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Rehabilitation training and Bio-ceramics for waist injury in sportsperson

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Many biomaterials especially bio-ceramics are currently being used to treat sports injuries. It is also important to research the biocompatibility of composite biomaterials, which combine the benefits of a variety of materials, in order to assure that there will be no new injury to the human body after implantation. Here in this work, we provide the current situation, main factors, results of rehabilitation and the future perspective of employing bio-ceramics for sports injuries. A sample of 23 sportspersons were selected to analyze the severity, category of waist injury, as well as methods and effects of rehabilitation physical training provided. The athletes were given targeted rehabilitation physical training, based on JOA Low back pain Rating Scale, and movement screening in addition other testing methods were used to test the physical characteristics and competitive ability of the athletes, combined with the training results of the athletes, the level of physical movement function and injury rehabilitation of the athletes before and after rehabilitation physical training were evaluated and guided. Bio-ceramics together with rehabilitation physical training can improve the effects of waist injury and the recovery of physical function of male weightlifters.

Keywords: Bio-ceramics, Rehabilitation, Composite.

Introduction

With the development of sports, the demands of sports on athletes are increasing. In high-intensity and competitive competitions and training, the incidence of athlete injuries is very high [1]. Sports injury greatly affects the improvement and play of athletes' competitive level. The training cycle of elite athletes is long, and an injury will bring great loss to their sports life and future, so the prevention and rehabilitation of sports injuries is particularly important [2]. The waist injury is a serious disabling injury, and the recovery or improvement of walking function is one of the main purposes of the rehabilitation of the waist injury. Many domestic and foreign scholars have studied the rehabilitation treatment of waist injury, however, patients with complete waist injury have more obvious functional dysfunction due to the severe degree of waist injury, and have a higher chance of various complications in the long term [3]. How to maximize the development of residual function of patients with complete waist injury and improve their walking ability are of great significance for the prevention of complications, improvement of quality of life and life expectancy [4]. In addition to rehabilitation training solid biomaterials which include bio-ceramics and biopolymers play significant roles in both regeneration and renewal of human tissues in injury area.

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Taking male competitive weightlifters as an example, the rehabilitation training of sports trainers with waist injury assessed by isokinetic test system was studied. Competitive weightlifting is a very competitive and dangerous sport, which requires a high level of exercise and competition, so the athletes have a high chance of injury in training and competition. The negative effects brought by sports injuries are obvious. The waist strength is used very frequently in weightlifting [5]. The waist is one of the most basic sources of strength in weightlifting, it is the first force used when the barbell is lifted off the ground in both attempts, the athlete must tighten the waist when preparing for the position, which is often called waist tightening. Rather than just replacing missing tissue, today's bioceramic materials in tissue repair concentration is on materials that assist, even guide and promote the body's natural healing process. This technique is seen in the treatment of sports injuries. In reality, in addition to age-related disease, tissue degradation, and loss of function, trauma therapy is a major concern for orthopaedics [6]. In each training mode, patients performed myoelectrical experiments to verify the muscle strength performance of the driving motor. In addition, motion capture analysis using inertial measurement units can achieve gait symmetry between the injured limb and the uncollected limb as demonstrated by motion capture analysis [7-14]. Here in this work, we provide the current situation, main factors, results of rehabilitation and the future perspective of employing bio-ceramics for sports injuries.

Results and Analysis

Sample selection and degree of injury

Probability of waist injury

A total of 23 weightlifting persons from 8 levels in a provincial men's weightlifting team were taken as the research objects, among which 17 of them had waist injuries of different degrees. From the sample of 23 men 17 athletes have different degrees of waist injury, accounting for about 73.91% of the total number of athletes. Among the 17 athletes suffering from waist injury, their average training years are 9.5 years, in them, 3 are national athletes, 7 are national first class athletes and 7 are national second class athletes. According to the data analysis, the incidence of waist injury of weightlifters is directly proportional to the professional training years and competitive level of the athletes, the longer the professional training time and the higher the competitive level of the athletes, the higher the incidence of waist injury.

Nature of lumbar injury

According to the time of injury occurrence, the types of waist injury of weightlifters can be divided into acute waist injury, subacute waist injury and chronic waist injury [15]. Acute waist injury is usually caused by direct or indirect violence during training, among 17 athletes with waist injury, there were 6 cases of acute waist injury, with an incidence of 35.3%; Subacute waist injury is due to the acute waist injury has not been fully recovered and changed to chronic waist injury, there are 2 cases from acute waist injury changed to chronic waist injury, the incidence of 11.8%. The occurrence of chronic waist injury is caused by the accumulation of minor injuries and long-term excessive load in the local lumbar vertebra of athletes. The incidence of chronic waist injury is 52.9%. Due to the long training years and rich training experience of most of the athletes surveyed, the probability of acute waist injury is low, while the probability of chronic waist injury is high [16-17].

Location of lumbar injury

Through the men's weightlifting team 17 athletes suffering from waist injury survey statistics; Athlete waist injury mainly concentrated in lumbar vertebra, waist muscles and ligaments and other parts. Lumbar injury accounted for the largest proportion, 47%, the main types of injury were lumbar disc herniation or prolapse, lumbar spondylolisthesis, facet joint disorder, etc. It was followed by iliac spinous muscle injury (29.4%), mainly including psoas muscle strain and muscle strain. Ligament injuries accounted for 23.6%. See Table 1.

Table 1. Lumbar injury sites (N=17)

Site of injury	The number of injuries	Damage rate
Lumbar spine injury	8	47%
Lumbar muscle injury	5	29.4%
Ligament injury	4	23.6%

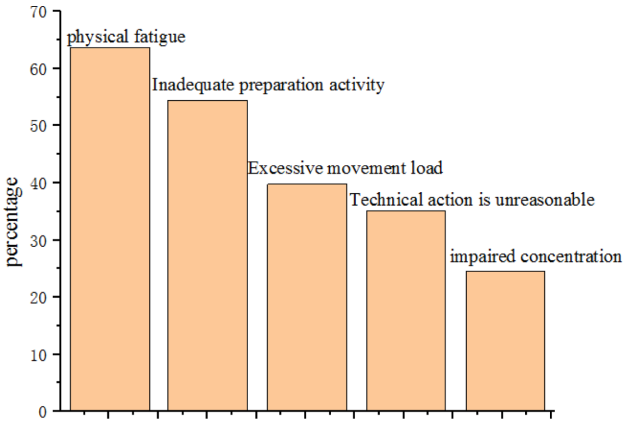

Fig. 1. Main causes of waist injury of weightlifters in a province.

Main factors of waist injury in weightlifters training

According to the description in Fig. 1, through the investigation and analysis of 23 athletes in the men's weightlifting team, it can be seen that the factors causing athletes' waist injuries mainly include the following aspects: Physical fatigue is the main cause of waist injury in weightlifters. When athletes' physical ability and physical function decline, they cannot adhere to the normal training according to the training plan, but still adhere to the training task of high intensity and heavy load, which is easy to cause sports injuries. Inadequate preparation activities are also an important cause of waist injury of weightlifters [18, 19]. Athletes' physical ability, competitive ability and other physical functions need to go through a process of gradual mobilization, running-in and adaptation from the static state to the most active state. Therefore, in the high intensity, large load training, must do a good job to prepare activities based warm-up process. The exercise load is unreasonable. Excessive training load, the athlete's body cannot recover well after training, and the next day must complete the planned amount of training, it will not only cause the athletes' sports function is reduced, but also the athletes' body is always in a state of fatigue, which is easy to occur chronic fatigue sports injury without adequate adjustment and recovery. Especially the intense training, easy to lead to acute sports injury. Wrong technical action. Inattention is the most common cause of injury in weight lifters during training.

Composition of rehabilitation physical training program

According to the basic objectives and training tasks of rehabilitation physical training, the whole rehabilitation physical training plan for weightlifters with waist

injury can be divided into three parts: stability training of lumbar joints, strength training of waist muscles and core explosive strength training. The following is to take the rehabilitation physical training plan of the athlete with waist injury as an example to analyze:

(1) Mr. He, male, an athlete of weight lifting, trained for 16 years. After a weightlifting championship, he had pains and convulsions in his waist, and at the same time, he could obviously feel radiating pain in his iliac tail and buttocks [20]. Detailed results of imaging examination showed that: Anteroposterior and lateral display of lumbar C-D image: The discs were extruded 0.2 cm, 0.3 cm, and 0.3 cm, respectively, and the dural sac was pressed posteriorly, no significant narrowing of the corresponding spinal canal was observed. Bilateral recess of the lumbar 3/4 and 4/5 was pressed. Right straight leg raise test (+), left straight leg raise test (-), double "4" test (-), JOA (Japan Orthopaedic Association) low back pain Rating Scale score 8 points, FMS score 9 points.

Diagnosis and treatment: the treatment of prolapse of lumbar intervertebral disc is mainly to improve the blood circulation and nutrition level of the lumbar joint through the athletes' own hard training with the help of rehabilitation therapists, strengthen the power imbalance of the functional muscles of the waist and abdomen, so that the physiological structure of the lumbar spine can be repaired to a certain extent, finally, a new balanced and stable state of neuromuscle is formed to achieve normal physiological functions of the lumbar joint [21]. Therefore, the rehabilitation training is mainly divided into three stages in the process of injury recovery.

Analysis and comparison of test results before and after rehabilitation physical training

Men's weightlifting team athletes have carried out a comprehensive test before the winter training, including the object of this paper. After four months of intense winter training. The second test was conducted for 17 key members of the men's weightlifting team. The two tests before and after the winter training included FMS (Functional Movement Screen), SFMS and so on. After the complete and systematic training in the winter training stage, the physical function and competitive ability of athletes have changed significantly compared with before. Next, the data related to waist injuries were analyzed (see Table 2).

Table 2 shows the distribution of scores in FMS and it can be seen that 0 points are mainly distributed in squat, front and back leg squat, active straight leg knee lift and rotation stability. Athletes complain of pain mainly in the waist and knee. Similarly, athletes generally lack of pillar strength and core stability, which may be related to the athlete's back injury.

Table 3 shows the number of athletes scoring in each FMS event after the end of winter training, by comparing Table 2 with Table 3, it can be seen that the number of athletes scoring 0 is significantly reduced, indicating that the physical function of athletes has been well improved. The difference between the mean values of FMS before and after the winter training was statistically significant (as shown in Table 3), and the total score of FMS test after the winter training was higher than that before the winter training. The results indicated that the rehabilitation physical training had a significant impact on the FMS test results, and the athletes improved their performance ability, physical function and competitive ability through rehabilitation physical training.

As can be seen from Table 4, there is a significant difference in the average growth rate of FMS score of athletes with waist injuries before and after rehabilitation training (see Table 5).

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Table 2. Statistical table of scores in each FMS test before winter training (L: left, R: right)

Score (points)	Squat	Push-ups	Hurdles frame step		Squat in front & back		Shoulder flexibility		Take the initiative to lift the leg with straight knee		Rotational stability	
			L	R	L	R	L	R	L	R	L	R
0	9	3	4	2	11	9	5	3	13	11	9	12
1	3	11	9	8	6	7	3	1	2	3	6	5
2	7	7	8	11	5	5	10	12	3	2	3	3
3	3	2	2	2	1	2	5	7	5	7	5	3

Table 3. Statistical table of scores in each FMS test after winter training (L: left, R: right)

Score	The squat	Push-ups	Hurdles frame step		Squat in front and back		Shoulder flexibility		Take the initiative to lift the leg with straight knee		Rotational stability	
			L	R	L	R	L	R	L	R	L	R
0 points	3	2	3	2	5	6	4	2	11	8	5	9
1 points	9	9	10	9	8	9	6	3	5	5	7	7
2 points	8	10	9	9	8	7	8	13	2	3	6	4
3 points	3	2	2	3	2	2	5	5	5	7	5	3

Table 4. Differences of FMS total scores before and after winter training

	Before the winter training	After the winter training	The differences
Average FMS total score	9.45±2.89	12.62±2.54	0.002**

Note: * means p<0. 05, which means significant difference; ** means p<0. 01, which means extremely significant difference

Table 5. Comparison of FMS total achievement growth rate of lumbar injury athletes before and after rehabilitation training

	Average growth rate of FMS score before rehabilitation training (%)	Average growth rate of FMS after rehabilitation training (%)	The differences
The percentage	31.29±21.39	64.25±38.12	0.042*

Note: * means p<0. 05, which means significant difference; ** means p<0. 01, which means extremely significant difference

heal on their own due to extreme conditions or because their size exceed those of wounds that can be repaired by the natural healing capacity of the bone; previously, critical-size defects could only be treated via comprehensive bone-grafting procedures [22]. Therefore, it is critical to remember the process of bone production, mending, and remodelling when tackling the problem of creating bioceramics for bone regeneration [23]. To address these problems, Biomedical composite materials are biomedical materials that are made up of two or more different types of materials. They are mostly utilized in the repair and replacement of human tissues and organs, as well as the enhancement of their functioning and the creation of artificial organs [24].

Conclusions

To sum up, the total score of FMS of athletes has been significantly improved after rehabilitation physical training, with the growth rate from 31.29 to 21.39 before rehabilitation training to 64.25 to 38.12 after rehabilitation, by comparing the average growth rate of FMS score before and after rehabilitation training, there is a significant difference in the growth rate of the total score of waist injury and body function recovery, rehabilitation physical training can improve the effects of waist injury and the recovery of physical function of male weightlifters The incidence of waist injury of weightlifters is directly proportional to competitive level, training years and training intensity. The waist injury of weightlifters is mainly chronic injury. High intensity and heavy load training is the main cause of waist injury in weightlifters.

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