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A study of the effects of Kongzhu exercise on 6-year-old children with vestibular disorders

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Abstract: *The purpose of the study is to investigate the improvement status of the intervention training of Kongzhu (A Chinese traditional sport) for children with mild and moderate vestibular disorders and normal children, and to lay a good foundation for the student's athletic ability in elementary school as well as the children's future development. This study mainly used the literature method, questionnaire survey method, experimental method and data statistics to test the sensory integration for a total of 85 students aged 6 years old in XuZhai Primary School in WeiYang District, Xi'an City, and selected three grades of mild vestibular dysfunctions, moderate vestibular dysfunctions and normal children to participate in the intervention experiment. After three months of experiment, the results of the experiment are as follows: Moderate vestibular dysfunction and mild dysfunction had a very significant improvement in vestibular function after the experiment (P<0.01), and there was a significant improvement in normal vestibular function in children after the experiment (P<0.05). It is concluded from the experiment that bamboo drill has an improving effect on vestibular disorders.*

Keywords: *Bamboo Drill, Vestibular Dysfunction, Impact Study*

1. Introduction

Preface: The theory of sensory integration which was put forward by Dr Ayresa.J's states that the role of the brain is to integrate sensory information inputs from the various organs of the body, to respond to perceptions inside and outside the body, and to coordinate the neural responses of the different parts of the body so that the individual can make smooth contact and integration with the external environment. 'Sensory integration disorder' refers to the lack of neural integration ability of the brainstem part of the brain without damage or congenital underdevelopment, and the inability to effectively establish the connection between the nerves and behaviours[1] . According to the survey report of relevant scholars, the children with sensory integration disorder in China account for 32.6%. It can be seen that the number of children with sensory integration disorder in China is large, and more and more children need sensory integration training. Although the number of sensory integration training institutions is increasing rapidly in China, educators and parents generally have low awareness, and only a small number of children with sensory integration disorders have received sensory integration training[2]. In some large and medium-sized economically developed cities, the phenomenon of children's sensory integration disorder is more serious, and shows a rising trend year by year. Therefore, to solve this problem has now become the focus of attention of researchers in child behavioural sciences, and to solve this kind of 'era' disease has become extremely urgent[3]. Researchers have identified sensory integration disorders in three main areas: tactile, vestibular, and proprioceptive disorders. This paper focuses on vestibular disorders, and related scholars have concluded that most of the uncoordinated body movements are link to vestibular disorders. In recent years, the training methods involving vestibular dysfunction are: targeted special training, sports games training, gymnastics training, martial arts training and so on[4]. However, there have not been any researchs on the intervention of training means to improve children's vestibular disorders in China, so this paper aims at the experimental research and discussion in terms of the characteristics of vestibular disorders and children's strong participation.

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2. Research Methods

2.1 Literature method

Literature about sensory integration and current training means related to children with sensory disorders was retrieved through the full-text database of China Academic Network (CNKI), and videos of the skills related to the Kongzhu were also watched. It was also systematically sorted, summarised and analysed to provide a strong theoretical basis for this thesis.

2.2 Expert Interview Method

According to the needs of the study, Xi'an University of the Elderly, WeiYang District Teachers' Training School and Xi'an Children's Hospital (Jingkai Campus) were visited to make relevant inquiries by telephone and face-to-face interviews[5]. We invited Mr Fan from Xi'an University for the Aged to teach Kongzhu skill. Mr Fan designed Kongzhu drills that can be performed by Grade 1. Then he removed difficult movements that were not age-appropriate and dangerous movements with high risks, and he also added or replaced some movements that were more appropriate for the content of the study[6]. We then showed the modified Kongzhu drills to Mr Xu and Mr Wang of the Weiyang Teachers' Training School, and modified the inappropriate parts of the drills to obtain the unanimous approval of the two teachers and researchers. Then the video of the exercise was sent to Dr Liu, who is engaged in the research of sensory integration in Xi'an Children's Hospital (Jingkai Hospital District), for the test of reliability and validity. Finally, a more scientific content of the Kongzhu drill was determined, so as to be fully prepared for the next teaching experiment.

2.3 Questionnaire method

This study used the ‘Sensory Integration Rating Scale’,which was compiled by Professor Ayres years of research and then modified in 1985 by Taiwanese scholar Cheng Hsin-hsiung according to the Chinese cultural context. This scale has been standardised in China, and has been tested in many areas of the country, resulting in a re-test reliability of 0.44-0.73, a split-half reliability of 0.68-0.77, and a homogeneous reliability of 0.44-0.63[7]. The questionnaire is filled out by the parents. And the questions in this questionnaire are those that appear in the daily life of the child,which are expressed in a simple, clear manner that is easy for the parents to understand and answer. The questions include: vestibular imbalance (14 items), tactile dysfunction (21 items), proprioceptive dysfunction (12 items), and underdeveloped learning ability (8 items) (filled in by 6 years old and above), and any standard score <=40 indicates the presence of sensory integration disorder. In general, standard scores between 30 and 40 are considered mild, 20 to 30 are moderate, and 20 or less are severe. For vestibular functioning scores: <20 is a severe vestibular dysfunction based on test results, 20-30 is a moderate vestibular dysfunction based on test results, 30-40 is a mild vestibular dysfunction based on test results, >40 is a mild vestibular dysfunction based on test results, and >40 is a severe vestibular dysfunction based on test results. >40 points according to the test result, normal vestibular function[8].

2.4 Experimental method

2.4.1 Experimental hypothesis

Intervention training in Kongzhu will have an improving effect on vestibular dysfunction.

2.4.2 Experimental purpose

To verify the positive effects of the Kongzhu intervention training on 6-year-old children with sensory integration disorders.

2.4.3 Subjects

The experimental subjects were from 6-year-old children with sensory integration disorder in the first grade of Xuzhai Primary School in Weiyang District, Xi'an. A total of 16 subjects (10 boys and 6 girls) participated in the experiment from three levels of vestibular dysregulation: moderate, mild normal and normal. The details are shown in the table1 below:

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Table 1: Basic information of the subjects (n=16)

Name	Gender	Degree	Vestibular score	Bad behavior performance
Hu **	Male	Moderate	27	Limb incoordination
Wu **	Male	Moderate	21	Not into sports
Zhang **	Male	Mild	32	Unwilling to communicate with classmates, play, do Not like to participate in sports activities
Fu **	Male	Mild	30	Unresponsive
Zhang **	Male	Moderate	25	Have anti-emotional intensity, do not like to participate in sports activities
Liu **	female	Mild	36	Don't like to participate in physical activities and have no awareness of rules
Zhang **	Male	Mild	35	Not active in sports, timid
Wang **	Male	Moderate	21	Intense emotional reactions, irritability, and dislike participating in physical activities
Li **	female	Moderate	27	Do not like to participate in sports activities, timid
Li **	female	Mild	31	Lack of physical activity and uncoordinated body
Deng **	Male	Mild	34	Don't like to participate in physical activities and have no awareness of rules
Yu **	female	Normal	45	Do not like to participate in physical activities, slight physical incoordination
Zhao **	Male	Normal	41	Intense emotional reactions, irritability, and dislike participating in physical activities
Zhou **	female	Normal	47	Not involved in physical activities, timid, uncoordinated body
Han ***	female	Normal	41	Not active in sports
Ming **	Male	Normal	44	Irritability, conflict prone to hitting, no sense of rules

2.4.4 Experimental variables

Independent variable: Training for the Kongzhu intervention

Dependent variable: Improvement of vestibular disorders

2.4.5 Test indicators

Pre-experimental test: using the Sensory Integration Rating Scale (SIRS) rating scale to screen out the subjects needed for the experiment.

Post-experimental test: using the Sensory Integration Rating Scale (SIRS) to evaluate the experimental data.

The content of the experiment: Kongzhu Exercise The content of the study is from the self-composed Kongzhu skill drill within 4 minutes and 48 seconds of Xuzhai Primary School in Weiyang District. It is Mainly for vestibular disorders training, and the principle of its creation is to use the left and right hand , upper and lower limbs coordination to complete the airborne bamboo skills.The main movements include: big crane, single-handed hand bell, jumping and shaking, geese flying south, throwing high, red lights hanging high, swinging, jumping and shaking and so on[9].

The training time: the total length of 3 months, 5 times a week, 40mins per training.

2.5 Data statistical method

The valid data were collated, and the scores of the children's sensory integration scale were totalled and converted into standard scores for evaluation. With the software SPSS25.0 statistics,statistics were

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collected and analyzed. The statistical analysis was mainly used within the group paired samples T-test on the data before and after the experiment, and observed whether there is a significant difference between before and after the experiment of the subjects.

3. Results and analyses

3.1 Comparison of vestibular dysfunction results before and after the experiment

3.1.1 Paired samples t-test was conducted before and after the experiment for three levels of vestibular dysfunction: mild, moderate and normal.

Table 2: Comparison of vestibular dysfunction scores before and after the experiment (n=16)

Groups	Before the experiment	After the experiment	P
Moderate dysregulation	20.17±2.65	77.00±8.32	0.007 * *
Mild dysregulation	33.00±1.33	81.23±6.34	0.007 * *
Normal	43.60±1.00	85.35±7.42	0.013 *

Note: *P<0.05 has a significant difference, **P<0.01 has a very significant difference.

The results are shown in Table 2:

The scores of children with moderate vestibular disorders were subjected to paired samples t-tests before and after the experiment, and the p-value of the scores of children with moderate vestibular disorders was P=0.007, and P<0.01 means that there was a highly significant difference between the scores of children with moderate vestibular disorders before and after the experiment.

The scores of children with mild vestibular dysfunction were subjected to paired samples t-test before and after the experiment, and the p-value of the scores of children with mild vestibular dysfunction was p=0.007, and p<0.01 means that there was a highly significant difference between the scores of children with mild vestibular dysfunction before and after the experiment.

The scores of children with normal vestibular function were subjected to paired samples t-test before and after the experiment, and the p-value of the scores of children with normal tactile sensation was p=0.013, and p<0.05 means that there was a significant difference between the scores of children with normal vestibular function before and after the experiment.

According to the analysis of the statistical results, it is concluded that there are more children with vestibular disorders and the rate of disorders is higher, which may be mainly caused by the students' disinterest in participating in physical exercise and the parents' lack of attention to physical exercise[10]. The intervention training of 'Kongzhu Exercise' showed highly significant improvement (P<0.01) in children with moderate and mild vestibular disorders, and children with normal vestibular function showed significant improvement (P<0.05) after the experiment.

Behaviour and neural connections are closely linked[11]. Completion of any coordinated movement is a process of sensory integration of all systems of the organism[12] If the organism can not receive stimuli or can not do a coordinated integrated action response in the process of sensory integration, then the phenomenon of sensory integration disorder will appear[13]. Researchers have concluded that uncoordinated movements are mostly related to vestibular disorders. The three pairs of semicircular canals and otolithic apparatus in the inner ear constitute the main structure of vestibular receptors[14]. When the body undergoes rapid acceleration or deceleration, upward or downward, counterclockwise rotation or clockwise rotation, the changes in speed and direction will cause the receptor cells in the semicircular canals to move and sense the body's movements, therefore producing sensory signals. These signals cause corresponding neural activity, and the resulting neural signals are transmitted along the vestibular branch of the eighth cerebral nerve to the cerebral nociceptors, causing the perception of the signals [15]. The creation of the 'Kongzhu Drill' is aimed at the physiological mechanism of vestibular function, mainly to exercise the children's left and right hands and hand-foot coordination; the 'Kongzhu Drill' has a total of 8 sections, all of which are needed to be left and right hands plus feet coordination to complete. Repeated exercises are designed to improve children's coordination and vestibular disorders.

3.2 Case analysis

Subject Wang**, born by caesarean section in June 2018, male, has been living with his parents. According to the Children's Sensory Integration Ability Development Rating Scale, he was assessed as

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having a moderate vestibular disorder. Before the experiment, he showed the following behaviours: he could turn round without getting dizzy, and his limbs were severely uncoordinated during movements. In his daily behaviour, he was irritable and had no sense of rules.He often got into fights with his classmates, and had poor concentration on his studies. After communicating with the head teacher, Ms Hao, we learnt that Wang's parents spoiled their child and allowed her not to participate in sports for fear of injury. Wang's mother was over-protective of her child, so he had no sense of right and wrong. After a series of communication, Wang's parents agreed to allow her child to participate in the 'Kongzhu Drill' intervention training, and took the initiative to set rules for her child to help him change his bad behaviour. At the beginning of the experiment, Wang did not have a sense of rules in class and laughed and played around in class. When I criticised and communicated with him after class, he realised his problem and promised the teacher that he would follow the rules in class. After a period of training, Wang's problems such as not getting dizzy when spinning and serious limb incoordination during movement were improved. After the experiment, Wang reached the normal level of vestibular function, falling over hinself and doing movements also gradually improved from the original incoordination.

Subject Li**, born by caesarean section in October 2017, a girl, was assessed as having a mild vestibular disorder according to the Children's Sensory Integration Ability Development Rating Scale. Before the experiment, she was obese and her limbs were uncoordinated during exercise. By communicating with her parents, we learnt that her mother placed too much emphasis on her intellectual development, and ask her to attend various intellectual development training courses after class. Therefore she hardly do any physical exercise. Due to her lack of physical exercise,I took the initiative to let her participate in the 'Kongzhu Drill' training. When she first participated in the training of 'Kongzhu Drill', Li showed poor coordination and couldn't keep up with the rhythm. Seeing this situation, I took the initiative to help her practice moves in class,and encouraged her to practice many times. After a period of training, Li's motor ability have been greatly improved. Her coordination has become better, and her vestibular function score has reached normal level.

Subject Han**, born by caesarean section in September 2017, has been living with her parents. She was assessed as a child with normal vestibular function according to the Children's Sensory Integration Ability Development Rating Scale. Before the experiment, she showed low motor ability. I talked to her head teacher, Mr Zheng, and learnt that Han was quiet and did not like to participate in sports activities. With my encouragement, she participated in the 'Kongzhu Drill' training, which not only made her more lively, but also improved her motor ability. After the experiment, Han's vestibular function score improved from the original one.

4. Conclusion and Recommendations

4.1 Conclusion

Kongzhu Drill intervention training showed significant improvement in all three levels of the children of moderate vestibular dysfunction, mild vestibular dysfunction, and normal function. Also some children's undesirable behaviours and emotions were also improved, resulting in the development of children's motor skills and coordination. This proves that Kongzhu exercise has great plasticity on children's vestibular function, and traditional Kongzhu skills training can be added to children's sports.

4.2 Recommendations

1) The number of subjects in this study is small, so the results will be more rigorous and scientific if supported by big data.

2) This study uses questionnaires before and after measurements, and there will be a little subjectivity in filling out the questionnaires. We hope that future researches can be combined with the emerging EEG technology to verify the experimental results in a more scientific and rigorous way.

3) It is hoped that the traditional sports programme of Kongzhu can enter the campus and the classroom, so that more children are willing to participate in sports activities and promote traditional culture.

4) In order to ensure the effectiveness of sensory integration training, it is recommended that a combination of school education and family education be adopted. Schools should hold publicity activities to make parents understand the concept of sensory integration and its training methods. Meanwhile, parents should encourage their children to participate in more sports activities and actively

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participate in their children's sensory integration training. This will enable children's sensory integration training to be closely combined inside and outside the school.

References

[1] (Czech) Comenius. Theory of Great Teaching [M]. Beijing: People's Education Press, 1984.156, 157.
[2] Guiying Ren. Sensory integration and sensory integration disorders in children[J]. Chinese Journal of Mental Health, 1994, 04:186-188.
[3] Shengbiao Zhang. Sensory integration disorders in children and motor therapy[J]. Journal of Anshan Normal College, 2005.
[4] Guangfeng Wang, Yongxiang Chen, Lamei Li. Research on the intervention effect of basic gymnastics on rural young children's sensory integration ability disorder [J]. Sichuan sports science and technology, 2017, 6.
[5] Yueqin Huang, Xudong Li, Yufeng Wang. A follow-up study of sensory integration disorder in children [J]. Chinese Journal of Paediatrics, 2002, 40(5):260-262.
[6] Yunhua Zhang. Introduction and Choreography of Aerobics Pace[J]. Teaching Materials and Methods 2003, 2.
[7] Guiying Ren. Report on the test of children's sensory integration scale[J]. China Mental Health, 1994.8(4): 145-147.
[8] Xiaoli Liu.Current situation of children's sensory integration disorder and its intervention experimental research [D]. Shanxi Medical University, 2004.5.
[9] Haijun Lu. On the originality of works[J]. Legal and Social Development, 2010, 16(02):78-91.
[10] Ren Guiying, Yufeng Wang, Bomei Gu, et al. A survey report on children's behavioural problems and sensory integration disorders in urban Beijing[J]. Chinese Journal of Mental Health, 1997(11):34-36.
[11] Ayres AJ. Learning disabilities and the vestibularsystem [J]. Disabilities, 1978(11):30-41.
[12] Menghua Wang, Lihua Yang, Pengfei Wen. Current status of research on sensory integration disorder and sensory integration training [J]. Journal of Zhaoqing College, 2017, 38(02).
[13] Binbin Mao. Investigation and training of sensory integration ability of 4-6 years old children[D]. Shanxi Normal University, 2009.
[14] Xiujing Cao, Yinguang Lin, Wang Ping, et al. Analysis of the occurrence of behavioural problems in school-age children with sensory integration disorders[J]. China School Health, 2004, 25(4):407-408.
[15] AyresA.J. Sensory integration and learning disorder [M]. LosAngeles: Western Psychological Services, 1972:204-218.