AHEAD OF PRINT

Original paper

Is malocclusion a predictor of pain in patients suffering from TMD pain?

Magdalena Osiewicz[A–F], Bartosz Ciapała[B,D]

Department of Integrated Dentistry, Institute of Dentistry, Faculty of Medicine, Jagiellonian University Medical College, Krakow, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
D – writing the article; E – critical revision of the article; F – final approval of the article

Dental and Medical Problems, ISSN 1644-387X (print), ISSN 2300-9020 (online) *Dent Med Probl*.

Address for correspondence
Magdalena Osiewicz
E-mail: osiewicz.magdalena@gmail.com

Funding sources
None declared

Conflict of interest
None declared

Acknowledgements
None declared

Received on July 9, 2023
Reviewed on October 22, 2023
Accepted on November 28, 2023

Published online on April 23, 2024

Abstract

Background. Temporomandibular disorders (TMD) affect the masticatory muscles, temporomandibular joints (TMJs) and associated structures. The relationship between occlusion and TMD is a contentious issue in the dental field.

Objectives. Although there is a strong argument against invasive and irreversible therapeutic TMD procedures, the TMD biopsychosocial model is still not accepted by some clinicians. Hence, this study aimed to verify whether malocclusions are related to TMD pain.

Material and methods. The study included 49 adult patients with one or multiple TMD diagnoses and without any other diseases that could mimic TMD. A reliable investigator diagnosed the patients using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) protocol. The sample was divided into pain and non-pain TMD groups, and the predictor of malocclusion was categorized as the dependent variable. There were 33 patients in the TMD pain group and 16 patients in the non-pain TMD group. Analyses were conducted at a significance level of 0.05. The χ^2 test (with Yates' correction for 2×2 matrix) was used to compare qualitative variables between the groups.

Results. Malocclusion was present in 13 patients in the pain group and 7 patients in the non-pain group.

Conclusions. According to our study, there is no correlation between malocclusion and TMD pain.

Keywords: pain, TMD, TMJ, RDC/TMD, malocclusion

Cite as
Osiewicz M, Ciapała B. Is malocclusion a predictor of pain in patients suffering from TMD pain? [published online as ahead of print on April 23, 2024]. *Dent Med Probl.* doi:10.17219/dmp/176032

DOI
10.17219/dmp/176032

Introduction

Temporomandibular disorders (TMD) affect the masticatory muscles, temporomandibular joints (TMJs) and associated structures.[1] Patients with TMD commonly report fluctuating and dull pain in the masticatory muscles and the temporomandibular region. Other TMD symptoms include limitations in the mandibular range of motion and TMJ sounds such as clicking and crepitation during jaw function, which may cause discomfort on a daily basis. However, the etiology, diagnostics and treatment of TMD remain unclear.

The relationship between occlusion and TMD is a contentious topic in dentistry, often leading to controversy.[2] In 1934, the otolaryngologist James Costen diagnosed 11 patients and concluded that missing teeth or malocclusion could cause hearing loss, blocked ears, tinnitus, sinus problems, dizziness, TMD, and headaches.[3] In the following decades, patients underwent irreversible and invasive dental, orthodontic, and sometimes even surgical procedures.[4–7] Evidence-based medicine is required to link malocclusion and TMD with scientific research, given the invasive nature of such therapies. This approach has correctly explained the correlation between these 2 disorders. Recent literature does not support the prominent role of malocclusion as a primary risk factor in the onset of TMD symptoms. The role of occlusion as a risk factor for TMD remains controversial in the field of dentistry.[8–14]

The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) and Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), an improved and updated version of the former test representing the current reference for standardizing TMD diagnoses for research purposes, have been used to assess diagnosis frequency.[15,16] Axis I disease has been reported as the most common within the muscles in both European and non-European countries. Research conducted among non-patient and patient populations in Poland confirmed that myofascial pain was the most frequent diagnosis.[17,18]

According to Manfredini et al., the epidemiology of different TMD should be studied separately due to specific risk factors and age-related features identified in research samples.[19] It is a shortcoming in the literature that most risk assessment studies on TMD are based on non-patient populations, while studies on TMD patient populations focus on specific TMD subpopulations. Additional studies conducted by Schiffman et al. and Osiewicz et al. have shown that the primary Axis I diagnoses of the RDC/TMD can be distinguished based on the presence or absence of pain, resulting in 2 distinct groups. However, malocclusion was not considered a risk factor.[16,20]

Although there is a strong body of evidence against invasive and irreversible therapeutic TMD procedures, the biopsychosocial model of TMD is still not accepted by some clinicians. Therefore, this study aimed to verify whether malocclusions are related to TMD pain.

Material and methods

Participants

The study included 49 adult patients treated at the University Dental Clinic of Jagiellonian University in Krakow, Poland. The study period was 6 months and the inclusion criteria were:

1. the presence of one or multiple TMD, diagnosed according to the RDC/TMD;
2. the absence of symptoms of systemic or local diseases that may mimic TMD (e.g., fibromyalgia, hypothyroidism, lupus erythematosus, scleroderma, Parkinson's disease, Lyme disease, and dystonia). When in doubt, patients consulted a specialist who was authorized to exclude the patient from the study;
3. the absence of other orofacial disorders that may mimic TMD-like signs and/or symptoms, as determined by the patient's previous treatment history and relevant consultant's report. These symptoms included, but were not limited to, neuropathic pain, tension-type headaches, autonomic cephalalgias, migraines, psychogenic pain, myositis, infections, or any injuries.

All patients signed a consent form. The study adhered to the principles of the Helsinki Declaration and was approved by the Bioethics Committee of Jagiellonian University (approval No. KBET/90/B/2010).

Study design

This cross-sectional study involved examination of all patients by a reliable investigator who had undertaken specific training on RDC/TMD evaluation from a gold-standard examiner within the framework of a three-year specialty program in TMD and Orofacial Pain, and was rated as excellent.[21] All participants underwent a thorough assessment in accordance with the RDC/TMD guidelines to receive both Axis I and Axis II diagnoses based on the Polish official adaptation of the RDC/TMD.[16,22]

Axis I assessment involves a questionnaire and a clinical examination that can assign an individual to one or more of the 3 diagnosis groups. Group I comprises 2 muscle disorder subgroups: myofascial pain (IA); and myofascial pain with limited opening (IB). The only difference between IB and IA is that IB exhibits limited movement and stiffness of the muscle during stretching in the presence of myofascial pain. Group II disc displacements consist of disc displacement with reduction (IIA), disc displacement without reduction or limited mouth opening (IIB), and disc displacement without reduction or limited opening (IIC). Group III was represented by 3 subgroups: arthralgia with pain and tenderness in the joint capsule and/or the synovial lining of the TMJ (IIIA); osteoarthritis with pain and tenderness in the joint capsule and/or the synovial lining of the TMJ and the appearance of coarse crepitus in the TMJ and/or tomograms showing pathology in the TMJ

(IIIB); and osteoarthrosis with no pain but coarse crepitus in the TMJ and/or tomograms showing pathology in the TMJ (IIIC). All patients received a diagnosis based on the RDC/TMD and a malocclusion diagnosis.

The clinical research classified a malocclusion when the diagnosis was far from the correct class based on Angle's classification, which refers to the posterior-anterior jaw position. An anterior crossbite was diagnosed when 2 or more mandibular front teeth overlapped the maxillary teeth. A posterior crossbite was diagnosed when 2 or more back teeth overlapped the mandibular teeth. An open bite was registered when overbite was negative, and a deep bite was noted when the top front teeth covered more than half the length of the bottom front crown. Finally, an overjet was registered when the distance between the lip surface of the top foretooth was more than 4 mm larger than the lip surface of the bottom foretooth. All of the above cases were classified as malocclusion.[23]

Statistical analysis

The study sample consisted of 2 groups based on the RDC/TMD diagnosis: a pain TMD group; and a non-pain TMD group. The predictor of malocclusion was identified as the dependent variable. Analyses were conducted at a significance level of 0.05, and the χ^2 test (with Yates' correction for 2 × 2 matrix) was used to compare qualitative variables in both groups. All analyses employed R v. 3.6.1 software (https://cran-archive.r-project.org/bin/windows/base/old/3.6.1).

Results

Data analysis was performed on 49 patients (81.7% females, mean age: 33.2 ±14.7 years, min = 18, max = 72, range = 54). The study sample consisted of a pain TMD group, which included patients with myofascial pain/myofascial pain with limited opening (IA/IB) and arthralgia/osteoarthritis (IIIA/IIIB), and a non-pain TMD group including patients with disc displacement with reduction (IIA), disc displacement without reduction and with limited opening/disc displacement without reduction or limited opening (IIB/IIC), and osteoarthritis (IIIC). The study included 33 patients in the pain TMD group and 16 patients in the non-pain TMD group. The number of patients diagnosed with malocclusion in the pain TMD group was 13, and 7 patients were diagnosed in the non-pain TMD group (Table 1). Malocclusion had no significant effect on pain in both groups ($p > 0.05$).

Table 1. Frequency of malocclusion in TMD groups with and without pain

Study group	Malocclusion ($n = 20$)	No malocclusion ($n = 29$)	p-value (χ^2 test)
Pain TMD	13 (65.00)	20 (68.97)	1.000
Non-pain TMD	7 (35.00)	9 (31.03)	

Data presented as frequency (percentage) (n (%)). TMD – temporomandibular disorders.

Discussion

Based on the results of the present study, the null hypothesis stating that malocclusion is related to painful TMD was rejected. The association between ear symptoms, occlusion and TMD has been hypothesized since the early theories of Costen. Malocclusion is a prevalent oral disorder worldwide.[24] However, according to the multiple regression analysis of 11 common occlusal features conducted by Pullinger et al., occlusion cannot be considered the unique or dominant factor in defining TMD populations.[25] A review by Manfredini clearly indicated that, based on the available literature, the concept of equilibrating the occlusion to treat and/or prevent TMD should not be used. Also, further routine appraisal of biological rationale is not recommended.[26] A study by Amer et al. investigated the dental and skeletal aspects of malocclusion in the antero-posterior and vertical dimensions in a population of TMD patients and found no association between TMD and malocclusion.[27] Similarly, there was no correlation between transverse malocclusion and TMD signs and symptoms.[28] Moreover, Manfredini et al. found no significant association between dental Angle class asymmetry and TMD, despite Angle class being one of the most frequently used factors to determine malocclusion.[29] Our findings suggest that malocclusion does not directly cause TMD pain.

Many disease-related variables across multiple domains (i.e., biological, psychosocial and pain processing) impact TMD pain, making TMD a complex disease.[30] The current study supports the so-called biopsychosocial model of pain, indicating that malocclusion cannot be considered the sole risk factor. Therefore, the evaluation of both Axis I and Axis II is necessary.

Due to the small sample size, we recommend adopting the updated DC/TMD to a larger and more diverse patient population, including individuals from different countries and cultures. Such an approach would enable the potential application of the study findings in cross-cultural comparisons. Another limitation concerns the diagnosis of malocclusion, which should have been more specifically assessed.

Conclusions

The investigation rejected the null hypothesis that malocclusion is related to painful TMD and suggested that the contribution of occlusion to TMD pain is negligible. Furthermore, the study supports a much-diminished role of peripheral anatomical-structural factors in the pathogenesis of TMD pain.

Ethics approval and consent to participate

The study adhered to the principles of the Helsinki Declaration and was approved by the Bioethics Committee of Jagiellonian University (approval No. KBET/90/B/2010). All patients signed a consent form.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

ORCID iDs

Magdalena Osiewicz https://orcid.org/0000-0002-8108-4546
Bartosz Ciapała https://orcid.org/0000-0003-4912-121X

References

1. De Leeuw R, Klasser GD, eds. Differential diagnosis and management of TMDs. In: *Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management (American Academy of Orofacial Pain)*. 6th ed. Hanover Park, IL: Quintessence Publishing; 2018:143–207.
2. Türp JC, Greene CS, Strub JR. Dental occlusion: A critical reflection on past, present and future concepts. *J Oral Rehabil*. 2008;35(6):446–456. doi:10.1111/J.0305-182X.2007.01820.X
3. Costen JB. I. A syndrome of ear and sinus symptoms dependent upon disturbed function of the temporomandibular joint. *Ann Otol Rhinol Laryngol*. 1934;43(1):1–15. doi:10.1177/000348943404300101
4. Schwartz LL. Pain associated with the temporomandibular joint. *J Am Dent Assoc*. 1955;51(4):394–397. doi:10.14219/JADA.ARCHIVE.1955.0223
5. Laskin DM. Etiology of the pain-dysfunction syndrome. *J Am Dent Assoc*. 1969;79(1):147–153. doi:10.14219/JADA.ARCHIVE.1969.0234
6. Goodman P, Greene CS, Laskin DM. Response of patients with myofascial pain-dysfunction syndrome to mock equilibration. *J Am Dent Assoc*. 1976;92(4):755–758. doi:10.14219/JADA.ARCHIVE.1976.0419
7. Laskin DM, Greene CS. Influence of the doctor-patient relationship on placebo therapy for patients with myofascial pain-dysfunction (MPD) syndrome. *J Am Dent Assoc*. 1972;85(4):892–894. doi:10.14219/JADA.ARCHIVE.1972.0416
8. Perrotta S, Bucci R, Simeon V, Martina S, Michelotti A, Valletta R. Prevalence of malocclusion, oral parafunctions and temporomandibular disorder-pain in Italian schoolchildren: An epidemiological study. *J Oral Rehabil*. 2019;46(7):611–616. doi:10.1111/joor.12794
9. Bindayel NA. Occurrence of malocclusion in patients with orofacial pain and temporomandibular disorders. *J Contemp Dent Pract*. 2018;19(5):477–482. PMID:29807955.
10. Boscato N, Nascimento GG, Leite FRM, Horta BL, Svensson P, Demarco FF. Role of occlusal factors on probable bruxism and orofacial pain: Data from the 1982 Pelotas birth cohort study. *J Dent*. 2021;113:103788. doi:10.1016/j.jdent.2021.103788
11. Zúñiga-Herrera ID, Herrera-Atoche JR, Escoffié-Ramírez M, Casanova-Rosado JF, Alonzo-Echeverría ML, Aguilar-Pérez FJ. Malocclusion complexity as an associated factor for temporomandibular disorders. A case-control study. *Cranio*. 2023;41(5):461–466. doi:10.1080/08869634.2020.1868907
12. Uetanabaro LC, Gerber JT, Dos Santos KM, et al. Prevalence and associated factors of myofascial pain in orthognathic patients with skeletal class II malocclusion. *Oral Maxillofac Surg*. 2023;27(1):25–31. doi:10.1007/s10006-022-01046-1
13. Manfredini D, Lombardo L, Siciliani G. Temporomandibular disorders and dental occlusion. A systematic review of association studies: End of an era? *J Oral Rehabil*. 2017;44(11):908–923. doi:10.1111/joor.12531
14. Myllymäki E, Heikinheimo K, Suominen A, et al. Longitudinal trends in temporomandibular joint disorder symptoms, the impact of malocclusion and orthodontic treatment: A 20-year prospective study. *J Oral Rehabil*. 2023;50(9):739–745. doi:10.1111/joor.13471
15. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: Review, criteria, examinations and specifications, critique. *J Craniomandib Disord*. 1992;6(4):301–355. PMID:1298767.
16. Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†. *J Oral Facial Pain Headache*. 2014;28(1):6–27. doi:10.11607/JOP.1151
17. Wieckiewicz M, Grychowska N, Nahajowski M, et al. Prevalence and overlaps of headaches and pain-related temporomandibular disorders among the Polish urban population. *J Oral Facial Pain Headache*. 2020;34(1):31–39. doi:10.11607/OFPH.2386
18. Loster JE, Osiewicz MA, Groch M, Ryniewicz W, Wieczorek A. The prevalence of TMD in Polish young adults. *J Prosthodont*. 2017;26(4):284–288. doi:10.1111/jopr.12414
19. Manfredini D, Castroflorio T, Perinetti G, Guarda-Nardini L. Dental occlusion, body posture and temporomandibular disorders: Where we are now and where we are heading for. *J Oral Rehabil*. 2012;39(6):463–471. doi:10.1111/J.1365-2842.2012.02291.X
20. Osiewicz MA, Lobbezoo F, Loster BW, Loster JE, Manfredini D. Frequency of temporomandibular disorders diagnoses based on RDC/TMD in a Polish patient population. *Cranio*. 2018;36(5):304–310. doi:10.1080/08869634.2017.1361052
21. Lobbezoo F, van der Zaag J, Visscher CM, Naeije M. Oral kinesiology. A new postgraduate programme in the Netherlands. *J Oral Rehabil*. 2004;31(3):192–198. doi:10.1046/J.0305-182X.2003.01244.X
22. Osiewicz MA, Lobbezoo F, Loster BW, Wilkosz M, Naeije M, Ohrbach R. Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD): The Polish version of a dual-axis system for the diagnosis of TMD.* RDC/TMD form. *J Stomatol*. 2013;66(5):576–649. doi:10.5604/00114553.1065048
23. Manfredini D, Visscher CM, Guarda-Nardini L, Lobbezoo F. Occlusal factors are not related with self-reported bruxism. *J Orofac Pain*. 2012;26(3):163–167. PMID:22838000.
24. Kragt L, Dhamo B, Wolvius EB, Ongkosuwito EM. The impact of malocclusions on oral health-related quality of life in children – a systematic review and meta-analysis. *Clin Oral Investig*. 2016;20(8):1881–1894. doi:10.1007/S00784-015-1681-3
25. Pullinger AG, Seligman DA, Gornbein JA. A multiple logistic regression analysis of the risk and relative odds of temporomandibular disorders as a function of common occlusal features. *J Dent Res*. 1993;72(6):968–979. doi:10.1177/00220345930720061301
26. Manfredini D. Occlusal equilibration for the management of temporomandibular disorders. *Oral Maxillofac Surg Clin North Am*. 2018;30(3):257–264. doi:10.1016/j.coms.2018.04.002
27. Amer NM, Aboalnaga AA, Elnahas MO, et al. Malocclusion and temporomandibular disorders: Verification of the controversy. *J Oral Facial Pain Headache*. 2019;33(4):440–450. doi:10.11607/ofph.2260
28. Amer NM, Aboalnaga AA, Fayed MMS, Labib AH. Transverse malocclusion and temporomandibular disorders: Verification of the controversy. *J Oral Facial Pain Headache*. 2019;33(4):355–361. doi:10.11607/ofph.2286
29. Manfredini D, Lombardo L, Siciliani G. Dental angle class asymmetry and temporomandibular disorders. *J Orofac Orthop*. 2017;78(3):253–258. doi:10.1007/S00056-016-0079-4
30. Ohrbach R, Slade GD, Bair E, et al. Premorbid and concurrent predictors of TMD onset and persistence. *Eur J Pain*. 2020;24(1):145–158. doi:10.1002/ejp.1472