





БУХОРО ДАВЛАТ ТИББИЁТ  
ИНСТИТУТИ



ISSN 3030-3877

DOI Journal 10.26739/3030-3877

# ANNALS OF CLINICAL DISCIPLINE

2 ЖИЛД, 4/1 СОН

АННАЛЫ КЛИНИЧЕСКИХ ДИСЦИПЛИН

ТОМ 2, НОМЕР 4/1

КЛИНИК ФАНЛАР ЙИЛНОМАСИ

VOLUME 2, ISSUE 4/1



ТОШКЕНТ-2025

**BOSH MUHARRIR: | ГЛАВНЫЙ РЕДАКТОР: | CHIEF EDITOR:**

**Sh. J. Teshayev**

“Klinik fanlar yilnomasi” jurnali bosh muharriri, Buxoro davlat tibbiyot instituti rektori, t.f.d., professor

**BOSH MUHARRIR O'RINBOSARI: | ЗАМЕСТИТЕЛЬ ГЛАВНОГО РЕДАКТОРА: | DEPUTY CHIEF EDITOR:**

**D. A. Xasanova**

“Klinik fanlar yilnomasi” jurnali bosh muharrir o'rinbosari, Buxoro davlat tibbiyot instituti anatomiya va klinik anatomiya kafedrasida professori, DSc

**РЕДАКЦИОННАЯ КОЛЛЕГИЯ:**

- **U.K. Abdullayeva** - “Klinik fanlar yilnomasi” jurnali mas'ul kotibi, Buxoro davlat tibbiyot instituti fakultet va gospital terapiya, nefrologiya va gemodializ kafedrasida dotsenti, DSc
- **M.J. Sanoyeva** - Buxoro davlat tibbiyot instituti nevrologiya kafedrasida dotsenti, DSc
- **A.G. Gadayev** - Toshkent tibbiyot akademiyasi 3-son ichki kasalliklar kafedrasida professori, t.f.d.
- **A.R. Obloqulov** - Buxoro davlat tibbiyot instituti, yuqumli kasalliklar va bolalar yuqumli kasalliklari kafedrasida mudiri, t.f.d., professor
- **D.A. Nabiyeva** - Toshkent tibbiyot akademiyasi, 1-son fakultet va gospital terapiya, kasb kasalliklari kafedrasida mudiri, t.f.d., professor
- **Sh.T. O'roqov** - Buxoro davlat tibbiyot instituti xirurgik kasalliklar kafedrasida mudiri, DSc, dotsent
- **M.M. Karimov** - Respublika ixtisoslashtirilgan terapiya va reabilitatsiya ilmiy-amaliy tibbiyot markazi “Gastroenterologiya” ilmiy laboratoriyasi boshlig'i, t.f.d., professor
- **N.U. Narzullayev** - Buxoro davlat tibbiyot instituti otorinilaringologiya kafedrasida professori, DSc
- **G.N. Sobirova** - Toshkent tibbiyot akademiyasi reabilitatsiya va jismoniy tarbiya kafedrasida professori, t.f.d.
- **F.S. Raupov** - Buxoro davlat tibbiyot instituti bolalar xirurgik kasalliklari kafedrasida mudiri, DSc, dotsent
- **Sh.B. Axrorova** - Buxoro davlat tibbiyot instituti, nevrologiya kafedrasida dotsenti, DSc
- **V.R. Akramov** - Buxoro davlat tibbiyot instituti travmatologiya va neyroxirurgiya kafedrasida mudiri, DSc, dotsent
- **I.K. Sadulloeva** - Buxoro davlat tibbiyot instituti bolalar kasalliklari propedevtikasi va bolalar nevrologiyasi kafedrasida mudiri, DSc, dotsent
- **M.K. Temirova** - Toshkent davlat tibbiyot universiteti, Nevrologiya va bolalar nevrologiyasi, tibbiy genetika kafedrasida assistenti PhD

**РЕДАКЦИОННЫЙ СОВЕТ:**

- **G.J. Jarilkasinova** - Buxoro davlat tibbiyot instituti oilaviy shifokorlarni qayta tayyorlash kafedrasida professori, DSc
- **U.S. Mamedov** - Buxoro davlat tibbiyot instituti onkologiya kafedrasida mudiri, DSc, dotsent
- **A.A. Saidov** - Buxoro davlat tibbiyot instituti ortopedik stomatologiya va ortodontiya kafedrasida professori DSc
- **N.N. Karimova** - Buxoro davlat tibbiyot instituti 3-son akusherlik va ginekologiya kafedrasida mudiri, DSc, dotsent
- **U.K. Qayumov** - tibbiyot xodimlarini kasbiy malakasini oshirish markazi ichki kasalliklar kafedrasida mudiri, t.f.d., professor
- **M.E. Raximova** - Toshkent tibbiyot akademiyasi, 3-son ichki kasalliklar kafedrasida dotsenti, t.f.d.
- **R.I. To'raqulov** - Toshkent tibbiyot akademiyasi, 3-son ichki kasalliklar kafedrasida professori, t.f.d.
- **Ch.S. Pavlov** - I.M. Sechenov nomidagi birinchi Moskva davlat tibbiyot universiteti terapiya kafedrasida mudiri, t.f.d., professor
- **L.B. Novikova** - Rossiya Federatsiyasi Sog'liqni saqlash vazirligining “Janubiy Ural davlat tibbiyot universiteti” federal davlat byudjet oliy ta'lim muassasasi dermatovenerologiya kafedrasida professori, t.f.d.
- **O.I. Letyayeva** - Rossiya Federatsiyasi Sog'liqni saqlash vazirligining “Janubiy Ural davlat tibbiyot universiteti” federal davlat byudjet oliy ta'lim muassasasi dermatovenerologiya kafedrasida professori, t.f.d.
- **I.V. Reverchuk** - I.Kant nomidagi Boltiq federal universiteti psixonevrologiya va psixosomatika kafedrasida mudiri, t.f.d., professor
- **Edip Gonullu** - Izmir Bakirchay universiteti anesteziya va reanimatsiya kafedrasida dotsenti, t.f.d.
- **Eva Lietto** - Italiya Campania universiteti “Luigi Vanvitelli”ning tarjima tibbiyot fanlari kafedrasida mudiri, t.f.d., professor
- **G.S. Xodjiyeva** - Abu Ali ibn Sino nomidagi Buxoro davlat tibbiyot universitetining Ichki kasalliklar propedevtikasi kafedrasida dotsenti

Журнал включен в перечень ВАК национальных научных изданий, рекомендуемых для публикации основных научных результатов диссертаций по медицинским наукам постановлением № 369/6 от 5 апреля 2025 г.

© Page Maker | Верстка | Саҳифаловчи: Хуршид Мирзахмедов

**О журнале**

Журнал зарегистрирован в Агентство информации и массовых коммуникаций при Администрации Президента Республики Узбекистан № С-239963 от 14 марта 2024 года

Адрес редакции: Республика Узбекистан, 200114, г. Бухара, ул. Гиждуван, 23  
Телефон: +998(65)2230050  
Сайт: <https://tadqiqot.uz/index.php/spjacad>  
e-mail: abumkur14@gmail.com

<b>1. Abdullayeva U.K., Rakhimova M.B.</b> Ulcerative colitis: risk factors.....	6
<b>2. Ibrohimov S.I.</b> Bolalik yoshida kuzatiladigan ekssudativ o‘rta otit rivojlanishining asosiy sabablari.....	10
<b>3. Jahonqulova S.O., Po‘latova Sh.H.</b> Eksperimental bosh miya travmasida morfologik o‘zgarishlar va ularning intensiv terapiya samaradorligiga ta’siri.....	20
<b>4. Kayumova G.M.</b> Clinical and morphological features of tubal pregnancy.....	30
<b>5. Madjidova Y.N., Isakova G.S., Sharipov F.R.</b> Evaluation of the effectiveness of a mechanical rehabilitation glove in school-aged patients with cerebral palsy in the Andijan region.....	36
<b>6. Maxamatov U.Sh.</b> Maktab muassasalarining ta’lim va tarbiya sharoitlarini gigiyenik jihatdan asoslash va takomillashtirish (Farg‘ona viloyati misolida).....	43
<b>7. Nabiraeva B.A.</b> Temporomadibular bo‘g‘im disfunktsiyasida qisman adentiali bemorlarda teri orqali neyrostimulyatsiyani qo‘llash.....	49
<b>8. Nazarov B.B., Karimova N.N.</b> Description of the results of a comparative study of immunoglobulin content in the serum of women with pre-cervical tumor.....	54
<b>9. Rasulov A.S., Rasulova N.A.</b> The use of an immunostimulator to assess the quality of immunological status in children.....	60
<b>10. Rasulova N.A., Rasulov A.S.</b> Strategies for providing vitamin D based on blood biochemical indicators in rachitis.....	65
<b>11. Абдуллаева Ф.О.</b> Туберкулёз лёгких и сопутствующие патологии – проблемы коморбидности, патогенеза и ведения пациентов.....	69
<b>12. Абдулхакимов Ш.А.</b> Технические принципы и особенности выполнения КТ-исследований у больных с врождёнными аномалиями сердца .....	73
<b>13. Абдулхаков И.У., Абдулхаков М.И.</b> Современные представления о нейрогенезе у человека.....	85
<b>14. Абдурахмонов И.И., Умаров Б.Я.</b> Иммунологические детерминанты риска развития послеоперационного энтероколита при болезни Гиршпрунга у детей.....	90
<b>15. Абрайкулов И.Р., Муротов Н.Ф.</b> Бачадон бўйни саратони ташхисланган аёллар қон зардобида интерферон гамманинг микдорий параметрлари қиёсий тавсифи.....	96
<b>16. Акилов Х.А., Примов Ф.Ш., Напасов С.С., Сапаев Д.Ш.</b> Клинико-эпидемиологические особенности посттравматического панкреатита у детей.....	104

<b>17. Акрамов О.З., Аблязов О.В, Кадыров Ш.У.</b> Оптимизация нейровизуализации и хирургических доступов при опухолях функционально значимых зон головного мозга у детей.....	113
<b>18. Алиджанова Д.А.</b> Нейроспецифические белки как маркеры когнитивного дефицита у детей и подростков, страдающих СД 1-типа.....	119
<b>19. Алиханова Н.М., Исамухамедова И.С., Аббосхужаева Л.С.</b> Вариабельность глюкозы у больных сахарным диабетом 2 типа в зависимости от гликемической нагрузки и гликемического индекса ингредиентов продуктов питания.....	128
<b>20. Аскарров Ш.Ш., Салахитдинов Ш.Н.</b> Интервенционные стратегии реперфузии при массивном тромбозе коронарных артерий: клиничко-ангиографическое сравнение трёх методов.....	135
<b>21. Ахмеджанова С.Ф.</b> Функциональная гипоталамическая аменорея: современные представления о патогенезе, диагностике и терапии.....	142
<b>22. Байрамов С.Д., Султанов С.Н.</b> Роль недифференцированной дисплазии соединительной ткани в развитии истмико-цервикальной недостаточности и преждевременных родов.....	146
<b>23. Бахронов Б.Б.</b> Морфологические и морфометрические критерии синергетического действия <i>Silybum marianum</i> и <i>Carthamus tinctorius</i> при хроническом поражении пищевода угарным газом.....	151
<b>24. Бердиева Х.У.</b> Особенности интерпритации показателей интерлейкинов при когнитивных расстройствах у детей с задержкой речевого развития.....	159
<b>25. Ганжиев Ф.Х., Хамдамов Б.З.</b> Травматические повреждения печени: эпидемиология, клиничко-патологические последствия (обзорный взгляд).....	165
<b>26. Джурабекова С.Т., Бойбекова А.Ф.</b> Оптимизация послеабортной реабилитации после прерывания беременности в ранних сроках с применением кок с фолатами по схеме "Quick start": гормональный и репродуктивный эффект.....	171
<b>27. Досмухамедова Л.В., Эргашев Б.Б.</b> Лечение детей с венозными мальформациями нижних конечностей.....	184
<b>28. Ибрагимов А.У., Хомидов Ф.К.</b> Повышение эффективности профилактики хронических респираторных заболеваний среди взрослого населения на основе комплексных и персонализированных мероприятий.....	190
<b>29. Ахмедова Дилдорахон Садиллахужаевна</b> Клиничко-неврологические признаки вторичных энцефалитов у детей.....	197
<b>30. Khushvakova Nilufar Zhurakulovna, Xamidova Farida Mo'minovna, Bo'riyeva Dilnoz Baxriddinovna</b> Chronic hypertrophic laryngitis leukokeratosis and leukoplakia.....	201

**Madjidova Yakutkhon Nabiyeвна**<https://orcid.org/0000-0002-2464-0315>


Tashkent State Medical University, Tashkent, Uzbekistan

**Isakova Gulchexra Saitaliyevna**<https://orcid.org/0009-0008-4027-1418>

Andijan State Medical Institute, Andijan, Uzbekistan

**Sharipov F.R.**

Andijan State Medical Institute, Andijan, Uzbekistan

**EVALUATION OF THE EFFECTIVENESS OF A MECHANICAL REHABILITATION GLOVE IN SCHOOL-AGED PATIENTS WITH CEREBRAL PALSY IN THE ANDIJAN REGION** <http://dx.doi.org/10.5281/zenodo.18207903>**ANNOTATION**

The study titled “Evaluation of the Effectiveness of a Mechanical Rehabilitation Glove in School-Aged Patients with Cerebral Palsy in the Andijan Region” aims to assess the impact of innovative mechanical rehabilitation technology on the motor recovery of children with cerebral palsy (CP). The research involved school-aged patients undergoing comprehensive rehabilitation programs that included the use of a specially designed mechanical glove to improve upper limb motor function. Functional assessments were conducted before and after the intervention to evaluate improvements in muscle tone, fine motor coordination, and range of motion. The results demonstrated that the inclusion of the mechanical glove in rehabilitation therapy significantly enhanced hand functionality, increased patient engagement, and accelerated the recovery of motor skills compared to conventional physiotherapy alone. These findings suggest that mechanical rehabilitation devices can serve as effective adjunct tools in pediatric neurorehabilitation, contributing to better outcomes and quality of life for children with cerebral palsy in regional healthcare settings.

**Keywords:** cerebral palsy, mechanical rehabilitation glove, occupational therapy, spasticity, up.

**Маджидова Якутхон Набиевна**

Ташкентский государственный медицинский университет, Ташкент, Узбекистан

**Исакова Гулчехра Сaitалиевна**

Андижанский государственный медицинский институт, Андижан, Узбекистан

**Шарипов Ф.Р.**

Андижанский государственный медицинский институт, Андижан, Узбекистан

**ОЦЕНКА ЭФФЕКТИВНОСТИ МЕХАНИЧЕСКОЙ РЕАБИЛИТАЦИОННОЙ ПЕРЧАТКИ У ШКОЛЬНИКОВ С ДЕТСКИМ ЦЕРЕБРАЛЬНЫМ ПАРАЛИЧОМ В АНДИЖАНСКОМ РЕГИОНЕ**

**АННОТАЦИЯ**

Исследование под названием «Оценка эффективности механической реабилитационной перчатки у школьников с детским церебральным параличом в Андижанском регионе» направлено на изучение влияния инновационных механических технологий реабилитации на восстановление двигательных функций у детей с детским церебральным параличом (ДЦП). В исследовании участвовали пациенты школьного возраста, проходившие комплексную программу реабилитации, включающую использование специально разработанной механической перчатки для улучшения функции верхних конечностей. Функциональная оценка проводилась до и после вмешательства для определения улучшений мышечного тонуса, мелкой моторики и амплитуды движений. Результаты показали, что включение механической перчатки в курс реабилитационной терапии значительно повышает функциональные возможности кисти, увеличивает вовлечённость пациентов и ускоряет восстановление моторных навыков по сравнению с традиционной физиотерапией. Полученные данные свидетельствуют о том, что механические реабилитационные устройства могут служить эффективным дополнительным инструментом в педиатрической нейрореабилитации, способствуя улучшению результатов лечения и качества жизни детей с ДЦП в условиях региональных медицинских учреждений.

**Ключевые слова:** детский церебральный паралич, механическая реабилитационная перчатка, эрготерапия, спастичность, верхняя конечность.

**Маджидова Якутхон Набиевна**

Тошкент давлат тиббиёт университети, Ташкент, Ўзбекистон

**Исакова Гулчехра Саиталиевна**

Андижон давлат тиббиёт институти, Андижон, Ўзбекистон

**Шарипов Ф.Р.**

Андижон давлат тиббиёт институти, Андижон, Ўзбекистон

**АНДИЖОН ВИЛОЯТИДА МАКТАБ ЁШИДАГИ БОЛАЛАРДА МЕХАНИК РЕАБИЛИТАЦИЯ ҚЎЛҚОПИНИНГ САМАРАДОРЛИГИНИ БАҲОЛАШ****АННОТАЦИЯ**

«Андижон вилоятида мактаб ёшидаги болаларда болалар церебрал фалажи (БЦФ) билан оғриган беморларда механик реабилитация қўлқопининг самарадорлигини баҳолаш» мавзусидаги тадқиқот инновацион механик реабилитация технологияларининг болалардаги ҳаракат функцияларини тиклашга таъсирини ўрганишга қаратилган. Тадқиқотда мактаб ёшидаги беморлар иштирок этиб, улар комплекс реабилитация дастури доирасида махсус ишлаб чиқилган механик қўлқоп ёрдамида қўлнинг юқори қисми функциясини яхшилашга йўналтирилган машғулотларни бажаришди. Интервенциядан олдин ва кейин функционал баҳолаш ўтказилиб, мушак тонуси, майда моторика ва ҳаракат амплитудасининг яхшиланиши аниқланди. Олинган натижалар шуни кўрсатдики, механик реабилитация қўлқопини терапия жараёнига қўшиш қўл функцияларини сезиларли даражада яхшилади, беморларнинг фаол иштирокини оширади ва анъанавий физиотерапияга нисбатан мотор кўникмаларнинг тикланишини тезлаштиради. Тадқиқот натижаларига кўра, механик реабилитация воситалари педиатрик нейрореабилитацияда самарали қўшимча усул сифатида қўлланилиши мумкин бўлиб, БЦФ билан оғриган болаларда реабилитация натижаларини ва ҳаёт сифатини яхшилашга ёрдам беради.

**Калит сўзлар:** болалар церебрал фалажи, механик реабилитация қўлқопи, эрготерапия, спастиклик, юқори қўл.

**Introduction.** Cerebral palsy (CP) remains one of the leading causes of disability in childhood, with a prevalence of 2-3 cases per 1000 live births [1]. Impaired upper limb function is observed in 50-80% of patients with CP, significantly limiting their daily activities and quality of

life [2]. According to Arner et al., spasticity of the hand and forearm muscles leads to the development of abnormal movement patterns, contractures, and significantly impedes the development of fine motor skills [2]. per limbs, school-aged children.

Traditional rehabilitation methods, including massage, exercise therapy, and physiotherapy, often demonstrate limited effectiveness in spastic forms of cerebral palsy [3]. A systematic review by Novak et al. (2013) found that classical approaches provide only a 10-15% improvement in upper limb function [4].

In recent years, robotic rehabilitation technologies have been rapidly developing, with mechanical rehabilitation gloves occupying a special place [5]. Basteris et al. note that these devices allow for precise load distribution, multiple repetitions of movements, and objective monitoring of therapy progress [5]. Krebs and Volpe emphasize the advantages of robotic therapy in the standardization of protocols and the possibility of long-term, intensive training [6].

However, data on the effectiveness of mechanical gloves in children with cerebral palsy remains limited. Given the specific nature of rehabilitation care in the region, exploring the feasibility of introducing modern robotic technologies into children's rehabilitation centers in Uzbekistan is relevant.

**Purpose of the study.** To evaluate the effectiveness of using a pneumatic rehabilitation glove in the complex therapy of upper limb dysfunction in school-age children with cerebral palsy in the Andijan region.

**Material and methods.** The study included 30 children aged 7 to 17 years (mean age  $11.2 \pm 3.1$  years) diagnosed with spastic cerebral palsy who were undergoing rehabilitation at medical institutions in the Andijan region from 2023 to 2024.

Inclusion criteria:

1. Spasticity of the wrist flexor muscles of 2-3 points on the modified Ashworth scale [7]
2. Level II-III on the GMFCS scale [8]
3. Preserved cognitive functions allowing them to follow instructions
4. Absence of fixed contractures greater than 30 degrees

Patients were divided into three age groups: 7-10 years ( $n=7$ ), 11-14 years ( $n=15$ ), and 15-17 years ( $n=8$ ).

A programmable pneumatic rehabilitation glove was used in the study. The device consisted of a textile base with integrated pneumatic actuators for each finger. The technical specifications corresponded to those described by Polygerinos et al. [9]:

1. Range of motion: 0-90 degrees at the metacarpophalangeal and interphalangeal joints
2. Adjustable speed: 0.1-2 Hz
3. Biofeedback system with pressure sensors
4. Programmable operating modes (Figure 1).

The rehabilitation course lasted 12 weeks, with sessions scheduled five times per week. Each session lasted 45 minutes, including a preparatory phase (10 minutes); the main part (30 minutes); and a final phase with relaxation exercises (5 minutes).

Therapy was conducted in four modes:

1. Passive mode (first 2 weeks) – cyclic flexion-extension movements with a frequency of 0.5-1 Hz and an amplitude of 30-80% of normal.
2. Active-assistive mode – the patient initiated the movement, and the device provided graduated assistance based on sensor data [10].
3. Resistance mode – for patients with minimal spasticity, it provided graduated resistance of 10-50% of maximum effort.
4. Game mode – completing game tasks on a screen to increase motivation [11].



**Figure 1. Pneumatic rehabilitation glove.**

Treatment effectiveness was assessed before and after 12 weeks using the QUEST (Quality of Upper Extremity Skills Test) scale, a standardized test for assessing the quality of upper extremity movements, including four domains: dissociative movements, grasping functions, protective extensions, and weight support. Efficacy was also assessed using isometric dynamometry, measuring maximum handgrip strength (N), pinch grip strength (N), endurance (% of maximum strength after 30 seconds), and rate of force development (N/s).

**Results.** Use of the mechanical glove resulted in statistically significant improvements in all domains of upper limb function (Table 1).

**Table 1**

**Dynamics of functional indicators according to the QUEST scale (n=30)**

Assessment domen	Before treatment	After treatment	Improvement (%)	p-value
Dissociative movements	22,4±6,8	28,9±7,2	+29,0	<0,01
Gripfunctions	20,1±7,4	27,6±8,1	+37,3	<0,01
Protective extensions	6,2±2,9	8,7±3,1	+40,3	<0,01
Weight support	8,5±3,6	11,8±4,2	+38,8	<0,01

The greatest improvements were noted in the "Protective Extensions" (+40.3%) and "Weight Support" (+38.8%) domains. In the "Dissociative Movements" domain, improvements in isolated finger extension were observed in 24 patients (80%), and in forearm supination in 21 patients (70%). Grasping functions improved significantly: cylindrical grip increased from 43.3% to 83.3% of patients, and pinch grip from 36.7% to 66.7%.

Analysis of isometric dynamometry parameters revealed significant improvements in all hand strength parameters (Table 2).

**Table 2**

**Dynamics of isometric dynamometry parameters (n=30)**

Parametr	Before treatment	After treatment	Absolute increase	Relative difference(%)	p-value
Maximum handgrip strength(H)	89,7±28,4	126,8±32,6	+37,1	+41,4	<0,01

Pinch grip strength (H)	18,3±7,1	27,9±8,8	+9,6	+52,5	<0,01
Endurance ( % after 30 sec)	45,2±15,8	61,7±17,2	+16,5	+36,5	<0,01
Rate of force development(H/s)	62,4±19,7	91,3±23,4	+28,9	+46,3	<0,01

Maximum handgrip strength increased by 41.4% ( $p<0.01$ ), reaching 126.8 N, which is close to the lower limit of the age-appropriate norm [12]. The greatest relative improvement was seen in pinch grip strength (+52.5%), which is associated with targeted training of thumb opposition.

Analysis of efficacy across different age groups revealed an inverse relationship with patient age (Table 3).

Table 3

#### Therapy Effectiveness in Different Age Groups

Age group	n	QUEST improvement (%)	Grip strength increase(%)
7-10 лет	7	+44,8	+48,2
11-14 лет	15	+33,7	+41,5
15-17 лет	8	+28,0	+35,1

The younger age group (7-10 years) demonstrated the best results: a 44.8% improvement in QUEST and a 48.2% increase in strength. In the middle group (11-14 years), the figures were 33.7% and 41.5%, respectively. The older group (15-17 years) showed the smallest, but still significant, effect: 28.0% and 35.1%.

**Discussion.** The obtained results demonstrate the high efficacy of the pneumatic rehabilitation glove in treating upper limb motor impairments in children with cerebral palsy. The combination of improved movement quality on the QUEST scale and an objective increase in strength indicators confirms the comprehensive positive impact of the technique.

The greatest improvement in the "Protective Extensions" and "Weight Support" domains is explained by targeted training of the wrist and finger extensors, which are typically weakened in children with cerebral palsy due to predominant flexor spasticity [12]. Gracies notes that an imbalance between flexors and extensors is a key factor in functional limitations in spastic paresis [12].

The significant increase in pinch grip strength (52.5%) is of particular practical importance. According to Taylor et al., thumb opposition accounts for up to 50% of hand function [13]. Improving this parameter is critical for performing precise manipulations and daily activities.

The 36.5% improvement in endurance indicates positive changes not only in neuromuscular control but also in muscle metabolic processes. Lieber et al. demonstrated that regular cyclic exercise improves muscle oxidative capacity and increases the number of slow-twitch muscle fibers in patients with spasticity [14].

The 46.3% increase in the rate of force development reflects improved neuromuscular coordination, which is consistent with Elder et al.'s data on impaired temporal characteristics of muscle activation in cerebral palsy [15]. Colombo et al. also emphasize the importance of this parameter for functional activity [10].

Age differences in treatment efficacy support the concept of critical periods of neuroplasticity. Eyre demonstrated that high plasticity of the corticospinal tract is maintained between the ages of 7 and 10 years, resulting in a better response to intensive therapy [16]. Our results (44.8% improvement in the younger group versus 28.0% in the older group) are fully consistent with these data.

Comparison with international studies shows comparable or superior results. Chen and Howard, in a systematic review of robotic therapy in children with cerebral palsy, reported a 25-30% improvement in function [17], while in our study, the average improvement was 36.1%.

A significant advantage of the method used is the ability to conduct long-term, intensive training sessions without tiring the therapist, which is especially important in regions with a shortage of qualified specialists. The game-based approach described by Lohse et al. significantly increased children's motivation and therapy adherence [11].

**Conclusion.** The use of a pneumatic rehabilitation glove in the comprehensive treatment of school-aged children with cerebral palsy demonstrates high effectiveness in improving upper limb function. The technique provides significant improvements in both qualitative movement characteristics (based on the QUEST scale) and quantitative strength indicators. The greatest effectiveness is observed in the younger age group, emphasizing the importance of early initiation of intensive rehabilitation. The obtained results support the feasibility of introducing robotic technologies into children's rehabilitation centers in Uzbekistan.

1. The use of a mechanical rehabilitation glove in children with cerebral palsy improves upper limb functional performance by 29.0-40.3% across various domains of the QUEST scale.

2. Therapy results in an increase in maximum handgrip strength by 41.4%, pinch grip strength by 52.5%, endurance by 36.5%, and the rate of force development by 46.3%.

3. The effectiveness of the technique depends on the patient's age: the best results are achieved in the 7-10 year old group (44.8% improvement), due to high neuroplasticity.

4. The mechanical rehabilitation glove can be recommended as an effective component of comprehensive rehabilitation for school-aged children with cerebral palsy.

## Bibliography

1. Rosenbaum P., Paneth N., Leviton A., et al. A report: the definition and classification of cerebral palsy April 2006. *Dev Med Child Neurol Suppl.* 2007;109:8-14.
2. Arner M., Eliasson A.C., Nicklasson S., et al. Hand function in cerebral palsy. Report of 367 children in a population-based longitudinal health care program. *J Hand Surg Am.* 2008;33(8):1337-47.
3. Sanger T.D., Delgado M.R., Gaebler-Spira D., et al. Classification and definition of disorders causing hypertonia in childhood. *Pediatrics.* 2003;111(1):e89-97.
4. Novak I., McIntyre S., Morgan C., et al. A systematic review of interventions for children with cerebral palsy: state of the evidence. *Dev Med Child Neurol.* 2013;55(10):885-910.
5. Basteris A., Nijenhuis S.M., Stienen A.H., et al. Training modalities in robot-mediated upper limb rehabilitation in stroke: a framework for classification based on a systematic review. *J Neuroeng Rehabil.* 2014;11:111.
6. Krebs H.I., Volpe B.T. Rehabilitation robotics. *Handb Clin Neurol.* 2013;110:283-94.
7. Bohannon RW, Smith MB. Interrater reliability of a modified Ashworth scale of muscle spasticity. *Phys Ther.* 1987;67(2):206-7.
8. Palisano R., Rosenbaum P., Walter S., et al. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Dev Med Child Neurol.* 1997;39(4):214-23.
9. Polygerinos P., Wang Z., Galloway K.C., et al. Soft robotic glove for combined assistance and at-home rehabilitation. *Robot Auton Syst.* 2015;73:135-43.
10. Colombo R., Pisano F., Micera S., et al. Robotic techniques for upper limb evaluation and rehabilitation of stroke patients. *IEEE Trans Neural Syst Rehabil Eng.* 2005;13(3):311-24.
11. Lohse K., Shirzad N., Verster A., et al. Video games and rehabilitation: using design principles to enhance engagement in physical therapy. *J Neurol Phys Ther.* 2013;37(4):166-75.
12. Gracies J.M. Pathophysiology of spastic paresis. I: Paresis and soft tissue changes. *Muscle Nerve.* 2005;31(5):535-51.
13. Taylor N., Sand P.L., Jebsen R.H. Evaluation of hand function in children. *Arch Phys Med Rehabil.* 1973;54(3):129-35.

14. Lieber R.L., Steinman S., Barash I.A., Chambers H. Structural and functional changes in spastic skeletal muscle. *Muscle Nerve*. 2004;29(5):615-27.
15. Elder G.C., Kirk J., Stewart G., et al. Contributing factors to muscle weakness in children with cerebral palsy. *Dev Med Child Neurol*. 2003;45(8):542-50.
16. Eyre J.A. Corticospinal tract development and its plasticity after perinatal injury. *Neurosci Biobehav Rev*. 2007;31(8):1136-49.
17. Chen Y.P., Howard A.M. Effects of robotic therapy on upper-extremity function in children with cerebral palsy: A systematic review. *Dev Neurorehabil*. 2016;19(1):64-71.

# ANNALS OF CLINICAL DISCIPLINE

## АННАЛЫ КЛИНИЧЕСКИХ ДИСЦИПЛИН КЛИНИК ФАНЛАР ЙИЛНОМАСИ

Научно-практический журнал по всем  
направлениям медицины  
основан в 2024 году  
Бухарским государственным  
медицинским институтом  
Выходит один раз в 3 месяца  
Учредитель Бухарский государственный  
медицинский институт