Protet Stomatol, 2022; 72(2): 162-172
DOI: 10.5114/ps/150123

Headaches and temporomandibular disorders in adolescents

Bóle głowy i zaburzenia czynnościowe układu ruchowego narządu żucia u młodocianych

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KEY WORDS:
headache, temporomandibular joint, temporomandibular joint disorders, adolescents

HASŁA INDEKSOWE:
bóle głowy, staw skroniowo-żuchwowy, zaburzenia czynnościowe układu ruchowego narządu żucia, młodociani

Summary

Introduction. *Temporomandibular disorders (TMD) and headaches (HA) are conditions that often coexist in patients. HA could be related to functional disorders and, at the same time it is often idiopathic.*

Aim of the study. *To determine the co-occurrence of HA and TMD in adolescents in the same age group. The study group was free of systemic diseases, which can help predict future treatment needs. Another aim was to inform patients about treatment options of the initial problems with TMJ disorders.*

Material and methods. *A group of 259 volunteers (192 females and 67 males) were examined. The participants were aged between 16.7 and 19.3 years. The mean age was 17.9 years (SD 0.57). The functional disorders were classified using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). To determine the occurrence of HA, the questionnaire of Slaviček was used. Statistical analysis was performed to assess the co-existence of HA and symptoms of TMD, such as facial*

Streszczenie

Wprowadzenie. *Zaburzenia czynnościowe układu ruchowego narządu żucia i bóle głowy są schorzeniami, które często razem występują u pacjentów. Bóle głowy mogą być objawem zaburzeń czynnościowych, ponadto zdarza się, że jest to ból idiopatyczny.*

Cel pracy. *Celem badania było określenie związku pomiędzy bólami głowy a zaburzeniami czynnościowymi u młodocianych w tym samym wieku. Badana grupa pacjentów nie była obciążona chorobami ogólnymi, co umożliwia przewidywanie potrzeb leczniczych. Ponadto możliwe było przekazanie młodzieży informacji o możliwości leczenia początkowych zaburzeń stawów skroniowo-żuchwowych.*

Materiał i metody. *W badaniu wzięło udział 259 ochotników (192 kobiety i 67 mężczyzn). Badane osoby były w wieku od 16,7 lat do 19,3 lat. Średni wiek badanych wynosił 17,9 lat(SD 0,57). Zaburzenia czynnościowe były oceniane przy pomocy kwestionariusza Badawczych Kryteriów Diagnostycznych Zaburzeń Czynnościowych Układu Ruchowego Narządu Żucia(BKD/*

pain, pain in the temporomandibular region, and muscle spasm.

Results. *Fifteen participants (5.79%) (group II of RDC/TMD) were diagnosed with a painless form of TMD, while 54 volunteers (20.85%) (group I or III) were diagnosed with pain-related TMD. Facial pain was reported by 22 subjects with functional disorders. Those diagnosed with TMD suffered from HA with statistically higher frequency (p<0.001). This problem was more common among females.*

Conclusions. *The correlation between HA and TMD in adolescents was thus confirmed, with females being more frequently affected.*

ZCURNŻ), bóle głowy oceniano za pomocą kwestionariusza prof. Slavička. Została przeprowadzona analiza statystyczna aby określić związek pomiędzy występowaniem bólów głowy a zaburzeniami czynnościowymi, takimi jak: ból twarzy, ból w okolicy stawów skroniowo-żuchwowych, przykurcz mięśni.

Wyniki. *U 15 uczestników badania(5.79% grupa II BKD/ZCURNŻ) zdiagnozowana została bezbólowa postać zaburzeń czynnościowych, u 54 osób(20,85% grupa I lub III) zdiagnozowano postać bólową zaburzeń czynnościowych. Ból twarzy występował u 22 osób z zaburzeniami czynnościowymi. Osoby, u których zostały zdiagnozowane zaburzenia czynnościowe, statystycznie częściej cierpiały z powodu występowania bólu głowy(p<0,001). Problem ten częściej dotyczył kobiet.*

Wnioski. *Potwierdzono korelację pomiędzy bólami głowy a zaburzeniami czynnościowymi u młodocianych z częstszym występowaniem zaburzeń wśród kobiet.*

Introduction

Temporomandibular disorders (TMD) can manifest themselves with various signs and symptoms, such as pain and disability in the temporomandibular joint or in the masticatory muscles.[1] The symptoms affect the face and neck areas: the temporal, occipital, and frontal areas of the head. The pain appears in the preauricular or auricular areas.[2] Similar symptoms could also be related to headaches (HA) rather than to TMD. The type of chronic pain is common in patients with TMD and is usually the only masticatory system symptom. The frequency, duration of pain, intensity, and location of HA may vary between patients.

There are a number of questionnaires to evaluate headaches, e.g. International Headache Society (IHS) questionnaire,[3] the second edition of the International Classification of Headache Disorders (ICHD-II), International Classification of Headaches Disorders, 3rd edition (ICHD-3)[4] and Slaviček's questionnaire.[5] *Stovner* et al. estimated that HA affects as many as 50% of people living in Europe.[6] The prevalence of primary HA is probably still at 50%, as confirmed by recent Estonian studies.[7]

The correlation between TMD and HA has been investigated by various researchers. *Nazeri* et al. observed a connection between TMD, depression, and migraine.[8,9] The association between migraine and TMD was also examined by *Magnusson* and *Carlsson* who observed a co-existence of HA and TMD: patients with TMD, especially females, more often suffered from HA than the control group.[10] The study of *Ballegaard* et al. performed on a group of 99 volunteers showed that 56.1% of patients with HA had TMD.[11] The correlation between TMD and HA was examined by *Gonçalves* et al., who confirmed the higher frequency of TMD in

groups with migraine and chronic migraine than in the control group.[12] *Franco* et al. examined 226 patients (158 with TMD and 68 without TMD as control). Among individuals with TMD, 84.2% (133 participants) were female and 15.8% (25) were male. The mean age of patients was 40.1 years (females) and 41.7 years (males). In groups of patients with TMD, HA more often coexists than in the control group without TMD (85.5% vs. 45.6%)[13]. *Wozniak* et. al. observed that HA was associated with mastication muscle tone in patients with TMD.[14] *Reiter* et al. noticed that headache attributed to TMD in a painful TMD can be related to a central sensitization process.[15]

Gonçalves et al. concluded that people with myofacial temporomandibular disorders more often suffer from chronic daily headaches, migraine and episodic tension-type headache. The frequency of headache episodes was related to painful temporomandibular disorders.[16]

In their review, *Peter Svensson* and *Abhishek Kumar* noticed that multifunctional and cognitive behavioral approaches, physiotherapy and pharmacology should be considered. The ongoing applied therapy should be modified due to the constantly changing conditions, the individualization of treatment and reference to the knowledge of phenotypes and genotypes of patients may help.[17]

In the research of *Ballegaard* et al. the prevalence of TMD and headaches was on the level of 56.1%. Among patients with TMD psychosocial dysfunction and depression was found as significant. They concluded that high proportion of headache patients had significant disability because of the ongoing chronic TMD pain.[11] In that group of patients multidisciplinary diagnostic approaches should be carried out.[18]

It is known that the problem of TMD and headache is multifactorial and often coexists with depression and mental factors.[9] *Ballegaard* et al. emphasize the role of the masticatory examination especially in patients with headache.[11] It is worth noting that headache, temporomandibular disorders, muscles pain – especially temporalis muscles – have clinical similarities, which is why more research on that topic should be conducted.[19]

After literature review the authors of this study decided to conduct research on a homogenous group of adolescents to estimate the prevalence of HA and TMD in the examined group, and to help prevent their coexistence by patients' education. The aim of the study was to approach a group of young people to recognize the scale of the problem.

Methods

Participants

A group of volunteers, all adolescents from Poland, were examined. They were students from three randomly selected secondary schools. This group was previously described by *Loster* et al.[20] The volunteers were from the second year of three-year schools and from the third year of four-year high schools. Each form consisted of about 30 to 35 students. The response rate was about 70%. All the participants were informed of the aim of the examination and were asked to sign consent forms. The Bioethics Committee gave consent for the study. The examinations took place between May 2011 and February 2013.

TMD classification

TMD was classified using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), the Polish version of the RDC/TMD questionnaire translated by *Osiewicz* et al. with both Axes.[21,22,] The clinical examination with Axis I was performed by the same operators experienced in the examination with RDC/TMD (AW and JEL) trained and calibrated by a specialist who had received specific RDC/TMD training in 3-year specialty program in TMD and Orofacial Pain.

Having completed both questionnaires, each participant could be diagnosed using RDC/TMD for both sides as one of the following group of disorders: Ia – myofascial pain; Ib – myofascial pain with a limited opening; group IIa - disc displacement with reduction (without pain); IIb – disc displacement without reduction with a limited opening (without pain); IIc – disc displacement without reduction, without limited opening (without pain); group IIIa – arthralgia; IIIb - osteoarthritis; IIIc – osteoarthrosis; or lacking a diagnosis. Patients with Ia, Ib or IIIa-c diagnosis were considered as having been diagnosed with pain. Those with IIa, IIb and IIc diagnosis lacked pain. The analysis considered the participants' answers to Question 1, from Axis I in the RDC/TMD questionnaire, which concerned pain in the TMJ region and its location on the face sides.

Headache

Headache occurrence was additionally classified based on Slaviček's questionnaire, but this classification was not categorized by the type of pain.[5] Using this diagnostic sheet, the participants answered questions about their general health, past and present. They described their systemic diseases, dental history (including dental complaints and problems with mastication), as well as muscle pain and function. The answer "yes" or "no" to Questions 7, 8 and 9 were selected for analysis. Question 7 concerned the pain in the area of the temporomandibular joint (TMJ), as facial pain. Question 8 related to HA complaints. Question 9 was associated with cramps and spasms in the head, neck or throat.

The inclusion criteria included a fully completed Slaviček questionnaire and Axis II of the RDC/TMD by the participants, and a complete clinical physical examination with Axis I in the RDC/TMD questionnaire. The exclusion criteria included absence of consent, patients who did not cooperate during the study, whose intellectual state was insufficient to participate in the study. Moreover, patients with trismus, active herpes and those on psychotropic drugs were excluded.

Statistical Analysis

Qualitative values were compared using the chi-square test with Yates' correction for 2×2 tables or Fisher's test (significance level was 0.05). All values below 0.05 were accepted to be statistically significant. The analysis was performed in the R program, version 3.5.2.[23]

Results

The group included 260 volunteers from secondary schools (192 females and 68 males). All participants were aged between 16.7 and 19.3 years: the mean age was 17.9 years (SD 0.57). One person was excluded because of an incomplete questionnaire. Consequently, 259 participants were included in the analysis (Table 1).

Table 1: Diagnosis in RDC/TMD and the results based on Professor Slaviček's questionnaire

Diagnosis	Participants
Group I – Myofacial pain	34
Group II – Disc displacements	16
Group III – Other joint conditions	2
Facial pain (Professor Slaviček's questionnaire)	22
Pain in TMJ region *RDC/TMD)	30
Deadache (Professor Slaviček's questionnaire)	124

RDC/TMD diagnosis

TMD diagnosis according to Axis I RDC/TMD was 26.64%. The total number of volunteers without Axis I diagnosis in RDC/

TMD was 73.35%. Among the participants with Ia diagnosis (myofascial pain) for either the right or the left joint, 9.65% were diagnosed in the right joint, and 10.42% in the left. 8.88% subjects had IIa diagnosis (disc displacement with reduction) for the right or the left joint, and 1 person (0.38%) for both joints. Six participants had IIIa diagnosis (arthralgia) for either the right or the left joint and 1.93% subjects in both sides. None of the participants had IIIb diagnosis. One person was diagnosed with IIIc (osteoarthrosis), in this case for both joints.

Headache

Thirty patients (11.58%) reported pain in the jaw joints region as a facial pain, and 88.42% did not, based on the Question 7 from the Slaviček questionnaire. Of all the respondents, 47.88% participants complained of the occurrence of headache; females were especially affected (102 subjects, or 53.12% of all respondents with HA). Also 22 men (8.49%) reported headache, which accounted for 32.84% of all the patients with HA problems. One hundred thirty-five (52.12%) participants had no HA problem based on their answer to the Question 8. The final question (number 9) concerned cramps and spasms in the head, neck, or throat area. The positive answer was recorded for 26 females (13.54%) and 5 males (7.46%). Table 2 presents the co-occurrence of HA and facial pain. Patients with HA had facial pain more often than those without HA, and the difference was statistically significant.

Correlation between TMD and HA

The patients diagnosed with TMD statistically more frequently suffered from HA. Slaviček's questionnaire indicated that HA was more common among females (53.12% from the group of the examined females), with statistical significance $p=0.007$ chi^2. The pain occurred in 32.84% of males. In the group of 259 respondents 69 people had TMD and 124 patients had HA. Both TMD and HA were reported in the group of 54 patients. There were 15 patients with TMD and without HA.

Study participants indicated which side of their face was more painful. Their answers are presented in Figure 1; there was no statistically significant difference between sides.

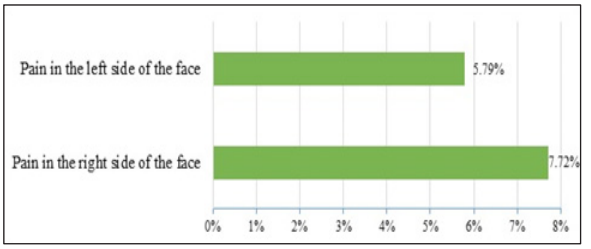
Statistical analysis shows that pain in the TMJ region on the left or the right side of the body is not associated with tension or contractures in the head area. The result was not statistically significant ($p>0.05$; for the right side, $p=0.074$, Fisher's test; and for the left side, $p=0.401$, Fisher's test). The chi-square and Fisher's tests revealed significant differences between patients with pain in the TMJ area ($p<0.001$, Fisher's test) and those without ($p=0.002$ chi^2). Statistical analysis showed that the first group suffered from HA more often. These findings are presented in Figure 2.

Among the fifteen patients diagnosed with IIa by the RDC/TMD (that is, diagnosis without pain), two subjects noted in Slaviček's questionnaire that they suffered from HA. In turn, 20.85% volunteers diagnosed with Ia, IIIa or IIIc by the RDC/TMD also confirmed the

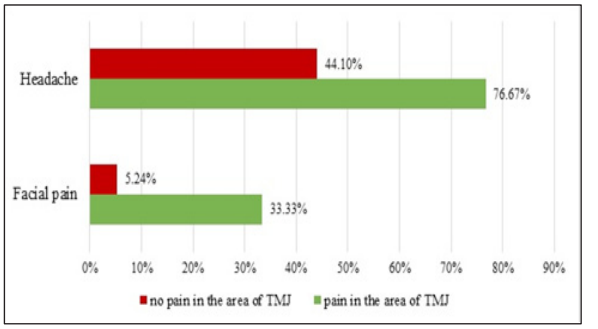
Table 2: Relationship between headache and facial pain

	Headache (N=124)	No headache (N=135)	p*
Facial pain	16 (12.90%)	6 (4.44%)	0.027
No facial pain	108 (87.10%)	129 (95.56&)	

* chi-square test.



Ryc. 1. Pain incidence by side of the face.

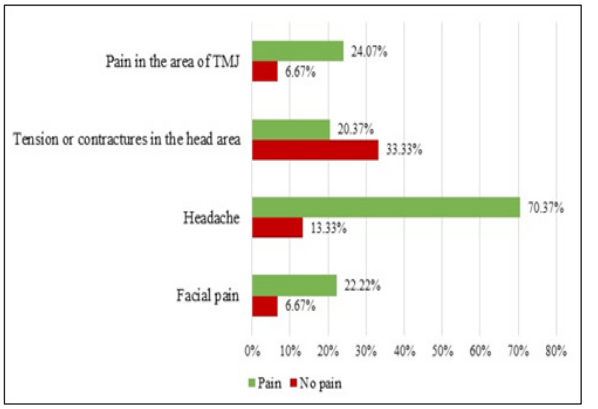


Ryc. 2. Location of pain in patients with HA and facial pain.

prevalence of HA. There were 14.67% of such patients with both HA and pain diagnosis. The results of the chi-square and Fisher's tests were statistically significant ($p<0.001$, chi^2).

The differences between patients with Ia, IIIa or IIIc and without a pain diagnosis (IIa) were also examined. These two groups were considered in terms of the occurrence of facial pain, tension, and contractures in the head area, and of pain in the TMJ area. These results proved statistically insignificant ($p>0.050$). However, they are presented in Figure 3 due to the frequency of pain diagnosis.

The results confirm that females suffer from HA more often than men. The study group included 102 females (53.12%) and 22 males (32.84%). The pain-free diagnosis was made for fifteen participants (5.79%) (group II of RDC/TMD), while painful types were diagnosed in 54 patients (20.85%) (group Ia or IIIa or IIIc of pain-related TMD). Pain in the TMJ region, as per Axis I of the RDC/TMD, was reported by 30 patients (11.58%), and HA, as per Slaviček's questionnaire, was noted in 124 adolescents (47.88%). Facial pain was reported by 22 patients (8.49%), while 31 (11.97%) participants noted tension-type HAs.



Ryc. 3. Relationships between patients with and without pain diagnosis (by RDC/TMD) and pain localization.

Discussion

The clinical diagnostic results confirm that patients with pain diagnosis in RDC/TMD often suffer from HA. Furthermore, HA more commonly occurs together with facial pain. It is also worth considering the results that were not statistically significant; in every case, patients with pain diagnoses more frequently had problems with facial pain ($p=0.544 chi^2$) or tensions and contractures ($p=0.271 chi^2$), as well as with the pain in the TMJ area ($0.441 chi^2$), than did patients without pain. One strength of the present study is that all volunteers were of a similar age, just nearing the end of the development period, which is valuable in the analysis of the results. Slight age deviations make it possible to infer on the basis of a group in a similar developmental period, similar living environment, which enables a reliable generalization of the results for this age group. Our findings confirm those of other researchers.[12] *Franco* et al. examined 226 patients, though of different ages: the

female patients with TMD were on average 40.1 years old, while the men were on average 41.7 years old. In the control group, the mean age was 38.4 for females and 36.8 for males; 185 females and 41 males were included. The number of females examined in our study was 192, and the number of males 67, giving 259 participants in total. The gender distribution of the subjects was similar. The results from the current study are in agreement with the findings of the *Franco's* study in the sense that gender prevalence of the examined problems starts with the subjects' development time and the hormone associations need to be explored in the future.

Gonçalves et al. recruited 38 females with migraines, 23 with chronic migraines, and 30 without HA, with ages ranging from 20 to 55 years. The patients were examined using the Second Edition of the International Classification of Headache Disorders (ICHD-II) and RDC/TMD, leading to diagnoses of TMD in ten females without HA (33.33% of all the examined), 33 (86.8%) females with migraines, and 21 (91.3%) females with chronic migraines.[12] The researchers' conclusion was that there was an association between TMD diagnosis with migraine and chronic migraine. The results showed that females had a higher prevalence were at greater risk of TMD. Despite the different ages of the participants, their conclusion agreed with that of the present study.

Ashraf et al. examined 5876 volunteers in three age categories: 30–44, 45–59, and 60 years and older, using RDC/TMD and questions regarding HA in interviews during home visits. The researchers observed that the prevalence of TMD and migraine was higher in females than in males in every one of the three age categories.[24] It was also confirmed that the prevalence of TMD was associated with the prevalence of migraine, especially in the case of muscular TMD.[22,24]

The correlation between TMD and primary HA can be explained via the continuous stimulation of the trigeminal subnucleus caudalis. This, in turn, affects the frequency and intensity of primary HA.[25,26] Due to the overlapping symptomatic areas of TMD and HA, patients often seek help from neurologists; it is less obvious to patients that they could turn to dentists for help. The prevalence of TMD in females may be associated with depression and anxiety, as was the case in the research of *Nazeri* et al., who concluded that depression and anxiety could modify both conditions through their association with TMD and HA.[8] *Fernandes* et al. came to the same conclusion that TMD and HA were comorbidities in young patients; however, the age of their patients was different, at 13-15 years old.[27]

Vivaldi et al. reported that patients with HA which was attributed to TMD suffered more often from painful areas in the head and neck region, and had higher TMD pain intensity.[28]

As *Memmedova* et al. and *Greenbaum* et al. stated in the study on HA and TMD that it often coexisted but nowadays the knowledge is vast as the different type of headaches are known and significant.[29,30]

On the other hand, following *Alonso-Blanco* et al. who examined the female group of patients aged over 45 years, TMD diagnosis and myofascial trigger points had important role in the reported.[31]

Więckiewicz et al. described the relationship between TMD based on DC/TMD questionnaire and HA using the newest version of ICHD-3. Their research evaluated 213 participants, of which 149 were females and 64 males; the mean age was 37 years. Their conclusion was that HA was more frequent in patients suffering from painful TMD.[32] The coexistence of HA and TMD symptoms leads patients to seek help from different medical specialists; most often, patients go to see a neurologist, but no dysfunction is found. Medical specialists

generally do not associate the presented symptoms with dental problems. If symptoms persist for a long time, and there is no diagnosis or treatment, the prognosis for TMD worsens. Various health problems also affect TMD: *Demir* et al. noted significantly higher parathyroid hormone level in people with TMD. They concluded that vitamin D deficiency should be assessed, as there was an influence of hormones. The mean age of the 50 patients with TMD was 28.24 ±10.41 years; 39 were female and 11 male. The mean age of the control group was 30.90±8.49 years. The results are valuable, but the age range is wide, as biological age is different and there are hormonal differences. The study showed that hormones had an effect on TMD, but further research is needed, as the age range of 18 to 38 may involve major hormonal fluctuations, especially for females. To gain more detailed insights, groups that are more homogeneous in age should be used.[33] Group of patients in the study described here was homogeneous in age. The results allow one to conclude that in relatively young there is a co-occurrence of TMD and HA. It is worth considering the growth and maturation because the explanation could be found in these factors. Additionally, the influence of sex hormones on the occurrence of these conditions should be carefully considered.

Another important fact is that in patients with TMD the correlation with psychological factors e.g. depression, somatization and symptoms of anxiety was found.[34,35] This can make a proper diagnosis difficult.

A lot of researchers included into the examination patients of different age, with large discrepancy. What is more, older people more often suffer from general diseases. The group included in the current research was similar in age, and the participants were of good general health, which facilitated the examination, and the results could be compared with the group without additional diseases.

Sex hormones also affect the prevalence of joint hypermobility. *Graf* et al. examined 1005 patients aged from 10 to 18 years. They concluded that there was a positive relation between testosterone, estradiol, sex-hormone-binding-globulin serum level, and hypermobility in both genders.[36]

The risk of disease increases with age, which also affects TMD and HA. Age variations in the study group and the different levels of maturity can affect the research conclusion; this is very often the weak point of studies. For this reason, the strong point of the present study was that it was carried out using an age-homogeneous group of healthy adolescents. Participants were all of young biological ages at the end of their puberty period and were volunteers who presented without symptoms; they had not sought medical assistance. Some of them may have had problems, but did not seek any medical help. The use of RDC/TMD instead of DC/TMD is a limitation, especially if it is a gold standard for TMD diagnosis today. Unfortunately, the official translation is still not available in Polish and it results in the bioethical committee disagreement for the research if the DC/TMD is to be used. The use of Slavicek's questionnaire could be also interpreted as a limitation, but the results from that survey were compared with a validated RDC/TMD questionnaire.

Conclusion

Our research has confirmed the correlation between HA and TMD also in adolescents. Further research on both conditions and their co-existence should be carried out. It ought to be noted that each of these conditions can be diagnosed and treated by a range of specialists. The use of the newest validated research standards is necessary in further research. Cooperation in diagnosis and treatment between dentists and neurologists should also

be considered. Our results show the presence of headache in patients with TMD, with females being more frequent sufferers.

Ethical Considerations

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Bioethics Committee of [Blinded] University Medical College.

Conflicting Interest (If present, give more details)

The authors declare that they have no conflicts of interest regarding the publication of this paper.

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Zaakceptowano do druku: 17.05.2022 r.
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