Scientific Article
UDC 616.724-08
DOI: 10.17816/pmj411120-131

ANALYSIS OF HARDWARE METHODS OF TREATMENT OF PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION

A.A. Dolgalev[1]*, D.Yu. Khristoforando[1], Ya.N. Garus[1], V.N. Ivensky[1], A.N. Brazhnikova[1], O.Yu. Khorev[1], E.A. Bulycheva[2], P.N. Geletin[3], Z.V. Kerefova[4], Yu.V. Chepurko[5], O.A. Uspenskaya[6]

[1]Stavropol State Medical University, Stavropol,
[2]Pavlov First Saint Petersburg State Medical University,
[3]Smolensk State Medical University,
[4]Tkhazaplizhev Republican Dental Center, Nalchik,

tel. +7 962 403 58 69
e-mail: Dolgalev1@mail.ru

[Dolgalev A.A. (*contact person) – MD, PhD, Professor, the Head of the Department of Orthopedic Dentistry, ORCID: 0009-0001-2434-417X; Khristoforando D.Yu. – MD, PhD, Associate Professor, Associate Professor of the Department of Dental Surgery and Maxillofacial Surgery, ORCID: 0000-0002-2624-7453; Garus Ya.N. – MD, PhD, Professor, Professor of the Department of Propaedeutics of Dental Diseases, SPIN-код 266-9669 Author ID 295471; Ivensky V.N. – Candidate of Medical Sciences, Associate Professor of the Department of Propaedeutics of Dental Diseases, ORCID: 0009-0008-1615-3614; Brazhnikova A.N. – Candidate of Medical Sciences, Associate Professor, Associate Professor of the Department of Organization of Dental Care, Management and Prevention of Dental Diseases, ORCID: 0000-0003-2117-2218; Khorev O.Yu. – Candidate of Medical Sciences, Associate Professor, Associate Professor of the Department of Orthopedic dentistry, ORCID: 0009-0004-6862-129X; Bulycheva E.A. – MD, PhD, Professor, Professor of the Department of Orthopedic Dentistry and Material Science with Adult Orthodontics Course; Geletin P.N. – MD, PhD, Professor, Professor of the Department of Propaedeutic Dentistry, ORCID: 0000-0001-8187-0865; Kerefova Z.V. – Orthodontist, SPIN-код:8642-2973; Chepurko Yu.V. – Assistant of the Department of Dentistry, ORCID: 0009-0008-2147-1270; Uspenskaya O.A. – MD, PhD, Associate Professor, Head of the Department of Therapeutic Dentistry, ORCID: 0000-0003-2395-511X].

тел. +7 962 403 58 69
e-mail: Dolgalev1@mail.ru

[Долгалев А.А. (*контактное лицо) – заведующий кафедрой ортопедической стоматологии, доктор медицинских наук, профессор, ORCID: 0009-0001-2434-417X; Христофорандо Д.Ю. – доцент кафедры хирургической стоматологии и челюстно-лицевой хирургии, доктор медицинских наук, доцент, ORCID: 0000-0002-2624-7453; Гарус Я.Н. – профессор кафедры пропедевтики стоматологических заболеваний, доктор медицинских наук, профессор, SPIN-код 266-9669 Author ID 295471; Ивенский В.Н. – доцент кафедры пропедевтики стоматологических заболеваний, кандидат медицинских наук, ORCID: 0009-0008-1615-3614; Бражникова А.Н. – доцент кафедры организации стоматологической помощи, менеджмента и профилактики стоматологических заболеваний, кандидат медицинских наук, доцент, ORCID: 0000-0003-2117-2218; Хорев О.Ю. – доцент кафедры ортопедической стоматологии, кандидат медицинских наук, доцент, ORCID: 0009-0004-6862-129X; Булычева Е.А. – профессор кафедры стоматологии ортопедической и материаловедения с курсом ортодонтии взрослых, доктор медицинских наук, профессор; Гелетин П.Н. – профессор кафедры пропедевтической стоматологии, ORCID: 0000-0001-8187-0865; Керефова З.В. – врач-ортодонт, SPIN-код: 8642-2973; Чепурко Ю.В. – ассистент кафедры стоматологии, ORCID: 0009-0008-2147-1270; Успенская О.А. – заведующий кафедрой терапевтической стоматологии, доктор медицинских наук, доцент, ORCID: 0000-0003-2395-511X].

[5]Rostov State Medical University, Rostov-on-Don,
[6]Privolzhsky Research Medical University, Nizhny Novgorod, Russian Federation

АНАЛИЗ АППАРАТНЫХ МЕТОДОВ ЛЕЧЕНИЯ ПАЦИЕНТОВ С ДИСФУНКЦИЕЙ ВИСОЧНО-НИЖНЕЧЕЛЮСТНОГО СУСТАВА

А.А. Долгалев[1]*, Д.Ю. Христофорандо[1], Я.Н. Гарус[1], В.Н. Ивенский[1], А.Н. Бражникова[1], О.Ю. Хорев[1], Е.А. Булычева[2], П.Н. Гелетин[3], З.В. Керефова[4], Ю.В. Чепурко[5], О.А. Успенская[6]

*[1]Ставропольский государственный медицинский университет,
[2]Первый Санкт-Петербургский государственный медицинский университет имени академика И.П. Павлова,
[3]Смоленский государственный медицинский университет,
[4]Республиканский стоматологический центр имени Т.Х. Тхазаплижева, г. Нальчик,
[5]Ростовский государственный медицинский университет, г. Ростов-на-Дону,
[6]Приволжский исследовательский медицинский университет, г. Нижний Новгород, Российская Федерация*

Objective. To conduct a comparative analysis of effectiveness of treatment of patients with dysfunction of temporomandibular joint (DTMJ) using hardware methods of treatment with occlusive mouthguards of various types.
Materials and methods. 99 patients (88 females and 11 males aged 41,2 ± 10,7) with different combinations of revealed and confirmed signs of DTMJ were examined from 2013 to 2023. According to the personal clinical picture, complaints revealed, aetiology and pathogenesis of the disease all the patients of the comparison group and 2 main groups (99 patients) were administered individual complex treatment for DTMJ. The treatment was aimed at the elimination of pain, relief of masticatory muscles spasm, improvement of the extent of opening of mouth, correction of the lower jaw position, occlusive interference elimination and restoration of height of the lower third of the face.
While carrying out the hardware treatment, occlusive mouthguards of 3 types were made based on the jaw model of the patients. The models were got from the silicone imprints of the jaw.
Results. MR images of temporomandibular joints of the 99 patients showed that ventral dislocation of articular disk occurred most frequently (in 88 patients). Less frequently (4 % of cases) it was combined with dislocation of the disk laterally. Rarely distal dislocation of the articular disk occurred – 1,9 % of cases (2 patients). Study of the results of the appliance of different types of occlusive mouthguards demonstrates the necessity to work out the types of occlusive devices allowing decompression of temporomandibular joint elements, centering lower jaw position and orthodontic elimination of dentofacial abnormalities and deformities which lead to occlusive interference.
Conclusions. Analysis of occlusive devices used in the diagnosis and treatment of patients with DTMJ shows that the most effective devices are those that successfully combine elements of splints with a narrower purpose.
Keywords. Dysfunction of temporomandibular joint, occlusal splint, occlusive mouthguards, splints, orthotics, occlusal abnormalities.

Цель. Провести сравнительный анализ эффективности лечения пациентов с дисфункцией височно-нижнечелюстного сустава (ДВНЧС) с применением аппаратурных методов лечения окклюзионными каппами различных видов. Высокая распространенность среди стоматологических заболеваний дисфункций височно-нижнечелюстного сустава (ДВНЧС) обусловливает необходимость совершенствования имеющихся и создание инновационных методов лечения. Высокая корреляция ДВНЧС с нарушениями смыкания зубных рядов обусловлена высокой встречаемостью аномалий, деформаций зубных рядов, а также частичной потери зубов, дефектов твердых тканей среди пациентов разных возрастных

групп и гендерной принадлежности. Среди консервативных методов, входящих в комплексный подход лечения пациентов, страдающих ДВНЧС, особое место занимают аппаратурные методы лечения.
Специалистами предложены различные виды ортопедических конструкций: сплинты, окклюзионные шины, окклюзионные каппы, ортотики и другие. Все виды лечебно-диагностических аппаратов имеют конструктивные сходства и отличия, выполняются из различных стоматологических материалов, могут быть отнесены к одному из видов: разобщающие, центрирующие (репозиционные), релаксационные, стабилизирующие шины.
Материалы и методы. В период с 2013 по 2023 г. обследовано 99 пациентов с различными комбинациями выявленных и подтвержденных признаков ДВНЧС, с распределением по гендерному признаку – 88 женщин, 11 мужчин (средний возраст 41,2 ± 10,7 года). В соответствии с индивидуальной клинической картиной, выявленными жалобами, этиологией и патогенезом заболевания всем пациентам группы сравнения и двух основных групп ($n = 99$) назначалась индивидуальная тактика комплексного лечения ДВНЧС. Лечение было направлено на устранение болевого синдрома, снятие спазма жевательных мышц, нормализацию объема открывания рта, нормализацию положения нижней челюсти относительно верхней, устранение окклюзионных интерференций, восстановление высоты нижней трети лица.
При проведении аппаратурного лечения всем пациентам по моделям челюстей, полученным по силиконовым оттискам, по показаниям изготавливали окклюзионные каппы трех видов.
Результаты. Данные анализа МРТ ВНЧС 99 обследованных показали, что наиболее часто (у 88 обследованных из 99) встречается вентральная дислокация суставного диска – в 88,8 % случаев, и реже в комбинации со смещением диска латерально 4 %. Редко встречается дистальный сдвиг суставного диска – 1,9 % (2 пациента из 99). Изучение результатов применения различных видов окклюзионных капп позволяет сделать вывод о необходимости разработки видов окклюзионных аппаратов, сочетающих в себе возможности декомпрессии элементов ВНЧС, центрирования положения нижней челюсти относительно верхней и ортдонтического устранения зубочелюстных аномалий и деформаций, являющихся причинами окклюзионных интерференций.
Выводы. Анализ окклюзионных аппаратов, применяемых при диагностике и лечении пациентов с ДВНЧС показывает, что наиболее эффективными являются аппараты, удачно сочетающие в себе элементы шин с более узким назначением.
Ключевые слова. Дисфункция височно-нижнечелюстного сустава, окклюзионные шины, окклюзионные каппы, сплинты, ортотики, окклюзионные нарушения.

INTRODUCTION

Orthopedic structures that provide a disconnecting, centering (repositioning occlusal splints), relaxing, and stabilizing effect are commonly used in the complex treatment of dysfunction of the temporomandibular joint (DTMJ) [1–8]. Among the types of occlusal splints, importance is given to orthotics, which are devices commonly developed for the lower jaw, having on their surface imprints of the chewing surface of antagonist teeth made of silicone. Such an occlusal device allows for separation of the dentition, thereby achieving decompression in the temporomandibular joint (TMJ) and masticatory muscle relaxation and centering the position of the lower jaw relative to the skull. However, this design of the occlusal apparatus does not allow normalizing the shape of the dental arches and the position of the teeth in the dental arch and does not eliminate occlusal interference [9–16].

In the practice of orthodontists, along with the use of edgewise techniques, an in-

novative method of treating anomalies, dental deformities, and occlusal interferences has become widespread, namely, the use of removable aligners. Several specialists consider occlusal interference as a cause of DTMJ, which, in turn, is caused by anomalies and deformities of the dentition [17–20]. Hence, orthodontic treatment is considered for preventing and treating DTMJ. However, with a narrow approach to correcting deformities and anomalies of the dentition, without proper comprehensive functional diagnostics of the state of the TMJ and masticatory muscles, normalization of the dentition occlusion do not always lead to spontaneous compensation of the morphological, functional, and combined changes in the TMJ and masticatory muscles [21–24].

This study aimed to conduct a comparative analysis of the efficiency of DTMJ treatment using instrumental treatment methods.

Materials and methods

In 2013 to 2023, we examined 99 patients with various combinations of identified and confirmed signs of DTMJ, distributed by sex (88 women, 11 men; average age: 41.2 ± 10.7 years).

The inclusion criteria were complaints of pain, crunching, jamming, clicking, and stiffness in the TMJ. In accordance with ICD-10, patients were diagnosed with temporomandibular pain-dysfunction syndrome (Costen's syndrome; K07.60), recurrent dislocation or subluxation of the lower jaw (K07.62), arthrosis of the TMJ (M19.0X), and clicking jaw (K07.61).

Exclusion criteria were lack of patient consent to participate in the study, cancer, acute stage or exacerbation of a chronic general somatic disease, history of trauma to the skull and maxillofacial area, pregnancy, and lactation.

Using free randomization, patients were distributed to a comparison group with 33 people (28 women, 5 men) and two main groups with 33 patients each.

All patients included in the study underwent comprehensive and clinical examinations, an interview, obtaining diagnostic casts and models of the jaws, and MRI of the TMJ.

Magnetic resonance imaging (MRI) of the TMJ was performed in MRI laboratories in Stavropol, with an MRI scanner power of at least 1.5 Tesla. The study was performed with the patient's mouth closed and open (with fixation with an individual mouthguard), in T1, T2, and PD modes and in oblique sagittal, frontal, and horizontal views.

In accordance with the individual clinical presentation, identified complaints, etiology, and pathogenesis of the disease, individual approach for complex DTMJ treatment was prescribed to all patients in the comparison group and two working groups (n = 99). Treatment aimed to eliminate pain, relieve masticatory muscle spasms, normalize the volume of mouth opening, normalize the position of the lower jaw relative to the upper jaw, eliminate occlusal

interference, and restore the height of the lower third of the face.

For this purpose, drug treatment was used (nonsteroidal anti-inflammatory drugs, painkillers, chondrotropic drugs), and massage of the masticatory muscles, myogymnastics, and instrumental treatment were prescribed. When performing hardware treatment, occlusive mouthguards were made for all patients based on jaw models obtained from silicone imprints.

The main group 1 included 33 patients (3 men, 30 women) whose complex treatment included using an orthotic device. An orthotic for the lower jaw was created from dental silicone for mouthguards and had imprints of the teeth of the upper jaw, allowing the lower jaw to be directed to a centric position when closing the jaws when closing the mouth, which corresponded to the centric relation (CR) of the jaws, determined by analyzing the TMJ MRI of each patient.

The orthotic was made by vacuum pressing according to the model of the lower jaw. The amount of separation of the dentition (thickness of the orthotic) was determined by analyzing the TMJ MRI based on the articular disc thickness criterion. The orthotic was used daily, for 2–3 hours during the day and all night.

The main group 2 included 33 patients (3 men, 30 women), whose complex treatment included orthodontic aligners to eliminate occlusal interference associated with dentition anomalies and deformities. When planning orthodontic treatment, special locking elements (pads) were introduced into the design of the aligners in the software, allowing the centering and stabilization of the lower jaw position relative to the upper jaw in accordance with individual data obtained from TMJ MRI analysis.

The planning, design, and production of aligners were performed in specialized laboratories using silicone imprints of the patients' upper and lower jaws. The CR of the jaws was determined using an anatomical and functional method, and registration was performed using occlusal silicone.

The aligners were used for 20–22 hours per day, with breaks for meals and hygiene procedures; each pair of aligners was replaced with the next set every 2 weeks.

Group 3 (comparison group) included 33 patients (28 women, 5 men) whose complex treatment of DTMJ, in addition to drug treatment according to clinical indications, selective grinding of occlusal interferences, normalization of the volume of mouth opening, myogymnastics, and massage of the masticatory muscles, involved using a 0.2-mm-thick dental mouthguard, made by vacuum thermopressing according to the model of the lower jaw to provide a placebo effect. The occlusal surface of the mouthguard wherein the antagonist teeth occlude was perforated to eliminate barriers and distortions of the usual occlusal contacts to ensure greater efficiency of the placebo effect.

All participants were asked to read and sign an informed consent to participate in a scientific study, on a mutually free basis,

providing information about the possible use of the placebo effect in the treatment plan through random randomization. Patients who refused to sign the informed consent under the specified conditions were excluded, and the results of the examination and treatment of these patients were not used in data processing.

Statistical processing of the data obtained as a result of the study was performed using Statistica 8.0 software. To assess the type of distribution of characteristics, the Shapiro – Wilks criterion was used. Values were presented as $M \pm SE$, where M is the sample mean and SE is the standard error of the mean. The significant differences in the average values of independent samples were assessed using the nonparametric Mann–Whitney U-test. In the case of normal distribution, the paired Student's T-test was utilized to compare the samples. When comparing several groups with each other, the Bonferroni correction was applied. In statistical analysis, the achieved level of significance (p) was considered, and the critical level of significance was equal to 0.05.

RESULTS AND DISCUSSION

During a clinical examination of patients and analysis of diagnostic models of the jaws of all 99 patients included in this study, various anomalies and deformities of the dentition and dental occlusion were identified in 29.3 % of cases (29 patients).

Dental anomalies and deformities were detected in 30.3 % of cases in group 1 (10 patients), in 27.2 % of cases in group 2 (9), and in 30.3 % of patients in the control group (10).

The most common dental anomalies were distal occlusion in 42.4 % of cases (43 of 99 patients) and anomalies in the transversal plane (cross occlusion in 26.2 % of cases; 26 of 99 patients). Combined, associated forms of anomalies accounted for 97.1 % (67 of 69 patients with identified maxillofacial anomalies) of all identified cases.

MRI of the TMJ of 99 examined patients showed that ventral dislocation of the articular disc occurs most commonly (in 88 of 99 patients examined; 88.8 % of cases) and less often in combination with lateral displacement of the disc (4 %). Distal displacement of the articular disc is rare (1.9 %; 2 of 99 patients).

When analyzing TMJ MRI in DTMJ patients, the average dimensions of the joint space on the right were determined as 2.7 ± 0.5 mm in the anterior section, 1.9 ± 1.2 mm in the superior section, and 1.9 ± 1.0 mm in the posterior section. The average dimensions of the joint space in DTMJ patients on the left were 2.2 ± 1.3 mm in the anterior section, 2.1 ± 1.1 mm in the superior section, and 2.0 ± 0.3 mm in the posterior section ($p = 0.003$).

During the examination before DTMJ treatment, possible complete reduction of the articular disc from the ventral dislocation on one side, without reduction on the contralateral side, during functional tests of mouth opening/closing, was determined in 45 of 99 patients (45.5 %).

The results of complex treatment of DTMJ using orthotics, aligners with pads, and mouthguards with an open occlusal surface were assessed 14 and 30 days and 6 months after the start of treatment.

The disappearance of symptoms, such as pain and crunching in the TMJ when opening/closing the mouth as a result of complex treatment, and adaptation to occlusive mouthguards occurred 2 weeks later in 53 of 99 patients (52.5 %). Distribution of the degree of reduction of pain, discomfort, and crunching in the TMJ when opening/closing of the mouth as a result of complex treatment in groups, according to the signs of treatment with various devices, occurred unevenly.

Among patients who used an orthotic as an occlusal guard in the complex treatment of DTMJ, 24 patients noted a decrease in pain 2 weeks after the start of treatment.

Among the patients whose complex treatment was performed using orthodontic aligners with pads, 15 patients noted a decrease in the manifestations of DTMJ after 2 weeks.

In the comparison group, where a mouthguard was used to achieve a placebo effect, 14 patients noted a decrease in pain 2 weeks after the start of complex treatment for DTMJ.

In the group of patients whose complex treatment of DTMJ included the use of an orthotic, during a control examination 1 month after the start of treatment, the disappearance of noises and clicks when opening/closing the mouth and the absence of pain on palpation in the TMJ area and masticatory muscles were observed. Less than a quarter of patients report minor discomfort in the morning after removing the orthotic, which was associated with a change in the closure of the dentition and disappears shortly (within 30 minutes). The ongoing adaptation leads at the initial stage of treatment to the possibility in patients of this group to set the jaw in two positions, namely, habitual and reconstructive, determined by orthotic.

After 6 months, possible spontaneous retention of the lower jaw was noted in patients of this group in the reconstructive position due to the masticatory muscles, which was not accompanied by a feeling of discomfort. Moreover, in 11 of 33 patients in this group (33.3 %), a lack of close contact between the dentition of the upper and lower jaws in the lateral sections, simultaneous advancement of the lower jaw and its displacement downward, and a decrease in overbite were noted.

In this case, patients were offered to complete the treatment using a prosthetic method, namely, production of occlusal permanent overlays made of zirconium dioxide composite or pressed ceramics on the occlusal surface of separated teeth in the lateral parts of the jaws. Otherwise, patients were instructed to continue using the orthotic all night and 2–3 hours during the day.

A control analysis of TMJ MRI of patients in this group, performed 6 months after the start of complex treatment of

DTMJ, determined the elimination of ventral dislocation of the articular disc, elimination of joint space narrowing in the distal part, and symmetrical arrangement of the heads of the lower jaw in the analysis of tomograms in frontal view in 18 patients (54.5 %).

When examining patients whose hardware treatment was performed using aligners modified by pads, an improvement in the lower jaw biomechanics was observed in 29 patients (87.9 %) after 14 days, as well as elimination of zigzag movements of the lower jaw when opening/closing the mouth and a decrease or smoothing of clicks in the TMJ when opening the mouth

Six months after the start of complex treatment of DTMJ using aligners, 29 patients (87.9 %) noted the absence of pain and discomfort when opening the mouth, the absence of clicking and crunching, and an increase in the smoothness of opening/closing the mouth. Depending on the severity of dentoalveolar anomalies and deformities, patients using aligners in the treatment process experience varying degrees of improvement in the occlusal relationships of the dentition of the upper and lower jaws. In patients who, according to orthodontic indications, received more than 30 pairs of aligners and in whom treatment lasted more than 1.5 years, the elimination of the main manifestations of DTMJ occurred earlier than the end of the orthodontic correction phase.

MRI analysis of the TMJ in DTMJ patients, whose treatment involved the use of aligners, performed 6 months after the start of treatment, revealed an improvement in the morphofunctional signs of the TMJ, such as a more pronounced centricity of the location of the head of the mandible in the articular fossa, uniformity of the width of the joint space on the right and left, symmetry of the location of the heads of the lower jaw relative to the skull when analyzing the frontal projection, and absence of ventral dislocation of the articular disc (in 13 of 33 patients, 39.3%). In other cases, no reliable MRI data characterizing favorable changes in the structure and function of the TMJ ($p = 0.412$) were obtained. However, analysis of the intermediate or, in some cases, the final stage of orthodontic treatment showed the high efficiency of aligners in eliminating dentofacial anomalies and deformities. In turn, considering the role of dentition anomalies and deformities and associated occlusal disorders in the etiology and pathogenesis of DTMJ, we can assume that such a restructuring of the dentition, aimed at eliminating occlusal interference, can have a favorable effect on the morphofunctional state of the TMJ and may be considered as a measure to prevent the worsening of pathological processes in the TMJ and masticatory muscles.

The use of aligners in the treatment of DTMJ in 84% of patients enabled improvement in the shape and relationship of the dentition, reducing the formation of static and dynamic occlusal interferences. Separation and centering of the dentition using special pads in aligners increased the

efficiency of DTMJ treatment to 98% in the period from 4 months to 8 months ($p = 0.003$).

However, the use of thin orthodontic aligners does not allow effective control of the height correction of the lower third of the face; the disconnection effect when using this type of hardware treatment is achieved to a lesser extent than when using orthotics.

In the comparison group (33 DTMJ patients), the use of a placebo occlusive mouthguard led to a decrease in pain 2 weeks after the start of complex treatment of DTMJ in 14 patients (42.4%) ($p = 0.003$). This proves the efficiency of complex treatment of DTMJ and confirms the lower efficiency and significance of hardware treatment as an individual treatment.

The absence of positive dynamics of morphofunctional changes was confirmed by MRI results of the TMJ obtained 6 months after the start of treatment. In patients of this group, the TMJ MRI analysis revealed ventral dislocation of the articular disc, uneven width of the joint space on the right and left, and shift of the mandible, that is, asymmetrical position of the heads of the mandible relative to the skull, as in the primary analysis, before treatment. Upon completion of participation in the study, the patients in this group were advised to continue treatment using hardware treatment according to indications using an orthotic or aligners. Among 33 patients in this group, 28 continued treatment and follow-up according to the proposed regimen. Having noted a decrease in discomfort and pain in the TMJ area when closing/opening the mouth, five patients decided to discontinue further treatment.

This has led to the conclusion that complex treatment of DTMJ using occlusive mouthguards with an open chewing surface of the dentition as a placebo can reduce the subjective manifestations of DTMJ, which confirms the significant role of the psychoemotional component in the development of this pathology and determines the role of factors such as the height of the lower third of the face and severity of occlusal interference in the pathogenesis of DTMJ based on the results of a TMJ MRI analysis over time, over a 6-month follow-up.

The results of using various types of occlusive mouthguards indicate that it is crucial to develop occlusal devices that combine the capabilities of decompressing the TMJ elements, centering the position of the lower jaw relative to the upper jaw, and orthodontic elimination of dentofacial anomalies and deformities that are the causes of occlusal interference.

CONCLUSIONS

1. The use of occlusive mouthguards in the treatment of DTMJ in the shortest possible time, within 2 weeks, leads to a reduction in pain and discomfort caused by decompression associated with the separation of the dentition and TMJ elements and the efficiency of drug analgesic and anti-inflammatory treatment. The as-

sociated absence of compression of the bilaminar zone prevents degenerative changes in the TMJ structures and deformity of the mandibular head and the articular disc that occur with chronic trauma to the articular surfaces.

2. Analysis of TMJ MRI in DTMJ patients showed that ventral disc dislocation occurs most often (in 88.8 % of cases) in patients in this group.

3. Elimination of ventral dislocation of the articular disc in the complex treatment of DTMJ is most effectively achieved by using occlusive aligners (orthotics), which allow decompression of the TMJ and restoration of the height of the lower third of the face.

4. The use of aligners with pads in DTMJ patients improves anomalies and deformities of the dentition and eliminate occlusal interference, which, in turn, makes it possible to create conditions for preventing the worsening of DTMJ signs, confirmed by dynamic the TMJ MRI results.

5. The use of orthotics and aligners as therapeutic devices in DTMJ patients has certain indications and varying efficiency. The general positive effect of the use of these devices in the treatment of DTMJ is the separation of the dentition and associated decompression in the TMJ, centering the position of the lower jaw relative to the upper jaw. However, completion of treatment with an orthotic requires a prosthetic treatment protocol in 23 % of cases to ensure a stable result in correcting ventral articular disc dislocation.

References

1. *Galebskaya K.Yu.* Modern view on the etiology and treatment of temporomandibular joint dysfunction. *Scientific notes of Pavlov St. Petersburg State Medical University* 2015; 22 (4): 8–12 (in Russian).

2. *Lepilin A.V., Konnov V.V., Bagaryan E.A., Arushanyan A.R.* Clinical manifestations of pathology of temporomandibular joints and masticatory muscles in patients with impaired occlusion of teeth and dentition. *Saratov Scientific Medical Journal* 2010; 6, 2: 405–410 (in Russian).

3. *Naumovich S.A., Naumovich S.S.* Occlusive splints: types and role in the complex therapy of pathology of the temporomandibular joint. *Modern dentistry* 2014; 1 (58): 7–10 (in Russian).

4. *Tikhonov V.E., Guskov A.V., Oleynikov A.A., Mitina E.N., Kalinovsky S.I., Chizhenkova N.V., Mikheev D.S.* Splint therapy as a separate approach in the framework of complex treatment of dysfunction Temporomandibular joint from the point of view of physiological concepts. *Science of the young (Eruditio Juvenium)* 2021; 9, 3: 447–456. DOI: 10.23888/HMJ202193447-456 (in Russian).

5. *Yang Ch., Shen P.* Evaluation of occlusal splints during reposition of anterior dislocation of the temporomandibular joint with reposition: observation from 3 to 36 months. *Almanac of Clinical Medicine* 2017; 45 (6): 478–485. DOI: 10.18786/2072-0505-2017-45-6-478-485 (in Russian).

6. *Postnikov M.A., Potapov V.P., Nesterov A.M.* Comprehensive treatment of patients with temporomandibular joint dysfunction using occlusal digital splint. Proceedings of stomatology and maxillofacial surgery 2020; 17, 2: 10–16. EDN: YECVNB.

7. *Xiao-Chuan F., Lin-Sha M., Li C., Diwakar S., Xiaohui R.-F., Xiao-Feng H.* Temporomandibular Joint Osseous Morphology of Class I and Class II Malocclusions in the Normal Skeletal Pattern: A Cone-Beam Computed Tomography Study. Diagnostics (Basel) 2021; 11 (3): 541. DOI: 10.3390/diagnostics11030541

8. *Kamal A.T., Fida M., Sukhia R.H.* Dental characteristics of patients suffering from temporomandibular disorders. Journal of Ayub Medical College Abbottabad 2020; 32 (4): 492–496.

9. *Ortiz-Culca F., Cisneros-Del Aguila M., Vasquez-Segura M., Gonzales-Vilchez R.* Implementation of TMD pain screening questionnaire in Peruvian dental students. Acta Odontol Latinoam 2019; 32 (2): 65–70.

10. *Vasiliev A.M., Ivanova S.B., Zhigalova D.D.* Features of occlusive relationships of young patients, their relationship with dysfunction of masticatory muscles and temporomandibular joint. *Tver Medical Journal* 2023; 1: 66–72 (in Russian).

11. *Denisova Y.L., Rubnikovich S.P., Baradina I.N., Grishchenkov A.S.* New approaches in the complex treatment of dental anomalies in combination with temporomandibular joint dysfunction. Dentist Minsk 2020: 20–31. DOI: 10.32993/stomatologist.2020.2(37).9 (in Russian).

12. *Nithin, Junaid A., Nanditha S., Nandita S., Almas B., Ravikiran O.* Morphological Assessment of TMJ Spaces, Mandibular Condyle, and Glenoid Fossa Using Cone Beam Computed Tomography (CBCT). A Retrospective Analysis. Indian J Radiol Imaging 2021; 31: 78–85. DOI: 10.1055/s-0041-1729488

13. *Xavier T., Jaume P., Juan B., Llorenз Q., Carlos N., Josep M.M., Vicente C.* MRImaging of Temporomandibular Joint Dysfunction: A Pictorial Review. RadioGraphics 2006; 26: 765–781. DOI: 10.1148/rg.263055091

14. *Arsenina O.I., Popova A.V., Gus L.A.* The significance of occlusive disorders in temporomandibular joint dysfunction. *Dentistry* 2014; 93, 6: 64–67. DOI: 10.17116/stomat201493664-67 (in Russian).

15. *Iordanishvili A.K., Serikov A.A., Soldatova L.N.* Functional pathology of the chewing-speech apparatus in young people. *Kuban Scientific Medical Bulletin* 2016; 6 (161): 72–76. DOI: 10.25207/1608-6228-2016-6 (in Russian).

16. *Konnov V.V., Pichugina E.N., Popko E.S., Arushanyan A.R., Pylaev E.V.* Musculoskeletal dysfunction and its connection with occlusive disorders. *Modern problems of science and education* 2015; 6-S: 131–138.

17. *Fadeev R.A., Ovsyannikov K.A.* Etiology and pathogenesis of diseases of the temporomandibular joint and masticatory muscles. *Bulletin of the Novgorod State University* 2020; 4 (120): 50–59. DOI: 10.34680/2076-8052.2020.4(120).50-59 (in Russian).

18. *Chkhikvadze T.V., Bekreev V.V.* Occlusive therapy of disorders of the temporomandibular joint. *Medical journal RUDN* 2018; 22 (4): 387–401. DOI: 10.22363/2313-0245-2018-22-4-387-401 (in Russian).

19. *Bianchi J., Goncalves R.J., de Oliveira Ruellas A.C., Pastana Bianchi J.V., Ashman L.M., Yatabe M., Benavides E., Soki F.N., Soares Cevidanes L.H.* Radiographic interpretation using high-resolution Cbct to diagnose degenerative temporomandibular joint disease. PLoS ONE 2021; 16 (8): e0255937. DOI: 10.1371/journal.pone.0255937

20. *Emshoff R., Jank S., Rudisch A., Bodner G.* Are high-resolution ultrasonographic signs of disc displacement valid? J. Oral Maxillofac. Surg 2002; 60 (6): 623–628. DOI: 10.1053/joms.2002.33105

21. *Rudisch A., Emshoff R., Maurer H., Kovacs P., Bodner G.* Pathologic-sonographic correlation in temporomandibular joint pathology. Eur Radiol 2006; 16 (8): 1750–6. DOI: 10.1007/s00330-006-0162-0

22. *Rui-yong Wang, Xu-chen Ma, Wan-lin Zhang, Deng-gao Liu.* Investigation of temporomandibular joint space of healthy adults by using cone beam computed tomography. Beijing Da Xue Xue Bao Yi Xue Ban 2007; 39 (5): 503–6.

23. *Kalle von Th., Winkler P., Stuber T.* Contrast-enhanced MRI of normal temporomandibular joints in children-is there enhancement or not? Rheumatology 2013; 52: 363–367. DOI: 10.1093/rheumatology/kes268

24. *Tomas X., Pomes J., Berenguer J., Quinto L., Nicolau C., Mercader J.M., Castro V.* MRImaging of Temporomandibular Joint Dysfunction: A Pictorial Review. RadioGraphics 2006; 26: 765–781. DOI: 10.1148/rg.263055091

Funding. The study had no external funding.

Conflict of interest. The authors declare no conflict of interest.

Author contributions are equivalent.

Received: 10/13/2023
Revised version received: 12/20/2023
Accepted: 01/15/2024

Please cite this article in English as: Dolgalev A.A., Khristoforando D.Yu., Garus Ya.N., Ivensky V.N., Brazhnikova A.N., Khorev O.Yu., Bulycheva E.A., Geletin P.N., Kerefova Z.V., Chepurko Yu.V., Uspenskaya O.A. Analysis of hardware methods of treatment of patients with temporomandibular joint dysfunction. *Perm Medical Journal*, 2024, vol. 41, no. 1, pp. 120-131. DOI: 10.17816/pmj411120-131