



CEREBRAL PALSY. RISK FACTORS, REHABILITATION FEATURES (LITERATURE REVIEW)

M. Sh. Ibragimova

Samarkand State Medical University, Uzbekistan

Article DOI: <https://doi.org/10.36713/epra16590>

DOI No: 10.36713/epra16590

ABSTRACT

The review presents current data on cerebral palsy, a disease that is quite common and characterized by multifactorial etiology, has a complex pathogenesis mechanism based on neuromotor disorders, resulting in impaired motor function, muscle tone and posture. Motor disorders most often characteristic of this pathology are accompanied by impaired sensitivity, perception and the development of secondary problems – disorders of the musculoskeletal system. Given the relevance and ongoing scientific research in this area, rehabilitation measures to restore functional activity among patients using modern physical methods, physical therapy, kinesiotaping are of great interest.

KEYWORDS: *cerebral palsy, neuromotor disorders, childhood, kinesiotaping, rehabilitation, physical therapy, physical methods of exposure, muscle tone, spasticity, sensitivity.*

Cerebral palsy (CP) is a fairly a common movement disorder in children that is complicated by development disability due to multiple impairments.

By definition, cerebral palsy is a neurological, non-progressive disease that occurs due to damage to the brain (BM), its motor centers or pathways, that occur before, during or after childbirth. Cerebral palsy leads to lifelong disability with impaired motor functions caused by exposure to viral diseases (measles, influenza, parainfluenza) with subsequent development of meningoencephalitis; Sometimes may be associated with emerging hemorrhages in the brain during pathological, long, rapid labor [3, 7, 21].

The first description of cerebral palsy was historically carried out in 1880. English surgeon William Little, after whom the described form of cerebral palsy began to be called spastic diplegia, and Little's disease. The first mentions of the term "cerebral palsy" were introduced in 1897 famous Austrian psychiatrist Sigmund Freud, who introduced proposal for differences in forms of cerebral palsy based on topographic features, i.e. by number and the presence of affected limbs.

Etiology and causal factors in the development of cerebral palsy. The main etiological factors for the occurrence of cerebral palsy are considered to be many reasons, i.e. a polyetiological brain disease that begins in the intra- and perinatal periods [1, 11, 13]. There are many reasons: birth trauma with the development of hemorrhage in the brain, asphyxia of the fetus, anemia, the presence of endocrine diseases in the mother, intrauterine infection, immunological conflict due to incompatibility of mother and fetus, development and severe the course of toxicosis in pregnant women, hereditary predisposition, the presence of bad habits, difficult environmental conditions with the presence of radiation exposure or harmful industries that cause genetic mutations [2,16,29].

The following disorders are specific to cerebral palsy: decreased muscle tone, or lack thereof; coordination of movements and balance; rectifying reflexes (statokinetic); pathological tonic reflexes [4,21].

Currently, the most applicable among clinicians is the classification of K.A. Semenova, in which the following forms are distinguished: 1. Spastic diplegia - a form in which the predominant lesion is characteristic of the lower extremities; 2. Double hemiplegia – a form with the presence of spastic tetraparesis with a predominance of lesions upper limbs than lower; 3. Hemiplegia – the lesion is predominantly localized on one side of the body; 4. Hyperkinetic form – characterized by aggravated by hyperkinesis; 5. Atonic-astatic – this form is characterized the presence of decreased muscle tone; 6. Mixed form (Table 1).



Table 1.
Classification of cerebral palsy (according to K.A. Semenova 1976):

Early age	Older age
Spastic forms: - hemiplegia - diplegia - bilateral hemiplegia Dystonic form Hypotonic form	Spastic forms: - hemiplegia - diplegia - bilateral hemiplegia Hyperkinetic form Ataxic form Atonic-astatic form Mixed forms: - spastic-ataxic - spastic-hyperkinetic - atactico-hyperkinetic

The following stages of development of cerebral palsy are distinguished:

- Early: up to 4-5 months;
- Initial residual stage: from 6 months to 3 years;
- Late Residual: older than 3 years.

Based on the location of movement disorders, they are distinguished:

- Monoplegic - motor disorders in this form are characteristic only in one limb;
- Hemiplegic - disorders of this form occur on one side of the body, within this case, symptoms appear partially or completely on two limbs;
- Diplegic – damage to motor disorders on both upper or lower limbs;
- Quadriplegic – severe motor impairment on all four limbs.

Characteristic of all forms of cerebral palsy are motor disturbances of the reflex type, i.e. there are movements, but they are not controlled by the patient, they are carried out compensatory with the formation of a motor stereotype, violation of coordinating movements, increased muscle tone.

All these manifestations are characterized by the following symptoms:

- Spasticity – occurs as a result of increased muscle tone;
- Tremor - the presence of trembling of the limbs, which is not voluntary;
- Athetosis - involuntary twitching with increasing range when moving limbs;
- Ataxia – imbalance in the patient;
- Rigidity – excessive muscle tension due to increased muscle tone.

Depending on the severity and time of occurrence of the pathology, diagnose cerebral palsy possible either during the mother’s pregnancy or during childbirth, or after birth of the child.

The symptom complex of patients with cerebral palsy is quite diverse and can manifest itself and change with the growth and development of the child. Initial signs appearing from birth are the following:

- Presence of hypo- and hypertonicity of muscles; delayed motor development;
- Preservation of the automaticity of spinal reflexes for a long time;
- Possible disturbances of external respiration; bowel problems associated with atony of intestines;
- Characteristic skin lesions with the development of neurodermatitis;
- Nutritional disorders, which in infants are characterized by impaired sucking reflexes, in older ages, chewing of food, difficulties in swallowing reflexes with the presence of coughing, choking during the act of eating, the possibility of taste disturbances; the occurrence of problems with urination, the presence of salivation, which is associated with a violation of muscle tone and motor activity of the muscles of the oropharyngeal zone;
- Characteristic low motor activity of the child, up to immobility;
- Frequent falls as a result of statokinetic disorders and inability maintaining the body in an upright position; the presence of strabismus, which is characteristic of all children with a spastic form caused by pathological hypertonicity of oculomotor muscles;
- Delayed development of auditory and speech reactions.

Many patients, due to hyper-/hypofunction of muscle tone, experience pathological synkinesis, the development of contractures and deformities, and involuntary movements various parts of the body due to hyperkinesis. Thus, the main manifestations of cerebral



palsy are pronounced motor disorders, changes in the locomotor apparatus causing spasms of the lower muscles limbs, development of contracture, high muscle tone, tendon reflexes, decreased muscle strength and performance, deformation of the musculoskeletal system (MSK) with impaired coordination of movements, correct standing and walking, active development of involuntary movements, synkinesis [5, 20].

Usually this pathology causes mental disorders with resulting in disorders of functional activity of cranial nerves (CN) and the development of clinical signs such as hearing impairment, vision impairment, strabismus with progression of bulbar and pseudobulbar disorders [12, 27].

According to the International Classification of Functioning Systems (CFS), the development of this pathology has a direct effect on the structures of the body (limbs), functional activity of the body (intelligence), types of activities (walking/standing), participation (sports). Emerging functional deficiencies caused by the disease, lead to impairment, limitation of functions and participation. Psychomotor disorders in cerebral palsy lead to the development of limited use of limbs, paralysis, difficulties in performing daily activities, dependence on others (relatives, friends), decreased quality of life (dQL). This necessitates carrying out therapeutic manipulations in the early stages of the onset of pathology.

Muscle tone disorders in patients with cerebral palsy from early childhood lead to limited functionality, which causes difficulty in self-care, learning the skills of movement, walking, which requires the use of any means to ensure movement, contributing to the formation motor deficit.

As it progresses, pathological reflexes arise, instability of the vertical position leads to the formation of contractures, subluxations and dislocations of the joints of the upper and lower extremities. These processes explain the formation of pathological attitudes and deformations. Cerebral palsy is characterized by the development of muscle tone disorders. The most characteristic type of spasticity, rigidity, hypo- and dystonia is the development of spasticity, caused by high muscle tone, the causative factors of which are lesions of the pyramidal system of the brain. Clinical manifestations of spasticity can range from painful muscle spasms to widespread lesions leading to the development of the main symptoms of hemi-, para- and tetraparesis.

With central paresis, patients with cerebral palsy experience pronounced spasticity, while a pronounced degree of paresis of muscle spasticity can make it easier to maintain the body in an upright position, and walking, which reduces it, contributes to impaired support function. Treatment of spasticity, in this regard, is indicated only in cases where it impairs motor functions, causing discomfort, making it difficult to care for the patient [1].

The presence of spasticity causes the development of secondary changes in the muscular-articular apparatus, which further enhances motor disorders. In this regard, the resulting muscle resistance during its stretching depends not only on the reflex tone and muscle tension, but also on the secondary changes that arise - the development of fibrosis, atrophy, contracture. Features of the development of spastic conditions in cerebral palsy are manifested by the presence of pathological tonic reflexes, which manifests itself when changing body position; the appearance of pathological synkinetic activity when performing voluntary movements; impaired coordination of the interaction of muscles of synergists and antagonists; increased reflex excitability.

Features of spasticity in cerebral palsy are that it is accompanied by inhibition of spinal stretch reflexes, with preservation of postural automatisms; muscle tone is directly proportional to the degree and speed of stretching of spasmodic muscles, in which postural reflexes, activated by changing the position of the body in space, play a big role in changing tone.

It should be noted that spasticity has a negative impact on the quality of life of patients with cerebral palsy, leading to severe complications from the musculoskeletal system, the occurrence of pain, disorders of energy metabolism with worsening disability. All this determines a difficult prognosis and also complicates the processes of rehabilitation of patients. Another of the complications associated with cerebral palsy are orthopedic ones caused by the growth and development of the child, progression and increase in loads on the musculoskeletal system, violations of adequate muscle function, the presence of spastic tone, impaired blood circulation, causing retardation of the growth of the affected limbs, the formation of pathological postures and skeletal deformities of the growing patient.

Spinal curvature, hip dislocations, and joint contractures are typical problems for patients with cerebral palsy. Often skeletal and joint deformities are accompanied by pain, which makes physical activity impossible. It is advisable to prevent orthopedic complications from the beginning by preventing them (by means of exercise therapy, orthopedics and physiotherapy), massages, physical exercise and orthotics; If skeletal deformities have formed, they are corrected surgically.

Monitoring the dynamics of the condition of the musculoskeletal system of a growing patient is carried out using annual x-ray monitoring of the condition of the joints and, first of all, the hip, as the most susceptible to dislocations and degenerative processes.



In the presence of secondary skeletal deformities, the rehabilitation treatment program is revised taking into account concomitant pathology, in particular, the load on the joints in the presence of dysplasia or dystrophic changes, on the bones in the presence of osteoporosis is limited (Novacheck, TF., 2007).

The most common spastic syndromes leading to the formation of deformities in the joints and spine in patients with cerebral palsy are:

Triceps syndrome or dynamic equinus. With the development of equinus, walking on toes is formed, the knee joint is in a state of flexion. Triceps syndrome is formed with the participation of the cervical symmetrical tonic reflex. Most often it occurs with increased tone in m. triceps surae. Increased tone in the gastrocnemius and soleus muscles, possible involvement of the plantar muscles. Plantar flexion of the foot occurs with the participation of m. Triceps surae, m. tibialis posterior, m. plantaris, m. fl exor hallucis longus, m. fl exor digitorum longus, m. peroneus longus and m. peroneus brevis.

Adductor spasm or adductor syndrome. This clinical syndrome, the second most common in cerebral palsy, is caused by spastic contracture of the adductor muscles of the thigh (m. adductor magnus, m. adductor longus, m. adductor brevis, m. gracilis - during internal rotation of the hip), it is also necessary to take into account the activity of the leg flexor muscles (m. semimembranosus and m. semitendinosus), if the spasm is accompanied by flexion of the knee. Features of movement: the hips are tightly in contact, there is a cross at the level of the hips or knee joints, pronounced frontal instability, it is difficult to move the leg forward when walking, hyperlordosis in the lumbar region, there is always weakness of the outer thigh muscles, the gluteus medius and minimus muscles. As a rule, adductor syndrome is accompanied by hip dysplasia, sometimes with subluxation or dislocation of the femoral head, as well as a positive Trendelenburg sign. The most common is paresis of the gluteal muscles (antagonists of the adductor group).

Hamstring syndrome. This is the third most common syndrome in cerebral palsy, accompanied by an increase in the tone of the posteromedial group of thigh muscles (m. semimembranosus, m. semitendinosus, long head of m. biceps femoris), which extend the hip joint, flex the lower leg, and carry out internal rotation of the bent knee. Features of gait: the patient stands on legs bent at the knee joints, feet in the equinus position, support on the entire foot is possible, the pelvis is tilted forward or backward. Total kyphosis of the spine is possible.

Rectus syndrome. This syndrome is a common motor disorder in cerebral palsy. With a straightened fixed knee, the voltage in m. Rectus femoris causes the pelvis to tilt forward and downward. Rectus syndrome is formed when the cervical symmetrical tonic reflex and labyrinthine tonic reflex increase. There are two variants of rectus syndrome. With an increase in the cervical symmetrical tonic reflex, walking on straight legs, hyperlordosis in the lumbar region, and a pronounced forward tilt of the pelvis are characteristic. With an increase in the cervical symmetrical tonic reflex and labyrinthine tonic reflex, walking on bent legs is characteristic, lordosis in the lumbar region is smoothed or normal, and the forward tilt of the pelvis is less pronounced. There is also rectus rotation syndrome, which also has two development options.

With an increase in the cervical symmetrical tonic reflex, the patient stands and walks on straight, inwardly rotated legs, feet in equinovarus with pronounced internal rotation, hyperlordosis in the lumbar spine. With an increase in the cervical symmetrical tonic reflex and labyrinthine tonic reflex, he walks with legs bent and rotated inward, the feet in the equinus and equinovarus positions, the torso tilted forward, the lordosis is smoothed or normal. When contractures and deformities of the musculoskeletal system develop, orthopedic surgical treatment is used.

The goal of treatment is to eliminate the resulting deformities and restore normal range of motion in the joints. However, without adequate physical correction of spastic and hyperkinetic syndromes, contractures soon recur.

Spasticity is a movement disorder that is part of the upper motor neuron syndrome, characterized by a speed-dependent increase in muscle tone and accompanied by increased tendon reflexes as a result of hyperexcitability of stretch receptors.

Spasticity is detected during the study of passive movements in the limb as increased resistance (contraction) of the muscle when it is rapidly stretched. It is usually combined with increased tendon reflexes, clonus and pathological signs (for example, Babinski's sign) in paretic limbs.

An increase in muscle tone similar to spasticity can occur both due to increased excitability of a-motoneurons and due to an increase in the number of excitatory afferent impulses arising in response to muscle stretching.

Damage to the central motor neuron leads to a decrease in inhibitory effects on motor neurons, which increases their excitability, and on interneurons of the spinal cord, which leads to an increase in the number of impulses reaching a-motoneurons in response to muscle stretching. Other causes of spasticity are suggested to be structural changes at the level of the segmental apparatus of the



spinal cord, resulting from damage to the central motor neuron: shortening of the dendrites of motoneurons and collateral sprouting (proliferation) of afferent fibers that make up the dorsal roots.

For the treatment of cerebral palsy, many generally accepted therapeutic regimens are currently used, including botulinum toxin injections, orthopedic surgical correction, forced movement therapy, oral medications, occupational and physical therapy [11, 14, 17]. The main goal in the treatment of children with this pathology is to normalize muscle tone, reduce muscle-joint contractures, solve sensory and cognitive disorders, increase muscle strength, range of motion using dynamic methods and the inclusion of proprioceptive neuromuscular facilitation [15, 17, 19].

Physiotherapeutic methods of treatment for cerebral palsy are pathogenetically justified, since their use promotes the development of a neurohumoral reaction in the patient's body aimed at the emergence of unconditioned and conditioned reflexes, which in turn influence the course of basic processes in the central nervous system. As a result of the restoration of the relationship between excitation and inhibition, excitation decreases and inhibition increases, helping to reduce the rigidity of muscle spasticity and the intensity of hyperkinesis with the development of functional connections in the brain with the development of conditioned motor reflexes, contributing to compensatory adaptation mechanisms that improve and restore coordination of movement and posture.

One of the most promising and currently actively used injections are botulinum toxin injections [15].

Existing rehabilitation methods are numerous, but do not allow children with cerebral palsy to achieve complete and stable correction of motor disorders; often the achieved result is short-lived and requires additional correction methods [13, 23]. This problem especially presents certain difficulties when correcting motor activity in sick children with cerebral palsy with spastic diplegia, since methods and means of physical development of children with disabilities are based on the specifics of the disease and the initial state of the patient's body [3, 26].

There are literature data on the effectiveness of treatment of movement disorders using exercise therapy methods, using special simulators, kinesiotherapy and hydrokinesiotherapy techniques [28].

Due to the inability to maintain an upright body position in patients with cerebral palsy with Spastic diplegia disrupts the formation of natural statokinetic reflexes and the development of movements [16].

There are also ways to use special suits and simulators, it is also recommended to use various expanders, rollers, of various designs that contribute to the development and activation of dynamic strength and flexibility, mini trampolines are also very popular, which promote and improve coordination functions in patients with cerebral palsy, sometimes a group of exercise machines can be combined depending on the correct application and various influences, their main properties are aimed at activating and restoring motor functions [9, 10].

But due to the high cost and the need for specially equipped rooms, it is necessary to develop rehabilitation methods that are easier to use and economical to operate, one of which is various kinesiotherapy (KT) techniques. KT is a form of therapeutic physical culture in which the patient's voluntary conscious active movements correct impaired motor functions. Method KT is a relatively new technique used in rehabilitation programs for cerebral palsy.

Most consistent findings have shown that KT as part of a multimodal therapy program can be effective in the rehabilitation of children with cerebral palsy to improve motor function and dynamic activity.

Kinesiotaping (KT) is a new method that is included in the rehabilitation program for patients with cerebral palsy; it has also found application in sports, orthopedics and is approved as an additional method when functional disorders of the body occur, in particular musculoskeletal system [20,23].

Kinesio tape is an elastic tape made from latex-free cotton fiber, designed specifically to simulate the elasticity of muscles, skin and fascia [18, 23]. It is based on relaxation techniques, muscle stimulation, with the possibility of passive and passive-active movements. The main task when rehabilitation of these patients is the achievement of a return to normal reflex motor activity, tone of the muscular system with a decrease in reflex excitability of the motor system, stimulation of statokinetic reflexes, and normalization of movements in the joints of the limbs. Proper taping helps support weak muscles and creates a full response of the muscular system. There is a hypothesis that KT has a dose-stimulated effect on the skin receptors of the peripheral sensorimotor system, and the receptors have a direct connection with pain, proprioception and motor control. Taping has a direct effect on skin receptors, lymph and circulatory systems, fascial muscles and joints, increasing proprioception, with a gradual decrease in pain and lymphostasis, swelling, muscle spasms with strengthening and normalization of muscle tone [26, 27, 28, 29].



By supporting the joints, KT affects the musculoskeletal system by restoring proprioception, improving neuromuscular transmission with subsequent alignment of posture and stimulating skin receptors that provide feedback so necessary to maintain the body in complete balance [22, 23].

The use of KT should be included in rehabilitation programs for patients with cerebral palsy, as it has a positive effect on sensorimotor functions significantly improving the processes of control and coordination of motor and motor functions of the upper limbs [21].

This allows us to consider KT a new therapeutic approach, with which it is possible to solve most problems of central origin, leading to severe consequences that worsen the prognosis of neurorehabilitation for cerebral palsy.

A study of review literature sources [6, 24] showed the possibility of using KT in the rehabilitation of patients with cerebral palsy in combination with other methods: increasing strength, increasing endurance, improving and reducing muscle spasticity - this can be achieved when using KT on the upper extremities. This use primarily allows you to achieve: positioning of the wrist, palm and thumb in a functional position, which allows you to open the hand for sensory stimulation, improving the functions of the fingers [12, 18]; reduction of spasticity; supination of the forearm [12], maintaining the shoulder in a functional position [14]; stimulating active movement of the wrist and fingers [24, 26]. The authors' studies prove the possibility of using KT of the upper limb to improve motor function, synchronization, speed and smoothness of movements, activation, dexterity, reduction of spasticity, and protective stretching in children [12, 25].

Most reviews of the literature show the effectiveness of using KT on the upper extremities, thereby confirming the opinions of researchers in this direction. KT tape allows you to achieve an increase in the active range of motion (ROM) at the wrist, while their effectiveness can be variable and mainly associated with the beginning of active KT.

The use of KT in the torso and lower extremities, including the ankle joint, to reduce and reduce spasticity of the Achilles tendon with increased strength of the anterior tibia, knee, paraspinal, quadriceps muscles allows you to activate general motor skills and improve their functionality. This affects primarily the activation of dynamic function, control of vascular pressure with normalization and increase, where this is necessary, muscle balance to maintain sitting and standing positions [22, 23, 25].

It should be noted that there are conflicting opinions of researchers who, when studying the effect of KT, did not achieve a significant effect in patients with cerebral palsy in terms of static balance and postural control, which were assessed using the GMFM and GMFCs scales of various levels [18], which indicates a low effect of KT in severe lesions.

The results of KT exposure may be associated with the pressure exerted, the tension of the tape on the skin, thereby increasing cutaneous sensory stimulation with the implementation of proprioceptive improvement in the transmission of information to the central nervous system (CNS), another important effect is to provide protection and support to the joints, contributing to the increase and improvement functions of standing and walking [17].

An analysis of the available modern literature on the use of KT in patients with cerebral palsy showed the positive effect of this method on small and large joints, the possibility of improving motor abilities and functional activity, with control over balance and holding the body in a sitting/standing position. The use of this method in the rehabilitation of patients with cerebral palsy must be combined with both drug therapy and other methods of physiotherapy, but it should be noted that in severe degrees of cerebral palsy the use of KT is not effective. This method has a psychophysiological effect, which manifests itself on a subconscious level, encouraging children to fully use their capabilities. Considering the small number of publications and studies conducted on the use of KT in rehabilitation in patients with cerebral palsy, in order to expand and obtain the most accurate results, it is necessary to increase scientific developments in this direction with the search for possible mechanisms of its effect, which is provided for by the objectives of this study.

REFERENCES

1. Алексеева Г. Ю., Шоломов И. И. Оценка факторов риска, участвующих в развитии ДЦП у детей-инвалидов // Саратовский научно-медицинский журнал. - 2011. - Т. 7. - №. 2. - С. 446- 450
2. Артыкова М. А., Набиева Н. А. Клинико-anamnestические факторы риска развития симптоматической эпилепсии при детском церебральном параличе. // Журнал неврологии и нейрохирургических исследований. - 2021. - №. special 1
3. Абдусаломова М. А., Мавлянова З. Ф., Ким О. А. Орқа мия ва умуртқа поғонасининг бўйин қисмининг туғруқ жароҳатлари билан беморларнинг диагностикасида электронейромиографиянинг ўрни //журнал биомедицины и практики. - 2022. - Т. 7. - №. 2.
4. Бурханова Г. Л., Мавлянова З. Ф., Равшанова М. З. Convulsive Syndrome In Children: Tactics Of Conduct //Журнал Биомедицины И Практики. - 2022. - Т. 7. - №. 1.



5. Данилова М. А., Бронников В. А., Залазаева Е. А. Влияние перинатальных факторов риска на формирование зубочелюстных и речевых нарушений у детей с церебральным параличом // Вятский медицинский вестник. – 2017. – №. 2 (54). – С. 88-92
6. Ибрагимова М. Ш. Реабилитационный Метод Кинезиотейпирования При Детском Церебральном Параличе //Central Asian Journal of Medical and Natural Science. – 2022. – Т. 3. – №. 6. – С. 138-144.
7. Колчина А.Г. Семья как фактор социокультурной интеграции ребенка с церебральным параличом. // Социокультурная интеграция и специальное образование. – 2015. – С. 49-56
8. Мавлянова З.Ф. Нутритивный статус детей с церебральным параличом. // Экспериментальная и клиническая гастроэнтерология. – 2021. – №. 1 (185). – С. 82-88.
9. Малюжинская Н.В., Полякова О.В., Тонконоженко Н.Л. Влияние интранатальных факторов на развитие детского церебрального паралича. -// Актуальные проблемы гуманитарных и естественных наук. – 2016. – №. 1-5. - С. 104-107
10. Мавлянова З. Ф., Ибрагимова М. Ш. Детский церебральный паралич и факторы риска его возникновения //Science and Education. – 2023. – Т. 4. – №. 2. – С. 42-47.
11. Меренков В.А., Чабаненко Т.В. Корреляция содержания социальной ситуации развития и динамики онтогенеза детей с детским церебральным параличом. // Северный регион: наука, образование, культура. - 2022. - №. 1 (49). - С. 47-54
12. Мишенева Д.А., Колчина А.Г. Влияние нейропсихологических синдромов на развитие детей с церебральным параличом // Современный взгляд на науку и образование. – 2020. – С. 141-145
13. Помыткина Т., Мавлянова З. Медико-психологическая реабилитация: критерии и методы организации, факторы, влияющие на процесс восстановления больных коронавирусной инфекцией (ОБЗОР). // Журнал кардиореспираторных исследований. – 2020. – Т. 1. – №. 1. – С. 30-34
14. Сербина Л.Ф., Борозинец Н.М., Филипович Е.И. Новые подходы в реабилитации лиц с ограниченными возможностями здоровья. // Вестник Ленинградского государственного университета им. АС Пушкина. – 2019. – №. 4. – С. 175-181.
15. Ткаченко Е.С. и др. Детский церебральный паралич: состояние изученности проблемы (обзор) // Мать и дитя в Кузбассе. – 2019. – №. 2. – С. 4-9.
16. Худойкулова Ф. В. и др. the structure, age features, and functions of hormones. *pedagog*, 1 (5), 681-688. – 2023.
17. Шарипова М. Особенности социальной адаптации детей с детским церебральным параличом. // Центральноазиатский исследовательский журнал междисциплинарных исследований. – 2021. – №. Conference TSPU. – С. 698-705.
18. Anatolevna K. O., Akbarovna A. M., Mamasharifovich M. S. Zhalolitdinova Shaxnoza Akbarzhon kizi, & Ibragimova Leyla Ilxomovna.(2022). the influence of risk factors on the development of cerebral strokes in children. *open access repository*, 8 (04), 179–182.
19. Apolo-Arenas M. D. et al. Standardized outcomes measures in physical therapy practice for treatment and rehabilitation of cerebral palsy: a systematic Review //Journal of personalized medicine. – 2021. – Т. 11. – №. 7. – С. 604.
20. Brainin M., Norring B., Sunnerhagen K. S., Goldstein L. B. Evolution of stroke rehabilitation: review of novel developments // Stroke. 2011. Vol. 42, Issue 3. P. 365-370.
21. Chen D., Huang M., Yin Y., Gui D., Gu Y., Zhuang T., Chen C., Huo K. Risk factors of cerebral palsy in children: a systematic review and meta-analysis. // *Transl Pediatr*. 2022 Apr;11(4):556-564. doi: 10.21037/tp-22-78.
22. Chesser B. T. et al. Effectiveness of the Wii for pediatric rehabilitation in individuals with cerebral palsy: a systematic review //Physical Therapy Reviews. – 2020. – Т. 25. – №. 2. – С. 106- 117.
23. Damiano D. L. et al. Systematic review of clinical guidelines related to care of individuals with cerebral palsy as part of the World Health Organization efforts to develop a global package of interventions for rehabilitation //Archives of physical medicine and rehabilitation. – 2021. – Т. 102. – №. 9. – С. 1764-1774.
24. Faccioli S. et al. Evidence-based management and motor rehabilitation of cerebral palsy children and adolescents: a systematic review //Frontiers in Neurology. – 2023. – Т. 14. – С. 1171224.
25. Gatta L.A., Hughes B.L. Premature Rupture of Membranes with Concurrent Viral Infection. // *Obstet Gynecol Clin North Am* 2020; 47:605-23.
26. Shavkatovna I. M. Effectiveness of hydrokinesiotherapy in the rehabilitation of children with spastic cerebral palsy //Conference Zone. – 2022. – С. 507-511.
27. Shavkatovna I. M. Spastic Forms of Cerebral Palsy: New Approaches to Rehabilitation //Best Journal of Innovation in Science, Research and Development. – 2024. – Т. 3. – №. 2. – С. 227-231.