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Research Progress of Physiotherapy in the Prevention and Treatment of Myopia

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Abstract: ***With the development of science and technology and the change of life style, myopia has become a global public health problem, especially in young people. This paper summarizes the research progress of physiotherapy in the prevention and treatment of myopia at home and abroad, analyzes the action mechanism, clinical efficacy and existing problems of each therapy, and emphasizes the importance of the combination of traditional Chinese medicine and western medicine in the prevention and treatment of myopia. The aim is to provide effective reference for the prevention and control of myopia.***

Keywords: Myopia, Physiotherapy, Prevention, Treatment**.**

1. Introduction

Myopia refers to the abnormal refractive state in which the parallel light passes through the refractive system of the eye and becomes a focus in front of the retina when the human eye is adjusted to rest [1]. Myopia will not only cause vision loss, but also lead to macular degeneration, retinal detachment, cataract, glaucoma and other complications, visual impairment and blindness [2]. Therefore, the progress of preventing and controlling myopia has become an important task in the field of global public health. As one of the main means to prevent and control myopia, physiotherapy covers a variety of forms, including optical interference, orthopedic therapy, myofascial therapy, vision training and virtual reality technology. as well as acupuncture, massage, auricular point pressing beans and other external treatments with traditional Chinese medicine characteristics. In view of this, the purpose of this paper is to comprehensively and systematically review the research progress of physiotherapy in the prevention and treatment of myopia at home and abroad, through in-depth analysis of the mechanism, clinical efficacy and existing problems of all kinds of physiotherapy. to provide a more valuable reference for the prevention and treatment of myopia.

2. Foreign Physiotherapy Methods for Prevention and Treatment of Myopia

2.1 Optical Interference

Optical interference means that myopic patients diverge through concave lens and external parallel light through concave lens and focus on the retina to improve visual acuity after entering the eyeball refractive system. It is the most commonly used means of correction, including multi-focus soft contact lenses, defocus collection multi-segment lenses and keratoplasty lenses. Based on the theory of peripheral defocus, multifocal soft contact lenses can better control the progression of myopia in a short time [3]. Hieda et al conducted a 2-year clinical study of soft multifocal contact lenses on the progression of myopia, including 100 primary school children with myopia of one to six years. The results show that multifocal contact lenses can effectively inhibit the progression of myopia [4]. However, multifocal soft contact lenses lack the results of clinical trials for many years, and its mechanism needs to be further studied. The light area of defocus set multi-segment lens (DIMS) includes a hexagonal central focus and an optical defocus. Each focus is accurately located in each region of the retina, forming a curved image similar to the eyeball on the retina, ensuring the clarity of the central image, eliminating the hyperopic defocus of the peripheral retina, and slowing or stopping the lengthening of the eye axis, so as to control and delay the deepening of myopia. A meta-analysis shows that daily use of DIMS glasses can effectively slow the progression and axial extension of myopia compared with monolithic glasses. At the same time, there is no significant difference in visual function between DIMS and monolithic glasses, but the best time and long-term effect of DIMS treatment are still uncertain. Long-term randomized studies are needed to determine its actual effectiveness and clinical application [5]. The mechanism of keratoplasty to slow down the progression of myopia is that patients wear reverse geometric lenses at night to make the corneal epithelium thinner and temporarily reshape the anterior corneal surface. after the lens is removed, the flatness of the corneal surface can last for a day. Santodomingo Rubido conducted a 2-year clinical study that showed that orthokeratology delayed myopia progression by 30% to 50% compared with glasses and soft contact lenses [6]. However, the long-term control effect is not fully studied, and there are some problems, such as high cost, risk of infection and so on.

2.2 Orthopedic Therapy

Orthopedic medicine is a non-invasive alternative form of manual treatment. Sandhouse et al. conducted a clinical trial on the effect of orthopaedic surgery on visual function. The results show that orthopedic manipulation can reduce intraocular pressure and affect visual field, and orthopedic therapy applied to the skull region can have a positive impact on visual function in young people [7]. There are two mechanisms to explain the effect of orthopedic therapy on visual acuity. One mechanism is that orthopedic therapy can change the position of the muscles in which the ocular nerve is

directly or indirectly connected to the eyeball, orbit and sphenoid bone, thus changing the length of the eye axis. Another mechanism is that the parasympathetic nerve of the eye penetrates the sphenoid fissure, and the manipulation of the sphenoid bone can reduce the tension of the bone or fascia, and then restore the normal function of the ocular autonomic system.

2.3 Myofascial Therapy

The eyeball fascia (Tenon) is the deep fascia of the eye, which is divided into three parts: anterior, central and posterior. The central part is the fascia sheath composed of superior rectus, medial rectus, inferior rectus, lateral rectus and superior and inferior oblique muscles. The posterior part fuses with the optic nerve sheath. Ohno-Matsui et al. conducted a study to study the structural characteristics of the posterior sclera and Tenon fascia in patients with high myopia. The outer layer of the sclera and the posterior part of Tenon fascia were examined by optical coherence tomography. The results showed that the retina and choroid were significantly thinner in patients with high myopia, and the muscle fibers arranged in the Tenon fascia were looser and split [10]. Myofascial therapy can relieve visual fatigue by relieving muscle tension.

2.4 Eyesight Training

The regulatory mechanism of myopia holds that myopia is related to the accommodative function of the eye and the accommodative lag of the eye. Therefore, the accommodative function of both eyes can be trained by wearing contact lenses combined with vision training, so as to reduce the accommodative lag of the eye and increase the accommodative function of the eye, thus delaying the development of myopia. Allen et al conducted a clinical study on vision training. A total of 94 myopic patients were included in the study. The experimental group used contact lenses with spherical aberration (SA) and received vision training, while the control group used contact lenses without SA without any training. Patients underwent 18-minute lens flipping exercise for 6 weeks. SA lenses improved the static adjustment response to nearby objects, and visual training increased the active adjustment index. Compared with the baseline, myopia and hyperopia were significantly improved after training [13].

2.5 Virtual Reality Technology

In recent years, virtual reality technology (VR) has been proposed to control the progress of myopia, but its effectiveness and impact on the visual system are still being explored. Turnbull et al. also conducted a study on the effect of wearing virtual reality headphones on the eyes. The results show that choroidal thickening is significantly increased after wearing VR devices, and choroidal thickening is related to the decrease of myopic progression in children. However, more research and practice are needed on whether the mechanism of choroidal thickening can help prevent myopic progression in children [14]. Therefore, the use of VR technology in the prevention and treatment of myopia requires multicenter and large sample studies to objectively evaluate its safety and its impact on visual function.

3. Domestic Physiotherapy for Prevention and Treatment of Myopia

3.1 Acupuncture Treatment

Acupuncture is the most commonly used treatment in external therapy, through acupuncture at different acupoints to strengthen the relationship between the eyes and the whole body viscera and meridians, regulate the autonomic nerve, promote blood circulation, regulate the physique of patients, so as to improve visual function. Acupuncture includes filiform acupuncture, magnetic plum needle, needle, intradermal needle, plum blossom needle and so on, among which filiform acupuncture is the most widely used in acupuncture clinic. Zhou Hong et al. [15] took 60 adolescent myopic patients as the research object to explore the effect of acupuncture (Yangbai, Sibai, Sibai, Sizhukong, Zanzhu, Taiyang and Hegu, etc.) in the treatment of myopia. The total effective rate was 83.3%, achieving the expected effect. Li Neng et al [16] used acupuncture combined with keratoplasty to treat mild to moderate myopia and made clinical observation. The results showed that the total improvement rate of 120 patients (240 eyes) with mild to moderate myopia was 36.73%. The total improvement rate of the combined acupuncture group was increased to 58.18%, and the difference between the two groups was statistically significant.

3.2 Massage Treatment

Massage acts on the acupoints of the human body through different techniques to achieve the effect of relaxing meridians and dredging collaterals. Studies have shown that the stimulation of periocular acupoints can enhance the blood circulation of periocular tissue, the pressing of cervical and shoulder acupoints can improve the blood supply of bilateral vertebral arteries, and the combined treatment can provide sufficient blood supply to eye tissue and optic nucleus, and regulate ciliary muscle. improve the lag of eye regulation, alleviate visual fatigue and promote the recovery of vision [17]. Zhang Shuxian et al. [18] by massage Fengchi, plucking Tianzhu bone, kneading old-age, bright and periocular acupoints to treat adolescent myopia, the curative effect is remarkable. Wang Zhaohui et al. [19] neck massage has achieved remarkable results in the treatment of college students' myopia, and the mechanism is related to the reflex system of "eye-vestibular-neck".

3.3 Auricular Point Therapy

Auricular points, that is, acupoints located on the auricle, also known as stimulation points or reaction points, can effectively improve the blood supply of head and facial features, promote eye health, and treat related viscera diseases by using adhesive tape to accurately apply medicine beans (such as Wang does not leave seeds) to the ear points and stimulating the corresponding reaction points of ear points. He Bihua et al. [20] think that pressing beans through auricular points can increase the blood supply of the eyes, activate the two-way regulation function of the body, and adjust the essence and qi of Zang-fu organs. Wang Zhiqiang [21] selected 58 adolescent patients with mild myopia and divided them into ear point group and mirror group. Shenmen, liver, spleen,

kidney, heart and brain were selected in ear point group to bury beans. Auricular point embedding beans can effectively improve the naked vision of patients with mild myopia and regulate refractive errors caused by spasm.

4. Conclusion

The prevention and control of myopia is still being explored, and the research progress on the mechanism of occurrence and development of myopia also provides a new idea for the treatment and prevention of myopia. At present, the optical interference of physiotherapy abroad is mainly based on the anatomical structure of the eyeball and the understanding of physiology, pathology and anatomical structure of myopia. Physiotherapy, such as orthopedic therapy and vision training, mainly slow down the progress of myopia by adjusting bones and muscles, improving blood circulation and nutritional supply around the eyes, and relieving eye fatigue and intraocular pressure, however, in the prevention and treatment of myopia, single physiotherapy can not completely solve the problem. The methods of traditional Chinese medicine and external treatment of traditional Chinese medicine in the prevention and treatment of myopia are flexible, simple and easy, and have unique characteristics and advantages. In accordance with the characteristics of "overall concept" and "syndrome differentiation and treatment" of traditional Chinese medicine, we should flexibly apply personalized diagnosis and treatment measures and special prescriptions for myopic patients with different physique, different morbidity, different syndromes and different conditions in clinic. it can improve the visual damage of myopia, actively prevent and control the occurrence and development of myopia, and improve the health level of children and adolescents.

Therefore, the use of external treatment of traditional Chinese medicine, reasonable combination of foreign physiotherapy to prevent and control myopia, and the application of TCM's own etiology, pathogenesis, syndrome differentiation and treatment methods at the same time, to a certain extent, can expand TCM's understanding of the prevention and treatment of myopia. The two complementary advantages can play a better role in the prevention and treatment of myopia.

References

[1] Morgan IG, Ohno-Matsui K, Saw SM. Myopia [J]. Lancet, 2012, 379(9827):1739-1748.

[2] Saw Seang-Mei, Gazzard Gus, Shih-Yen Edwin Chan, et al. Myopia and associated pathological complications. [J]. Ophthalmic & physiological optics: the journal of the British College of Ophthalmic Opticians (Optometrists), 2005, 25(5):381-391.

[3] Zhu Qin, Liu Yongsong, Tighe Sean, et al. Retardation of Myopia Progression by Multifocal Soft Contact Lenses. [J]. International journal of medical sciences, 2019, 16(2):198-202.

[4] Hieda Osamu, Nakamura Yo, Hiraoka Takahiro, et al. Clinical study on the effect of multifocal contact lenses on myopia progression in myopia school children [J]. Trials, 2021, 22(1):239-239.

[5] Carlà Matteo Mario, Boselli Francesco, Giannuzzi Federico, et al. Overview on Defocus Incorporated Multiple Segments Lenses: A Novel Perspective in Myopia Progression Management. [J]. Vision (Basel, Switzerland), 2022, 6(2):20-20.

[6] Santodomingo-Rubido Jacinto, Villa-Collar César, Gilmartin Bernard, et al. Long-term Efficacy of Orthokeratology Contact Lens Wear in Controlling the Progression of Childhood Myopia. [J]. Current eye research, 2017, 42(5):713-720.

[7] Sandhouse Mark E, Shechtman Diana, Sorkin Richard, et al. Effect of osteopathy in the cranial field on visual function--a pilot study. [J]. The Journal of the American Osteopathic Association, 2010, 110(4):239-243.

[8] Sandhouse Mark E, Shechtman Diana, Fecho Gregory, et al. Effect of Osteopathic Cranial Manipulative Medicine on Visual Function. [J]. The Journal of the American Osteopathic Association, 2016, 116(11): 706-714.

[9] Kakizaki Hirohiko, Takahashi Yasuhiro, Nakano Takashi, et al. Anatomy of Tenons capsule. [J]. Clinical & experimental ophthalmology, 2012, 40(6):611-616.

[10] Ohno-Matsui Kyoko, Fang Yuxin, Morohoshi Kei, et al. Optical Coherence Tomographic Imaging of Posterior Episclera and Tenon's Capsule. [J]. Investigative ophthalmology & visual science, 2017, 58(9): 3389-3394.

[11] Choh Vivian, Lew MinJung Y, Nadel Michel W, et al. Effects of interchanging hyperopic defocus and form deprivation stimuli in normal and optic nerve-sectioned chicks. [J]. Vision research, 2006, 46(67):1070-1079.

[12] Chakraborty Ranjay, Ostrin Lisa A, Benavente-Perez Alexandra, et al. Optical mechanisms regulating emmetropisation and refractive errors: evidence from animal models. [J]. Clinical & experimental optometry, 2020, 103(1):55-67.

[13] Allen Peter M, Radhakrishnan Hema, Rae Sheila, et al. Aberration control and vision training as an effective means of improving accommodation in individuals with myopia. [J]. Investigative ophthalmology & visual science, 2009, 50(11):5120-5129.

[14] Turnbull Philip R K, Phillips John R,. Ocular effects of virtual reality headset wear in young adults. [J]. Scientific reports, 2017, 7(14):16172.

[15] Zhou Hong, Yang Yanning, Zhang Lanfeng. The Efficacy of Acupuncture Combined with Tropicamide Eye Drops in the Treatment of Myopia in Adolescents [J]. Medical Equipment, 2020, 33(22):104-105.

[16] Li Neng, Lai Jian, Du Haiying, Zhang Rui. Observation on the Therapeutic Effect of Acupuncture Combined with Orthokeratology Lenses in the Treatment of Mild to Moderate Myopia in Adolescents [J]. Zhejiang Journal of Traditional Chinese Medicine, 2021, 56 (7):518.

[17] Wu Liyun. Clinical Observation of the Effect of Daizhui Vibration Technique Combined with Acupoint Massage in the Treatment of Myopia in Adolescents [D]. Fuzhou: Fujian University of Traditional Chinese Medicine, 2013.

[18] Zhang Shuxian, Sun Deren. Experience of Pediatric Tuina Massage in the Treatment of Pseudo-myopia in Adolescents [J]. Journal of Practical Traditional Chinese Medicine, 2017, 33(11):1338-1340.

[19] Wang Zhaohui, Li Yiming, Yan Yan, et al. Neck massage combined with sensory training on myopia in

college students [J]. Journal of Changchun University of Chinese Medicine, 2018, 34(2):346-348.
[20] He Bihua, Xie Xiangyong, Wei Lijiao. Observation of the Therapeutic Effect of Comprehensive Therapy in the Treatment of Mild to Moderate Myopia in Adolescents [J]. Guangxi Journal of Traditional Chinese Medicine, 2013, 36(1): 18-19.
[21] Wang Zhiqiang. Clinical Clinical Research on Juvenile Myopia Treated by Auricular Bean-Burying Therapy [J]. Henan Traditional Chinese Medicine, 2017, 37(12): 2200-2202.