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# Oro-facial pain experience among symphony orchestra musicians in Finland is associated with reported stress, sleep bruxism and disrupted sleep—Independent of the instrument group

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**Abstract**

**Background:** To evaluate whether oro-facial pain experience was related to the type of musical instrument and to learn more about the roles of sleep and sleep-related issues in the pain among professional musicians.

**Objectives:** A standard questionnaire was sent to all Finnish symphony orchestras ( $n = 19$ ), with altogether 1005 professional musicians and other personnel.

**Methods:** The questionnaire covered descriptive data, instrument group, items on perceived quality of sleep, possible sleep bruxism, stress experience and oro-facial pain experience during the past 30 days.

**Results:** In the present study, which included the musicians only, the response rate was 58.7% ( $n = 488$ ). All orchestras participated in the study, and there was no significant difference in the response rate between the orchestras. The mean age of men (52.3%) was 47.7 (SD 10.3) and of women (47.7%) was 43.4 (SD 9.8) years ( $P < 0.001$ ). Overall, current pain in the oro-facial area was reported by 28.9%, frequent bruxism by 12.1% and frequent stress by 20.8%. According to Somers'  $d$ , there were statistically significant but moderate correlations between overall pain reports in the oro-facial area and disrupted sleep ( $d = 0.127$ ,  $P = 0.001$ ), sleep bruxism ( $d = 0.241$ ,  $P < 0.001$ ) and stress experiences ( $d = 0.193$ ,  $P < 0.001$ ). Logistic regression revealed, independent of the instrument group (string, woodwind, brass wind, percussion), that current oro-facial pain experience was significantly associated with disrupted sleep ( $P = 0.001$ ), frequent sleep bruxism ( $P < 0.001$ ) and frequent stress ( $P = 0.002$ ) experiences.

**Conclusions:** Among symphony orchestra musicians, oro-facial pain experience seems to be related to perceptions of stress, sleep bruxism and disrupted sleep rather than the instrument group.

**KEYWORDS**

musician, oro-facial pain, sleep bruxism, sleep disorder, stress

## 1 | INTRODUCTION

Professional musicians playing in symphony orchestras may be at risk for various work-related factors detrimental to health: ambient noise, irregular working hours, tight schedules and high discipline (ie, low control, high demand), for example. These factors may cause excessive stress and/or sleep problems and physical impairment.<sup>1,2</sup>

Not only the work environment but also the type of instrument may relate to problems, which may affect work performance and further increase stress experience and worries. Especially, wind and violin/viola players may be suspected to be more prone to oro-facial pain problems than, say, percussionists; due to the playing techniques, wind players may overload their masticatory and facial muscles, and violin/viola playing may add strain in both masticatory and neck muscles. It should also be borne in mind that professional musicians most probably have started playing at an early age. However, studies on temporomandibular disorders (TMD) among musicians have remained ambiguous: some studies have reported no instrument-related associations with subjective TMD, whilst studies that have included clinical examinations have shown some.<sup>3</sup>

Perceived stress and poor sleep go reportedly hand in hand.<sup>4,5</sup> Evidence exists that these perceptions are associated with self-reported bruxism.<sup>6</sup> In addition, self-reported bruxism has been associated with oro-facial pain experience.<sup>7</sup> Considered as a gold standard, since the publication of Lavigne et al two decades ago,<sup>8</sup> sleep bruxism has been diagnosed by means of polysomnography (PSG) including audio/video recordings in sleep laboratories or by data gathered with ambulatory devices at home environment. Unfortunately, with respect to all the findings regarding masticatory muscle activity and concomitant physical events in the body, the PSG-based gold standard diagnostic cut-off point has shown poor clinical relevance regarding the relationship between bruxism and TMD.<sup>9</sup>

An international group of experts defined bruxism as a repetitive jaw-muscle activity characterised by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible.<sup>10</sup> Additionally, for operationalisation of the definition, a diagnostic grading system of "possible", "probable" and "definite" sleep or awake bruxism was suggested, the grade depending on the method how to assess bruxism. According to the consensus, however, self-reported bruxism can only provide an estimate of "possible bruxism." The consensus paper was updated in 2018 to distinguish sleep and awake bruxism: masticatory muscle activity during sleep (characterised as rhythmic or non-rhythmic) was not considered as a sleep disorder or a movement disorder in otherwise healthy individuals.<sup>11</sup> Similarly, masticatory muscle activity during wakefulness (characterised as repetitive or sustained tooth contact and/or by bracing or thrusting the mandible) is not a movement disorder.<sup>11</sup> In addition, the feasibility of self-reports to study bruxism behaviours in large-scale studies was addressed.<sup>11</sup>

Up to date, the impact of playing an instrument on perceived oro-facial pain has remained unclear. As a part of a large-scale sleep study among professional musicians in Finland, the aim of the present study was to evaluate whether the type of instrument was associated with oro-facial pain experience among professional symphony orchestra musicians in Finland. Sleep-related issues, stress experience and "possible sleep bruxism" were controlled for.

## 2 | MATERIALS AND METHODS

A standard questionnaire was sent to all Finnish symphony orchestras ( $n = 19$ ), with altogether 1005 musicians and other personnel. The objective was to collect data to understand sleep and sleep-related issues among professional musicians.

The questionnaire covered descriptive data, among others, items on perceived quality of sleep, sleep-related problems and symptoms,<sup>12</sup> stress experience<sup>13</sup> and oro-facial pain.<sup>14</sup>

For the present study, which comprised of musicians only, a special emphasis was on oro-facial pain experience. The following items were used:

- Age and sex.
- Instrument group (string, woodwind, brass, percussion).
- Oro-facial pain: "During the past 30 days, how long did any pain last in your jaw or temple area on either side?" (no pain, pain is present occasionally, pain is continuous).
- Sleep bruxism: "Sleep bruxism is involuntary periodical tooth grinding or tooth clenching. Do you have such symptoms?" (never, only a little, occasionally, almost every night, every night).
- Stress experience: "Stress means the situation when a person feels tense, restless, nervous or anxious, or is unable to sleep because his/her mind is troubled. Do you feel that kind of stress these days?" (not at all, seldom, to some extent, rather much, very much).
- Difficulties in initiating sleep: "How long does it usually take before you fall asleep?" (<10 minutes, 10-30 minutes, over 30 minutes).
- Disrupted sleep: "How many times do you usually wake up during the night?" (0-1 times, 2-3 times, 4 times or more).
- Non-restorative sleep: "How often do you feel refreshed after awakening?" (never or once a week, 2-4 times a week, 5 or more times a week).
- Tiredness: "How often do you feel tired or non-energetic during daytime?" (never or once a week, 2-4 times a week, 5 or more times a week).

### 2.1 | Statistical methods

For descriptive data, one-way ANOVA was used to compare the mean age within the instrument groups and the chi-square test to study the associations between the groups and categorical variables. In addition, Somers's  $d$  was run to assess the associations between oro-facial pain experience and disrupted sleep, sleep bruxism and

stress. Logistic regression model was fitted to analyse the probability of current oro-facial pain (any pain = 1, no pain = 0). The independent variables included in the model were categorised as follows: frequent sleep bruxism (almost every night or every night = 1, else = 0), frequent stress (rather much or very much = 1, else = 0), difficulties initiating sleep (30 minutes or more = 1, else = 0), disrupted sleep (4 times or more = 1, else = 0), non-restorative sleep (never or once a week = 1, else = 0), tiredness (5 or more times a week = 1, else = 0), each instrument group against a dummy variable (group  $x = 1$ , all other groups = 0, etc). Five respondents were excluded from the analyses due to the difficulty to categorise the specific instrument. Stepwise backward logistic models were tested to select variables for the final analyses, in which the method enter was used, that is, all independent variables were entered in a single step in the model. Odds ratios and the corresponding 95% confidence intervals were calculated. The model was adjusted by age and sex. IBM SPSS® statistical software (version 25.0; SPSS®, Inc) was used for the analyses.

### 3 | RESULTS

The response rate was 58.7% ( $n = 488$ ). There was no significant difference in the response rate between the orchestras. Of the respondents, 52.3% were men. The mean age of men was 47.7 (SD 10.3) and of women was 43.4 (SD 9.8) years ( $P < 0.001$ ), without significant difference between the studied instrument groups (viz. string, woodwind, brass, percussion).

Women were more often string instrumentalists (60.3%), whereas men were more often brass (81.4%) and percussion players (90.9%) ( $P < 0.001$ ). Overall, current pain in the oro-facial area was reported by 28.9%, frequent bruxism by 12.1% and frequent stress by 20.8%. Difficulties initiating sleep, disrupted sleep, non-restorative sleep and tiredness were reported by 13.6%, 6.0%, 21.7% and 8.9%, respectively. Descriptive data on the study population according to the instrument group are shown in Table 1.

According to Somers'  $d$ , there were statistically significant but moderate correlations between pain in the oro-facial area (no pain, pain is present occasionally, pain is continuous) and disrupted sleep ( $d = 0.127$ ,  $P = 0.001$ ), sleep bruxism ( $d = 0.241$ ,  $P < 0.001$ ) and stress experiences ( $d = 0.193$ ,  $P < 0.001$ ). This indicates that increased severity of disrupted sleep, sleep bruxism and stress are associated with the frequency of oro-facial pain experience.

Logistic regression revealed, independent of the instrument group and adjusted by age and sex, that current oro-facial pain experience was significantly associated with disrupted sleep ( $P = 0.001$ ), frequent sleep bruxism ( $P < 0.001$ ) and frequent stress ( $P = 0.002$ ). Odds ratios and their 95% confidence intervals are shown in Table 2.

### 4 | DISCUSSION

The purpose of our study was to evaluate whether oro-facial pain experience was related to the type of musical instrument and to

learn more about the roles of sleep and sleep-related issues in the pain among professional musicians. The main findings were that current oro-facial pain experience was significantly associated with perceptions of disrupted sleep, frequent sleep bruxism and stress. This in line with an earlier study.<sup>7</sup> It is worth of notion, however, that the occurrence of disrupted sleep was markedly lower compared to previous findings in Finland and in other adult populations.<sup>12,15</sup>

The overall response rate (58.7%) of the present study was considered fair. The sample size ( $n = 488$ ) enabled us to perform the multivariate analyses.

To assess current pain status, we measured oro-facial pain experience within the past month using the validated three-point single question included in the Diagnostic Criteria for TMD Axis I TMD screening protocol (question 1).<sup>14</sup> Chronic pain was not evaluated. This may be considered as a weakness of the study, bearing in mind that professional musicians probably have played since childhood/adolescence, which may have exposed them to excessive stress and even affected facial structures, for instance.<sup>16</sup> Unfortunately, as the present study is a part of a large-scale sleep study among professional musicians, it was not possible to set an in-depth focus on TMD.

It has been generally hypothesised that especially musicians playing a wind instrument could overload the masticatory system due to the muscle work in the masticatory and facial to control the playing. Also, string instrumentalist (violin and viola) use the same muscles together with neck/shoulder muscles to keep the instrument in position in relation to jaw and shoulder. However, a recent evidence-based review on TMD among musicians revealed that no clear-cut associations between TMD and wind instrument players exist.<sup>3</sup> Neither did the authors find reported differences between wind and other musicians. In the present study, none of the studied instrument groups was associated with current oro-facial pain experience.

Stress was measured using a validated method,<sup>13</sup> which in fact includes the aspects of anxiety and disturbed sleep. This measure of self-report of perceived stress, as well as state anxiety by the Symptom Checklist 90,<sup>17</sup> has also previously been reported to associate with the frequency of self-reported sleep bruxism in media workers with or without irregular shift work.<sup>18</sup> In the same data set, frequent sleep bruxism and disrupted sleep were found to be significantly associated with perceived current oro-facial pain.<sup>6</sup>

Bruxism is jaw-muscle activities of different aetiology and clinical relevance, viz. tooth grinding, clenching and masticatory muscle activities without tooth contact. It has two circadian manifestations; it may occur during sleep or awake. Tooth grinding is rarely or never present in healthy individuals during wakefulness. Bruxism may be a sign of underlying disorders, can represent a risk factor for clinical consequences or may be just a behaviour without any pathological relevance. This construct of bruxism has been the basis of a recently published updated consensus paper<sup>11</sup> that revisited the definition and diagnostic grading proposed in 2013 by a bruxism expert panel.<sup>10</sup> During the past two decades, it has become more or less evident that PSG-based diagnostic methods for sleep bruxism have poor relevance regarding its clinical consequences. Also,

**TABLE 1** Descriptive data on the study population according to the group of instrument

N = 483	Instrument group				P-value
	String n = 283	Woodwind n = 92	Brass n = 86	Percussion n = 22	
Mean (SD)					
Age	45.6 (10.2)	45.9 (10.4)	46.4 (9.9)	42.3 (11.3)	0.407
Percentages for					
Sex					<0.001
Male	39.7	54.8	81.4	90.9	
Female	60.3	45.2	18.6	9.1	
Oro-facial pain					0.580
No pain	71.8	67.7	77.9	72.7	
Occasional	26.5	29.0	22.1	27.7	
Continuous	1.7	3.2	0.0	0.0	
Sleep bruxism					0.561
Never	42.7	35.5	40.7	52.4	
Seldom	23.1	22.6	20.9	23.8	
Occasionally	24.1	24.7	25.6	9.5	
Almost every night	8.0	11.8	7.0	14.3	
Every night	2.1	5.4	5.8	0.0	
Stress experience					0.934
Not at all	6.7	4.3	7.0	4.5	
Seldom	35.4	38.7	36.0	40.9	
To some extent	36.8	39.8	34.9	27.3	
Rather much	15.1	11.8	11.6	18.2	
Very much	6.0	5.4	10.5	9.1	
DIS (sleep latency, minutes)					0.618
<10	43.2	41.9	40.7	22.7	
10-30	43.5	44.1	47.7	54.5	
Over 30	13.3	14.0	11.6	22.7	
DS (awakenings per night)					0.475
<2	53.3	43.0	49.4	59.1	
2-3	40.1	50.5	45.9	40.9	
4 times or more	6.6	6.5	4.7	0.0	
NRS (mornings per week)					0.922
<2	22.3	23.7	17.4	22.7	
2-4	54.4	55.9	60.5	50.0	
5 or more	23.3	20.4	22.1	27.3	
Tiredness (days per week)					0.043
<2	38.2	41.9	47.6	28.6	
2-4	53.4	50.5	45.2	42.9	
5 or more	8.5	7.5	7.1	28.6	

Note: One-way ANOVA for the group means, chi-square test for the categorical variables.

Abbreviations: DIS, difficulties initiating sleep; DS, disrupted sleep; NRS: non-restorative sleep.

self-reports and PSG findings do not match when compared. In the present study, according to earlier findings in Finland,<sup>7</sup> self-reported sleep bruxism (ie, possible sleep bruxism) and current oro-facial pain

experience were significantly associated. However, the limitation of the present study may be considered that awake bruxism was not included.

**TABLE 2** The probability of any pain in jaw, temple, ear or in front of the ear on one side or the other during the past 30 d

n = 483	OR	95% CI	P-value
Difficulties initiating sleep	0.9	0.5-1.8	0.908
Disrupted sleep	4.1	1.7-9.6	0.001
Non-restorative sleep	1.4	0.7-2.4	0.252
Frequent sleep bruxism	3.8	2.0-7.0	<0.001
Frequent stress	2.4	1.3-4.1	0.002
Instrument group			
String	0.9	1.3-5.4	0.861
Woodwind	1.1	0.2-6.9	0.958
Brass	0.7	0.1-4.9	0.742
Percussion	1.2	0.1-9.6	0.899

Note: Logistic regression. Adjusted by age and sex.

Sleep is the very basis for optimal cognitive functioning, viz., data handling, learning, consolidation of memory, to name a few. Sleep is also the essential conductor of metabolism and recovery.<sup>19</sup> Unfortunately, sleep disorders have become increasingly prevalent affecting health, well-being, and working ability,<sup>20</sup> causing a burden in economic and societal levels. Reportedly, shift workers and especially those working irregular shifts have been demonstrated to have higher prevalence of sleep problems compared to those with regular day work.<sup>21</sup>

Although some sleep disorders are strongly related to a sedentary lifestyle, there also can be several underlying mechanisms for certain sleep disorders, for example anatomic abnormalities, personality characteristics or genetic factors. The master biological clock, which locates in the bilaterally paired suprachiasmatic nucleus in the anterior hypothalamus, controls the timing of sleep and wake in humans and regulates the circadian behavioural, physiologic and biological rhythms,<sup>22</sup> with interindividual differences concerning the wake-sleep rhythm and the preferred timing to perform various activities. However, there are two extremes (in addition to the neutral type) in the so-called chronotype profiles: morning type (individuals who wake up early and go to sleep early) and evening type (individuals who wake up late and go to sleep late). It is noteworthy that these profiles may be in imbalance with social activities and work duties. Thus, in addition to other stress factors regarding work performance and environment, irregular working hours may also endanger good sleep among professional musicians often working at late hours and on public holidays.

It may be concluded that among symphony orchestra musicians the perceptions of disrupted sleep, stress and sleep bruxism seem to play a more important role with reports of oro-facial pain rather than the instrument group. To ensure optimal health and the high demand quality of work performance, the effects of workload, sleep quality and the need for sleep counselling should be further studied.

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