

Prevalence of temporomandibular disorders (TMD) among Finnish prisoners**Running head: Temporomandibular disorders in prisoners****Original article, cross-sectional clinical study**

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Abstract

Objective: The aim of the present study was to evaluate the prevalence of self-reported TMD symptoms and clinically diagnosed TMD among Finnish prisoners.

Material and methods: Altogether 100 prisoners from the Pelso Prison, Vaala, Finland, underwent dental and TMD clinical examinations performed by a calibrated and well-trained dentist. Symptom Questionnaire and clinical examination according to a Finnish pre-final version of the DC/TMD (Diagnostic Criteria for Temporomandibular Disorders) Axis I protocol were used to evaluate the prevalence of TMD sub-diagnoses.

Results: The most common TMD symptoms were facial pain (54.0%), temporomandibular joint noises (43.0%) and headache (37.0%). The prevalence of joint-related TMD diagnoses was four and a half times higher than diagnoses attributed with pain (76.0% vs 17.0%). The most common TMD diagnoses were degenerative joint disease (33.0%) and disc displacement (DD) with reduction (33.0%).

Conclusions: The prevalence of self-reported TMD symptoms and clinical assessed TMD, especially joint-related TMD diagnoses, is high among Finnish prisoners. Examination and treatment of TMD should become a common practice also in prison dental care.

Keywords: prisoner, temporomandibular disorders, TMD, DC/TMD

Introduction

Temporomandibular disorders (TMD) are common orofacial pain conditions. TMD covers various forms of dysfunctional, pain-related and intra-articular clinical problems related to temporomandibular joints (TMJs), masticatory muscles, and dentition and to closely related tissues [1]. Signs and symptoms of TMD are known to be common in the adult population [2]. TMD prevalence varies greatly, depending on the examination methods and diagnostic criteria used, as well as on the study population [2, 3, 4]. According to several studies, the prevalence of individual TMD symptoms in the adult population varies between 5-50%, while 40-90% of adults have clinical findings [2, 5, 6]. TMD has several background factors, including occlusal factors and oral parafunctions, trauma, age and gender, as well as genetic and psychological factors [3, 7, 8]. Psychosocial factors have substantial impact on pain persistence and responsiveness to treatment, which is why these factors should be taken into account when diagnosing TMD patients and planning their treatment [9]. Among prisoners, psychosocial factors may be over-presented as compared to general population [10]. Substance abuse i.e. alcohol consumption and illicit drug use as well as misuse of pharmaceuticals are highly prevalent among prison population worldwide [11].

Female gender and age are associated with TMD signs and symptoms; in the age group of 20-40 years TMD are common [3-6]. Some studies have reported that alcohol consumption [12] and smoking [13, 14] are associated with TMD, although the evidence is scarce [15]. A recently published study [16] revealed that major consumption of alcohol, daily smoking and use of snuff increased the risk for nearly

all TMD symptoms among young Finnish adults. Non-smokers with TMD have lower pain severity than smokers with TMD [13]. There are only a few studies concerning the association between illicit drug use and TMD. According to Winocour et al. [17], drug addicts have more TMD signs and symptoms and oral motor parafunctions than non-drug users. Especially methamphetamine and ecstasy increase parafunctional activities such as bruxism [18, 19].

The international scientific community has recently developed DC/TMD criteria (The Diagnostic Criteria for Temporomandibular Disorders), which provide an international, consistent and valid method for diagnosing TMD and are suitable for both clinical and research settings [20]. The DC/TMD criteria comprise two axes: Axis I include valid diagnostic criteria for the most common TMD sub-diagnoses, based on Symptom Questionnaire and clinical examination, and Axis II includes new bio-behavioural instruments. The Finnish version of DC/TMD (DC/TMD-FIN) was completed in December 2016 [21].

In the prison population lower social classes are over-presented and prisoners have fairly low socio-economic status (SES) [22] and their education level is low [23]. Based on the above-mentioned background factors behind TMD, it could be assumed that the prevalence of TMD is high among prisoners. The aim of the present study was to evaluate the prevalence of self-reported TMD symptoms and clinically assessed TMD diagnoses among Finnish prisoners based on DC/TMD Axis I diagnostic criteria.

Material and methods

Participants

The study population comprised a convenience sample involving all prisoners in the Pelso Prison, Vaala, Finland. The data collection was conducted between September 2014 and February 2015, and the prisoners' oral health was examined. First fifty prisoners were also interviewed for their background factors and use of psychoactive substances. The Pelso Prison is a closed prison having facilities at that time for 110 prisoners. The details of the prisoners' sentences were not available for the research group, but there are more convicted than remanded (short stay) prisoners in the Pelso Prison. All prisoners were invited to participate, and altogether 100 of them participated in the study: 89 men (mean age 35 years, range 21-70) and 11 women (mean age 38 years, range 21-61).

Use of psychoactive substances

To evaluate the use of psychoactive substances (smoking, snuff, alcohol, drugs), one-on-one oral interview was used with the following questions: "Do you smoke" (*yes/no*)? "Have you used illicit drugs at some point of your life" (*yes/no*)? "Did you use snuff in civil life" (*yes/no*)? "Did you use alcohol in civil life?" with the different answer alternatives (*no / twice a month or less frequently / once a month / every other week / once a week / more than once a week*)? Reasonable users were drinking alcohol twice a month or less frequently or once a week and drinking alcohol more than once a week was considered major consumption. The prisoners were assisted with the questionnaires when needed by one of the authors (RV).

Medication

The data on pharmaceuticals used by the prisoners were obtained from their medical files and were categorised as antipsychotics, analgesics, sleeping and falling

asleep/insomnia, gastrointestinal, asthma, allergy and cardiovascular medications, as well as drug-related compensation pharmaca and others.

TMD symptoms

The Finnish version of the DC/TMD Symptom Questionnaire was used to inquire the presence of TMD symptoms during the past 30 days [21]. When necessary, the questionnaire was completed using one-on-one interview.

Clinical examination

The clinical examination of TMD was performed according to the DC/TMD Axis I diagnostic criteria, using the pre-final version of DC/TMD-FIN. Author RV, working as a dentist in Pelso Prison, performed all the clinical examinations. Before the TMD examinations, the examiner (author RV) was trained on the study protocol. The calibration was performed against reference standard examiner (KS), who has been accredited in the DC/TMD Training and Calibration Center in Malmö, Malmö University, Sweden. The clinical diagnoses were obtained according to the diagnostic algorithms for DC/TMD sub-diagnoses. For the inter-examiner agreement, authors RV and KS examined a total of 13 patients in two occasions about two months apart.

Ethical approval

All the prisoners at the Pelso Prison were allowed to participate in the study and the participation was voluntary. Informed consent was obtained from all the participants. The study was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District (ETTMK: 50/2014) and the Finnish Criminal Sanctions Agency.

Statistics

The inter-examiner agreement was investigated by calculating kappa values (κ) for every TMD sub-diagnosis. The kappa values were estimated as follows: > 0.75 excellent reliability, $0.40-0.75$ fair to good reliability and < 0.40 poor reliability [24]. The data of both genders was combined for analyses due to the limited number of females. Data on TMD symptoms and sub-diagnoses were described as frequencies and proportions of the total study sample, stratified by age (20-34y vs. 35 y or more). Differences between age groups were considered statistically significant at p levels < 0.05 . All the statistical analyses were performed by using the SPSS (version 24.0, SPSS, Inc., Chicago, IL, USA).

Results

Substance use and medication

Most of the prisoners smoked (88%) and one fifth of them (20%) had used snuff. Almost two-thirds (62%) reported having used illicit drugs at some point of their life. Prior to imprisonment, one fourth of them (24%) had been major consumer of alcohol. There were not significant associations between TMD diagnoses and substance use.

Nearly all prisoners (87%) used at least one pharmaceutical. Antipsychotics (55%) and analgesics (45%) were the most commonly used medication, followed by medicines for (sleeping/falling asleep) insomnia (39%), gastro-intestinal problems (27%), asthma (21%), and allergy (10%). Five prisoners used drug-related compensation medication.

Inter-examiner reliability

The kappa value for inter-examiner agreement was 1.00 for arthralgia, headache attributed to TMD and DD without reduction without limited opening, indicating excellent inter-examiner reliability. Inter-examiner reliability was excellent also for myalgia ($k=0.81$). For myofascial pain with referral ($k=0.41$), DD with reduction ($k=0.49$) and degenerative joint disease ($k=0.58$), the reliability was from fair to good. For diagnoses DD with reduction with intermittent locking and DD without reduction with limited opening, the agreement was 100%.

Temporomandibular disorders

Based on the DC/TMD-FIN Symptom Questionnaire, 84 prisoners out of 100 (84.0%) reported having one or more TMD symptoms during the preceding 30 days. The most reported TMD symptom (54.0%) was pain in areas of jaw, temple, ear or front of ear on either side, followed by joint noises (43.0%), headache (37.0%), jaw locking (7.0%) and jaw locking when opening mouth (8.0%). Facial pain prevalence for males was 52.8% and for females 63.6%. Younger prisoners (<35y) had more facial pain and joint noises than older ones (Table 1).

Of the total study sample, 36.0% had one and 24.0% had two or more clinical TMD diagnoses. Here joint-related diagnoses were 4.5 times (76.0% vs 17.0%) more prevalent than diagnoses attributed with TMD pain. The most common TMD diagnoses were degenerative joint disease (33.0%) and disc displacement (DD) with reduction (33.0%) (Table 2). Younger prisoners (<35y) had more degenerative joint diagnoses than older ones, though there were no significant differences in the prevalence of TMD diagnoses between the age groups. None of the subjects had DD without reduction with limited opening.

Discussion

The present study reveals that the prevalence of TMD is high among prisoners. To our knowledge, there is very little information available about the prevalence of symptoms and clinical signs of TMD among prisoners. In the present study, the new internationally developed and validated diagnostic criteria, the DC/TMD Axis I protocol, was used. This is also the strength of this study and will allow comparing the results with future studies. The joint-related TMD sub-diagnoses were most common among this marginal study population, whereas the diagnoses attributed with pain were markedly less common. Every third prisoner had a degenerative joint disease and DD with reduction, clinical findings related to these diagnoses are commonly found in population [2]. The prevalence of TMD found in the present study (60%) having one or more TMD sub-diagnoses was higher than in the former study by Enguelberg-Gabbay et al. [25] from 152 prisoners, who showed that the prevalence of TMD was 46.3% for drug-user prisoners (n=69) and 25.6% for non-drug users (n=83). The results are somewhat comparable, as Enguelberg-Gabbay et al. used the RDC/TMD Axis I- protocol. (Research Diagnostic Criteria for Temporomandibular disorders)

The prevalence levels for pain-related diagnoses among Finnish prisoners seem to be approximately at the same level as those found in the Finnish general population, but considerably higher for joint-related diagnoses. A recent study by Jussila et al. [27] on the Northern Finnish Birth Cohort 1966, consisting of 45-46-year-olds, found that the most common TMD diagnoses were DD with reduction (7.0%), arthralgia (5.3%), degenerative joint disease (5.1%) and myalgia (5.0%). In addition, Manfredini et al. [28] found in their systematic review that DD with reduction was the most common diagnosis among the general population, the

percentages ranging from 8.9% to 15.8%. Among the present study population, the prevalence were much higher for DD with reduction and degenerative joint disease, both being 33.0%. In the present study, the original DC/TMD criteria were used, whereas Jussila et al. [27] used a modified version of DC/TMD and did not register myofascial pain with referral, locations of headaches, DD with reduction with intermitting locking with limited opening, DD without reduction with limited opening or DD without reduction without limited opening. It should be noted the validity of DC/TMD joint-related diagnoses has been reported to be relatively low, and additional examinations, such as CBCT (cone-beam computer tomography) is suggested to confirm the diagnosis when needed [20].

The prevalence of self-reported TMD symptoms was as high as 84.0% among the Finnish prisoners but still corresponds to the general view of the matter. The high prevalence may be related to prisoners' tendency to worsen their symptoms, which may be due to medication-seeking behaviour and/or related benefits in the prison. Our findings are in line with previous studies where self-reported TMD symptoms are more prevalent than clinical signs [4]. In a cross-sectional epidemiological study, Köhler et al. [29] found that among a Swedish study population aged 20-70 years, the proportion of TMD symptom-free subjects (based on self-reporting) decreased over two decades from 73.0% to 62.0%. In the present study, the proportion of those without TMD symptoms was only 16.0%. The most frequently reported symptoms were pain in areas of jaw, temple, ear or front of ear, followed by joint noises and headache. Although pain was reported fairly often, the clinical pain diagnoses did not reach a high level. Miettinen et al. [16] reported a lower prevalence of self-reported face/jaw pain among young Finnish adults aged 18-20 years: jaw pain prevalence for males was 25.3% and for females 33.8% and

facial pain was 13.6% for males and 14.9% for females. In the present study, the prevalence for facial pain were 52.8% and 63.6% for males and females, respectively. The majority of the subjects in the present study group were under 40 years old, the mean age being 35 years. The present study inquired pain in face and other areas within last the 30 days, while in the study by Miettinen et al. [16] pain during the preceding year was inquired. The differences in the prevalence can partly be explained by the subjects of different ages and the time periods used in the questionnaire.

The inter-examiner reliability in this study was excellent for most of the TMD pain-related Axis I diagnoses, whilst for joint-related diagnoses more variability was found. The lowest kappa values (although rated as fair to good) were shown for myofascial pain with referral ($k = 0.41$), DD with reduction ($k = 0.49$) and degenerative joint disease ($k = 0.58$). This is partly in concordance with a recent study published by Leskinen et al. [30], which evaluated the reliability of the Finnish version of the DC/TMD Axis I diagnoses and showed the lowest kappa values for the joint-related diagnoses. The degenerative joint disease and DD with reduction diagnoses are based on TMJ noises reported in the Symptom Questionnaire and during the clinical examination. Thus, discrepancies in only one discrete finding between the examiners may have a great impact on kappa values. In the present study, the relatively low kappa values for myofascial pain with referral may be explained by possible deficiencies in the cognitive capacity of the subjects. Understanding the question whether pain was felt under the finger or also anywhere else was difficult for some participants and this may be one reason for low kappa value for myofascial pain with referral. Overall, the inter-examiner reliability can be considered to be very good. Based on the present study, DC/TMD-

FIN (as a pre-final version), which was used for the first time for epidemiological purposes, proved to be an applicable tool for assessing TMD among adults and can thus be implemented to clinical practice.

The present study had several strengths. The participation rate was high (91%) and the study population was homogenous in terms of living conditions and lifestyle and also health and oral-health related habits, i.e. common use of psychoactive substances. It should be noted that in the interview current smoking was asked, whereas the use of substances, i.e. alcohol, snuff and drugs before imprisonment was inquired. The reason for that is that the use of other psychoactive substances than smoking is not allowed in Finnish prisons. Further, snuff sale is prohibited in Finland, although it is illegally imported from Sweden. Prisoners used many pharmaceuticals, especially the use of antipsychotics and analgesics was common and indicated psychosocial problems. On the other hand, use of medicines and psychoactive substances, acting also as analgesic agents, may induce higher pain threshold and thus less reporting pain.

Using the international, validated and evidence-based DC/TMD protocol was also a strength of the study. The Finnish version of the DC/TMD Symptom Questionnaire with interview was used to overcome literacy problems, because at least some of the prisoners had reading and spelling difficulties. Interviewing the prisoners took time but provided probably more information than could have been obtained from self-written responses. Overall, the attitudes of the prisoners towards this study were positive, with only a few exceptions. The relatively small number of participants, especially the number of female prisoners, can be considered a limitation of this study. Due to that, any comparisons between genders were not

performed. In general, the proportion of women in the prison population is considerably lower than that of men.

Prisoners' way of life exposes them to various traumas, fights and crashes. Accidents and injuries resulting from various causes are common [31]. Part of the joint diagnoses could probably also be explained by traumas, which were not studied here and could be a topic for future study.

The prevalence of self-reported TMD symptoms and especially joint-related TMD diagnoses was high among Finnish prisoners.

Examination and treatment of TMD should become a common practice also in prison dental care and also patient's information on the background factors is important.

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Table 1. Prevalence of self-reported TMD symptoms and sub-diagnoses of TMD among Finnish prisoners (n=100).

	Age n (%)			<i>p</i> -value
	<35 y 53 (53.0)	≥35y 47 (47.0)	Total n (%)	
Symptom n (%)				
Facial pain	31 (58.5)	23 (48.9)	54 (54.0)	0.339
Joint noises	26 (49.1)	17 (36.2)	37 (37.0)	0.564
Headache	21 (39.6)	16 (34.0)	43 (43.0)	0.194
Jaw locking	4 (7.5)	3 (6.4)	7 (7.0)	n.s
Jaw locking in wide jaw opening	3 (5.7)	5 (10.6)	8 (8.0)	0.469
Diagnoses attributed with pain n (%)				
Myalgia				
Myofascial pain with referral				
Arthralgia				
Headache attributed to TMD				
Temporomandibular joint diagnoses n (%)				

Table 2. Prevalence of sub-diagnoses of temporomandibular disorders, TMD among Finnish prisoners, n=100

Age group (%)	Diagnoses attributed with pain				Temporomandibular joint diagnoses				
	Myalgia	Myofascial pain with referral	Arthralgia	Headache attributed to TMD	DD● with reduction	DD with reduction with intermittent locking	DD without reduction without limited opening	Degenerative joint disease	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
<35:53 (53.0)	4 (7.6)	3 (5.7)	2(3.8)	1 (1.9)	17 (32.1)	1 (1.9)	5 (9.4)	20 (37.7)	53
≥35:47 (42.0)	3 (6.4)	1 (2.1)	2(4.3)	1 (2.1)	16 (34.0)	0	4 (8.5)	13 (27.7)	40
Total	7 (7.0)	4 (4.0)	4 (4.0)	2 (2.0)	33 (33.0)	1 (1.0)	9 (9.0)	33 (33.0)	93
p-value	0.821	1.000	0.239	0.409	0.390	0.562	0.840	0.539	

● Disc displacement

There were no DD without reduction with limited opening