pain than other subjects (Table III).

### Discussion

In the present study, we investigated the associations of perceived orofacial pain, bruxism, and insomnia symptoms in media personnel who could be considered as under sustained pressure at work due to intense on-going technological and organizational changes. Also, as the study formed part of a

comprehensive investigation on shift work and its sleep/awake consequences, there was a special focus on irregular shift work, although this did not emerge as a significant factor in itself. This may in part have been because of the low response rate in the regular day work group.

Our main findings were that frequent bruxism was significantly associated with the intensity of chronic orofacial pain, and also that in the multivariate analysis it was associated with the overall probability of having orofacial pain while the effects of all other studied variables were simultaneously controlled. In fact, frequent bruxers were over six times more likely to report orofacial pain than those reporting less bruxism. A possible mechanism for the development of the pain in bruxers may be fatigue in the masticatory muscles caused by overload, but the complex path of pain experience cannot be ignored.

To assess chronic orofacial pain severity, the RDC/TMD Axis II graded chronic pain scale was used. The RDC/TMD permits multiple physical diagnoses for each subject (Axis I) and a dual-axis classification can be applied to psychological issues (Axis II) [27,28]. The Finnish version of the RDC/TMD has recently been introduced and successfully used in non-patients [29,30]. In the present study, the observed prevalence (19.6%) of acute or current orofacial pain was relatively high, but within the range shown in previous surveys [1,7,16,31]. It is noteworthy in the present non-patient population, however, that almost all (88.3%) of those reporting orofacial pain had perceived their symptoms over 6 months and thus according to the RDC/TMD had a chronic, although fluctuating, pain problem. Congruent with earlier reports, female gender was significantly associated with both current and more intense chronic orofacial pain [1,32,33].

Using questionnaires, as was done in the present study, may cause difficulties when it comes to defining the actual prevalence of bruxism: it may be even more common among populations than surveys indicate, but not registered as a behavior by individuals because of its potential subconscious nature. Moreover, reporting of bruxism may be influenced by negative affectivity, and individuals with subjective distress may be more likely to perceive, overreact to, and complain about their sensations [34]. Although data on bruxism gathered by questionnaires may be difficult to operationalize, numerous surveys have been performed to evaluate possible interactions between bruxism and psychological factors.

According to recent epidemiological data, Finland has a unique pattern of insomnia compared with many other European countries [35], particularly as regards DS. Overall, the high prevalence of insomnia complaints in the Nordic countries has been explained by the dark period during mid-winter, which is thought to influence circadian rhythms. Irregular shift work has been shown to affect circadian rhythm,

sleep disturbances, and their daytime consequences. In the present study, when comparable methods were used, both DIS and DS were about 1.4 times more common than previously found in the general population [35], which may be connected to the overall stressful work environment.

All the studied insomnia symptoms and dissatisfaction with workshift schedule were associated with more intense pain, which may imply that these items are linked to experiencing more severe stress. In the case of dissatisfaction with workshift schedule, this too has been suggested in another study derived from the same data [24]. On the other hand, nobody reported disabling chronic orofacial pain, which may well be because this was a non-patient population.

However, although insomnia symptoms are associated with the intensity of orofacial pain in the bivariate analyses, according to logistic regression only DS is associated with the probability of having current orofacial pain. This may simply be because bruxism episodes can occur during the transient arousal response [13–15], i.e. those suffering from DS brux more often, which, in turn, may cause fatigue in the masticatory muscles and provoke pain. The non-significant associations of DIS and EMA are more difficult to interpret, but at least in the case of EMA—suggested more or less to indicate depressive mood [25]—the explanation may be the overall low psychological dysfunction earlier found among the present non-patients [30].

In conclusion, our results reveal a clear-cut association between perceived orofacial pain and reported bruxism. The association held with both chronic orofacial pain intensity and current pain. Based on the multivariate analyses, it can be concluded that DS and bruxism may be concomitantly involved in the development of orofacial pain.

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## References

- [1] Von Korff M, Dworkin SF, Le Resche L, Kruger A. An epidemiologic comparison of pain complaints. *Pain* 1988; 32:173–83.
- [2] De Kanter RJ, Truin GJ, Burgersdijk RC, Van't Hof MA, Battistuzzi PG, Kalsbeek H, et al. Prevalence in the Dutch adult population and meta-analysis of signs and symptoms of temporomandibular disorders. *J Dent Res* 1993;72:1509–18.
- [3] Agerberg G, Bergenholtz A. Craniomandibular disorders in adult populations of West Bothnia, Sweden. *Acta Odontol Scand* 1989;47:129–40.
- [4] Bovim G, Schrader H, Sand T. Neck pain in the general population. *Spine* 1994;19:1307–9.
- [5] Goulet JP, Lavigne GJ, Lund JP. Jaw pain prevalence among French speaking Canadians in Quebec and related symptoms of temporomandibular disorders. *J Dent Res* 1995;74: 1738–44.

- [6] Elliot AM, Smith BH, Penny KI, Smith WC, Chambers WA. The epidemiology of chronic pain in the community. *Lancet* 1999;354:1248–52.
- [7] Macfarlane TV, Blinkhorn AS, Davies RM, Kinsey J, Worthington HV. Oro-facial pain in the community: prevalence and associated impact. *Community Dent Oral Epidemiol* 2002;30:52–60.
- [8] American Academy of Orofacial Pain. In: Okeson JP, editor. Orofacial pain. Guidelines for assessment, diagnosis, and management. Chicago: Quintessence Publishing Co.; 1996.
- [9] Glaros AG, Tabacchi K, Glass EG. Effect of parafunctional clenching on temporomandibular disorder pain. *J Orofac Pain* 1998;12:145–52.
- [10] Molina OF, dos Santos Jr J, Nelson SJ, Nowlin T. A clinical study of specific signs and symptoms of CMD in bruxers classified by the degree of severity. *J Craniomand Pract* 1999;17:268–79.
- [11] Dao TT, Lund JP, Lavigne GJ. Comparison of pain and quality of life in bruxers and patients with myofascial pain of the masticatory muscles. *J Orofac Pain* 1994;8:350–6.
- [12] Ahlberg J, Rantala M, Savolainen A, Suvinen T, Nissinen M, Sarna S, et al. Reported bruxism and stress experience. *Community Dent Oral Epidemiol* 2002;30:405–8.
- [13] Lavigne GJ, Montplaisir JY. Restless legs syndrome and sleep bruxism: prevalence and associations among Canadians. *Sleep* 1994;17:739–43.
- [14] Kato T, Montplaisir JY, Guitard F, Sessle BJ, Lund JP, Lavigne GJ. Evidence that experimentally induced sleep bruxism is a consequence of transient arousal. *J Dent Res* 2003;82:284–8.
- [15] Macaluso GM, Guerra P, Di Giovanni G, Boselli M, Parrino L, Terzano M. Sleep bruxism is a disorder related to periodic arousals during sleep. *J Dent Res* 1998;77:565–73.
- [16] LeResche L. Epidemiology of temporomandibular disorders: implications for the investigation of etiologic factors. *Crit Rev Oral Biol Med* 1997;8:291–305.
- [17] Lavigne GJ, Goulet JP, Zuconni M, Morrison F, Lobbezoo F. Sleep disorders and the dental patient: an overview. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999;88:257–72.
- [18] Rantala MAI, Ahlberg J, Suvinen TI, Lindholm H, Nissinen M, Savolainen A, et al. Temporomandibular joint related painless symptoms, orofacial pain, headache, and psychosocial factors among non-patients. *Acta Odontol Scand* 2003;61:217–22.
- [19] Jewett E, Dijk D-J, Kronauer E, Dinges DF. Dose-response relationship between sleep duration and human psychomotor vigilance and subjective alertness. *Sleep* 1997;20:171–9.
- [20] Kecklund G, Åkerstedt T. Morning work effects of early rising on sleep and alertness. *Sleep* 1997;20:215–23.
- [21] Härmä M, Sallinen M, Ranta R, Mutanen P, Muller K. The effect of an irregular shift system on sleepiness at work in train drivers and railway traffic controllers. *J Sleep Res* 2002;11:141–51.
- [22] Sallinen M, Härmä M, Mutanen P, Ranta R, Virkkala J, Muller K. Sleep-wake rhythm in an irregular shift system. *J Sleep Res* 2003;12:103–12.
- [23] Ahlberg J, Savolainen A, Rantala M, Lindholm H, Könönen M. Reported bruxism and biopsychosocial symptoms: a longitudinal study. *Community Dent Oral Epidemiol* 2004;32:307–11.
- [24] Ahlberg K, Ahlberg J, Könönen M, Partinen M, Lindholm H, Savolainen A. Reported bruxism and stress experience in media personnel with or without irregular shift work. *Acta Odontol Scand* 2003;61:315–18.
- [25] American Psychiatric Association (APA). Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), 4th edn. Washington: American Psychiatric Association; 1994.
- [26] American Academy of Sleep Medicine (AASM). The international classification of Sleep Disorders Revised: Diagnostic and Coding Manual (ICSD). Rochester: American Academy of Sleep Medicine; 1997.
- [27] Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. *J Craniomand Dis Fac Oral Pain* 1992;6:301–55.
- [28] Dworkin SF, Sherman J, Mancl L, Ohrbach R, LeResche L, Truelove E. Reliability, validity, and clinical utility of the Research Diagnostic Criteria for Temporomandibular Disorders Axis II scales: depression, non-specific physical symptoms, and graded chronic pain. *J Orofac Pain* 2002;16:207–20.
- [29] Rantala MAI, Ahlberg J, Suvinen TI, Savolainen A, Könönen M. Symptoms, signs, and clinical diagnoses according to the Research Diagnostic Criteria for Temporomandibular Disorders among Finnish multiprofessional media personnel. *J Orofac Pain* 2003;17:311–16.
- [30] Rantala MAI, Ahlberg J, Suvinen TI, Savolainen A, Könönen M. Chronic myofascial pain, disk displacement with reduction and psychosocial factors in Finnish non-patients. *Acta Odontol Scand* 2004. In press.
- [31] Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. *J Orofac Pain* 1999;13:232–7.
- [32] Bush FM, Harkins SW, Harrington WG, Price DD. Analysis of gender effects on pain perception and symptom presentation in temporomandibular pain. *Pain* 1993;53:73–80.
- [33] Egermark I, Carlsson GE, Magnusson T. A 20-year longitudinal study of subjective symptoms of temporomandibular disorders from childhood to adulthood. *Acta Odontol Scand* 2001;59:40–8.
- [34] Turner JA, Dworkin SF, Mancl L, Huggins KH, Truelove EL. The roles and beliefs, catastrophizing, and coping in the functioning of patients with temporomandibular disorder. *Pain* 2001;92:41–51.
- [35] Ohayon M, Partinen M. Insomnia and global sleep dissatisfaction in Finland. *Sleep* 2002;11:339–46.