Signs and symptoms of temporomandibular disorders and radiologically observed abnormalities in the condyles of the temporomandibular joints of professional violin and viola players

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The frequency of temporomandibular disorders (TMDs) and radiologically observed abnormalities in the condyles of the temporomandibular joints (TMJs) of professional violin and viola players was investigated in 26 orchestra violinists/violists (VP group) and in their sex-, age-, and dentition-matched controls (C group). A routine clinical stomatognathic examination, a standardized interview, and radiography of the condyles were carried out for all subjects. The VP group showed a higher frequency of subjective symptoms and clinical signs of TMD, such as palpatory tenderness of masticatory muscles, TMJ clicking, painful mandibular movements, and deviation on opening or closing. There was no difference between the groups in terms of radiologic findings in the condyles. Weekly playing hours correlated positively with some signs of TMD. It is concluded that professional violin or viola playing might be a predisposing factor for TMD.
☐ *Occupation; radiology; temporomandibular joint; violinist*

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There have been several case reports (1–5) but only one controlled study (6) on the association between temporomandibular disorders (TMDs) and viola or violin playing. It seems that after intense playing, violists and violinists may experience facial and temporomandibular joint (TMJ) pain, TMJ clicking, and shoulder and neck pain (1, 3, 5, 7). Hirsch et al. (6) reported mandibular opening deviation to the right side and smaller maximal jaw opening in violists and violinists more often than in controls. The size of the deviation and the number of playing hours were positively correlated. Radiologically observed degenerative changes in the TMJ in young violinists have been described in only a few case reports (1, 2, 4).

The purpose of this study was to investigate whether professional violin and viola players have more signs and symptoms of TMD or radiologically observed abnormalities in the condyles of the TMJs than control subjects.

Materials and methods

Materials

The subjects were 26 professional violinists and violists (mean age, 37 years; range, 22 to 58 years), 13 men and 13 women, from the Helsinki Philharmonic Orchestra. There were 16 violinists (7 men, 9 women) and 10 violists (6 men, 4 women). All played right-handed—that is, held the instrument on the left. They had played on average for 29 years (range, 16 to 46 years) and at the time of the investigation were playing an average of 36 h (range, 24–62 h) per week. All the subjects had almost complete natural dentitions, at maximum two teeth missing (wisdom teeth excluded) and bilaterally at least one pair of occluding molars. None of the subjects was diagnosed as having any general joint diseases.

The controls were selected from patients seeking ordinary dental treatment at the Institute of Dentistry, University of Helsinki. They were individually matched with the study group on the basis of sex, age (± 2 years), and dentition with regard to molar support. None of the controls had played a violin or viola.

Clinical examination and interview

All subjects and controls underwent a routine stomatognathic examination in accordance with Krough-Poulsen (8) and Carlsson & Helkimo (9), including palpation of masticatory muscles and TMJs, examination of mandibular mobility with a ruler to the nearest millimeter, and recording of TMJ noises and painful mandibular movements. The occlusal relations were recorded as described by Wenneberg & Kopp (10). In addition, the sternocleidomastoid, trapezius, deltoid, and greater pectoral muscles were palpated, as were the muscles of upper limbs.

A tenderness score for each muscle was recorded as 0 (= no tenderness), 1 (= subjective tenderness), or

2 (= palpation caused palpebral reflex). All clinical examinations were carried out by the first author (O. Kovero). After the clinical examination a personal standardized interview was conducted with the subjects and controls by the first author, to establish their previous and present subjective symptoms of TMD. The questions concerned TMJ pain (when opening wide or chewing), locking, stiffness feeling and sounds of TMJs, pain in muscles of the face or temples, headache, and parafunctional oral habits. The players were also questioned about the playing and the individual instrument.

Radiologic examination

The TMJs of each subject and control were radiographed using a PM 2002 CC (Planmeca, Finland) panoramic tomograph, using its TMJ program. In the program the right and left TMJs are radiographed in a lateral projection both in the intercuspal position of the jaws and in the maximal opening position. From the panoramic tomograms the condyles were evaluated dichotomously (no sign = 0, sign = 1) for abnormalities in shape (flattening or broadening of the condylar head), sclerosis, osteophyte formation, erosion of the joint surface, periarticular ossicles, and osteoporosis. The tomograms were examined in random order and independently by two examiners who did not know the results of the clinical examination. When there were disagreements, the findings were discussed to reach the final diagnosis. Inter- and intra-examiner variations were analyzed, and the results are presented as agreement percentages. Intraexaminer readings occurred with an interval of 6 months.

Statistical methods

The significance of differences between the groups was tested using the paired t test (parametric variables) and Wilcoxon's matched pairs signed-ranks test (nonparametric variables). The correlations are given using Pearson's product moment correlation coefficient. The level of statistical significance is given when $p < 0.05$; otherwise it is denoted as NS.

Results

Subjective symptoms

The subjective symptoms reported in the interview are shown in Table 1. The violinist–violist group (VP) reported subjective TMD symptoms more frequently than the controls (C), but the difference was not statistically significant. An association between muscle symptoms and intense playing was reported by 22 of 26 players.

The severity of subjective TMD symptoms for both groups is shown in Fig. 1. The difference between the groups was not significant.

Table 1. Subjective symptoms of temporomandibular disorders in the violin/viola player (VP) and control (C) groups, given as numbers of subjects. Difference between groups is nonsignificant

	VP ($n = 26$)	C ($n = 26$)
Pain in TMJs* when opening wide	5	3
Pain in TMJs when chewing	0	1
Occasional locking of TMJ	4	1
TMJ sounds	11	5
Feeling of tiredness or stiffness in the jaws in the morning	4	2
Pain in muscles of face or temples	3	3
Headache every week	5	1
Grinding of teeth	8	8
Clenching of teeth	10	5
Other parafunctional habits	10	6

* TMJ = temporomandibular joint.

Clinical findings

When the tenderness scores of all masticatory muscles examined were summarized, players had palpatory tenderness (mean score, 2.5; range 0–10) more often than controls (mean, 1.0; range, 0–5 ($p < 0.01$). Palpebral reflex was evoked in seven subjects in the VP group and

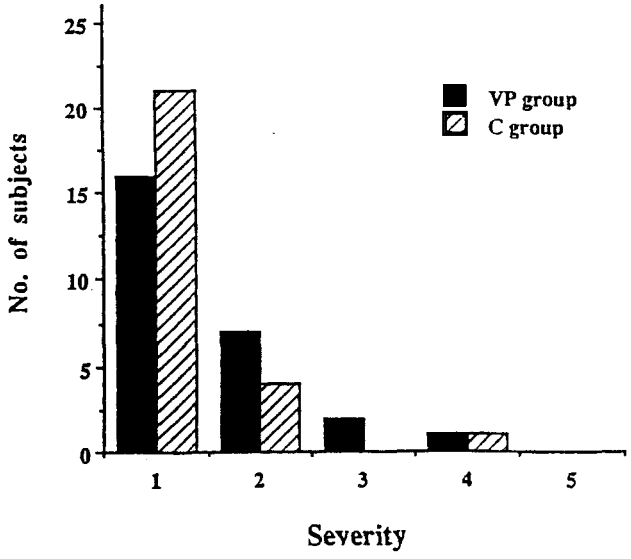

Fig. 1. The severity of subjective symptoms of temporomandibular disorders as number of subjects in the violin/viola player (VP) group ($n = 26$) and the control (C) group ($n = 26$). Scale used: 1 = no or minimal discomfort, 2 = slight discomfort, 3 = moderate discomfort, 4 = severe discomfort, 5 = very severe discomfort. Difference between groups is nonsignificant.

Table 2. Clinical findings in the temporomandibular joint (TMJ) in the violin/viola player (VP) and control (C) groups, given as numbers of subjects

	VP ($n = 26$)	C ($n = 26$)	p
TMJ tenderness to palpation			
Laterally	9	3	NS
Dorsally	4	3	NS
TMJ clicking (with unaided ear)	5	0	< 0.05
Crepitation (with unaided ear)	1	0	NS
Crepitation (with stethoscope)	1	4	NS
Painful mandibular movements	7	0	< 0.01

in none in the C group ($p < 0.02$). When the scores of the right and left masticatory muscles were calculated separately, the VP group showed tenderness more often than the C group, but only the left-side difference was significant ($p < 0.01$). The difference in palpatory tenderness of the individual masticatory muscles was statistically significant ($p < 0.05$) for the left deep masseter muscle, the left medial pterygoid muscle, and the left lateral pterygoid muscle. With regard to other than masticatory muscles, only the difference in the palpatory tenderness of the left deltoid muscle was statistically significant ($p < 0.05$), the players showing tenderness more often than the controls.

The two groups showed similar ranges of border movements, whereas the VP group showed deviation (≥ 2 mm) twice as often (20 of 26) as the C group (11 of 26); the difference was statistically significant ($p < 0.01$). The mean size of the deviation was 3.3 mm in the VP group and 1.5 mm in the C group ($p < 0.05$). The deviation in the VP group was more often to the right (62%) than to the left (9%), whereas 29% showed irregular openings. The corresponding figures in the C group were 45.5% to the right, 45.5% to the left, and 9% irregular. Mandibular movements were observed to be painful in seven subjects in the VP group and in none in the C group ($p < 0.01$). The VP group had audible clicking more often than the C group ($p < 0.05$). (Table 2).

Radiologic findings of the condyles

The inter- and intra-examiner agreements in the radiologic findings were 95.8% and 99.5%, respectively.

In the VP group abnormality of shape (5 of 26), sclerosis of the joint surface (12 of 26), and osteophyte formation (3 of 26) were found in the condyles, whereas in the control group the corresponding figures were 7 of 26, 14 of 26, and 2 of 26, respectively, and one of the control subjects had erosion of the joint surface. The difference between the groups was not statistically significant.

Correlations

Weekly playing hours correlated significantly with the TMJ pain during movement ($r = 0.55$; $p < 0.01$), the number of tender masticatory muscles ($r = 0.51$; $p < 0.01$), the number of tender masticatory muscles on the right side ($r = 0.47$; $p < 0.02$), and with the subjective severity of TMD ($r = 0.42$; $p < 0.05$). In the VP group female sex correlated with reported TMJ sounds ($r = 0.44$; $p < 0.05$) and the severity of subjective TMD ($r = 0.63$; $p < 0.001$). The VP group also showed positive correlations between occasional locking of the TMJ reported in the interview and clickings (bilateral or left-sided) recorded at clinical examination ($r = 0.78$; $p < 0.001$). Right-sided clicking and locking were also significantly correlated ($r = 0.49$; $p < 0.02$).

In the C group female sex correlated with clenching ($r = 0.50$; $p < 0.02$), whereas age correlated negatively with headache ($r = -0.51$; $p < 0.01$) and positively with locking of the TMJ ($r = 0.49$; $p < 0.02$). The severity of subjective TMD correlated with the palpatory tenderness of the masticatory muscles ($r = 0.49$; $p < 0.02$).

Discussion

The players had signs of TMD such as muscle tenderness, painful mandibular movements, deviation of opening/closing movement, and TMJ sounds statistically significantly more often than the controls. Reports of subjective symptoms of TMD were also commoner in the VP group, but the difference was not statistically significant.

Hirsch et al. (6) have conducted the only investigation with any similarity to ours. In their investigation, however, both the clinical part and the interview were more limited, and thus their results are comparable with ours in very few aspects. For example, in their study the control group was not individually matched but comprised dental students much younger than the players. Further, the masticatory muscles were not palpated.

In the present study 27% of the VP group were found clinically to have TMJ pain in the maximal movements of the mandible, whereas 78% of the violists and 73% of the violinists in the study of Hirsch et al. (6) reported TMJ pain. This great difference is almost certainly due to the methods. In the present study the concept of TMJ pain was meticulously defined, whereas in the study of Hirsch et al. (6) the evaluation of TMJ pain was based on whether the players had sought treatment for jaw problems.

The prevalence of a deviation on opening/closing of the jaws is similar in the present study (81%) and in the study of Hirsch et al. (6) (94% and 100% in violists and violinists, respectively), and there is also a similar trend with regard to the directions and range of the deviation.

The frequency of audible clicking differs greatly between the present study (19%) and the study of Hirsch

et al. (6) (93%). This is evidently due to the difference in the concept 'audible clicking' in these studies. In the present study only clicking that was heard with the unaided ear within a distance of half a meter was recorded as audible clicking. Crepitations heard with the unaided ear and with a stethoscope were placed in a separate crepitation category. In the Hirsch et al. study 'the examiner noted audible clicking and palpable crepitus'. In general, there seems to be great variation in the frequency of recorded TMJ sounds because of the different recording techniques (11, 12). In the general population the frequency of clicking (audible without a stethoscope) is 13% according to an investigation of 1000 adult dental patients made by Vincent & Lilly (13).

There were no statistically significant differences between the players and controls with regard to the radiologic findings of the condyles observed in the panoramic tomograms of TMJs. Thus, the radiologically observed degenerative changes of TMJs of young violinists reported in the literature seem to be rare, extreme cases.

It is concluded that professional violin and viola players have clinical signs of TMD more frequently than their controls. Thus, professional violin and viola playing seems to be a factor predisposing to TMD.

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