Quality of Life in patients with TMD pain and tinnitus

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Abstract

Aim: The aim of this study was to investigate the association between temporomandibular disorders (TMD), tinnitus and the impact on quality of life (QoL). The study evaluated this by comparing self-reported QoL in TMD patients with and without tinnitus.

Materials and Methods: The sample for this study was drawn from the follow up examination in a large comprehensive prospective study, designed to validate the Research Diagnostic Criteria for TMD. Of 401 subjects, 213 (198 women, 24 men) completed questionnaires about tinnitus and the Short Form Health Survey (SF-12). The subjects were divided into three groups: “TMD with pain”, “TMD without pain” and “No TMD” (control group). A majority of the 213 subjects (n=204) were classified as “TMD with pain” and was the only group analysed. The data were analysed, p-value <0.05 was considered as statistically significant.

Results: The prevalence of tinnitus in the TMD with pain group (n=204) was 22.5% and significantly higher (p=0.017) in men (43.5%) than in women (19.9%). There were no significant differences for TMD patients with or without tinnitus for physical (p=0.15) or mental (p=0.91) subscores on SF-12.

Conclusion: Tinnitus as an addition to TMD with pain showed no impact on QoL. The study population was similar in terms of QoL, both physical- and mental, compared to the mean value for SF-12.
Sammanfattning

Syfte: Syftet med denna studie var att undersöka sambandet mellan temporomandibulär dysfunktion (TMD), tinnitus och dess inverkan på livskvalitet (Quality of life, QoL). Detta utvärderades genom att jämföra självrapporterad QoL hos TMD-patienter med eller utan tinnitus.

Material och Metod: Populationen utgjordes av patienter från en uppföljningsundersökning i en större prospektiv studie gjord för att validera Research Diagnostic Criteria för TMD. Deltagarna delades in i tre huvudgrupper: "TMD med smärta", "TMD utan smärta" och "ingen TMD" (kontrollgrupp). Tinnitusdiagnos ställdes genom egenrapportering i frågeformulär och QoL utvärderades med Short Form Health Survey (SF-12). Av 401 patienter fanns det data för ovan nämnda variabler från 213 individer (198 kvinnor, 24 män). 204 individer diagnostiserades med "TMD med smärta" och var den enda gruppen som analyserades, "TMD med smärta" och "ingen TMD" (kontrollgrupp) exkluderades p.g.a. för få individer. Ett p-värde < 0.05 ansågs vara statistiskt signifikant.

Resultat: Tinnitusprevalensen i gruppen (n=204) var 22.5% och signifikant högre (p=0.017) för män (43.5%) jämfört med kvinnor (19.9%). Ingen statistisk signifikant skillnad sågs med avseende på livskvalité hos TMD-patienter med, respektive utan, tinnitus (SF-12 fysisk p=0.15, mental p=0.91)

Konklusion: Tinnitus verkar inte ge ytterligare negativ påverkan på livskvalité för patienter med TMD med smärta. Studiepopulationens QoL ligger inom ramen för det medelvärde som anses normalt vid användning av SF-12.
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Introduction

Tinnitus

Tinnitus is a subjective sensation of sounds in the absence of any external audio source or stimulation. The soundings of tinnitus can be described as ringing, whizzing or roaring sounds. Although many people have experienced these type of symptoms, for example after being exposed to a loud noise, it’s important to distinguish between such short term, transient problems, and the chronic symptoms that people with tinnitus experience continuously (1).

Tinnitus is believed to be caused by a disturbance or damage to the auditory organ, e.g. from noise, trauma or infections. The true actiology is unclear, but a common theory is that any of these factors may disrupt the nerve fibres that innervate the ear and its insulating layer. The disruption could then in turn lead to an abnormal and uncontrolled transmission of impulses in adherent nerves to the brain, which perceives it as sound impulses (2,3). Different anatomical anomalies in the individual such as malocclusion, but also muscle twitching in the proximity of the ear(1), medications, metabolic disorders, diet and depression have also been suggested as a possible cause for nerve impulses that are falsely perceived as auditory stimuli (3).

About 10-15% of the Swedish population suffers from tinnitus(1) and in the US; the prevalence is 15% for some types of tinnitus (4). It is reported that about 2-3% of patients are disturbed by their tinnitus to the extent that their quality of life (QoL) is significantly compromised (5). Thus, studies have shown clear association between tinnitus and reduced QoL (6). Tinnitus was significant and negatively associated with QoL meaning that individuals who reported more severe tinnitus were more likely to report poorer QoL (7). The major complaints in patients with tinnitus are sleeping disorders, difficulty in concentrating and discomfort (8). Tinnitus is more common among men, which historically was believed to be the cause of more men having noise polluted work environment. Tinnitus is also more prevalent with coexisting hearing impairment and also gradually becomes more prevalent with increasing age. Most often, the symptom is bilateral, but unilateral tinnitus is also reported (1).

Tinnitus is often categorized based on the experience that the patient reports (ringing, noise, tone, volume, etc.) (1) and since tinnitus is a subjective symptom it is difficult to measure in a reliable way. Different questionnaires have been developed to obtain information about the
symptoms from the patient, where one of the most frequently used one is Tinnitus Handicap Inventory (THI) (9). THI is a validated questionnaire (9) but there are several other instruments with slight variations, and the literature have shown that it could be difficult to determine which of these that is the best at providing the correct information (1).

Currently there is no treatment that effectively provides a complete resolve of the symptoms and consequences caused by tinnitus. Treatment such as Cognitive Behavioural Therapy (CBT) is used more for helping the patient cope with the discomfort (insomnia, depression and concentration difficulties) that comes with tinnitus rather than improving the sound itself (1). However, there is some support from different studies that treatments that affects the temporal mandibular joint (TMJ) and the surrounding muscles and structures, such as oral splints, movement exercises and relaxation of the facial muscles, can reduce or resolve the sounds that the patients are experiencing. However, the extent of the resolution of tinnitus may be limited or unresolved for some patients (10,11).

**Temporomandibular disorders**

Temporomandibular disorders (TMD) is a collective term for clinical symptoms that involve the masticatory muscles, the TMJs, and the surrounding structures (12). The condition is usually classified into one of two subgroups depending on anatomical origin: (i) TMJ-related, which includes the TMJ disc and surrounding structures or (ii) muscular-related, which includes the masticatory muscles and the muscles involved with the disc (13). TMD is characterized by pain during jaw function and on palpation of the TMJs and/or muscles, TMJ noises during jaw function and irregular/limited jaw-movement (14). Subsequently, the term TMD does not solely include problems relating to the TMJ but includes all parts of the masticatory system (joint, disc, muscles, ligament) (12).

The literature reports a prevalence of TMD of 10%−15% in the general population in Sweden. TMD is also reported to be most common in the 20−40-year age group, less common in the young or those over 60 years (15,16), and twice as common in women as in men (15).

TMD has a multi-factorial aetiology and expresses in various ways depending on the tissues or structures that are involved (12,17). Joint-related symptoms such as TMJ clicking and pain in the area near the joint indicate that the problem originates in the disc and the jaw joint while tiredness, stiffness, pain upon movement and headache point to a muscular origin (18).
Muscle-related symptoms are more common than joint-related (19). As mentioned earlier, the aetiology of TMD is multi-factorial and complex. Usually, factors associated with TMD are divided into predisposing factors (increasing the risk), precipitating factors and prolonging factors. Although a direct causal relationship has not been demonstrated studies have suggested several risk factors for TMD such as somatic awareness, psychosocial stress, pain catastrophizing, trauma, emotional stress, parafunction and occlusion (12,20,21). It has also been shown that general health affects the risk of developing TMD. Slade et.al. reported different risk factors and ranked these based on how well they predict the development of TMD. One of those, which made the greatest contribution to TMD, was a checklist of 20 health conditions/health status variables, for example depression and ringing in the ears. Bodily pain and general health, both measured in 12-item Short Form Health Survey (SF-12) were also ranked high (22).

To diagnose TMD, a combination of a standardized patient questionnaire and a standardized clinical examination is advocated. This system, “Diagnostic Criteria for TMD” (DC/TMD), is an upgraded version of the “Research Diagnostic Criteria” (RDC/TMD) that were introduced in 1992. DC/TMD is intended for use both in research and clinically(14).

Because of the multi-factorial aetiology there are many different types of treatments for TMD. The treatments most often recommended by the Swedish National Board of Health and Welfare currently are occlusal appliances, jaw exercises, behavioural therapy and pharmacology, often in different combinations (23).

**Relationship between tinnitus and TMD**

A relationship between tinnitus and TMD has been proposed (24,25). The prevalence of tinnitus among TMD patient ranges between 33% and 76%(8). However, the causal link between TMD and tinnitus is unclear (12) and several theories have been proposed. Some studies reports that tinnitus is more common in patients with TMD and that treatment to improve TMD symptoms had a positive effect also on the severity of tinnitus, which may suggest a shared pathophysiology as a result of nearby anatomical structures (10,11,26-28). One study has also indicated that tinnitus together with facial pain is associated with a higher degree of depression (24) and could therefore have a negative impact on quality of life. Further studies to investigate the mechanisms common to tinnitus and TMD and the
The comorbidity of tinnitus to TMD could have a crossover advantage for both tinnitus patients in general health care and TMD patients.

**Aim**

The aim of the present study was to evaluate the association between TMD, tinnitus and the impact on quality of life (QoL). Both TMD and tinnitus have been shown to have an impact on QoL, and therefore the two diagnoses combined may cause a higher impact. This study evaluated this by comparing self-reported QoL in TMD patients with and without tinnitus.

**Hypothesis**

The hypothesis is that there is a positive relationship between TMD and tinnitus and a negative impact on quality of life.
Materials and Methods

Study sample and setting

The sample for this study was drawn from the follow up examination in a large comprehensive prospective study, designed to validate the RDC/TMD classification system (29). The baseline examination was carried out from 2003 to 2006 as a multisite collaboration between researchers at the University of Minnesota, the University of Washington, and the University of Buffalo, and 724 subjects underwent complete clinical dental examination and TMJ imaging.

The exclusion criteria included current pregnancy, rheumatoid disease, neurological disorders, previous head and neck surgery, widespread pain, and the use of analgesic(s) other than acetaminophen for 3 days before examination (29,30) and as a consequence 19 subjects were excluded. The baseline sample consisted of a total of 705 subjects, 614 subjects with TMD and 91 without TMD. Approximately 550 of the study participants were consecutively recruited and the remainder was selectively recruited. The participants were drawn from two sources; direct appointments from local health care providers to the respective university-based TMD centre and responses to community advertisements (29,31). About 7 years after the baseline examination, a convenience patient sample of 401 participants (331 women and 70 men) from the baseline sample, were recalled for follow-up examination (31).

Of these 401 subjects, 213 individuals (198 women and 24 men) completed the questionnaires SF-12 about health and well-being and “Medical History”, including a section “Neural and sensory conditions” were the participants were asked about auditory symptoms. Demographic data for the final study sample of 213 individuals as well as the 181 individuals who did not complete the necessary questionnaires are provided in Table 1.
Table 1. Total follow-up sample (n=401), excluded individuals (n=188) and study sample who completed the Medical History and SF-12 questionnaires (n=213).

<table>
<thead>
<tr>
<th></th>
<th>Total sample</th>
<th>Excluded individuals</th>
<th>Study sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=401</td>
<td>N= 188</td>
<td>N=213</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W: women</td>
<td>331 (82.5%)</td>
<td>W: 142 (75.6%)</td>
<td>W: 189 (88.7%)</td>
</tr>
<tr>
<td>M: men</td>
<td>70 (17.5%)</td>
<td>M: 46 (24.4%)</td>
<td>M: 24 (11.3%)</td>
</tr>
<tr>
<td>Age range</td>
<td>18-67 years</td>
<td>18-66 years</td>
<td>18-67 years</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>37.5 (12.9)</td>
<td>37.5 (12.7)</td>
<td>37.4 (13.2)</td>
</tr>
<tr>
<td>TMD</td>
<td>347 (86.5%)</td>
<td>135 (71.8%)</td>
<td>212 (99.5%)</td>
</tr>
</tbody>
</table>

W: women, M: men, Mean (SD): years.

The excluded individuals (Table 1) showed no statistically significant difference in terms of age distribution (p = 0.936) compared to study sample. There was however a statistically significant difference in gender (p = 0.001) and TMD prevalence (p < 0.001) between the study sample and excluded individuals.

The Institutional Ethics Review Board at each site approved the study prior to the beginning of the project. Written informed agreement was obtained from all subjects before participation in the study. Subjects were compensated 200 USD for their participation. For details regarding subject demographics and clinical characteristics, see Schiffman et.al. (29).
Study design

Classification of TMD

TMD cases were classified by two researchers at each of the three universities participating in the project (29,31). The classification was based on a self-administered questionnaire and physical examination together with radiographs of the TMJ. According to the RDC/TMD terminology that was used at the time of examination, the eight physical diagnoses according to Axis I are: Myofascial pain without limited opening, Myofascial pain with limited opening, Disc displacement with reduction, Disc displacement without reduction, with limited opening, Disc displacement without reduction, without limited opening, Arthralgia, Osteoarthritis of the TMJ, and Osteoarthrosis of the TMJ (31,32). These diagnoses were further divided into two main groups; “TMD with pain” (muscle disorders, arthralgia, arthritis, osteoarthrosis), “TMD without pain” (disc displacement) together with the control group “No TMD”.

Outcome Variables

Subjects provided the following data through self-reporting using standardized instruments:

- **Neural and sensory conditions (NANDS)**
  The questionnaire “Medical history” contains nine “yes” or “no” questions, of which three asks about auditory symptoms – earaches (I), ringing in ear (II) and hearing loss (III). In the present study, the answer “yes” on the question “ringing in ear” was defined as tinnitus. Ringing in ear could have been reported together with other auditory symptoms but was not analysed further in this study to avoid too many subgroups.

- **SF-12**
  The SF-12 is a self-administered questionnaire assessing general health status. It is a shortened version of the SF-36 and provides a QoL measurement by evaluating the patients’ views about their health and the possible impact on the daily life. It contains a physical (PCS-12) and a mental component summary scale (MCS-12). The instrument is validated and reliable for use in studies of general health and health related quality of life. The 12 questions, include one or two items from each of the following eight health concepts; physical functioning, role-physical, bodily pain, general health, energy/fatigue, social functioning, role-emotional and mental health. The summaries from the two components (PCS-12 and MCS-12) are scored and transformed to have a mean of 50 and a standard deviation of 10 in the general US-population. Low scores indicate poor health and high scores well-being (33).
**Statistical Methods**

All questionnaire data was inserted into IBM SPSS Statistics 23 (SPSS), statistical software. The different variables in SPSS were made to represent the questionnaires. Statistical analyses, accounting for missing variables within the population and computing frequencies of prevalence within the population were all made in SPSS. The data were when possible manually checked to verify that the data handling was correct. The two authors performed the manual counting separately, and then reviewed the results to confirm that it was correct. No differences between the authors occurred in this process. Independent samples student’s t-test (two tailed) was performed where applicable for numerical data (age, SF-12 score, prevalence of TMD). For categorical data Fischer’s exact test where performed (gender). A p-value <0.05 was considered as statistically significant.
Results

TMD groups
All 213 participants were, as described earlier, examined and classified according to the RDC/TMD. For this study the subjects were further divided into two TMD groups “TMD with Pain” (muscle disorders, arthralgia, arthritis, arthrosis) and “TMD without pain” (disc displacement) together with the control group without TMD (Table 2).

Table 2. Subgroups of TMD and control group without TMD for the study sample (n=213).

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMD with Pain</td>
<td>204</td>
<td>95.7%</td>
</tr>
<tr>
<td></td>
<td>(W: 181, M: 23)</td>
<td></td>
</tr>
<tr>
<td>TMD without Pain</td>
<td>8</td>
<td>3.8%</td>
</tr>
<tr>
<td></td>
<td>(W: 7, M: 1)</td>
<td></td>
</tr>
<tr>
<td>Control group</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>(W: 1, M: 0)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
<td>100%</td>
</tr>
</tbody>
</table>

W: women, M: men.

Due to the small group sizes for “TMD without pain” (n=8) and the control group without TMD (n=1) it was decided to exclude these groups from the analysis (Table 2). Thus, the group “TMD with pain” (n= 204; 181 women and 23 men) represent the sample analysed for the present study (Fig. 1). In this group, 33 patients (16.2%) had a TMD pain diagnosis only, whereas 171 patients (83.8%) had a TMD pain diagnosis in combination with disc displacement with or without reduction.
The prevalence of tinnitus in the study sample (n=204) was 22.5% and significantly higher in men (43.5%) than in women (19.9%) (Table 3). The mean age for individuals for tinnitus was 42.0 years (SD 13.5) and for patients without tinnitus 36.1 years (SD 12.9) with a statistically significant age differences (p = 0.008). The prevalence of any auditory symptom (tinnitus, earache or hearing loss) was 41.7% for the whole group and with no significant gender difference (Table 3).
Table 3. Prevalence of tinnitus, and any auditory symptom (tinnitus or earache or hearing loss) in women and men for the study sample (n=204).

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Women</th>
<th>Men</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Tinnitus</td>
<td>46 (22.5)</td>
<td>36 (19.9)</td>
<td>10 (43.5)</td>
<td>0.017</td>
</tr>
<tr>
<td>Any auditory symptom</td>
<td>85 (41.7)</td>
<td>73 (40.3)</td>
<td>12 (52.2)</td>
<td>0.369</td>
</tr>
</tbody>
</table>

*Gender difference tested with Fishers exact test.

The mean SF-12 sub score for physical health for patients with tinnitus was 48.5 (SD 9.5) and without tinnitus 51.6 (SD 8.8). The mean sub scores for mental health for patients with tinnitus were 50.0 (SD 9.3) and without tinnitus 50.0 (SD 9.3) (Fig. 2). There were no significant differences for TMD patients with and without tinnitus for physical (p=0.15) or mental (p=0.91) sub scores on SF-12.

Figure 2. Physical and mental sub scores (SF-12) for TMD patients with (hatched) and without tinnitus (white).
Discussion

The main finding in the present study was that patients with a TMD pain diagnosis not differ in terms of QoL, both physical- and mental-scoring, compared to the mean value (50.0) calculated by an algorithm for SF-12 in a US population (33). Tinnitus combined with painful TMD did not have a higher impact on QoL compared to painful TMD alone. The fact that there were no statistically differences for QoL with or without tinnitus, and that the SF-12 scores were close to those reported for the population in general indicates that our hypothesis was false.

SF-12

Different methods and instruments exist for assessing general health and quality of life. Although the use of SF-12 is validated and can be used as a measurement on QoL, one might argue that Oral Health Impact Profile (OHIP), (34) would have been a better measurement in the present study as it relates specifically to QoL related to health in the orofacial region. It could also be valuable to be able to determine the impact from a specific diagnosis, specifically for tinnitus in relation to QoL this could relate to the THI since the questions are specific about how the tinnitus symptoms affects the daily life. However, SF-12 in general covers the same areas that the other instruments in the sense that it targets the areas in where an individual might be affected by something that interfere with everyday life. The downside though is that SF-12 allows for possible comorbidities to be the cause of the lower QoL, whereas THI and OHIP investigate how different specific symptoms affect the QoL.

We did not find that addition of a diagnose of tinnitus to painful TMD had any negative impact on QoL. Reports have shown that tinnitus and TMD separately have an impact on QoL. It has also recently been shown that TMD in combination with multiple comorbidities showed a lowering in Oral Health Related Quality of Life (OHRQoL), although TMD on its own was also shown to have a large negative impact (35). However that study used OHIP as a measurement for OHRQoL compared to this study where SF-12 was used. One possible explanation for the results from our study may be that patients may not report their TMD problems to be as bad when the questions are more general, as in SF-12, rather than specific oral health related as is the case in OHIP. It could also be that tinnitus does not have a clear additional impact on patients who are already suffering from pain. The ringing in ears is
perhaps negligible compared to a long-term chronic orofacial pain, either due to central processing of signals, or due to the pain signals overshadowing the tinnitus. This is also in accordance with the study by Oghli et.al. where painful diagnoses (TMD with pain symptoms the “last month”, according to the DC/TMD protocol) had a higher impact on OHRQoL than a non-painful diagnoses (35).

TMD with and without pain

In the present study we divided the follow-up sample into three groups; “TMD with pain”, “TMD without pain” and controls without TMD. The aim was to evaluate the impact on QoL and therefore the impact of pain and dysfunction is more of interest than the specific TMD diagnosis itself. This is a common subdivision of TMD diagnosis used in similar studies. It should be noted though that osteoarthritis of the TMJ may not always be associated with pain although some patients experience periods of pain through the progression of the disease (36). Due to small group sizes we had to exclude “TMD without pain” and “No TMD” from our analysis. This results in a restriction for comparing TMD impact on QoL.

Tinnitus

In the present study, the prevalence of tinnitus in the TMD population was 22.5%, which is higher compared to the general population in US (15%) (4) but within the range of what has been reported from other studies on TMD populations (37). In our study however, tinnitus was significantly more common in men, whereas other TMD-populations studies have reported higher prevalence of tinnitus in women (37). These differences between TMD populations may be due to differences in study settings and recruitment of patients, although tinnitus is more common among men in the general population (1).

Population

The age and gender distribution of our study population is comparable to previous studies on patients with TMD (38-40) indicating that our study sample is representative of a TMD population and therefore the results can be compared to other studies in the same field. TMD is most common in women; which is also reflected in our study population where women are overrepresented.

Study population

The present data was from a follow-up examination, based on a convenience sample of 401 of
705 individuals. A comparison with other studies based on the same study material shows that the missing data did not differ significantly in gender and age from subjects included in this study (31).

The excluded individuals (n=188) did differ in gender and TMD prevalence compared with study sample (n=204), but not in age. The individuals where data for the SF-12 and/or the “Neural and sensory conditions” part of the Medical History form is missing, may be mainly healthy as healthy individuals perhaps are less motivated to fill out forms that they feel don’t apply to them. This could be one explanation for the large percentage of dropouts for healthy TMD individuals accounting for the missing data in the forms mentioned above. This could in turn explain the difference in gender distribution in the study sample compared to the total sample. Since TMD is more common in women, a larger percentage of healthy TMD individuals are likely to be men and therefore explain the larger percentage of men in the excluded population, but this is only a speculation.

Clinical aspects and relevance
The result did not show any statistically significance in QoL in patients with TMD with or without tinnitus, as assessed by the SF-12. A problem may be that the instrument is not sensitive enough to detect differences in QoL in conditions such as tinnitus. This is in accordance with the fact that QoL in our study group with a TMD pain diagnosis not differ compared to the population in general as assessed by the SF-12 (33). This result however are on a population level, extreme values among individuals is an important factor to take in to account. For patients that report a low QoL, the health professionals managing the treatment should be assessing the patients’ status regarding both physical and mental wellbeing.

Ethical, social perspective and further studies
Ethical aspects of the examination and data collection from the patients were approved for the original baseline study, and therefore also applicable for this present study.

Taken together, the results from the present study imply that on a population level the impact on daily life, as measured by SF-12, for patients suffering from painful TMD and tinnitus seems to be negligible. However, to be able to with confidence rule out negative impact on QoL in the diagnoses investigated (painful TMD), a control group of healthy individuals would be needed, preferably also a group of patients with non-painful TMD, and QoL may preferably no be assessed by SF-12, but with other instruments better suited for diagnoses affecting oral health, for example OHIP.
The present study does not have an impact on treatment of the different diagnoses and does not benefit the patients directly. The conclusion may however increase knowledge and help further studies in the same area to better understand and help patients with pain and chronic diagnose that affects their daily life. Patients with low QoL may have a high economical cost for society and it was therefore of interest to investigate this subject.

Strengths and weaknesses
The strength of this study is the large amount of data collected with the different instruments, and the relatively large study population. A weakness is that we have not carried out the data collection ourselves, and therefore have limited insight into the reasons for missing data, e.g. why subjects did not fill out all forms. The division in different TMD subgroups meant that only one group, TMD with pain, had more than ten individuals. It was therefore determined that this was the only group that could be analysed due to concern regarding lack of power for the other subgroups. This leads to the lack of healthy control groups regarding TMD diagnosis.

Conclusion
Tinnitus as an addition to painful TMD did not affect the impact on QoL. The study population was similar in terms of QoL, both physical- and mental, compared to the mean value for SF-12.

The authors declare no conflict of interest

Acknowledgment
Firstly, we would like to thank our supervisor Birgitta Häggman Henrikson for genuine guidance, inspiration and time invested in our project. We also would like to thank our second supervisor Thomas List for good input and proofreading and also for providing us with the material from Eric Schiffman. Lastly, thanks to Per-Erik Isberg for guiding us in the statistical analysis.

The TMJ IMPACT Project was supported by NIH grant U01DE019784. The project program also acknowledges resources specifically provided for this project by the respective host universities: University of Minnesota, University at Buffalo, University of Washington. The authors thank the staff and participants of the project for their important contribution. This
manuscript was not prepared in collaboration with investigators of the project and does not necessarily reflect the opinions or conclusions of the project or the NIDCR.
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