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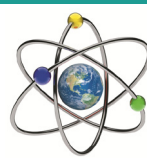
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- 13.00.00 Pedagogika fanlari
- 13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
- 13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
- 13.00.03 Maxsus pedagogika
- 13.00.04 Jismoniy tarbiya va sport mashg'ulotlari nazariyasi va metodikasi
- 13.00.05 Kasb-hunar ta'limi nazariyasi va metodikasi
- 13.00.06 Elektron ta'lim nazariyasi va metodikasi (ta'lim sohaları va bosqichlari bo'yicha)
- 13.00.07 Ta'limda menejment
- 13.00.08 Maktabgacha ta'lim va tarbiya nazariyasi va metodikasi
- 13.00.09 Ijtimoiy pedagogika
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- 01.00.00 Fizika-matematika fanlari
- 02.00.00 Kimyo fanlari
- 03.00.00 Biologiya fanlari
- 09.00.00 Falsafa fanlari
- 10.00.00 Filologiya fanlari
- 11.00.00 Geografiya fanlari

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# MAKTABGACHA VA MAKTAB TA'LIMI

Pedagogika, psixologiya fanlariga ixtisoslashgan ilmiy jurnal



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# APPLICATION OF MECHANOTHERAPY TECHNIQUES IN ORAL AND CRANIOFACIAL SURGICAL METHODOLOGIES (LITERATURE REVIEW)

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**Abstract:** This review article investigates many approaches to use mechanotherapy in addressing temporomandibular joint (TMJ) issues. Both national and international scientific investigations concerning the use of mechanotherapy in the integrative treating of TMJ ailments were scrutinised. The significant developments related to this therapeutic strategy were underscored, and evidence validating the effectiveness of mechanotherapy in multiple TMJ disorders was assembled. The study explored the use of mechanotherapy in conjunction with arthrocentesis for internal dysfunctions of the temporomandibular joint.

**Purpose of the investigation.** Improve the treatment outcomes for persons suffering from TMJ issues by using the recommended mechanotherapy approach that incorporates arthrocentesis.

**Techniques and outcomes.** Information was amassed from databases of scientific literature in Russian (eLIBRARY, CyberLeninka) and English (PubMed/MEDLINE, ClinicalKey, Elsevier, Google Scholar). An extensive review was carried out on 38 significant publications, which included 20 overseas journals. An study of subgroups was performed to explore the roots of heterogeneity.

**Findings.** Evaluation of the amassed data indicated the notable success of mechanotherapy in managing masticatory muscle contractures, mandibular fractures, arthrosis, TMJ ankylosis, and internal derangements of the temporomandibular joint.

**Summary statement.** Employing mechanotherapy augments treatment outcomes in several TMJ conditions: masticatory muscle contractures, arthrosis, TMJ ankylosis, and internal TMJ derangements. Mechanotherapy serves to diminish localised ischaemia, augment proprioception, sever fibrous adhesions, generate synovial fluid, and decrease pain in internal TMJ dysfunctions. Nevertheless, variations in statistically significant outcomes disclosed by multiple researchers, along with a deficiency of extensive studies regarding the influence of mechanotherapy when combined with alternative treatment approaches, emphasise the imperative to refine mechanotherapy practices and boost their effectiveness.

**Key words:** mechanotherapy, joint aspiration, joint imaging, internal anomalies, temporomandibular articulation.



**Annotatsiya:** Ushbu sharh maqolasida chakka-pastki jag' bo'g'imi (CPJB) muammolarini bartaraf etishda mexanoterapiyadan foydalanishning ko'plab yondashuvlari o'rganilgan. CPJB kasalliklarini kompleks davolashda mexanoterapiyadan foydalanishga oid mahalliy va xalqaro ilmiy tadqiqotlar ko'rib chiqildi. Ushbu terapevtik strategiya bilan bog'liq muhim rivojlanishlar ta'kidlandi hamda CPJBning turli kasalliklarida mexanoterapiyaning samaradorligini tasdiqlovchi dalillar jamlandi. Tadqiqotda chakka-pastki jag' bo'g'imining ichki disfunktsiyalarida mexanoterapiyani artrotsentez bilan birgalikda qo'llash o'rganildi.

Tadqiqot maqsadi. Artrotsentezni o'z ichiga olgan tavsiya etilgan mexanoterapiya yondashuvidan foydalanish orqali CPJB muammolaridan aziyat chekayotgan shaxslarni davolash natijalarini yaxshilash.

Usullar va natijalar. Ma'lumotlar rus tilidagi (eLIBRARY, CyberLeninka) va ingliz tilidagi (PubMed/MEDLINE, ClinicalKey, Elsevier, Google Scholar) ilmiy adabiyotlar bazalaridan to'plandi. Jami 38 ta muhim nashr, jumladan, 20 ta xorijiy jurnal keng qamrovda ko'rib chiqildi. Geterogenlik manbalarini o'rganish uchun kichik guruhlar tahlili o'tkazildi.

Natijalar. To'plangan ma'lumotlarni baholash mexanoterapiyaning chaynash mushaklari kontrakturalari, pastki jag' sinishlari, artroz, CPJB ankilozi va chakka-pastki jag' bo'g'imining ichki buzilishlarini davolashda sezilarli samaradorligini ko'rsatdi.

Yakuniy xulosa. Mexanoterapiyadan foydalanish CPJBning bir qator holatlarida, jumladan, chaynash mushaklari kontrakturalari, artroz, CPJB ankilozi va CPJBning ichki buzilishlarida davolash natijalarini yaxshilaydi. Mexanoterapiya mahalliy ishemiyani kamaytirish, proprioepsiyani kuchaytirish, fibroz bitishmalarni ajratish, sinovial suyuqlik hosil bo'lishini ta'minlash va CPJBning ichki disfunktsiyalarida og'riqni kamaytirishga xizmat qiladi. Shunga qaramay, turli tadqiqotchilar tomonidan keltirilgan statistik jihatdan ahamiyatli natijalardagi tafovutlar, shuningdek, mexanoterapiyaning boshqa davolash yondashuvlari bilan birgalikdagi ta'siriga oid keng qamrovli tadqiqotlarning yetishmasligi mexanoterapiya amaliyotlarini takomillashtirish va ularning samaradorligini oshirish zarurligini ta'kidlaydi.

**Kalit so'zlar:** mexanoterapiya, bo'g'im aspiratsiyasi, bo'g'imni tasvirlash, ichki anomalialar, chakka-pastki jag' bo'g'imi.

**Аннотация:** В данной обзорной статье исследуются различные подходы к применению механотерапии при проблемах височно-нижнечелюстного сустава (ВНЧС). Были рассмотрены отечественные и международные научные исследования, посвящённые применению механотерапии в комплексном лечении заболеваний ВНЧС. Были подчеркнуты значимые достижения, связанные с данной терапевтической стратегией, и собраны данные, подтверждающие эффективность механотерапии при различных заболеваниях ВНЧС. В исследовании изучалось применение механотерапии в сочетании с артроцентезом при внутренних дисфункциях височно-нижнечелюстного сустава.

Цель исследования. Улучшить результаты лечения лиц, страдающих заболеваниями ВНЧС, посредством применения рекомендованного подхода к механотерапии, включающего артроцентез.

Методы и результаты. Информация была собрана из баз научной литературы на русском языке (eLIBRARY, CyberLeninka) и английском языке (PubMed/MEDLINE, ClinicalKey, Elsevier, Google Scholar). Был проведён обширный обзор 38 значимых публикаций, включая 20 зарубежных журналов. Для изучения источников гетерогенности был проведён анализ подгрупп.

Результаты. Оценка собранных данных показала значительную эффективность механотерапии при лечении контрактур жевательных мышц, переломов нижней челюсти, артроза, анкилоза ВНЧС и внутренних нарушений височно-нижнечелюстного сустава.

Итоговое заключение. Применение механотерапии улучшает результаты лечения при ряде состояний ВНЧС: контрактурах жевательных мышц, артрозе, анкилозе ВНЧС и внутренних нарушениях ВНЧС. Механотерапия способствует уменьшению локальной ишемии, усилению proprioцепции, разделению фиброзных спаек, образованию синовиальной жидкости и снижению боли при внутренних дисфункциях ВНЧС. Тем не менее различия в статистически значимых результатах, представленных различными исследователями, наряду с недостатком масштабных исследований влияния механотерапии в сочетании с альтернативными подходами к лечению подчёркивают необходимость совершенствования методов механотерапии и повышения их эффективности.

**Ключевые слова:** механотерапия, аспирация сустава, визуализация сустава, внутренние аномалии, височно-нижнечелюстной сустав.

## INTRODUCTION

Mechanotherapy, which centers on using mechanical equipment for therapeutic and rehabilitative objectives, has its origins in Gustaf Zander (1835–1920), a notable Swedish physiotherapist who was a forerunner in this field in Europe. At the inception of his career, Zander dedicated himself to the development and implementation of tailored devices that allowed exact targeting of certain muscle groups during training.

In a limited context, mechanotherapy is the therapeutic approach for patients that use movement supported by specific mechanical equipment. An large selection of mechanical instruments was engineered to cover a wide range of movements. Systems grounded on the biomechanical concepts of joint dynamics need focused



study <sup>[1]</sup>. The changes and technological characteristics of first instruments are observable in present-day mechanotherapy equipment used today <sup>[2]</sup>.

Mechanotherapy is classified into two categories: active and passive. Active mechanotherapy is contingent upon the patient's natural motor proficiencies and capabilities, facilitating their ability to carry out tasks autonomously. Conversely, passive mechanotherapy harnesses energy from dynamic elements (mechanical, electro-mechanical, electromagnetic, hydraulic, and pneumatic training equipment) to provoke forced movement of the patient's limbs, targeting the rehabilitation of diminished joint mobility.

Mechanotherapy has use in several medical specialities such as traumatology, orthopaedics, cardiology, neurology, endocrinology, pulmonology, paediatrics, oncology, gerontology, and dentistry, while monitoring the circulatory system, which includes heart rate, blood pressure, and SpO<sub>2</sub>.

It seems that there is an absence of text available for paraphrase. Please provide the text that you would want me to reformulate<sup>[3]</sup>.

In the last 10 years, the success of rehabilitation for patients suffering from musculoskeletal ailments has notably improved because of the emergence of robotic mechanotherapy technologies. Mechanotherapy is used for addressing knee osteoarthritis. The use of robotic mechanotherapy (RM) with biofeedback has become widespread in rehabilitation, facilitating regulated loading and extra support during movement activities. Active mechanotherapy for youth with the Thera-Vital system is designed to enhance the capabilities of limb flexion and extension. Mechanotherapy is used in the integrative care of patients with musculoskeletal ailments, facilitating better circulation and nutrition to muscles and surrounding tissues, thereby enhancing the success of motor function rehabilitation. Mechanotherapy has been used in those diagnosed with cerebral palsy.

Within the realms of dentistry and maxillofacial surgery, current mechanotherapy instruments are derived on ideas proposed by regional researchers in the early 1900s (A.A. Limberg, TheraBite) <sup>[1]</sup>. These instruments evenly distribute pressure over the dental structure and, significantly, support both active and passive jaw movements (mouth opening and closing) <sup>[1]</sup>. Mechanotherapy is suggested after physiotherapy sessions <sup>[1]</sup>. To ease muscle tension and lessen scar tissue prior to mechanotherapy, it is suggested to use massage treatments (such stroking, rubbing, and light kneading) in combination with heat therapy <sup>[1]</sup>.

## LITERATURE REVIEW

In the maxillofacial domain, mechanotherapy is suggested for a range of diseases including masticatory muscle contractures, arthrosis, ankylosis of the temporomandibular joint, and internal derangements of the TMJ. In an investigation performed in 2012, A.N. Sidorenko presented data on mechanotherapy including a cohort of 17 patients with TMJ fibrous arthrosis [10]. The treatment's success was determined using clinical assessment, TMJ MRI, and immune system blood testing <sup>[10]</sup>. The length of mechanotherapy spanned 1 to 2 months, culminating in a full mouth opening of 4.0 to 4.2 cm <sup>[10]</sup>. The revival of temporomandibular joint operation was realised in 15 patients; still, 2 subjects showed mandibular deviation toward the injured side when opening.

Mechanotherapy is used for mandibular fractures post-fracture consolidation when masticatory muscle tightness arises <sup>[11]</sup>. The use of mechanotherapy decreased the timeframe for mandibular immobilisation to 1-2 weeks <sup>[11]</sup>. Individuals with mandibular fractures exhibited contractures of the masticatory muscles <sup>[11]</sup>. Subsequent to thorough treatment using mechanotherapy, the mandibular capabilities were rehabilitated in every participant <sup>[11]</sup>.

S.A. In 2012, Goncharenko elucidated the findings from a thorough therapeutic approach for patients suffering from fractures of the mandibular condylar process, using mechanotherapy <sup>[12]</sup>. In the recovery phase after surgery, 2 out of 82 patients (2.4%) showed problems associated with marginal mandibular branch facial nerve neuritis, and 3 patients (3.6%) developed contractures of the TMJ. These difficulties were alleviated as part of a therapeutic and rehabilitation strategy that included mechanotherapy <sup>[12]</sup>.

Writers from across the world similarly employ mechanotherapy for the rehabilitation of individuals suffering from mandibular fractures <sup>[13]</sup>. As noted, mechanotherapy may begin after the immobilisation duration, provided that bone tissue has grown at the fracture site. An assortment of specialised workouts for the masticatory muscles (including dynamic actions carried out at full extent, despite moderate to severe discomfort) aids patients in transcending present TMJ functional limitations <sup>[13]</sup>. Authorities advise against the simultaneous use of mechanotherapy and passive mandibular movements with splinting, as this may result in the development of non-union or pseudoarthrosis <sup>[13]</sup>.

Mechanotherapy is successfully used in the rehabilitation phase following orthognathic surgical procedures. Ninety-three percent of patients showed mandibular performance and articular disc configuration close to typical values six months after the procedure <sup>[14]</sup>. Findings suggest that six months after surgical correction of congenital maxillary and mandibular deformities, the disc's status improved, deviations were not present, and





no clicking or crepitus was seen during auscultation <sup>[14]</sup>. The opening of the mouth was similarly within accepted standards <sup>[14]</sup>.

Mechanotherapy was used in the treating of TMJ internal derangements after arthroscopy (V.V. Bekreev et al., 2013) <sup>[15]</sup>. Governed mandibular actions after arthroscopy are intended to rehabilitate the functioning of the articular disc and joint, inhibit the emergence of intra-articular fibrous adhesions, and amend any residual disc anomalies. When mechanotherapy was deemed ineffective, arthrocentesis together with hydraulic disc displacement was performed with ultrasound oversight <sup>[15]</sup>. In the extensive treatment of TMJ internal derangements via splints, hydraulic disc repositioning, and arthroscopy paired with mechanotherapy, 119 out of 218 patients (83.8%) exhibited either normalisation or substantial enhancement in disc alignment, as well as complete recovery of mandibular mobility range.

A.N. Kuznetsov (2016) presented outcomes from an elaborate treatment of 30 subjects afflicted with TMJ internal derangements using mechanotherapy <sup>[16]</sup>. Every patient reached normal mouth opening metrics by mechanotherapy <sup>[16]</sup>.

In her scholarly work, T.V. In her 2021 study, Bykovskaya suggested the use of active mechanotherapy post-TMJ arthroscopy, in combination with an occlusal splint, hydraulic disc repositioning, and the "TheraBite" equipment for jaw motion recovery <sup>[17]</sup>. The methodology conformed to the "rule of three sevens" (seven iterations every day, seven actions, seven seconds each) <sup>[17]</sup>. The basic goal of mechanotherapy was to facilitate the mobility of the articular disc, ease muscle contractions, and diminish the time required for postoperative rehabilitation <sup>[17]</sup>. The study revealed that postoperative mechanotherapy augmented the mouth cavity's width by 3-4 mm per week during the training phase <sup>[17]</sup>. The author ascertained that mechanotherapy is vital in the postoperative treatment of chronic TMJ disc dislocation, as it facilitates disc mobility and inhibits the development of new intra-articular fibrous adhesions <sup>[17]</sup>.

A.V. Yatsuk et al. (2023) described a tripartite treatment strategy for TMJ internal derangements <sup>[18]</sup>. The preliminary step included the use of anti-inflammatory medications and sedatives in combination with physiotherapy and mechanotherapy <sup>[18]</sup>. If the results at the first level were unsatisfactory, patients moved on to level two (splint therapy) <sup>[18]</sup>. Lack of adequate improvement post-level two established a rationale for surgical intervention <sup>[18]</sup>. The authors did not differentiate particular treatment findings exclusively related to the mechanotherapy facet.

P.G. Sysolyatin et al. (2001) investigated the use of mechanotherapy within the multifarious treatment of inflammatory TMJ ailments by physical therapy <sup>[19]</sup>.

M.K. Kadyrov et al. (2019) presented a clinical example of effective mechanotherapy for the treatment and rehabilitation of a patient afflicted with reoccurring TMJ fibrous ankylosis <sup>[20]</sup>.

## RESEARCH METHODOLOGY

This study employed a literature review approach to examine the application of mechanotherapy in the treatment of temporomandibular joint disorders. Scientific sources were collected from Russian-language databases (eLIBRARY, CyberLeninka) and English-language databases (PubMed/MEDLINE, ClinicalKey, Elsevier, Google Scholar). A total of 38 relevant publications, including 20 foreign journal sources, were analysed. Subgroup analysis was also used to identify possible sources of heterogeneity in the reviewed findings.

## ANALYSIS AND RESULTS

S.A. In their 2010 study, Yasonova et al. treated 42 children aged 3-15 who were experiencing TMJ bony ankylosis <sup>[21]</sup>. A cohort of 19 individuals had joint arthroplasty with the use of a distraction osteogenesis device, subsequently leading to progressive mandibular lengthening <sup>[21]</sup>. The initiation of mechanotherapy for these people occurred on postoperative days 2-3 and was sustained for at least one year <sup>[21]</sup>. The conclusive outcomes were measured by the range of mouth opening after the operation and one year subsequent to treatment <sup>[21]</sup>. An improvement in mouth opening greater than 20 mm was achieved in 79% of children <sup>[21]</sup>. The authors point out that this approach is not ideal for bilateral scenarios, as they need more extensive mechanotherapy, perhaps obstructing bone repair <sup>[21]</sup>.

Worldwide investigations emphasise mechanotherapy as a vital factor in addressing TMJ ankylosis <sup>[22]</sup>. H. Singh et al. (2023) documented a case series of patients with asymmetric Class II dentofacial abnormalities due to unilateral TMJ ankylosis <sup>[22]</sup>. The researchers explained a procedure using two distractors to adjust the alignment of the proximal condylar section <sup>[22]</sup>. Employing mechanotherapy for the adjustment of maxillofacial asymmetry resulted in stable effects during a 3-year follow-up timeframe <sup>[22]</sup>.

K.G. The results of comprehensive treatment for 12 patients afflicted with persistent TMJ disc dislocation, lasting over one year, were reported. Seferyan recommended the use of involuntary mouth opening using a

motor branch mandibular nerve block (Bershet-Dubov approach)<sup>[23]</sup>. Active mechanotherapy caused a partial dissolution of intra-articular fibrous adhesions<sup>[23]</sup>. The manual approach required that the physician put their index fingers on the lower incisal borders and their thumbs on the upper incisal edges, applying pressure to promote mouth opening<sup>[23]</sup>. In the event that manual opening failed, a mouth support was used<sup>[23]</sup>. Within a timeframe of 6-8 days, a steady diminishment of the disc was realised in four people<sup>[23]</sup>. After the separation of adhesion in mechanotherapy, the disc relocated onto the condylar surface, increasing the interincisal distance during mouth opening to physiological norms (40–42 mm)<sup>[23]</sup>.

A.E. Darkhanova (2022) examined the effectiveness of therapy with a mechanised device, namely the OpenWide apparatus, for patients with TMJ issues and restricted mouth opening. A total of twenty individuals, with ages spanning from 14-48 years, underwent assessment. The criteria for success were reaching a standard mouth opening (40-45 mm interincisal distance), regulating masticatory muscle tone (measured by electromyography), and decreasing pain intensity<sup>[24]</sup>. The creator devised an algorithm that emulates three essential phases of mandibular dynamics: vertical, translational-forward, and adjusted sagittal<sup>[24]</sup>. The clinical experience emphasised a diverse range of uses for the OpenWide device: constrained oral aperture, TMJ stiffness, TMJ osteoarthritis and ankylosis, recuperation after mandibular fractures, tension in masticatory muscles, and extended rehabilitation subsequent to complete joint replacement of the TMJ.

In 2019, A.A. Eshieva administered treatment and rehabilitation to a sample of 60 persons with traumatic arthritis. A comprehensive two-month mechanotherapy regimen was implemented after the accident, leading to significant advancements in mouth opening across all patients<sup>[25]</sup>. The researcher also analysed findings in subjects with inflammatory masticatory muscle contractures stemming from maxillofacial phlegmons (63 patients)<sup>[25]</sup>. After the splint is removed, patients require postoperative rehabilitation with mechanotherapy as a result of inflammatory contracture (grades 2–3, interincisal distance 2.5-3.5 cm)<sup>[25]</sup>. Nonetheless, hardly 20% of these subjects showed a decline in contracture (attaining an interincisal gap of 3-4 cm)<sup>[25]</sup>.

N.V. Nikolaychik (2008) noted the use of mechanotherapy for those with traumatic TMJ arthritis, proposing that lengthy, rigid immobilisation during intra-articular haemorrhage may cause fibrous adhesions to form<sup>[26]</sup>. In order to avoid adhesions, one should use resolute treatment followed by mechanotherapy (for example, potassium iodide electrophoresis on days 3-4 following injury, followed by mechanotherapy)<sup>[26]</sup>.

F.A. Khamitova (2024) analysed the efficiency of an integrated treatment method for TMJ deforming arthrosis using transcutaneous electrical nerve stimulation (TENS) in a group of 42 patients (ages 18-75)<sup>[27]</sup>. The interocclusal distance was initially enhanced by 2-3 mm using a splint, then combined with TENS stimulation of the masticatory muscles (up to 3 mA via Transair-01) and supplemented by myogymnastics and mechanotherapy until a physiological mouth opening of 40-42 mm was reached. This elaborate treatment cut the period of healing in half.

Smart Automation. Zubarev beside N.M. Dyuryagin (2006) chronicled a case of a 33-year-old individual with a facial disfigurement caused by burns<sup>[28]</sup>. Owing to an electrical burn, the patient had a deficiency in the lateral wall of the right maxillary sinus and zygomatic arch, showing a grade 1 keloid scar contracture on the neck<sup>[28]</sup>. To avoid scar contracture, every step of graft manipulation was executed with the mouth held ajar, later accompanied by postoperative mechanotherapy<sup>[28]</sup>.

Following the removal of malignant tumours in the maxillofacial region, postoperative constricted mouth opening is often seen. The foundational rehabilitation that incorporates articulatory exercises and mechanotherapy endeavours to re-establish mandibular movement, chewing, swallowing, and respiratory activities, reaching as much as 80% restoration of TMJ function<sup>[29, 30]</sup>. Initials K.A. In 2019, Asatullaevich et al. executed a retrospective examination including 107 cancer patients with surgical maxillofacial irregularities, confirming that postoperative mechanotherapy and myogymnastics aided in functional recovery.

A.S. Kovaleva et al. (2016) analysed trismus and soft tissue tension in scar contracture, using surgical surgery complemented by postoperative mechanotherapy, physiotherapy, and exercise<sup>[31]</sup>.

In a research led by Susan Armijo-Olivo and her team (2015), the active and passive kinematics of the mandible were examined in connection with TMJ disorders<sup>[32]</sup>. Ninety percent of patients noted an increase in mouth opening and a decrease in pain<sup>[32]</sup>. The implementation of isotonic jaw-opening resistance training substantially facilitated the relief of muscle soreness and the enhancement of mobility, mostly by inhibiting Golgi tendon organs<sup>[32]</sup>. Exercises focused on posture intended to ease cervical spine pain were shown to alleviate tension and stiffness in the facial and chewing muscles<sup>[32]</sup>. In a subsequent thorough examination and meta-analysis, S. Armijo-Olivo et al. (2016) indicated that mechanotherapy, which included postural and jaw exercises, substantially increased mouth opening and decreased pain in myogenic and arthrogenic TMJ conditions<sup>[32]</sup>.

The letter L. In a literature study of six studies with 498 participants, Zhang (2021) demonstrated that mechanotherapy by itself was less effective than occlusal splint therapy for reducing TMJ discomfort, but its combined application resulted in improved mouth opening range<sup>[33]</sup>.



N. Wadhawan et al. (2008) investigated the therapeutic impact of mechanotherapy with physiotherapy for TMJ dysfunction in a sample of 12 children (ages 10-14) with Class II malocclusion, receiving treatment with Twin Block or Bionator devices. MRI analysis substantiated that the amalgamation of mechanotherapy and physiotherapy mitigated joint pain, augmented mobility, and supported mastication<sup>[34]</sup>.

C.G. In their study, Stelea et al. (2021) used a passive jaw-mobilization equipment placed between the dental arches, systematically augmenting mouth opening by 1-2 mm each day over 30-40 days while ensuring no pain was experienced.

Letter E. Kijak et al. noted occurrences of TMJ dysfunction remedied by means of controlled jaw workouts (linear opening in front of a mirror and manual resistance)<sup>[36]</sup>. The Zebris JMA functional evaluation, conducted over six weeks, demonstrated substantial advancements in mouth aperture (attaining 36.3 mm, close to a 9 mm rise) and lateral mobility (right: 8.8 mm, left: 7.6 mm)<sup>[36]</sup>.

I.S. Waked et al. (2022) evaluated the effect of mechanotherapy and kinesio taping on a cohort of 30 patients post-TMJ surgery<sup>[37]</sup>. The experimental cohort (engaging in 20 minutes of active/passive exercises per session with kinesio taping three times a week over 14 days) showed an 81.03% increase in mouth opening (as opposed to 30.27% in the control group), a 23.75% decline in facial swelling, and an 89.11% reduction in discomfort<sup>[37]</sup>.

Initials L.B. Calixtre et al. (2015) analysed decreased blood circulation in the masticatory system as a consequence of TMJ dysfunction stemming from hypertonic vasoconstriction, which results in the development of metabolites and pain<sup>[38]</sup>. Myofibroblasts with  $\alpha$ -smooth muscle actin are involved in the dynamics of tissue tension and contraction<sup>[38]</sup>.

## CONCLUSION AND SUGGESTIONS

Thus, the use of mechanotherapy augments treatment efficacy for a variety of TMJ diseases such as masticatory muscle contractures, arthrosis, TMJ ankylosis, and internal derangements. The objective of mechanotherapy is to diminish localised ischaemia, foster proprioceptive input, resolve fibrous adhesions, boost synovial fluid generation, and alleviate pain related to internal TMJ diseases. Nevertheless, inconsistencies in statistically significant outcomes across studies and the sparse literature on the role of mechanotherapy within multi-modal frameworks emphasise the critical need for further refinement and standardising of mechanotherapy practices.

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- 13.00.00 Pedagogika fanlari
  - 13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
  - 13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
  - 13.00.03 Maxsus pedagogika
  - 13.00.04 Jismoniy tarbiya va sport mashg'ulotlari nazariyasi va metodikasi
  - 13.00.05 Kasb-hunar ta'limi nazariyasi va metodikasi
  - 13.00.06 Elektron ta'lim nazariyasi va metodikasi (ta'lim sohaları va bosqichlari bo'yicha)
  - 13.00.07 Ta'limda menejment
  - 13.00.08 Maktabgacha ta'lim va tarbiya nazariyasi va metodikasi
  - 13.00.09 Ijtimoiy pedagogika
  - 07.00.00 Tarix fanlari
  - 19.00.00 Psixologiya fanlari
  - 01.00.00 Fizika-matematika fanlari
  - 02.00.00 Kimyo fanlari
  - 03.00.00 Biologiya fanlari
  - 09.00.00 Falsafa fanlari
  - 10.00.00 Filologiya fanlari
  - 11.00.00 Geografiya fanlari



# AKTABGACHA VA AKTAB TA'LIMI

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**Ingliz tili muharriri:** Murod Xoliyorov

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"Maktabgacha va maktab ta'limi" jurnali 26.09.2023-yildan O'zbekiston Respublikasi Prezidenti Adminstratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligi tomonidan №C-5669363 reyestr raqami tartibi bo'yicha ro'yxatdan o'tkazilgan.  
**Litsenziya raqami: № 136361.**

**Manzilimiz:** Toshkent shahar, Yunusobod tumani  
19-mavze, 17-uy.