

Research Progress on Rehabilitation of Children with Spastic Cerebral Palsy

Xia Wang, Cheng Li, Yan Gao, Zhonghui Wu*

College of Physical Education, Southwest University, Chongqing 400715, China

* Corresponding author

Abstract: Spastic cerebral palsy is a classification of pediatric cerebral palsy, in China and even the world has a high incidence rate, the disease can lead to central motor injury, limited functional activity, posture development disorders and other symptoms. At present, there is no clinical treatment can be completely its root treatment, mainly by drug treatment and rehabilitation training combined methods for treatment. This paper mainly introduces the common rehabilitation techniques of spasm cerebral palsy rehabilitation, which are common in sports therapy, physical factor therapy, traditional Chinese medicine rehabilitation techniques and joint comprehensive rehabilitation nursing, and the latter have robotics, vibration therapy, cord blood stem cell transplantation. In order to provide reference suggestions and research ideas for the study of the rehabilitation of children with spastic cerebral palsy.

Keywords: Spasm cerebral palsy; Sports therapy; Physical factor therapy; Rehabilitation technology; Rehabilitation care.

1. Background

Spastic cerebral palsy is the highest incidence of all types of cerebral palsy, about 60% to 70%. In addition to muscle tone, postural reflexes and poor motor development, but also often associated with other neurological disorders. The more types of complications, the more serious the children's comprehensive dysfunction. This will not only bring all kinds of physical and psychological damage to children with cerebral palsy, the children's families will also face enormous economic pressure. Rehabilitation plays an important role in the management of cerebral palsy. Comprehensive and diversified rehabilitation training for children with spastic cerebral palsy can help them maximize their physical independence and health potential, reduce the negative effects of injury. Therefore, it is of great significance to study the rehabilitative treatment of spastic cerebral palsy.

2. Research Status at Home and Abroad

According to the relevant statistics [1], the world each year about 0.5% of newborns suffering from cerebral palsy. There are about 4 million confirmed cases of cerebral palsy in our country, and there are about 46,000 new cases every year. The epidemiological characteristics of cerebral palsy in our country are high morbidity, mainly in rural areas, and more boys. Facing the increasing incidence of cerebral palsy, medical workers should actively carry out rehabilitation intervention for the children with cerebral palsy. It is gratifying that with the rapid development of modern technology, many rehabilitation institutions for the study of infantile cerebral palsy have been added at home and abroad. Over the past hundred years, many treatment systems have been formed and many rehabilitation techniques for cerebral palsy have been developed. At present, Bobath therapy is still the most commonly used at home and abroad, but the latest used in clinical virtual reality technology, robotics, brain-computer interface, vibration therapy and so on [2]. In addition, in recent years, there has been a new hot research in

the field of clinical treatment of cerebral palsy-using umbilical cord blood (UCBC) stem cell transplantation to treat children with cerebral palsy [3].

3. Research Objects and Methods

Literature Review: Through reviewing the literatures related to the rehabilitation treatment of children with spastic cerebral palsy from 2010 to 2020 in various websites, to understand the current widely used and up-to-date rehabilitation techniques of spastic cerebral palsy.

4. Results

4.1. Overview of spastic cerebral palsy

Cerebral palsy (CP-RRB- refers to a permanent developmental disorder syndrome in the foetus and infants within one month before and after birth, often accompanied by other combined dysfunction, due to non-progressive brain damage [4]. Cerebral palsy is caused by many factors, any factors leading to brain injury, brain development can cause cerebral palsy, the most important reason is because of cerebral ischemia and hypoxia. Its typical clinical manifestations include dystonia, abnormal reflexes, abnormal postures, and dyskinesia.

Spastic cerebral palsy is divided into spastic quadriplegia, spastic diplegia, spastic hemiplegia, are mainly pyramidal system damage. There are symptoms of tendon hyperreflexia, limb muscle tension increase, flexor reflex is too strong, but their manifestations are different. At the initial stage, there are the following symptoms: no sucking or weak sucking after birth; less spontaneous movement; stiff body, high muscle tension, rigidity of both lower limbs; abnormal posture such as adduction of upper limbs; 3-5 months, hands can not be repeatedly played in front of the eyes; 7 months: can not sit, both lower limb flexion; 8 months: can not crawl, lower limb flexion without extension alternative movement. The principle of "Early detection, early diagnosis and early treatment" should be adopted in clinic. The younger the age of diagnosis and treatment, the better the therapeutic effect.

Therefore, when the child occurs in the growth of the above situation, to be vigilant to go to the hospital check and treatment.

4.2. Clinical common rehabilitation treatment techniques

The modern rehabilitation treatment of cerebral palsy is mainly classified from movement therapy, physical factor therapy, traditional Chinese medical rehabilitation technology, occupational therapy and prosthetic orthosis. In each category and invent a lot of new technology and on the basis of continuous innovation. The spastic cerebral palsy as a child cerebral palsy classification, the treatment and rehabilitation of cerebral palsy belongs to a system. At present, the most commonly used in clinical practice are: exercise rehabilitation training, mainly Bobath therapy, including Vojta therapy, ROOD technique and PNF; Such as the current domestic popularity is not high but popular in foreign spa; traditional acupuncture and massage technology. In clinical practice, the combination of rehabilitation techniques is often used, and many clinical trials have proved that the therapeutic effect of the combination of rehabilitation techniques is much better than that of the single technique.

4.2.1. Exercise Therapy

Bobath technology is used to treat patients with central nervous system disorders such as cerebral palsy and stroke. It includes key point control, promotion of normal postural reflex, reflex inhibitory mode, limb control, tactile and proprioceptive stimulation, etc. . Lu believes that in cerebral palsy rehabilitation, Bobath therapy is based on the growth and development of the patient, first suppressing the abnormal movement patterns of the child, and then slowly guiding the correct postural reflex. Control of key points can reduce the transmission of muscle receptors, and then reduce muscle tension. The promotion technology is the promotion to the balance and the righting response, mainly is the balance response. By observing the balance of the normal people, the patients are encouraged to use the affected limbs more, and the normal movement mode is established. The inhibitory reflex mode had better inhibitory effect on spasticity and abnormal posture. Tactile and proprioceptive stimulation can help children to strengthen their control. However, the Bobath technique has limitations, and studies have shown that different patients do not strictly follow the rules of development when restoring motor function. Bobath values the patient's sense of learning, but neglects the patient's active involvement. Bobath argues that PNF enhances the child's abnormal reflexes, but that the technique alone can not restore motor coordination. Therefore, the advantages of the Bobath technique should be used in the treatment, and other techniques should be used to achieve better results.

Vojta technology is used in a variety of neurophysiology treatments for brain injuries in infants and young children. Early intervention by Vojta can effectively reduce the incidence of cerebral palsy in high risk infants, and the earlier the intervention diagnosis is, the better the effect is. Xi Yinyin et al. (7) divided 64 high risk infants into two groups. The results showed that the total effective rate of routine treatment group was lower than that of Vojta Group ($P < 0.05$), and the incidence of cerebral palsy was higher than that of Vojta Group ($P < 0.05$). It is proved that Vojta therapy can significantly improve the functional symptoms and reduce the incidence of cerebral palsy. By repeatedly stimulating and pressing the specific part of the starting posture, the local limb

muscles were contracted and stretched, and the normal reflex path was established. Strengthen their motor function, reduce the occurrence of complications, improve the prognosis, reduce the incidence of cerebral palsy. However, if the technique is used in the condition of high muscular tension, it is difficult to obtain ideal effect. In order to make up for its deficiency, it can be interfered on the basis of combined rehabilitation training.

4.2.2. Physical Therapy

Functional electrical stimulation therapy (FES) FES uses low-frequency electrical currents to stimulate muscles, induce muscle contraction, improve or restore their function, and improve and replace lost function in limbs and organs. FES consists of 3 kinds of electrodes: surface electrode, intramuscular electrode and implanted electrode. Because of the non-invasive surface electrode, placement without pain, easy to operate, generally as the first choice for pediatric clinical [8]. Wu Shumin et al. [9] used Fes to treat the lower limbs of spastic children. After treatment, the degree of gastrocnemius muscle spasm decreased, gross motor score increased, and the degree of active dorsal curvature of ankle joint increased, the effect of FES group was better than that of routine group. It is proved that Fes can relieve muscle spasm, improve central control of movement, promote recovery of muscle function to coordinate muscle group movement and improve gross motor function of spastic cerebral palsy children. If combined with exercise training, FES can also make it easier for the central nervous system to grasp the right cortical excitement, promote their motor development, and prevent muscle atrophy.

Hydrotherapy, water as a medium, the use of different temperature, pressure and composition of water, in various forms on the human body impact, improve the rehabilitation effect. The buoyancy of water can help children with weight loss, and is beneficial to children with insufficient muscle strength. Hydrotherapy not only has mechanical properties such as bubbles and vortexes to arouse children's interest, but also can promote blood circulation with 38 ° C constant temperature water. Chen Hongbo treated spastic cerebral palsy with hydrotherapy. After treatment, the effective rate of control group was lower than that of hydrotherapy group ($P < 0.05$). It is indicated that hydrotherapy can effectively improve spasticity in children with spastic cerebral palsy, and this physical factor combined with exercise training can improve muscle strength, enhance muscle endurance, reduce abnormal muscle tension, and enlarge the range of motion of joints, strengthen the balance and coordination of children. Because the main place of the spa is in the treatment pool, there are many safety risks: the pool water depth should be controlled at about half a meter; During treatment, the therapist should pay close attention to each child's actions, preferably one-on-one treatment to avoid drowning.

4.2.3. Rehabilitation techniques of traditional Chinese medicine

Acupuncture therapy, modern research shows that [11] through acupuncture treatment can adjust the blood flow of the lateral cerebral cortex, improve the excitability of the peripheral nerve, relieve muscle spasm, improve muscle strength, and make the limbs more coordinated; Increase the cerebral blood flow, improve the children's limb movement and cognitive ability. Zheng Lina [12] treated cerebral palsy children with dyskinesia by acupuncture and moxibustion. The results showed that the scores of language, cognition, gross motion and fine motion in the control group were lower

than those in the acupuncture group ($P & Lt; 0.05$) . Conclusion acupuncture and moxibustion can promote the recovery of gross motor function and fine motor function, and the improvement of language, cognition and motor ability.

Child massage technique, an indispensable treatment for pediatric diseases, has many schools, and Liu's child massage is widely used in spastic cerebral palsy [13] . Shao Keyan [14] compared the treatment of spastic cerebral palsy with Liu's massage combined with modern rehabilitation techniques and simple modern rehabilitation techniques, the results showed that the scores of muscle tension, gross motion and comprehensive function in the test group were higher than those in the control group ($P & Lt; 0.05$) . It can be seen that the combination of massage and modern rehabilitation can not only make the limb function of children with Liu's obvious changes, but also improve their quality of life. Liu's massage is applied to the five internal organs, such as the heart, liver, spleen, lung and kidney. It can effectively restore the functions of the zang-fu organs, ensure the balance of yin and yang, stimulate the muscles and nerves, and help improve the elasticity of the muscles In addition, it can effectively improve blood circulation and cerebral cortex function.

4.2.4. Comprehensive Rehabilitation Nursing

Comprehensive Rehabilitation Nursing is a comprehensive nursing method, including diet, knowledge education, psychological intervention, various skills training and so on. Li Pan [15] proved through clinical research that comprehensive rehabilitation nursing intervention can consolidate the motor function of cerebral palsy children, improve the quality of life, and promote the rehabilitation of children with positive effects. Through comprehensive rehabilitation nursing intervention measures, it can actively promote the rehabilitation of children with cerebral dysfunction, correct abnormal behavior and abnormal limb posture in daily training, and improve motor function significantly. On the basis of emphasizing the dual health of body and mind, it can achieve multi-angle and multi-subject cooperation, which is beneficial to comprehensive rehabilitation.

4.3. The latest rehabilitation treatment technology

4.3.1. Robotics

Robot technology used to be used in the rehabilitation of patients with brain injury, stroke and so on, but it is gradually used in CP treatment, including game, language and limb rehabilitation robot. Playing games can improve children's ability to participate spontaneously and train their coordination and balance; The upper limb robot can improve the limb movement ability by assisting the children's limb movement, such as eating and grasping, so that the children can master some simple life skills Digiacoimo et al. 17 investigated the impact of robot-assisted gait training in the lower limbs on motor ability and endurance in children and found no significant improvement in clinical outcomes and speed after treatment, but significant improvement in total and mean distance. Robot-assisted gait training combined with routine physical therapy can improve children's performance and endurance.

Although robotic technology has achieved good results in the treatment of cerebral palsy, its high cost has been puzzling. If the cost of manufacturing robots can not be reduced, and the cost of treating children remains high, it will be difficult to popularize them.

4.3.2. Vibration therapy

Vibration therapy is the latest form of rehabilitation therapy, initially used in adults with skeletal muscle injuries. In the treatment of children with cerebral palsy, vibration therapy can promote the growth of muscle and bone, prevent and control muscle consumption and bone loss, and increase the regeneration and toughness of bone cortex in the limbs of children with cerebral palsy, it is helpful to protect children from fracture. Meng Wenbin et al. 18 found that the modified TARDIEN score, ankle movement angle, balance function score and gross motor function score in the whole body vibration training group were higher than those in the routine group. It is concluded that vibration therapy can improve the limb movement ability and the quality of life.

4.3.3. Umbilical cord blood stem cell transplantation [3]

Stem cells have the potential to ameliorate brain injury and are proposed as a treatment for cerebral palsy. Cord blood (UCB) is used as a source of stem cells because it is ethically less complex than other sources. It has been reported that hUCB-MSCs (human umbilical cord blood Mesenchymal stem cell) possess a wide range of differentiation abilities and can be induced by certain factors, such as Brain-derived neurotrophic factor, basic Fibroblast growth factor, differentiated into cells marked by neurons and neuroglia. The application of stem cell transplantation in the animal model of acute cerebral palsy and the treatment of neonatal hypoxia-ischemia have significantly improved neurological function. But there is still a lot of uncertainty in this study, and questions about the most appropriate cell type, the timing of the infusion, the dose required and the associated risks remain unanswered for further research.

5. Conclusion and Outlook

5.1. Conclusion

5.1.1 through the scientific treatment technology, the comprehensive treatment idea, may obviously improve the spastic cerebral palsy child's body function. To reduce the muscular tension of children with spastic cerebral palsy is the first problem to be solved. At present, many methods such as physical therapy, physical therapy and traditional Chinese medicine are used in clinic, especially the Bobath technique.

5.1.2 it can be seen from the latest clinical rehabilitation techniques that a large proportion of high-tech products are used. With the development of science and technology, network and electronic products can provide great convenience for the recovery of children. On the basis of the former rehabilitative treatment methods, the network and electronic technology are properly used, and other treatment methods are added to achieve the best rehabilitative effect, and the ultimate goal of children with cerebral palsy returning to their families and society is realized.

5.1.3 the clinical treatment of spastic cerebral palsy is difficult because of its complex symptoms and extensive brain damage. It is difficult to achieve the ideal curative effect by using only one rehabilitation method. Therefore, at present more use of comprehensive treatment methods, the role of the various treatment methods to be combined to make a common effect.

5.2. Outlook

The rehabilitation treatment of spastic cerebral palsy is a long and complicated process, which needs the close cooperation of hospital, family and society. Although there is

no satisfactory treatment for the central nervous system, with the standardization and specialization of various rehabilitation techniques, many children have shown significant improvement in their outcomes. The aim of cerebral palsy rehabilitation is to recover the physiological and psychological functions of the children with cerebral palsy to the greatest extent, to improve their independence of life, and to prepare for their study and work in the future. Therefore, efforts still need to be made by rehabilitated personnel.

References

- [1] Feng Haijiao. Research progress in early diagnosis and treatment of cerebral palsy in children [J]. World Latest Medical Information Digest, 2017 (81)
- [2] Ning M. Status and progress of rehabilitation treatment for children with cerebral palsy [J]. Medical Equipment, 2019 (24)
- [3] KylieCrompton; Iona Novak. Single group multisite safety trial of sibling cord blood cell infusion to children with cerebral palsy: study protocol and rationale[J].BMJ Open, 2020(03)
- [4] TANG Qiang. Clinical Rehabilitation [M]. China Traditional Chinese Medicine Press, 2017 (01)
- [5] Lu Yuan. The application of Bobath therapy in cerebral palsy rehabilitation [J]. Chinese Medical Guide, 2013 (04)
- [6] Fang Tao Zhang Jizhong et al. Application status and development trend of Bobath technology [J]. Massage and Rehabilitation and Medicine, 2020(06)
- [7] Effect of Vojta therapy in early intervention treatment of high-risk infants [J]. Chinese Convalescent Medicine, 2019 (04)
- [8] Yang Zheng Han Yuling et al. Effect of functional electrical stimulation on lower limb function in children with spastic cerebral palsy [J]. Chinese Journal of Rehabilitation Medicine, 2009 (04)
- [9] Wu Shumin and Zhang Xiaoyu et al. The value of functional electrical stimulation on lower limb motor function in children with spastic diplegic cerebral palsy [J]. Clinical Research, 2019(08)
- [10] Chen Hongbo. Therapeutic evaluation of spastic cerebral palsy in children treated by hydrotherapy [J]. Psychological Monthly, 2018 (10)
- [11] Wang Qiuli Liu Yingke et al. Clinical observation of chiropractic massage combined with acupuncture to improve swallowing disorder in children with cerebral palsy [J]. China Maternal and Child Health Research, 2017 (S2)
- [12] Zheng Lina. Clinical study on acupuncture for motor dysfunction in children with cerebral palsy [J]. Asian-pacific Traditional Medicine, 2019 (12)
- [13] Tang Leping Shao Xiangning et al. The development status and prospect of Pediatric massage [J]. Chinese Medicine Review, 2019 (07)
- [14] Shao Keyan. Effect of Liu's massage therapy combined with modern rehabilitation therapy on spastic cerebral palsy in children [J]. Chinese Medical Science, 2019 (02)
- [15] Li P. Effects of comprehensive rehabilitation nursing intervention on motor function and quality of life in children with cerebral palsy [J]. Shanxi Journal of Medicine, 2020 (01)
- [16] [Lou Xinxia Li Xiangyu et al. Effect observation and nursing care of children's upper limb rehabilitation robot assisted treatment of cerebral palsy [J]. Chinese Journal of Modern Medicine, 2017(04)
- [17] Digiacomo F, Tamburin S, et al. Improvement of motor performance in children with cerebral palsy treated with exoskeleton robotic training: a retrospective explorative analysis [J]. Restor Neurol Neurosci, 2019(03)
- [18] Meng Wenbin, Liu Fengwei et al. Effect of whole body vibration training on lower limb motor function in children with spastic cerebral palsy aged 1 to 3 years [J]. Journal of Zhengzhou University (Medical Edition), 2017(06)