


# Temporomandibular Disorders: Symptoms and Facial Pain in Orchestra Musicians in Finland

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## Abstract

The aim of this study was to investigate temporomandibular disorders (TMDs) and the symptoms and facial pain of professional symphony orchestra musicians. Results of questionnaires from musicians in Sinfonia Lahti and in The Finnish Radio Symphony Orchestra ( $n = 73$ ) showed that facial pain was common among orchestral musicians (30% of the musicians). The overall prevalence of the symptoms did not vary between the instrumentalist groups but indicated that the musicians playing different instruments had mixed susceptibilities to symptoms. In particular, night bruxism and sleep disturbances seemed to increase the number of symptoms of TMDs in wind players, whereas among string players sleep disturbances increased the occurrence of the symptoms. We conclude that unpleasant facial symptoms were prevalent in many of the professional musicians studied and, as such, may deserve attention as part of an occupational focus on health and wellness.

## Keywords

bruxism, facial pain, musicians, occupational medicine, TMDs

## Introduction

Temporomandibular disorders (TMDs) include collectively a number of clinical problems relating to the masticatory muscles, temporomandibular joint (TMJ), and associated structures.<sup>1-3</sup> Symptoms of TMDs are common and often slight but may cause discomfort and absence from work.<sup>4-6</sup> Particularly in musicians, symptoms of TMDs can strongly affect playing and the ability to work.<sup>7</sup> The TMDs are often associated with facial pain reducing the quality of life of the individual.<sup>8</sup> Information concerning the prevalence of symptoms of TMDs and facial pain in professional symphony orchestra musicians is important as it can be expected that playing an instrument can increase the vulnerability to these symptoms.<sup>9</sup> We investigated self-reported symptoms of TMDs and facial pain of musicians in 2 orchestras, Sinfonia Lahti and The Finnish Radio Symphony Orchestra.

The most common clinical symptoms and signs of TMDs are unintentional sounds and pain in TMJ or pain in masticatory muscles limiting the mouth function and causing dysfunction of the jaws.<sup>1,2</sup> Symptoms associated with TMDs include, for example, tinnitus, headache, earache, and facial pain. Symptoms are often slight and the diagnosis is often difficult to establish. Patients with TMDs may require special medical care and attention and may show reduced work performance.<sup>1,2,4-6</sup> The symptoms of TMDs may also be affected by general diseases, traumas, genetic and psychosocial factors, and former

pain conditions. It is not uncommon for people with stress and sleeplessness to have these symptoms.<sup>2,10</sup> Women tend to present with these symptoms more often than men.<sup>1,2</sup> According to a recent survey in employees of the Finnish Broadcasting Company Ltd, the occurrence of orofacial pain was 7%; and of the symptoms of TMDs, pain was the most common reason to seek medical help.<sup>2</sup>

Musicians in symphony orchestras tend to experience high levels of stress, and nonergonomic posturing can contribute to their stress.<sup>7,11-13</sup> The demands are high and there are few possibilities for self-care that assists musicians with their working conditions. Musicians in an orchestra often are required to be simultaneous soloists as well as collective musicians, while at the same time, they are required to follow the conductor's instructions. It has been shown that symptoms of TMDs are activated and accentuated when performing or practicing along with suboptimal ergonomic working conditions (eg, poor

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**Table 1.** Background Information (Sex, Age, and Stress Level) of the Musicians Who Participated in the Study, and Proportions of Different Symptoms of TMDs According to the Instrument Played

Instruments	n	Sex (m/f)	Age (yrs, min-max)	Stress <sup>a</sup>	Facial Pain (%)	TMJ Clicking (%)	TMJ Locking (%)	TMJ Crepitation (%)	Morning Jaw Pain (%)	Unpleasant Occlusion (%)
Violin and viola	31	8/23	42 (24-59)	2.8	29	29	23	23	16	3
Cello and double bass	13	10/3	45 (26-60)	2.5	15	23	0	23	0	15
Wind instrument	24	15/9	45 (29-56)	3.2	42	27	8	25	8	8
Other	5	3/2	47 (23-58)	2.6	20	20	20	20	20	40
Total	73	36/37	43 (23-60)	2.8	30	27	14	23	11	10

Abbreviations: TMDs, temporomandibular disorders; TMJ, temporomandibular joint.

<sup>a</sup>A question in the questionnaire: Do you feel stressed? 1 = *not at all*, 5 = *very much*. The mean value is presented.

posture and muscle tension).<sup>7</sup> Stressful and nonergonomic work may also raise the risk of mental strain and physical illnesses as musicians often underestimate or conceal their problems and ignore signals that require rest or even medical care.<sup>12</sup> These components in turn often increase the symptoms of TMDs among the musicians.

The playing of an instrument, alone, and in and of itself may increase one's propensity to develop symptoms of TMDs. For example, the violin is held between the shoulder and the left side of the jaw, and an earlier study among members of an orchestra and teachers at a music conservatory revealed that playing violin is indeed linked to symptoms of TMDs.<sup>14</sup> In another study conducted by Taddey<sup>7</sup> it was stated that "violinists and violists frequently clench their teeth or play with their teeth while performing." For wind players, the mouth is highly important when the sound is formulated (embouchure), and these musicians are also prone to have symptoms of TMDs, as shown in studies among orchestra musicians at a conservatory and in military force music groups.<sup>15,16</sup> Many orchestral musicians (40%-50%) have tinnitus at least temporarily, because they are often exposed to very loud sounds of up to 83 to 95 dB.<sup>12,17-19</sup> The use of hearing protectors is rare and difficult because they prevent the musicians from hearing their own and others' playing in an accurate and immediate way.<sup>17</sup> Tinnitus in musicians can present as, for example, a TMD-related symptom or acoustic trauma or may be the result of a psychological factor or brought on by stress.<sup>2,12,20</sup> In the present study, tinnitus was not included in symptoms of TMDs because it was already known to be common in musicians (41% of musicians reported having tinnitus).

The specific aim of the present study was to investigate the prevalence of symptoms of TMDs and facial pain in professional orchestra musicians with respect to age, sex, stress level, night and day bruxism, sleep disturbances, and physical exercise. We hypothesized that differences exist in the prevalence of symptoms among musicians of different instrument groups.

## Material and Methods

Self-reported symptoms of TMDs and facial pain were investigated among the musicians of 2 large, famous professional orchestras in Finland—Sinfonia Lahti and The Finnish Radio Symphony Orchestra. Permission for the study was granted by the general managers of both the orchestras. Sinfonia Lahti

has been founded in 1950 and consists of 67 musicians.<sup>21</sup> The Finnish Radio Symphony Orchestra was founded in 1927 and has today 99 musicians.<sup>21</sup>

The present survey was performed in the Fall of 2010 using a structured questionnaire (the Research Diagnostic Criteria for Temporomandibular Disorders [RDC/TMDs]); the reliability and validity of the forms used has been well documented.<sup>22</sup> We considered facial pain, TMJ clicking (symptom of chronic disc displacement with reduction), TMJ locking (symptom of disc displacements without reduction), TMJ crepitation (symptom of arthritis/arthrosis), jaw pain in the morning and unpleasant occlusion as symptoms of TMDs.<sup>22</sup> Furthermore, information was asked about background variables (the instrument, sex, and age), stress level, night and day bruxism, sleep disturbances, and nature and amount of physical exercise. In Sinfonia Lahti, the questionnaire was given to the musicians present in a rehearsal ( $n = 64$ ) and 57 persons (89%) participated, whereas in The Finnish Radio Symphony Orchestra 27 musicians (27%) participated (Table 1). Eleven musicians answered incompletely, and they were excluded from the final analyses.

We investigated separately the occurrence (0 = *no symptoms*, 1 = *at least 1 symptom*) and the number of symptoms of TMDs using generalized linear mixed models with glmmPQL function in the statistical program R.<sup>23,24</sup> Models for all instruments, violin and viola, string (violin, viola, cello, and double bass combined), and wind players were estimated separately. Occurrence models were estimated using quasi binomial (link "logit"), and count models using quasi Poisson error distribution (link "log"). An orchestra was as a random factor in the models, taking into account the fact that several musicians worked in the same workplace. As fixed effect variables included (1) age, (2) sex, (3) stress, (4) night bruxism, (5) day bruxism, (6) sleep disturbances, and (7) physical exercise (see Table 2). Correlations between the fixed effect variables were low enough ( $r \leq .48$ ), and thus all the variables were included in the final models. A variable concerning an instrument was added to all players' models (1 = *violin and viola*, 2 = *cello and double bass*, 3 = *wind instrument*, 4 = *other*) to investigate the differences between the instrumental groups.

## Results

Altogether 56% of the musicians reported at least 1 symptom of TMDs; 61% of the violin and viola players, 38% of the cello and

**Table 2.** Generalized Linear Mixed Models Concerning the Occurrence and Number of Symptoms of TMDs in the Instrument Players of Sinfonia Lahti and the Finnish Radio Symphony Orchestra<sup>a</sup>

	Intercept	Age, y	Sex <sup>b</sup>	Stress <sup>c</sup>	Night Bruxism <sup>d</sup>	Day Bruxism <sup>e</sup>	Sleep Disturbances <sup>f</sup>	Physical Exercise, min/wk
<b>Symptom occurrence</b>								
All players <sup>g</sup>	0.630 ± 2.004	-0.080 ± 0.032	0.401 ± 0.634	0.260 ± 0.404	0.204 ± 0.260	0.103 ± 0.317	0.884 ± 0.458	<0.001 ± 0.001
Violin players	0.137 ± 4.179	-0.050 ± 0.054	-0.584 ± 1.226	-0.168 ± 0.879	0.311 ± 0.531	0.360 ± 0.644	1.239 ± 0.864	-0.001 ± 0.002
String players	2.691 ± 3.056	-0.184 ± 0.060	-1.679 ± 1.084	1.125 ± 0.774	0.445 ± 0.406	-0.154 ± 0.340	1.510 ± 0.739	<-0.001 ± 0.001
Wind players	-1.120 ± 5.117	-0.249 ± 0.148	3.739 ± 2.816	2.081 ± 1.424	0.232 ± 0.528	-1.143 ± 1.342	3.752 ± 2.163	-0.002 ± 0.004
<b>Number of symptoms</b>								
All players <sup>g</sup>	-1.631 ± 0.963	-0.013 ± 0.015	0.312 ± 0.334	0.197 ± 0.180	0.240 ± 0.096	0.134 ± 0.118	0.366 ± 0.228	<0.001 ± 0.001
Violin players	-0.606 ± 1.888	-0.017 ± 0.026	-0.092 ± 0.568	-0.087 ± 0.313	0.174 ± 0.206	0.186 ± 0.190	0.554 ± 0.387	<0.001 ± 0.001
String players	0.058 ± 1.266	-0.047 ± 0.021	-0.186 ± 0.410	0.115 ± 0.233	0.147 ± 0.154	0.179 ± 0.127	0.515 ± 0.301	<0.001 ± 0.001
Wind players	-3.562 ± 1.681	-0.018 ± 0.027	1.450 ± 0.581	0.062 ± 0.275	0.448 ± 0.182	0.116 ± 0.247	0.922 ± 0.484	0.001 ± 0.001

<sup>a</sup>Models for all (n = 73), violin (n = 31), string (n = 42-43), and wind players (n = 23) have been estimated separately. Model coefficients and standard errors are given in boldface ( $P \leq .05$ ) and underlined ( $.05 < P \leq .10$ ) if a variable is statistically significant.

<sup>b</sup>Difference in sex (females compared to males).

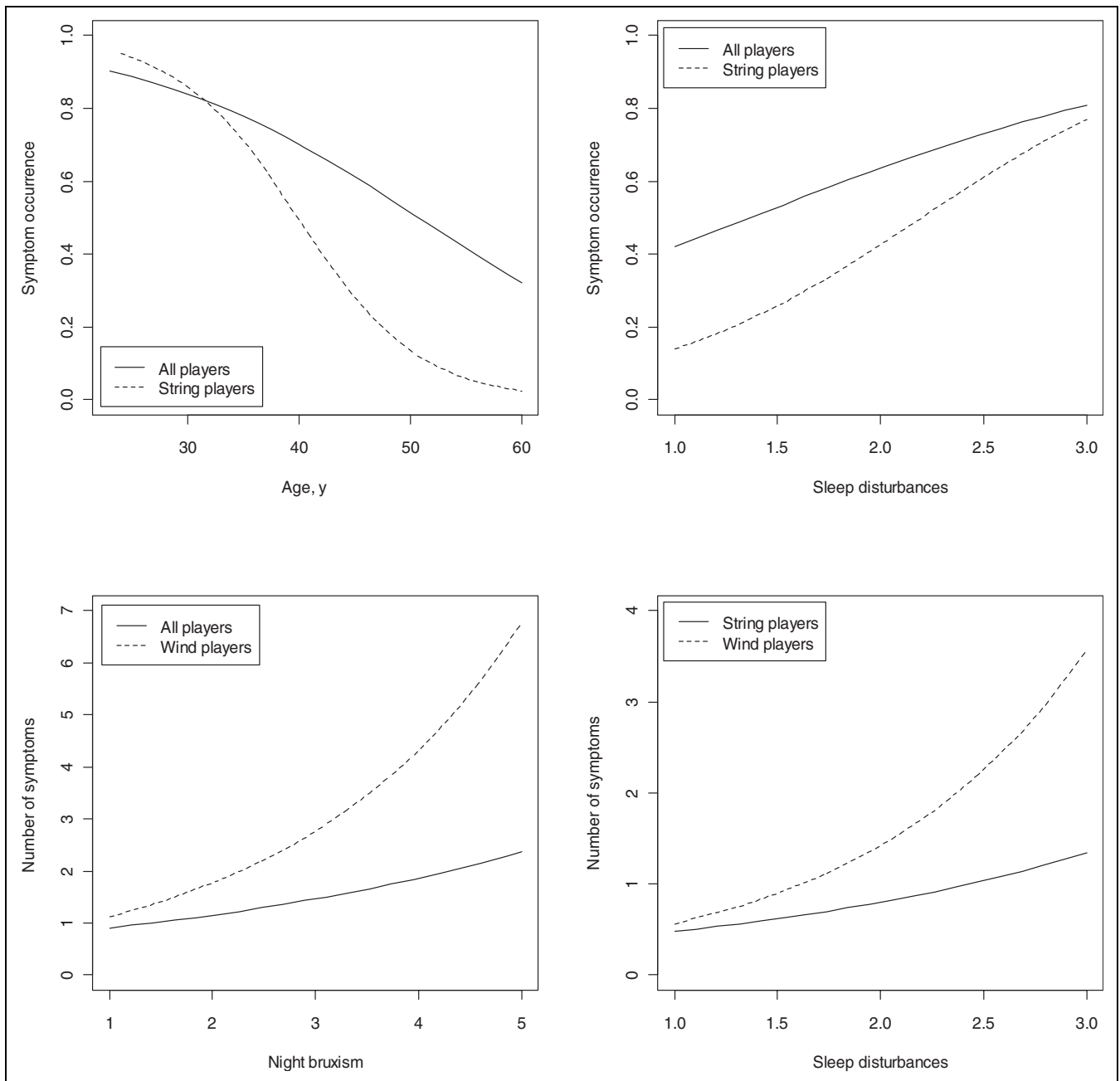
<sup>c</sup>A question in the questionnaire: Do you feel stressed? 1 = not at all, 5 = very much.

<sup>d</sup>In the last month, have you been told, or have you noticed that you grind or clench your teeth while sleeping? 1 = no, or less than once per month, 5 = every night or almost every night.

<sup>e</sup>During the day, do you grind or clench your teeth? 1 = no, or less than once a month, 5 = every day or almost every day.

<sup>f</sup>Have you been tired in the mornings, that is do you feel that your sleep has been nonrestorative for at least the last month? 1 = No, I have not been tired in the mornings, 3 = Yes, I have suffered from nonrestorative sleep for at least 1 month.

<sup>g</sup>Differences between the instrumentalist groups (1 = violin and viola, 2 = cello and double bass, 3 = wind instrument, 4 = other) have not been shown in the table as no differences were found.



**Figure 1.** Symptoms of TMDs relating to age, sleep disturbances, and night bruxism among musicians playing different instruments. Both occurrence (upper row) and count model curves (lower row) are presented (see Table 2). TMDs indicate temporomandibular disorders.

double bass players, 54% of the wind players and 62% of the others. The occurrence of the symptoms in all players and string players increased with sleeplessness but decreased with age (Table 2). For example, in string players when the age increased from 20 to 60 years, the occurrence of symptoms decreased from nearly 100% to almost 0% (Figure 1). Furthermore, the occurrence of symptoms of TMDs in string players increased approximately 5-fold when sleeplessness continued over 1 month. The occurrence of symptoms did not vary between the instrumentalist groups. In this study, sex, stress, night and daytime bruxism and physical exercise did not affect the occurrence of the symptoms.

The average number of symptoms in all players was 1.2 (range, 0-6); in violinists and viola players 1.2 (range, 0-4), in cellists and double bass players 0.8 (range, 0-4), in wind players 1.2 (range, 0-5), and in others 1.4 (range, 0-6). Night bruxism increased the number of symptoms in all players but especially among the wind players (Table 2). In wind players, when the occurrence of night bruxism increased from once a month to almost every night, the number of symptoms increased from 1 to 6 (Figure 1). Sleeplessness seemed to increase the number of symptoms in both the string and wind players. In wind players, when good sleep transformed into

insomnia in at least 1 month of duration, the number of symptoms increased from 1 to more than 3. Female wind players had significantly more symptoms than male wind players. However, the number of symptoms did not vary between the instrumentalist groups. Daytime bruxism, stress, and physical exercise did not affect the number of symptoms. Aging diminished the number of symptoms only in string players.

## Discussion

The purpose of our study was to investigate the reasons for the occurrence and number of symptoms of TMDs. Our results clearly showed that sleep disturbances related to increased symptoms of TMDs in string players and that night bruxism and sleep disturbances related to increased number of symptoms of TMDs in wind players.

A comparison to earlier literature shows that symptoms of TMDs and facial pain are more common in orchestra musicians than in the population of Finland in general. According to a recent national survey, 14% of Finns observed in a clinical examination had masticatory muscle pain and 15% had chronic disc displacement with reduction, that is TMJ clicking<sup>1</sup>; whereas among the musicians of the present study, 30% had self-reported facial pain and 27% had TMJ clicking. Furthermore, 7% to 19.6% of media personnel have facial pain,<sup>2,10</sup> the proportion being smaller than among the musicians in our study. However, comparison between the results is difficult because of the fluctuating nature of the symptoms and different research methods used in the investigations. In our study, the average number of symptoms was low, but it seems that more than half of the musicians nevertheless had at least 1 symptom. The most reported symptoms in the musicians were facial pain and TMJ clicking. For example, wind players had facial pain (42%), TMJ clicking, and crepitation (25%-27%). It is probable that producing sound with a wind instrument affects the muscles of the head and neck, which would present more frequently among wind players. Furthermore, approximately 23% to 29% of the violinists and violists had facial pain, TMJ clicking, locking, and crepitation, and jaw pain in the morning was also common (16%). Thus, it seems that playing violin and viola also increases one's likelihood of having symptoms of TMDs. This may be due to the fact that these instruments press against the left side of the jaw, resulting in an unnatural physiological posturing of the head.<sup>25</sup> Bryant<sup>26</sup> reported that viola players had asymmetric contraction of the left lateral pterygoid muscle that pushes the jaw forward and deflects it to the right which, in that study, was accompanied by "clicking" or "cracking" of the TMJ. Forward positioning of the cranium, needed to hold the instrument steadily while playing, may further render the player liable to the symptoms investigated.

Night bruxism and sleep disturbances (probably related to stress: a positive correlation between sleep disturbances and stress was 26% to 48% in the instrumentalist groups investigated) increased the symptoms in our study, whereas aging seemed to diminish them. Straining work stress and dissatisfying

work leads to bruxism, insomnia, and facial pain.<sup>10</sup> Wind players reported the highest stress scores. The authors attribute this to the fact that it is probable that most of the solo parts within an orchestra are often scored and played by wind players. There was a strong effect notable of night bruxism in wind players that could indeed have arisen from the strained muscles while playing frequent central solo themes. Bruxism seemed to be a more powerful factor causing symptoms of TMDs than sleep disturbances, suggesting that muscle strain could be a more significant cause of TMDs. Age, on the other hand, did not diminish the symptoms of TMDs as much in wind players as in string players. In earlier studies, the symptoms of TMDs have been found to be prevalent especially in females.<sup>1,2</sup> In our study, this gender difference was only observed in wind players.

In the earlier studies by Yeo et al<sup>16</sup> and Taddey,<sup>7</sup> it was suggested that reducing playing time might help in alleviating TMDs and overuse symptoms, but these means are difficult if not impossible to organize in a professional symphony orchestra. Characteristically, a working week means up to 25 to 30 hours of rehearsals and concerts plus continuous practicing at home.<sup>7</sup> In addition the musicians often play in chamber music groups and have teaching responsibilities. Especially for wind players, occlusal splints (a stabilization appliance) and instructions for jaw exercises could be useful to prevent night bruxism and tense muscles.<sup>16</sup>

The results of our study showed that the prevalence of symptoms of TMD and facial pain in orchestral musicians was high. Good health practices and attention to the physiological and psychological well-being of musicians should be of high priority in any professional symphony orchestra. Individual stress-related factors might need to be emphasized in the services provided and related to the occupational health services available to musicians. However, the present results did not confirm our study hypothesis, as no differences in the occurrence or the numbers of symptoms of TMDs were observed between the instrumentalist groups. On the other hand, the musicians playing different instruments had varying susceptibility to symptoms. Our study clearly showed that increased sleep disorders and night bruxism were associated with increased occurrence and number of symptoms of TMDs, whereas aging had a reverse relationship to them.

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