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*Is malocclusion and orthodontic treatment associated
with temporomandibular joint dysfunction (TMJD)?
Literature review (2000-2010)*

Czy wada zgryzu i leczenie ortodontyczne ma związek z dysfunkcją stawu skroniowo-
żuchwowego? Przegląd piśmiennictwa (2000-2010)

INTRODUCTION

Temporomandibular joint dysfunction (TMJD) can manifest as pain in muscles and temporomandibular joint, pain during jaw movement, limited range of jaw motions, as well as auscultatory symptoms [25]. Burdensome symptoms to patients make them start medical treatment – often collaborative one – as there is a widespread belief about the relationship between malocclusion and orthodontic treatment with dysfunctions. Based on the review of scientific publications from the years 1985-1997, McNamara et al [22] sought to answer the question whether such a relationship actually exists. The main argument against this thesis is the fact that symptoms of TMJD occur in people without malocclusion, never treated orthodontically [21]. The studies have shown that the incidence of TMJD increases in the population of 7-15 year-old children [18, 21], and intensifies during puberty. However, decrease in muscle pain occurrence has been shown between the age of 19 to 30 [24]. TMJD manifested during orthodontic treatment does not have to be causally related to it. Similarly, dental extractions – being part of orthodontic treatment – do not increase the risk of TMJD. No evidence was found indicating the relationship between TMJD and any course of orthodontic treatment. Adolescent treatment neither poses a risk of dysfunction, nor works preventively [22]. The objective of this review was to determine whether the results of the last decade (2000-2010) confirm the previous critical reports on the impact of malocclusion and its treatment on the formation of temporomandibular joint dysfunction, and, on the other side, the possibility of mitigating TMJD symptoms by means of orthodontic treatment.

MATERIAL AND METHODS

The research materials were collected by typing words (malocclusion, orthodontic treatment, temporomandibular disorder) in the PubMed web search engine. They were limited to articles published in English after 2000; 162 items were found. The study involved selected research works, which took into account: age, sex, type of malocclusion, group treated orthodontically, control group. Finally, 10 papers closely related to the topic of the discussion have become the subject of the analysis.

There are no papers written in Polish in any web browser, so the works in Polish researchers were searched for manually in the university library, using the key words: leczenie ortodontyczne (orthodontic treatment) and zespół stawu skroniowo-żuchwowego (temporomandibular joint syndrome). Sixty two items were found. After narrowing the criteria for the works issued after 2000 and meeting the conditions laid down for English-language works, 4 research works have been selected among Polish publications.

RESULTS

Henrikson, Nilner and Kurol [7] examined 183 girls aged 11–15 with a defect of class II. They were divided into two groups: orthodontically treated (65 girls) and without orthodontic treatment (58 girls). The control group consisted of 60 girls with occlusal standard. The study considered their mandibular range of motion, palpation of chewing muscles, crackles, overbite and overjet, central slip. The examination was repeated after two years. It was observed that cracks in the TMJ increased with age in all subjects, except for the groups with occlusal standard. Patients with class II defect and TMJD symptoms of muscular origin gained some benefit from their orthodontic treatment. The main conclusion was that orthodontic treatment did not result in the increased risk or severity of TMJD.

Retrospective evaluation of the impact of brace treatment and orthodontic treatment of temporomandibular joint dysfunction was conducted by Imai [8]. The study covered 58 subjects with a mean age of 18.4 years. Patients had been divided into three groups: ST - orthodontically treated in conjunction with a brace, NST – treated only orthodontically, TMD – treated only with a brace. At the beginning and the end of treatment the following symptoms were recorded: occurrence of pain, limitation of mandibular movements, pain during movements and cracks in the TMJ. One year later, orthodontically treated patients were reexamined. The study shows that orthodontic treatment in conjunction with a brace had an impact on the elimination of TJMD symptoms (such as pain and limitation of movement), but did not have any effect on crackling. On the other hand, orthodontic treatment alone was not an effective method of eliminating dysfunctions.

Franco et al [6] investigated the relationship between the treatment of class II defects with Frankel device and the shape and position of the articular disc. Magnetic resonance imaging was performed in 56 children before their growth spurt (8.8–12.6 years old) and it was repeated after 18 months. Upon the treatment, positive changes in the articular disc structure were noted. The studies have shown then, that functional orthodontic treatment has no harmful effect on the articular disc, and in some cases it may even help.

The effect of orthodontic treatment and of different malocclusions on different TMJD symptoms was studied by Egermark [5]. Four hundred and two people aged 7, 11 and 15 years had been randomly selected for clinical researches and surveys. The study was repeated in the same individuals after 5 and 10 years. After 20 years, as many as 320 persons completed the questionnaire.

The obtained results allowed to conclude that persons treated because of the different malocclusions in childhood, showed no dysfunction of temporomandibular joint when they grew older. The results proved that generally, there is no relationship between malocclusion and dysfunction in the temporomandibular joint. Only in some cases, unilateral crossbite may be the cause of TMJ dysfunction.

Landi [11] investigated the relationship between the deviation from the standard in occlusion and TMJ dysfunction in 81 women aged between 20 and 71. The control group consisted of 48 women. Eight parameters were being evaluated: slip between distal mandibular position and the maximum occlusion, overbite, overjet, midline discrepancy, occurrence of lateral crossbite, open bite, obstacle in lateral and anterior movement. It was found that the central slip greater than or equal to 2 mm and obstacles at the balancing side were related to myalgia of the stomatognathic system. In addition, it is difficult to predict the factors that cause disorders because of their complexity.

Möhlén [24] studied 1018 people aged 11, 15, 19 and 30 years while the size of the group at each successive trial was lower. TMJD symptoms, TMJ construction, PAR index, muscle endurance have been examined taking under consideration orthodontic treatment and psychological profile. At age of 19, 46% of men and 56% of women revealed a history of orthodontic treatment. Patients were treated with fixed appliances, fixed appliances in conjunction with removable ones and only removable ones. No relationship has been shown between the treatment with orthodontic appliances and the dysfunction of the temporomandibular joint in both sexes in the extraction and non-extraction cases. Crowding of the teeth was the only malocclusion which showed a relationship with the temporomandibular joint dysfunction. Orthodontic treatment does not seem to be the cause of TMJD, nor can be treated as preventing the occurrence of such disorders. Decrease in symptoms of dysfunction has been shown between the age of 19 and 30.

Miller et al [23] examined 29 women aged 18–70 years with severe retrognathia and TMJ pain. A control group consisted of 104 women without malocclusion. The study was conducted using a questionnaire and the anterior-posterior mandibular position was being determined based on the photographs by angle measurements. The relationship between the severe form of retrognathia and TMJ pain has been shown. Colonna-Walewska [3] studied 141 people with various malocclusions.

The control group consisted of 145 subjects with normal occlusion. Parafunctions, acoustic symptoms, masseter muscle hypertrophy, impaired mobility of the jaw, jaw deviation were examined. No effect of occlusion on the incidence of TMJ dysfunction was found. Malocclusion has an impact on the more frequent occurrence of acoustic symptoms during mandibular movements and deviation of the mandible during the opening of the mouth.

LeResche et al [13] surveyed 1996 randomly selected 11-year-old children. They were subdivided into a group without pain, and a group with pain; all the children were examined clinically and then the records were supplemented with the information about facial pain every 3 months for 3 years. The obtained results suggest that the development of TMJD in adolescence may reflect a hidden vulnerability to musculoskeletal pain of all joints.

Slami et al [29] conducted a study of 80 people aged 16–25. 40 people were treated with fixed appliances in the past, and 40 had no malocclusion. Static occlusion (in habitual and centric occlusion), dynamic occlusion (protrusive motion, laterotrusive movements, premature contacts, short-circuit obstacles), mandible abduction and adduction track, the maximum spacing of the jaws, palpation of muscles tension, palpation of the temporomandibular joint were performed on each of them. In the group not treated orthodontically, 81% of those with abnormal occlusion and 30% with normal occlusion demonstrated dysfunction. In the group of orthodontically treated, dysfunction was recorded in 93% of those with abnormal occlusion and in 44% those with normal occlusion. TMJD more frequently occurred in patients with abnormalities of occlusion and after orthodontic treatment.

Nawrocki-Furmanek [26] and colleagues examined 264 people with full dentition or single deficiencies, aged 19–25. A survey on the orthodontic treatment in the past, presence of parafunction and TMJ dysfunction was conducted. They underwent extraoral (facial symmetry, the state of masticatory muscles, TMJ palpation) and intraoral examination (range and track the movements of the jaw at the abduction, muscle soreness, Angle's class evaluation, canine classes, overbite and overjet, crowding, pathological symptoms of tooth abrasion). High incidence of dysfunction was found (57%). A potential risk factor for dysfunction may be malocclusions against the sagittal plane, multifaceted defects, and dental abnormalities. Orthodontic treatment does not contribute to the increased incidence of dysfunction in chewing organ.

Kalinowska and Gołębowska [10] examined 31 children with unilateral and lateral crossbite and 30 children with normal occlusion. They had been divided into three groups: with the early mixed dentition, with the late mixed dentition and children with early permanent teeth. Anamnesis was conducted (on the presence of pain, impaired mandible mobility). Palpation of TMJ and masticatory muscles, acoustic symptoms, restricted mandible mobility, deviation of the mandible has been performed clinically. It has been proven that the presence of unilateral and lateral crossbite affects the occurrence of dysfunction symptoms in TM joints.

Tecco [31] identified a group of 50 adults with anterior displacement of the articular disc in at least one joint. The subjects were divided into three groups: I–20 patients treated with braces, II–20 persons with fixed appliances, III (control group)–10 not treated persons. Joint pain, acoustic symptoms and muscle pain were examined every month for six months. In group III, a significant reduction in joint and muscle pain was observed. In group I, the reduction of crackles in comparison with group II was recorded. Equal effectiveness in treating joint and muscle pain has been shown with fixed appliances and braces but for the treatment method it did not eliminate crackles.

DISCUSSION

Analysis of the results of research published in PubMed in 2000–2010 regarding the problem of orthodontic treatment and TMJD showed conclusively that orthodontic treatment carried out in children and adolescents does not cause either an increase or decrease in the development of temporomandibular joint dysfunction in later life [4,5,7,24]. These research works support earlier observations [17,22]. However, Franco [6] showed that functional orthodontic treatment does not cause adverse changes in the positioning of articular disc and in some cases may even have a beneficial effect on it.

Can orthodontic treatment eliminate TMJ dysfunction? Most of the works shows that orthodontic appliances do not eliminate crackles in the TMJ [7,8,31] and in conjunction with braces, they predisposing to reduce pain perception [31] and reduce the limitation of mandibular movements [7,8].

It has been proved that orthodontic treatment with extractions or without extraction does not increase the risk of dysfunction of temporomandibular joint [4,6,7,24,26]. This is consistent with previous observations [1,16,20,27,28]. If so, how can we explain the occurrence of articular disorders in the orthodontic treatment? The answer is the time in which the treatment is provided. It has to do with the fact that the TMJD symptoms worsen in adolescence [13]. Luther's research of 1997 reporting a 30%-60% increase in symptoms between 7 and 15 years of age (or duration of orthodontic treatment) have been confirmed in the currently published studies, while a decrease in symptoms takes place between 19 and 30 years of age [24]. Dysfunctions are more common in women [17]. Polish epidemiological data report the incidence of TMJD in adolescents aged 10 to 15 years in the group with malocclusion ranges from 10.6% to 37%, whereas across the population, these values are within the range from 27.3% to 32% [9]. Litko [14] reports that, since the 1980's, the number of patients under 18 years of age who come to therapy because of the dysfunction has been steadily increasing. This is due to the major role of the civilization stress in the development of these disorders. In stressful situations, the severity of parafunctions intensifies and it comes to reduction of the adaptability of the masticatory motor system. Parafunctions of the masticatory system were recorded in 94% of the respondents (under 18 years of age) in the period 1987-2005. Girls represent 75.7% of young people with the dysfunction. Patients aged from 15 to 18 years come to doctors more often than 8-14 years old [15]. TMJ dysfunction may occur already in 3-6 year-old children. From the age of 7 to 11 years, the number of disorders is increasing rapidly from about 30% to 60%, then at the age of 12 to 14 years it remains at a constant level, to rise again to 80% at the age of 19. Impaired functions of muscles of the chewing organ and TMJ lesions may initially develop imperceptibly [14]. If, however, TMJ pain occurs during orthodontic treatment, you should reduce or eliminate the strength generated by braces (e.g. intermaxillary fixations; extraoral fixations, face mask) (Turp 1997).

The relationship between malocclusion and TMJ dysfunction is difficult to determine. Kabas-Słotwińska [9] showed that there was no connection between malocclusion and the development of dysfunction. Children with malocclusion and clear indications for orthodontic treatment showed similar motility as the children not needing any treatment. The range of lateral and vertical movements of the mandible is reduced in children with pain, but it does not depend on crackles in the TMJ. Only unilateral crossbite in earlier [22] and contemporary works [5,10] is mentioned as a predisposing factor, but this requires further investigation. Intensified retrognathia [23], crowding of teeth [24], the central slip > 2mm, obstacles of mediotrusive movements [17] may be the cause of muscle pain.

TMJ dysfunctions cover a wide range of symptoms and their etiology is multifactorial. Tomasz [33] says that factors affecting the normal masticatory function are diversified, which makes the diagnosis itself and the selection of elimination methods difficult.

Untreated malocclusion, unstable occlusion, stress, trauma, individual predispositions, structural conditions, mental and psychosocial factors play an important role in the development of TMJD

[24]. TMJ dysfunction in adolescents is explained by various psychogenic factors (stress at school, exams, entering into independent living, mental sensitivity that occurs during puberty, long-lasting parafunctions [15].

Problems with the temporomandibular joint are more common in women [21], and a drop in estrogen concentrations and rapid changes in its levels increase symptoms of TMJ pain [12]. Individual muscles influence each other forming muscle chains, which also involves the masticatory system. Disease problems with TMJ should be considered in conjunction with other functional symptoms; patient's body statics should be taken into account during examinations [2]. One should not also forget about the genetic factor [32]. Therefore, the proceedings in the case of TMJD should seek to detect and eliminate all possible causes and should be carried out by appropriate specialists [30].

Only one out of fourteen studies analyzed supports the relationship between malocclusion, orthodontic treatment and TMJ dysfunction [29]. Confirmation of this theory was only found in the study of Marczak-Wojtyńska [19], who writes that the temporomandibular joint dysfunctions are complications after finishing orthodontic and prosthetics treatment. (Both of these works had been written by Polish authors)

CONCLUSIONS

1. There is no sufficient evidence that the dysfunctions of the temporomandibular joint are associated with a specific malocclusion, although some disorders may predispose to its occurrence (severe retrognathia, unilateral crossbite, crowding of teeth).
2. Orthodontic treatment should not be treated as a prophylaxis of temporomandibular joint dysfunctions, as it does not increase the risk for dysfunction when it is carried out in childhood.
3. Orthodontic treatment with extractions does not impose any danger of inducing temporomandibular joint dysfunction.

REFERENCES

1. Beattie J.R. et al.: Functional impact of extraction and non-extraction treatments: a long-term. Am. J. Orthod. Dentofac. Orthop., 105, 444, 1994.
2. Buttner P. et al. Zastosowanie terapii manualnej w leczeniu dysfunkcji stawu skroniowo-żuchwowego. Czas. Stomatol., 61, 807, 2008.
3. Colonna-Walawska M., Split W.: Wady zgryzu u młodzieży *szkolnej* a dysfunkcje narządu żucia. Mag. Stomatol., 12, 66, 2005.
4. Egermark I. et al.: A prospective long-term study of sign and symptoms of temporomandibular disorders in patients who received orthodontic treatment in childhood. Angle Orthod., 75, 645, 2005.
5. Egermark I. et al.: A 20-year follow-up of signs and symptoms of temporomandibular disorders and malocclusion in subjects with and without orthodontic treatment in childhood. Angle Orthod., 73, 109, 2003.
6. Franco A.A. et al.: Frankel appliance therapy and the temporomandibular disc: A prospective magnetic resonance imaging study. Am. J. Orthod. Dentofacial Orthop., 121, 447, 2002

7. Henrickson T. et al.: A prospective and longitudinal comparison with untreated class II malocclusions and normal occlusion subjects. *Eur. J. Orthod.*, 22, 271, 2000.
8. Imai T. et al.: Long-term follow-up of clinical symptoms in TMD patients who underwent occlusal reconstruction by orthodontic treatment. *Eur. J. Orthod.*, 22, 61, 2000.
9. Kabasa-Słotwińska J. et al.: Motoryka żuchwy u dzieci 11-letnich. *Ortod. Współ.*, 1, 11, 1994.
10. Kalinowska M. et al.: Występowanie objawów dysfunkcji stawów skroniowo-żuchwowych u 7-12 letnich dzieci ze zgryzem krzyżowym bocznym jednostronnym. *Czas. Stomatol.*, 61, 428, 2008.
11. Landi N. et al.: Quantification of the relative risk of multiple occlusal variables for muscle disorders of the stomatognathic system. *J. Prosthet. Dent.*, 92, 190, 2004.
12. LeResche L. et al.: Changes in temporomandibular pain and other symptoms across the menstrual cycle. *Pain*, 106, 253, 2003.
13. LeResche L.: Predictors of onset of facial pain and temporomandibular disorders in early adolescence. *Pain*, 129, 269, 2006.
14. Litko M. et al.: Dysfunkcje narządu żucia u młodocianych – przegląd piśmiennictwa. *Protet. Stomatol.*, 57, 105, 2007.
15. Litko M. et al.: Dysfunkcje narządu żucia u pacjentów poniżej 18 roku życia w materiał Pracowni Zaburzeń Czynnościowych Narządu Żucia Akademii Medycznej w Lublinie. *Czas. Stomatol.*, 60, 118, 2007.
16. Luppnapornlarp S. et al.: The effects of premolar extraction: A long-term comparison of outcomes in “clearcut” extraction and non-extraction class II patients. *Angle Orthod.*, 63, 257, 1993.
17. Luther F. et al.: Orthodontics and the temporomandibular joint: Where are we now? Part 1. Orthodontics treatment and temporomandibular disorders. *Angle Orthod.*, 68, 295, 1998.
18. Luther F. et al.: Orthodontics and the temporomandibular joint: Where are we now? Part 2. Functional occlusion, malocclusion, and TMD. *Angle Orthod.*, 68, 305, 1998.
19. Marczak-Wojtyńska I. et al.: Szybko postępujące zmiany zwyrodnieniowe stawu skroniowo-żuchwowego u młodej pacjentki z dyskopatią skroniowo-żuchwową-opis przypadku. *Nowa Stomatol.*, 14, 24, 2000.
20. McNamara J.A. Jr.: Occlusion, orthodontic treatment, and temporomandibular disorders: a review. *J. Orofacial. Pain*, 9, 73, 1995.
21. McNamara J.A. Jr. et al.: Orthodontic treatment and temporomandibular disorders: Is there a relationship? Part I: Clinical studies. *J. Orofac. Orthop.*, 58, 74, 1997.
22. McNamara J.A. Jr. et al.: Orthodontic treatment and temporomandibular disorders. *Oral Surg. Oral Med. Pathol. Oral Radiol. Endod.*, 83, 107, 1997.
23. Miller J.R. Frankel appliance therapy and the temporomandibular disc: a prospective magnetic resonance imaging study. *Am. J. Orthod. Dentofacial Orthop.*, 121, 447, 2002.
24. Mohlin B.O. et al.: Malocclusion and temporomandibular disorder: a comparison of adolescence with signs and symptoms of temporomandibular disorder and their further development to 30 years of age. *Angle Orthod.*, 74, 319, 2004.
25. Mohlin B. et al.: TMD in relation to malocclusion and orthodontic treatment. *Angle Orthod.*, 77, 542, 2007.
26. Nawrocka-Furmanek J. et al.: Występowanie dysfunkcji narządu żucia w zależności od zaburzeń okluzji I wad zgryzu wśród młodych dorosłych. *Protet. Stomatol.*, 57, 183, 2007.

27. Paquette D.E. et al.: A long-term comparison of non-extraction and bicuspid-extraction edgewise therapy in "borderline" class II patients. *Am J Orthod Dentofac Orthop.*, 102, 1, 1992.
28. Sadowsky C. et al.: Orthodontic treatment and temporomandibular joint sounds: a longitudinal study. *Am J Orthod Dentofac Orthop.*, 99, 441, 1991.
29. Slami D. et al.: Ocena czynności stawów skroniowo-zuchwowych w aspekcie okluzji u pacjentów bez wady zgryzu i po leczeniu ortodontycznym aparatem stałym. *Dent. Med. Probl.*, 43, 390, 2006.
30. Suvinen T. I. et al.: Review of aetiological concepts of temporomandibular pain disorders: towards a biopsychosocial model for integration of physical disorder factor with psychological and psychosocial illness impact factors. *Eur. J. Pain*, 9, 13, 2005.
31. Tecco S. et al.: Fixed orthodontic therapy in temporomandibular disorder (TMD) treatment: an alternative to intraoral splint. *Cranio.*, 28, 153, 2010.
32. Tegeder I. et al.: Current evidence for a modulation of back pain by human genetic variants. *J. Cell. Mol. Med.*, 88, 1605, 2009.
33. Tomasz M. et al.: Leczenie ortodontyczne a relacje czynnościowe układu stomatognatycznego. *Ortodoncja*, 6, 47, 2004.
34. Turp J.C. et al.: Orthodontic treatment and temporomandibular disorders: Is there a relationship? Part 2: Clinical implications. *J. Orofac. Orthop.*, 58, 136, 1997

SUMMARY

Temporomandibular joint dysfunction (TMJD) can manifest as pain in muscles and temporomandibular joint, pain during jaw movement, limited range of jaw motions, as well as auscultatory symptoms. Burdensome symptoms to patients make them start medical treatment – often collaborative one – as there is a widespread belief about the relationship between malocclusion and orthodontic treatment with dysfunctions. Symptoms of TMJD occur in people without malocclusion, never treated orthodontically. The studies have shown that the incidence of TMJD increases in the population of 7–15 year-old children, and intensifies during puberty. However, decrease in muscle pain occurrence has been shown between the age of 19 to 30. TMJD manifested during orthodontic treatment do not have to be causally related to it. The research materials were collected by typing words (malocclusion, orthodontic treatment, tempomandibular disorder) in the PubMed web search engine. They were limited to articles published in English and Polish after 2000. There is no insufficient evidence that the dysfunctions of the temporomandibular joint are associated with a specific malocclusion, although some disorders may predispose to its occurrence. Orthodontic treatment should not be treated as a prophylaxis of temporomandibular joint dysfunctions, as it does not increase the risk for dysfunction when it is carried out in childhood. Orthodontic treatment with extractions does not impose any danger of inducing temporomandibular joint dysfunction.

Keywords: malocclusion, orthodontic treatment, tempomandibular disorder

STRESZCZENIE

Dysfunkcje stawu skroniowo-żuchwowego (dssż) objawiają się: bólem mięśni i stawu skroniowo-żuchwowego, bólem w trakcie ruchów żuchwy, ograniczeniem zakresu ruchów żuchwy, a także objawami osłuchowymi. Uciążliwe dla pacjenta dolegliwości powodują konieczność podjęcia leczenia – często zespołowego, ponieważ istnieje powszechne przekonanie o związku wad zgryzu i leczenia ortodontycznego z dysfunkcjami. Objawy dssż występują u osób bez wad zgryzu, nigdy nie leczonych ortodontycznie. Badania dowiodły, że częstość występowania objawów dssż wzrasta w populacji z wiekiem między 7 a 15 rokiem życia, a nasila się w okresie dojrzewania. Natomiast wykazano spadek występowania bólów mięśniowych od 19 do 30 roku życia. Dysfunkcje ssz objawiające się podczas leczenia ortodontycznego nie muszą być z nim związane przyczynowo. Materiał do badań zgromadzono wpisując w wyszukiwarkę internetową PubMed słowa: malocclusion, orthodontic treatment, tempomandibular disorders. Ograniczono się do artykułów wydanych po 2000 roku, w języku angielskim i polskim. Nie ma dostatecznych dowodów, że dysfunkcje stawu skroniowo-żuchwowego są związane z konkretną wadą zgryzu, chociaż pewne zaburzenia mogą predysponować do jej wystąpienia. Leczenie ortodontyczne nie powinno być traktowane jako profilaktyka dysfunkcji stawu skroniowo-żuchwowego, nie zwiększa też ryzyka pojawienia się dysfunkcji gdy prowadzone jest w dzieciństwie. Leczenie ortodontyczne z ekstrakcjami nie powoduje niebezpieczeństwa wywołania dysfunkcji stawu skroniowo-żuchwowego.

Słowa kluczowe: wada zgryzu, leczenie ortodontyczne, dysfunkcje stawu skroniowo-żuchwowego