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Evaluation of the effectiveness of occlusal splints in the complex treatment of patients with internal disorders of the temporomandibular joint

Tina V. Chkhikvadze¹ , Valery V. Bekreev¹ , Evgeny M. Roshchin², Gor G. Avetisian¹ , Dzhandet F. Rasulova¹ , Diana D. Khbulova¹ , Adam S. Sapaev¹ , Ramiz Mokhamed El-Khalaf¹

¹ Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), Moscow, Russian Federation

² Dental Clinic SDI Dent, Moscow, Russian Federation

tchkhik@mail.ru

Abstract

INTRODUCTION. The present study reports the outcomes of using occlusal splints in the comprehensive treatment of patients with internal temporomandibular joint (TMJ) disorders. The diagnosis of mandibular movement disorders was performed using an optical axiograph Dentograf Prosystem (Russia). The obtained axiographic data were utilized for the fabrication of myorelaxing and distraction splints. Axiography was repeated every three weeks to monitor treatment effectiveness. The position and function of the TMJ articular disc (AD) were evaluated by ultrasonography (US) one to two times per month.

AIM. To evaluate the effectiveness of various types of occlusal splints fabricated using mechanical and virtual articulators in the comprehensive treatment of patients with subluxation and chronic dislocation of the TMJ articular disc.

MATERIALS AND METHODS. Myorelaxing and distraction splints for patients with subluxation and chronic dislocation of the AD were fabricated using two approaches: (1) The classical method, involving a mechanical facebow and a mechanical articulator; (2) The CAD/CAM technology, employing a virtual articulator.

RESULTS. The effectiveness of myorelaxing splints fabricated with the mechanical articulator was 81.8%, while for those produced using the virtual articulator it reached 88.0%. The effectiveness of distraction splints fabricated with the mechanical articulator was 55.6%, whereas modeling with the virtual articulator yielded 68.8%.

Based on the obtained data, an algorithm was developed for the clinical use of occlusal splints fabricated by different methods (using mechanical or virtual articulators) in patients with internal TMJ disorders.

CONCLUSIONS. Following the diagnosis confirmed by magnetic resonance imaging (MRI), axiography, and ultrasonography, patients were divided into two groups: (1) In Group I (patients with articular disc subluxation), myorelaxing splints were applied at the initial treatment stage and subsequently remodeled into separating (discluding) splints after disc repositioning to consolidate the therapeutic outcome; (2) In Group II (patients with chronic disc dislocation), distraction splints were used at the first stage with subsequent occlusal correction. After the normalization of mandibular movements and TMJ disc repositioning, the distraction splints were remodeled into separating splints to stabilize the new maxillomandibular relationship. The use of a virtual articulator demonstrated higher treatment effectiveness compared to the mechanical method, confirming its clinical relevance and potential integration into complex TMJ disorder management protocols.

Keywords: internal temporomandibular joint disorders, magnetic resonance imaging, axiography, ultrasonographic evaluation, mechanical articulator, virtual articulator, myorelaxing splint, distraction splint, discluding splint








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Оценка эффективности применения окклюзионных капп в комплексном лечении пациентов с внутренними нарушениями височно-нижнечелюстного сустава

Т.В. Чхиквадзе¹ , В.В. Бекреев¹ , Е.М. Роцин², Г.Г. Аветисян¹ , Д.Ф. Расулова¹ ,
Д.Д. Хубулова¹ , А.С. Сапаев¹ , М.Р.А. Эль-Халаф¹ 

¹ Российский университет дружбы народов им. Патриса Лумумбы, г. Москва, Российская Федерация

² Клиника «SDI Dent», г. Москва, Российская Федерация

✉ tchkhik@mail.ru

Резюме

ВВЕДЕНИЕ. В работе представлены результаты применения окклюзионных капп в комплексном лечении пациентов с внутренними нарушениями височно-нижнечелюстного сустава (ВНЧС). Диагностика нарушений движений нижней челюсти проводилась с применением оптического аксиографа Dentograf Prosystom (Россия). Данные аксиографии использовали для изготовления миорелаксирующих и дистракционных капп. Аксиография с целью контроля эффективности лечения проводилась каждые три недели. Оценка положения и функции суставного диска (СД) ВНЧС оценивалась с помощью УЗИ 1–2 раза в месяц.

ЦЕЛЬ ИССЛЕДОВАНИЯ. Оценить эффективность применения различных видов окклюзионных капп, изготовленных с использованием механического и виртуального артикуляторов, в комплексном лечении пациентов с подвывихом и хроническим вывихом суставного диска ВНЧС.

МАТЕРИАЛЫ И МЕТОДЫ. Миорелаксирующие и дистракционные каппы для лечения пациентов с подвывихом и хроническим вывихом СД изготавливали 2 способами: классическим методом с использованием механической лицевой дуги, механического артикулятора и по CAD/CAM технологии с применением виртуального артикулятора.

РЕЗУЛЬТАТЫ. Эффективность применения миорелаксирующих капп, изготовленных с помощью механического артикулятора, составила 81,8%, а при применении виртуального артикулятора – 88,0%. Эффективность применения дистракционных капп, изготовленных с применением механического артикулятора, составила 55,6%, при моделировании капп с использованием виртуального артикулятора – 68,8%.

На основании полученных результатов исследования разработан алгоритм применения окклюзионных капп, изготовленных различными способами (с использованием механического или виртуального артикулятора) у пациентов с ВН ВНЧС.

ВЫВОДЫ. После постановки диагноза, подтвержденного данными магнитно-резонансной томографии (МРТ), аксиографии и УЗИ у пациентов I группы с подвывихом СД на первом этапе лечения применяли миорелаксирующие каппы, а после репозиции СД их перемоделировали в разобщающие для закрепления достигнутого результата. У пациентов II группы с хроническим вывихом СД на первом этапе лечения применяли дистракционные каппы с последующей окклюзионной коррекцией. На втором этапе лечения, после нормализации движений нижней челюсти и репозиции СД ВНЧС дистракционные каппы перемоделировались в разобщающие для стабилизации нового соотношения челюстей.

Ключевые слова: внутренние нарушения ВНЧС, магнитно-резонансная томография, аксиография, ультразвуковая диагностика, механический артикулятор, виртуальный артикулятор, миорелаксирующая каппа, дистракционная каппа, разобщающая каппа

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INTRODUCTION

Disorders of mandibular articulation associated with temporomandibular joint (TMJ) dysfunction are common in dental practice [1]. One of the main causes of TMJ dysfunction is internal TMJ disorders [2], which include various clinical forms, among which disc dislocation and subluxation are the most frequent [3]. In cases of chronic dislocation or subluxation, the articular disc is positioned non-physiologically relative to the mandibular condyle, most often located anterior to it [3].

Occlusal splint therapy is recognized as the treatment of choice at the initial stage of managing internal TMJ disorders [4–6]. When pain is present, additional pharmacotherapy may be prescribed [7].

In conservative management of internal TMJ disorders, the most frequently used types of occlusal splints are discluding, protrusive, distraction, myorelaxing, and stabilizing splints [8–10]. However, there is no consensus regarding the optimal treatment strategy or the selection of a particular splint type for patients with this joint pathology [11; 12].

The present study evaluates the treatment efficacy in patients with TMJ disc subluxation and chronic dislocation through the sequential use of myorelaxing, distraction, and discluding splints, with optical axiography and ultrasonography employed for treatment monitoring and objective outcome assessment.

AIM

To evaluate the effectiveness of the sequential use of myorelaxing, distraction, and discluding occlusal splints fabricated using different techniques in patients with temporomandibular joint disc subluxation and chronic dislocation.

MATERIALS AND METHODS

A total of 72 patients with internal temporomandibular joint (TMJ) disorders were examined. The patients were divided into two main groups:

- Group I – patients with TMJ disc subluxation;
- Group II – patients with chronic TMJ disc dislocation.

In both groups, subgroups were formed according to the degree of disc displacement and the method used for occlusal splint fabrication (Table 1).

Patients in subgroups IA and IIA were treated using occlusal splints fabricated with the mechanical articulator Artex CR (Girrbach), while patients in subgroups IB and IIB received splints modeled using the virtual articulator EXOCAD.

The age of the patients in both groups ranged from 23 to 39 years, including 61 women (84.7%) and 11 men (15.3%).

Patients with disc subluxation primarily complained of periodic TMJ pain and joint clicking, whereas those with chronic disc dislocation reported restricted mouth opening.

All participants underwent comprehensive clinical and instrumental examinations, including:

- magnetic resonance imaging (MRI) using *Toshiba Vantage Atlas X* (Japan);
- axiography with the *Dentograf Prosystom* optical axiograph (Russia);
- ultrasonographic evaluation (US) using *Samsung SONO ACE R3* (South Korea);
- cone-beam computed tomography (CBCT) with *NewTom 3G, QR srl* (Italy).

Axiography was performed every three weeks to monitor the effectiveness of treatment.

The following criteria were used to evaluate the effectiveness of myorelaxing splint therapy for disc subluxation based on axiographic data:

- absence of axiographic signs of clicking, such as zigzag deformation of joint trajectories;
- restoration of trajectory shape and lengthening of articular paths;
- absence of mandibular deviation during mouth opening;
- synchronization of condylar movements during mouth opening and closing;
- normalization of the range of mouth opening, protrusion, and laterotrusion.

– the position and function of the TMJ articular disc (AD) were assessed by ultrasonography (US) one to two times per month. The degree of AD deformation was determined by measuring and comparing the thickness of different disc regions on ultrasound images.

– in patients with disc subluxation, myorelaxing splints were used at the first stage of treatment, followed by discluding splints at the second stage – after disc repositioning – to consolidate the therapeutic effect.

– in patients with chronic disc dislocation, distraction splints were applied during the first stage of treatment. Upon the appearance of disc repositioning signs, the distraction splints were clinically modified into discluding splints by increasing the number and area of occlusal contacts.

– after splint therapy (lasting 4–6 months in Group I and 8–12 months in Group II), follow-up MRI was performed in all patients. The axiographic findings in every case were consistent with the MRI results, confirming the reliability of axiography in assessing TMJ functional dynamics.

– statistical criteria were selected based on the analysis of data distribution and its comparison with the normal Gaussian distribution using the Kolmogorov–Smirnov test. For comparison of repeated measurements, the nonparametric Wilcoxon Matched Pairs Test was applied.

– to assess the relationship between clinical parameters and instrumental findings, multivariate analysis of variance (MANOVA) and correlation analysis using the Pearson correlation coefficient were performed for numerical variables.

– differences were considered statistically significant at $p < 0.05$. Statistical data processing was carried out on a personal computer running Windows 10, using the software package STATISTICA 12.

Table 1. Distribution of patients with internal TMJ disorders by groups and subgroups according to the degree of disc displacement and the method of occlusal splint fabrication

Таблица 1. Распределение пациентов с внутренними нарушениями ВНЧС по группам и подгруппам в зависимости от степени смещения СД и метода изготовления окклюзионных капп

Groups	Subgroups	Number of patients	
		abs	rel.%
I 47 patients with TMJ subluxation	IA. Mechanical articulator	22	46.8
	IB. Virtual articulator	25	53.2
II 25 patients with chronic TMJ dislocation	IIA. Mechanical articulator	9	36.0
	IIB. Virtual articulator	16	64.0

RESULTS

The main complaints of the patients included periodic pain and discomfort in the temporomandibular joint (TMJ) area during mandibular movements such as mouth opening and closing, protrusion, and lateral excursions. Among them, 42 patients with TMJ disc subluxation reported clicking and crepitation, while 23 patients with chronic disc dislocation exhibited restricted mouth opening (ranging from 2.5 to 3.7 cm).

According to MRI, CBCT, and ultrasonographic examinations, the diagnosis of “TMJ disc subluxation” was confirmed in all patients of Group I, and “chronic disc dislocation” in Group II.

Axiographic analysis revealed asymmetry in condylar motion between the right and left sides in 38 out of 47 patients (80.9%). In the centric position of both mandibular condyles, patients with subluxation of one articular disc demonstrated asynchronous condylar movement during mouth opening. The condyle on the affected side exhibited delayed motion during disc recapture, whereas the contralateral condyle continued to move at a normal rate.

After treatment, axiographic recordings showed the disappearance of pre-treatment zigzag distortions of the condylar trajectory – a characteristic sign of disc repositioning – which was observed in 45 of 47 patients (95.7%), along with restored synchronization of condylar movements. Moderate shortening of the condylar path persisted in 14.9% of cases.

Figure 1 presents the number of patients in Group I (with TMJ disc subluxation) who achieved disc repositioning following treatment with myorelaxing splints fabricated using virtual (VA) and mechanical (MA) articulators, as confirmed by axiographic findings.

As shown in the histogram in Fig. 1, the use of myorelaxing splints fabricated with a virtual articulator resulted in a higher number of patients demonstrating normalization of disc position after treatment (22 out of 25 patients) compared with those fabricated using a mechanical articulator (18 out of 22 patients).

The treatment efficacy in Group I patients with TMJ disc subluxation using myorelaxing splints fabricated by different methods, expressed as a percentage according to axiographic data, is presented in Fig. 2.

The use of a virtual articulator provides a clear advantage for the high-precision fabrication of occlusal myorelaxing splints in patients with TMJ disc subluxation (treatment efficacy: 88.0% with the virtual articulator vs. 81.8% with the mechanical articulator). The differences in treatment efficacy between splints fabricated using mechanical and virtual articulators were statistically significant ($p < 0.05$).

The degree of disc deformation and displacement, as well as treatment effectiveness, can be assessed by measuring the thickness of different disc regions (the smaller the difference between anterior and posterior disc thickness, the lower the deformation).

Table 2 presents the mean thickness measurements of various TMJ disc regions in Group I patients before and after treatment with myorelaxing splints fabricated using mechanical and virtual articulators, based on ultrasonography data.

A reduction in the difference between the anterior and posterior disc thickness indicates a positive treatment response. A more pronounced improvement was observed in patients treated with splints fabricated using the virtual articulator.

Figure 3 shows an example of ultrasound images of the right TMJ in a 27-year-old patient (K.) with right TMJ disc subluxation, before and after treatment with a myorelaxing splint.

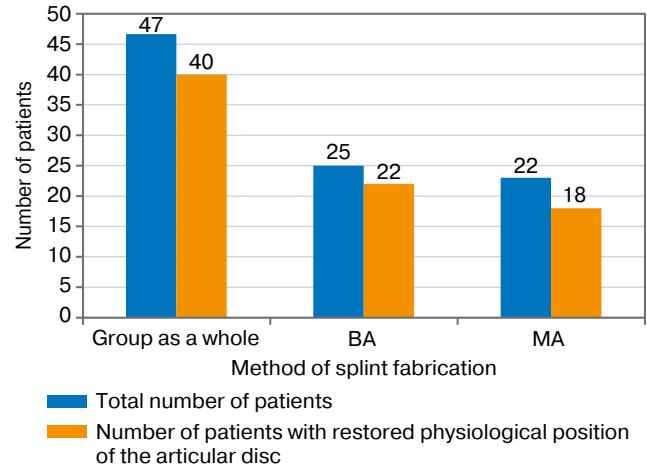


Fig. 1. Number of patients in Group I (with TMJ disc subluxation) demonstrating disc repositioning following the use of myorelaxing splints fabricated using virtual (VA) and mechanical (MA) articulators, according to axiographic data

Рис. 1. Количество пациентов группы I (с подвывихом СД ВНЧС) с репозицией диска в результате применения миорелаксирующих капп, изготовленных в виртуальном (BA) и механическом (MA) артикуляторах, по данным аксиографии

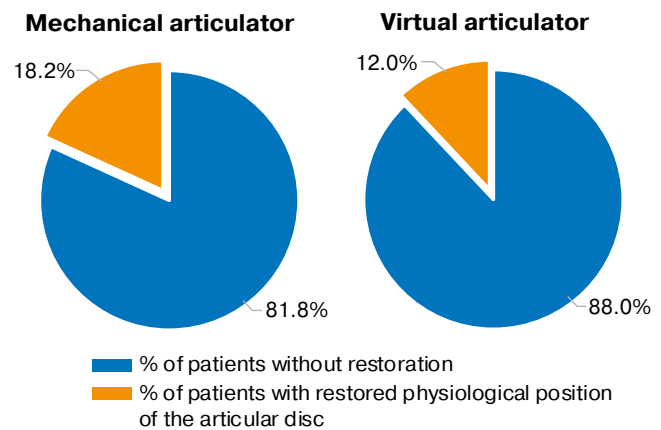


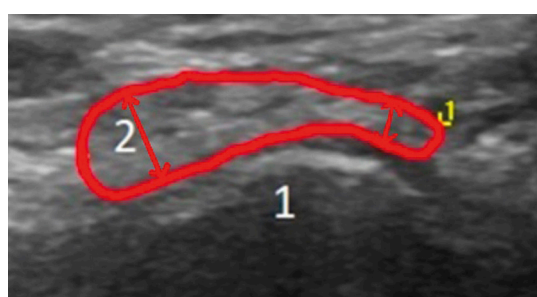
Fig. 2. Treatment efficacy in Group I patients with TMJ disc subluxation using myorelaxing splints fabricated with mechanical and virtual articulators, expressed as a percentage according to axiographic data

Рис. 2. Эффективность лечения пациентов группы I с подвывихом СД миорелаксирующими каппами, изготовленными в механическом и виртуальном артикуляторах, выраженная в процентном отношении, по данным аксиографии

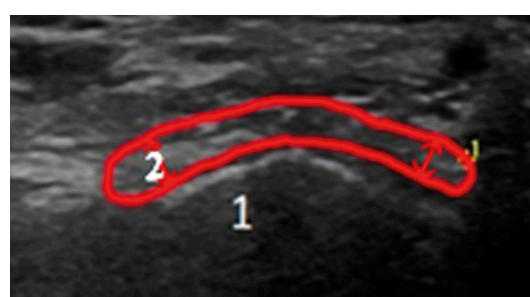
Table 2. Mean thickness of different regions of the TMJ articular disc in Group I patients (with disc subluxation) before and after treatment with myorelaxing splints fabricated using mechanical and virtual articulators, according to ultrasonography data

Таблица 2. Средние размеры толщины различных отделов СД ВНЧС у пациентов группы I (с подвывихом СД) до и после лечения миорелаксирующими каппами, изготовленными в механическом и виртуальном артикуляторах, по данным УЗИ

Measurement, cm	Before treatment with myorelaxation splints	After treatment with myorelaxation splints	
		Mechanical articulator	Virtual articulator
Thickness of the anterior part of the articular disc	0.47±0.14	0.44±0.15	0.43±0.06
Thickness of the middle part of the articular disc	0.44±0.11	0.33±0.3	0.33±0.08
Thickness of the posterior part of the articular disc	0.31±0.9	0.37±0.3	0.4±0.01
Ratio of the anterior-to-posterior thickness of the articular disc	1.52	1.19	1.08



A



B

Fig. 3. Ultrasound images of the right TMJ in a 27-year-old patient (K.): 1 – mandibular condyle; 2 – articular disc; A – before treatment: the disc is displaced anteriorly and deformed; B – after treatment: disc deformation is almost completely resolved

Рис. 3. Изображение правого ВНЧС пациентки К., 27 лет, при УЗИ: 1 – головка нижней челюсти, 2 – суставной диск; А – до лечения, диск смещен кпереди и деформирован; В – после лечения, деформация диска практически отсутствует

In all patients of Group II with chronic TMJ disc dislocation, pronounced alterations in condylar trajectories were observed on the affected side. During mouth opening, the condylar trajectory deviated from the normal concave pattern, appearing flattened and deformed in 24 of 25 patients (96%).

Axiographic analysis showed marked shortening of the condylar paths on the side of disc displacement in 100% of patients; the trajectories were flattened and deformed, and condylar movements were asynchronous. In cases of unilateral disc dislocation, movement initiated from the affected joint, and mandibular deviation toward the affected side was noted during mouth opening and protrusion.

The treatment outcomes in Group II patients using distraction splints fabricated with mechanical (MA) and virtual (VA) articulators, based on axiographic data, are presented in Fig. 4.

As shown in Fig. 4, the use of distraction splints fabricated with a virtual articulator (subgroup B) resulted in higher treatment efficacy in Group II patients with chronic TMJ disc dislocation (11 out of 16 patients) compared with splints fabricated using a mechanical articulator (5 out of 9 patients).

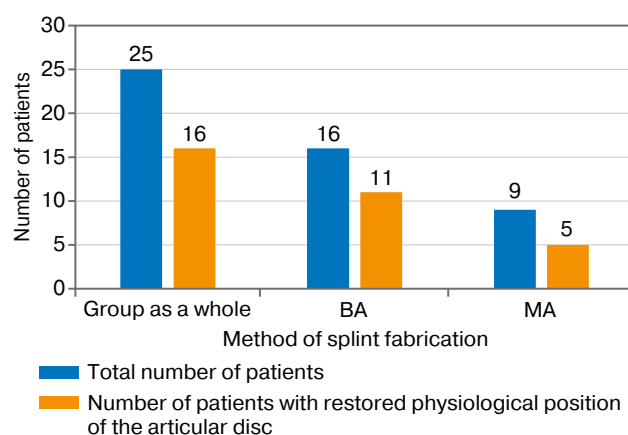


Fig. 4. Treatment outcomes in Group II patients (with chronic TMJ disc dislocation) using distraction splints fabricated with mechanical (MA) and virtual (VA) articulators, according to axiographic data

Рис. 4. Результаты лечения пациентов группы II (с хроническим вывихом СД) дистракционными каппами, изготовленными в механическом (МА) и виртуальном (ВА) артикуляторах, по данным аксиографии

The treatment efficacy in Group II patients, achieved through the sequential use of distraction and discluding splints (stages I and II), expressed as a percentage according to axiographic data, is presented in Fig. 5.

According to Fig. 5, the treatment efficacy in patients with chronic TMJ disc dislocation using distraction splints was significantly higher when fabricated with a virtual articulator compared with a mechanical articulator (68.8% vs. 55.6%, $p < 0.05$).

Table 3 presents the changes in thickness of different TMJ disc regions in Group II patients before and after treatment with distraction splints fabricated using mechanical and virtual articulators, based on ultrasonography data.

A reduction in the difference between the anterior and posterior disc thickness indicates a positive treatment response, with a more pronounced improvement observed in patients treated with splints fabricated using a virtual articulator.

Fig. 6 shows ultrasound images of the left TMJ in a 36-year-old patient (V.) with chronic left TMJ disc dislocation, before and after treatment with a distraction splint.

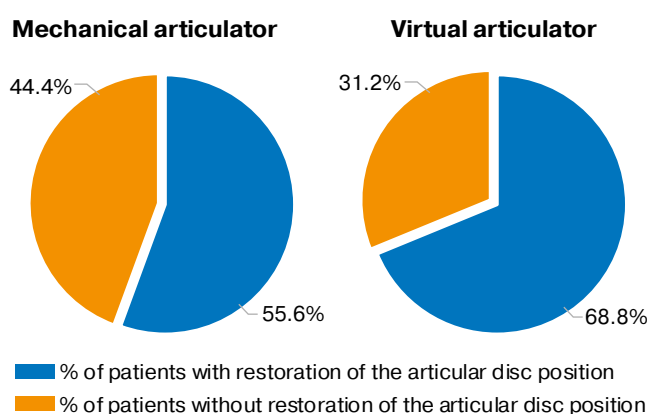


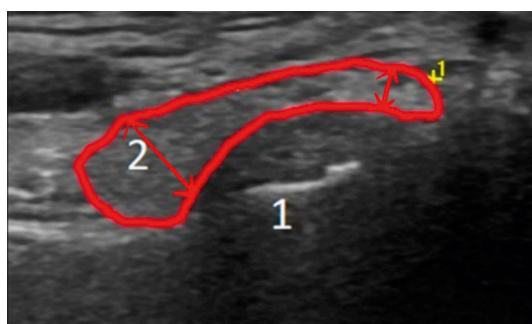
Fig. 5. Treatment efficacy in Group II patients with chronic TMJ disc dislocation using distraction splints fabricated with mechanical and virtual articulators, expressed as a percentage according to axiographic data

Рис. 5. Эффективность лечения пациентов группы II с хроническим вывихом СД distractionными каппами, изготовленными в механическом и виртуальном артикуляторах, выраженная в процентном отношении, по данным аксиографии

Table 3. Mean thickness of different regions of the TMJ articular disc in Group II patients before and after treatment with distraction splints fabricated using mechanical and virtual articulators, according to ultrasonography data

Таблица 3. Средние размеры толщины различных отделов СД ВНЧС у пациентов II группы до и после лечения distractionными каппами, изготовленными в механическом и виртуальном артикуляторе, по данным УЗИ

Parameter, cm	Before treatment with distraction splints	After treatment with distraction splints	
		Mechanical articulator	Virtual articulator
Thickness of the anterior part of the articular disc	0.53±0.15	0.48±0.1	0.41±0.12
Thickness of the middle part of the articular disc	0.53±0.09	0.39±0.2	0.38±0.09
Thickness of the posterior part of the articular disc	0.36±0.1	0.45±0.12	0.4±0.03
Ratio of the anterior-to-posterior thickness of the articular disc	1.47	1.07	1.03



A



B

Fig. 6. Ultrasound images of the left TMJ in a 36-year-old patient (V.) with chronic disc dislocation, before and after treatment with a distraction splint (disc boundaries indicated by red lines): *A* – before treatment: the disc is displaced anteriorly and markedly deformed; *B* – after treatment: the disc is positioned above the mandibular condyle, with a significant reduction in deformation

Рис. 6. Изображение левого ВНЧС пациентки В., 36 лет, с хроническим вывихом СД при УЗИ, до и после лечения distractionной каппой (красной линией показаны границы СД): *A* – до лечения, диск смещен кпереди и значительно деформирован; *B* – после лечения, диск расположен над головкой нижней челюсти, значительное уменьшение его деформации

After treatment with distraction splints, the disc achieved a physiological position, being evenly situated above the mandibular condyle. A reduction in the difference between anterior and posterior disc thickness was observed, indicating reduction or elimination of disc deformation.

Patients in Groups I and II who did not achieve normalization of disc position within the prescribed treatment periods were referred to a dental surgeon to consider surgical interventions (TMJ arthrocentesis or arthroscopy).

Thus, over 4–6 months of treatment in Group I patients (with disc subluxation), normalization of disc position and function was achieved in 81.8% of cases using myorelaxing splints fabricated with a mechanical articulator and in 88.0% of patients using a virtual articulator.

In Group II patients (with chronic disc dislocation), disc repositioning was achieved over 8–12 months through the sequential use of distraction and discluding splints, with an efficacy of 55.6% for splints fabricated using a mechanical articulator and 68.8% for those fabricated using a virtual articulator.

DISCUSSION

Analysis of the literature revealed significant discrepancies regarding the efficacy of different types of occlusal splints in the treatment of internal TMJ disorders. Furthermore, there are no clear guidelines on which types of splints should be used for the differential management of specific TMJ pathological conditions.

In light of this, the objective was to determine the efficacy of various types of discluding splints in patients with internal TMJ disorders.

During clinical examination, in Group I patients (with disc subluxation), the primary symptom was the presence of clicking or crepitus on palpation of the TMJ area (89.4%). In Group II patients (with disc dislocation), the main symptom was a marked reduction in mouth opening to 2.0–3.7 cm (92%), associated with more pronounced disc deformation. Overall, Group II patients exhibited a more severe clinical course compared with Group I.

All patients underwent axiographic examination to detect early disturbances in mandibular movement and disc position. In Group I, the leading axiographic signs of disc subluxation were zigzag distortion of condylar trajectories and asynchronous movement of the mandibular condyles, observed in 95.7% and 80.9% of patients, respectively. Moderate shortening of the condylar path was detected in 14.9% of patients. The most characteristic axiographic sign of disc subluxation was the appearance of zigzag distortion during disc repositioning, which should be considered an axiographic indicator of disc repositioning (click).

In Group II patients, condylar trajectories were significantly shortened, deformed, and flattened, with asynchronous condylar movements, observed in 96% of patients. The most characteristic sign of chronic disc dislocation was the combination of pronounced flattening and significant shortening of the mandibular condylar paths on axiograms.

Ultrasonography performed in all patients most frequently revealed the following features: altered physiological position of the TMJ disc (ventral displacement), reduced amplitude of disc movement of varying severity in Group II patients, disc deformation with heterogeneous echogenicity, changes in thickness and proportions of disc regions, and narrowing of the TMJ joint space.

For each patient group, a differentiated conservative treatment plan was developed based on data from additional diagnostic methods.

In patients with disc subluxation, treatment with myorelaxing splints led to the disappearance of clicking signs in 85.1% of the subgroup, indicating restoration of physiological disc position and, consequently, the effectiveness of the therapy. When myorelaxing splints were fabricated using a virtual articulator, this parameter was significantly higher than with mechanical fabrication (88.0% vs. 81.8%, $p < 0.05$).

In 64% of Group II patients with chronic disc dislocation, successful treatment with distraction splints was associated, during dynamic follow-up, with the appearance of axiographic clicking signs in the form of zigzag distortions of condylar trajectories, indicating partial restoration of disc mobility and repositioning. This trend was observed regardless of the fabrication method; however, when splints were modeled using a virtual articulator, the frequency of restoration of physiological disc position and function (fully or partially) was higher than with mechanical articulator fabrication (68.8% vs. 55.6%, $p < 0.05$).

The differences in efficacy between classical (mechanical) and milling (virtual) methods for treating chronic disc dislocation were statistically significant ($p < 0.05$).

In this study, the use of a virtual articulator for fabricating therapeutic myorelaxing and distraction splints demonstrated a minimal number of errors during the transfer of the maxillary model and high accuracy in positioning virtual scans according to the individual patient parameters. This was achieved because an optical facebow from the Dentograf system was used instead of a standard mechanical facebow. Consequently, the placement of models in the virtual articulator significantly reduced the inaccuracies that typically occur with conventional facebow transfer. Standard facebows do not account for individual patient parameters when transferring the maxillary model to the articulator, as they lack control over the distance from the maxilla to the mandibular condyles.

The higher efficacy of milled myorelaxing and distraction splints is attributable to improved precision at intermediate clinical and laboratory stages of fabrication. Milled occlusal splints are modeled in the virtual articulator using a dedicated CT module. In this study, precision in positioning virtual models within the articulator was enhanced by integrating individual CBCT data and axiographic findings with the virtual jaw models. Subsequently, these models were exported to the virtual articulator and incorporated into the modeling software, taking into account all patient-specific parameters derived from CBCT data.

In all patients of Group II with chronic disc displacement, distraction occlusal splints were fabricated at the initial stage of treatment in this study. The distraction splints were applied to move the mandibular condyles downward, thereby widening the joint space and creating sufficient room for the reduction of the displaced and deformed articular disc. This expansion of the TMJ cavity allows the disc, which was previously compressed between the mandibular condyle and the temporal fossa, to regain mobility. On axiograms, active disc movements were observed as characteristic signs of disc repositioning (clicking), manifested as zigzag distortions of the joint trajectories. However, in Group II patients, disc mobility with the use of distraction splints was partial, without complete restoration to its physiological position, necessitating additional treatment in the second stage with occlusal disengagement splints.

In this study, the effectiveness of distraction splints was 64%, which can be attributed to the severe pathology in these patients, including chronic disc displacement with impairment of all intra-articular structures and masticatory muscles, particularly the lateral pterygoid muscle. When distraction splints were fabricated using a virtual articulator, the success rate in Group II patients was significantly higher than with the mechanical articulator (68.8% vs. 55.6%, $p < 0.05$).

The differences in the effectiveness of occlusal splints (myorelaxing and distraction), fabricated using mechanical versus virtual articulators, in patients with internal TMJ disorders (disc subluxation and chronic displacement) were statistically significant ($p < 0.05$).

The differences in the number of patients in Groups I and II achieving normalization of disc position, as well as

in treatment duration, can be explained by the fact that deformation and displacement of the disc in chronic disc displacement are significantly greater than in disc subluxation.

CONCLUSION

1. The use of milled occlusal splints fabricated with a virtual articulator for the treatment of subluxation and chronic dislocation of the articular disc (AD) is preferable to splints made using the classical method. The effectiveness of myorelaxing splints was 88.0% when modeled with a virtual articulator and 81.8% when fabricated using a mechanical articulator. The differences in effectiveness between myorelaxing splints produced by the classical method and those milled were statistically significant ($p < 0.05$). For distraction splints in patients with chronic AD dislocation, the effectiveness was 68.8% and 55.6%, respectively, with statistically significant differences between splints fabricated in mechanical and virtual articulators ($p < 0.05$).

2. In patients with AD subluxation, the first stage of treatment involves myorelaxing splints fabricated using a virtual articulator. Patients who respond successfully to myorelaxing splints proceed to the second stage, using disclusion splints to stabilize the physiological position of the articular disc.

3. In patients with chronic AD dislocation, the first stage of treatment is appropriately conducted with distraction splints. At the second stage, disclusion splints should be used to stabilize the new mandibular position and restore the physiological position of the articular disc.

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INFORMATION ABOUT THE AUTHORS

Tina V. Chkhikvadze – Applicant, Department of Surgical Dentistry and Maxillofacial Surgery, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0000-0003-4642-1989>

Valery V. Bekreev – Dr. Sci. (Med.), Associate Professor, Department of Surgical Dentistry and Maxillofacial Surgery, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0007-4305-3099>

Evgeny M. Roshchin – Cand. Sci. (Med.), Dentist-Orthopedist, Dental Clinic SDI Dent, 14 Flotskaya Str., Moscow, 125493, Russian Federation

Gor G. Avetisian – Laboratory Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0003-7647-4958>

Dzhandet F. Rasulova – Laboratory Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0004-0257-2958>

Diana D. Khubulova – Laboratory Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0000-3772-7324>

Adam S. Sapaev – Laboratory Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0009-0000-4379-6043>

Ramiz Mokhamed El-Khalaf – Postgraduate Student, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; <https://orcid.org/0000-0002-9078-3197>

ИНФОРМАЦИЯ ОБ АВТОРАХ

Чхиквадзе Тина Владимировна – соискатель, кафедра челюстно-лицевой хирургии и хирургической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0000-0003-4642-1989>

Бекреев Валерий Валентинович – д.м.н., доцент, кафедра челюстно-лицевой хирургии и хирургической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0007-4305-3099>

Рощин Евгений Михайлович – к.м.н., врач-стоматолог-ортопед, клиника «SDI Dent», 125493, Российская Федерация, г. Москва, ул. Флотская, д. 14

Аветисян Гор Георгиевич – лаборант, кафедра терапевтической стоматологии Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0003-7647-4958>

Расулова Джандет Фаридовна – лаборант кафедры терапевтической стоматологии, Медицинский институт, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0004-0257-2958>

Хубулова Диана Давидовна – лаборант кафедры терапевтической стоматологии, Медицинский институт, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0000-3772-7324>

Сапаев Адам Сулейманович – лаборант кафедры терапевтической стоматологии, Медицинский институт, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0009-0000-4379-6043>

Мохамед Эль-Халаф Рамиз Алаеддинович – аспирант кафедры терапевтической стоматологии, Медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы», 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; <https://orcid.org/0000-0002-9078-3197>

AUTHOR'S CONTRIBUTION

Tina V. Chkhikvadze – participation in the development of the concept and structure of the study, analysis and interpretation of data, writing the text of the article.

Valery V. Bekreev – development of the concept and structure of the study, approval of the final version of the article submitted to the press.

Evgeny M. Roshchin – development of the concept and structure of the study, analysis and interpretation of data.

Gor G. Avetisian – analysis and interpretation of data, writing the text of the article.

Dzhandet F. Rasulova – analysis and interpretation of data, writing the text of the article.

Diana D. Khubulova – analysis and interpretation of data, writing the text of the article.

Adam S. Sapaev – analysis and interpretation of data, writing the text of the article.

Ramiz Mokhamed El-Khalaf – analysis and interpretation of data, writing the text of the article.

ВКЛАД АВТОРОВ

Т.В. Чхиквадзе – участие в разработке концепции и структуры исследования, анализ и интерпретация данных, написание текста статьи.

В.В. Бекреев – разработка концепции и структуры исследования, одобрение окончательной версии статьи, сдаваемой в печать.

Е.М. Рошин – разработка концепции и структуры исследования, анализ и интерпретация данных.

Г.Г. Аветисян – анализ и интерпретация данных, написание текста статьи.

Д.Ф. Расулова – анализ и интерпретация данных, написание текста статьи.

Д.Д. Хубулова – анализ и интерпретация данных, написание текста статьи.

А.С. Сапаев – анализ и интерпретация данных, написание текста статьи.

М.Р.А. Эль-Халаф – анализ и интерпретация данных, написание текста статьи.