

AQUATIC EXERCISES IN THE KNEE INJURY REHABILITATION OF ATHLETES

EXERCÍCIOS AQUÁTICOS NA REABILITAÇÃO DAS LESÕES NOS JOELHOS DE ATLETAS

EJERCICIOS ACUÁTICOS EN LA REHABILITACIÓN DE LESIONES DE RODILLA EN DEPORTISTAS



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ABSTRACT

Introduction: Volleyball requires jumping and strenuous movements and certain sports injuries inevitably occur during the sport. The surface of the knee joint is considerably large and shallow, making the lever effect strong and negative, easily targeted for injury in the unstable movements caused by this sport. **Objective:** Investigate the main causes of knee joint injuries in volleyball players and evaluate the effect of treatment with intervention through aquatic therapy. **Methods:** Eight volleyball players from a university with different degrees of knee joint injury were randomly divided into an experimental group and a control group. The experimental group used intervention training with aquatic exercise therapy, while the control group did not include additional rehabilitation measures. The knee condition of the subjects before and after the experiment was analyzed and compared. **Results:** The knee joint injury in the subjects in the experimental group was significantly improved, and the recovery from the knee joint injury of the subjects in the experimental group was better than that of the subjects in the control group. **Conclusion:** Water sports therapy can significantly improve the knee joint injury of volleyball players, leading to the belief that water sports therapy can effectively improve the agility, strength, and endurance of muscles adjacent to knee joints in patients, reducing their pain, and increasing the range of motion of these joints. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Aquatic Therapy; Volleyball; Exercise Therapy; Knee Injuries.

RESUMO

Introdução: O voleibol exige saltos e movimentos extenuantes sendo inevitável que certas lesões esportivas ocorram no decurso do esporte. A superfície da articulação do joelho é consideravelmente grande e pouco profunda, tornando o efeito de alavanca forte e negativo, facilmente alvo de lesões nos movimentos instáveis ocasionados por esse esporte. **Objetivo:** Investigar as principais causas das lesões da articulação do joelho nos jogadores de voleibol e avaliar o efeito do tratamento com intervenção através de terapia aquática. **Métodos:** Oito jogadores de voleibol de uma universidade, com diferentes graus de lesão articular do joelho, foram divididos aleatoriamente em um grupo experimental e um grupo controle. O grupo experimental utilizou treino de intervenção com terapia de exercício aquático, enquanto o grupo de controle não contemplou medidas de reabilitação adicionais. A condição do joelho dos indivíduos antes e depois da experiência foi analisada e comparada. **Resultados:** A lesão articular do joelho nos sujeitos do grupo experimental foi significativamente melhorada, e a recuperação da lesão articular do joelho dos sujeitos do grupo experimental foi melhor do que a dos sujeitos do grupo de controle. **Conclusão:** A terapia com esportes aquáticos pode melhorar significativamente a lesão da articulação do joelho dos jogadores de voleibol, levando a acreditar que a terapia com esportes aquáticos pode efetivamente melhorar a agilidade, força e resistência dos músculos adjacentes às articulações do joelho nos pacientes, reduzindo a sua dor, e aumentando a amplitude de movimento dessas articulações. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Fisioterapia Aquática; Voleibol; Terapia por Exercício; Traumatismos do Joelho.

RESUMEN

Introducción: El voleibol requiere saltos y movimientos extenuantes y es inevitable que se produzcan ciertas lesiones deportivas en el transcurso del deporte. La superficie de la articulación de la rodilla es considerablemente grande y poco profunda, lo que hace que el efecto de palanca sea fuerte y negativo, siendo fácilmente objeto de lesiones en los movimientos inestables que provoca este deporte. **Objetivo:** Investigar las principales causas de las lesiones de la articulación de la rodilla en jugadores de voleibol y evaluar el efecto del tratamiento con intervención mediante terapia acuática. **Métodos:** Ocho jugadores de voleibol de una universidad, con diferentes grados de lesión en la articulación de la rodilla, fueron divididos aleatoriamente en un grupo experimental y un grupo de control. El grupo experimental utilizó un entrenamiento de intervención con terapia de ejercicios acuáticos, mientras que el grupo de control no contempló medidas adicionales de rehabilitación. Se analizó y comparó el estado de las rodillas de los sujetos antes y después del experimento. **Resultados:** La lesión de la articulación de la rodilla en los sujetos del grupo experimental mejoró significativamente, y la recuperación de la lesión de la articulación de la rodilla de los sujetos del grupo experimental fue mejor que la de los sujetos del grupo de control. **Conclusión:** La terapia de deportes acuáticos puede mejorar significativamente la lesión de la articulación de la rodilla de los jugadores de voleibol, lo que lleva



a pensar que la terapia de deportes acuáticos puede mejorar eficazmente la agilidad, la fuerza y la resistencia de los músculos adyacentes a las articulaciones de la rodilla de los pacientes, reduciendo su dolor y aumentando la amplitud de movimiento de estas articulaciones. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptores: Terapia Acuática; Voleibol; Terapia por Ejercicio; Traumatismos de la Rodilla.

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INTRODUCTION

Volleyball is an extremely time limited sport. Athletes' instantaneous body position adjustment and frequent explosive take-off can easily lead to knee joint injury.¹ Especially in the spiking stage, the knee joint bears a great load from the quick start of the knee bending in the preparation posture, the quick braking before the run-up take-off, and even the support after the take-off and landing. Fracture around the knee joint is a common injury in clinical orthopaedics at present. The swelling and pain of the knee joint caused by injury and surgery make it unable to bear weight. In addition, factors such as long-term braking make the knee joint's mobility decline, activity is limited, and even the proprioception function declines.² In volleyball, the knee joints of athletes are often in the semi squat position during training and competition. In addition, there are many activities of all parties, which make them suddenly turn, move, take-off and other activities under the condition of unstable joints, and it is easy to damage various joint structures.³ There are many rehabilitation treatment methods commonly used in clinic. Acupuncture, massage and joint loosening techniques can relieve the pain of knee joint, improve the mobility of knee joint and improve the function of knee joint, but the above treatment methods belong to passive treatment.⁴ Due to severe wound pain, most of the patients can not take active functional exercise, which is very unfavorable to the postoperative recovery of the patients. In order to mobilize the enthusiasm of patients and alleviate the psychological anxiety of patients, passive treatment was transformed into active treatment.⁵ At present, exercise therapy is widely used in the exercise rehabilitation of bone injuries. In order to carry weight in the early stage of patients with lower limb fractures, we have standardized and summarized the "lower limb water exercise therapy" in clinical practice and applied it to clinical rehabilitation.⁶

METHODS AND RESULTS

Research method

Eight volleyball players with different degrees of knee joint sports injury in a university were selected as the research objects and randomly divided into the experimental group and the control group.⁷ The experimental group used water exercise therapy for intervention training, and the control group did not take other additional recovery measures. The knee conditions of the subjects before and after the experiment were analyzed and compared.⁸ The patients in the two groups were treated with routine comprehensive rehabilitation therapy.

According to the observation of fluoroscopic shooting results, under the condition that the rehabilitation training can be carried out, the patients in the control group are allowed to assist in standing or carry out rehabilitation exercise training such as auxiliary indoor walking.⁹

The experimental group was trained with water exercise therapy. The contraindications of hydrotherapy such as infectious disease, fever and inflammatory infection have been excluded through questionnaire survey and physical examination.¹⁰ The length of the sports pool is 6m × 8m, water depth of 0.8-1.2m, handrails in and around the pool, anti-skid pads on the floor of the pool, seat lifting devices, sky rails and wheelchair ramps installed at the pool side, and circulating heating, filtration

and disinfection devices.¹¹ Specific scheme of water sports: Guide the patient to walk in the water, so that the patient can maintain the correct posture, straighten the chest and retract the abdomen. It is necessary to pay attention that the range during the exercise should not be too large, and the speed should be maintained at about 60m per minute. At the beginning of movement, the patient can use the parallel bars, handrails, etc. to help him or her walk. After he or she is familiar with it, he or she can walk without any tools.¹² Allow the patient to stand on one leg in the water, which can help the patient train balance. Ensure that the patient carries out the knee joint extension position adjustment in the water, so that the patient can carry out hip joint abduction, keep the abduction 90 ° in the air, and can naturally keep it down for 5 seconds, so that the patient's two legs can be exchanged, and repeat the training several times.¹³

The study is Purely observational studies which no need to registry ID of ICMJE, and all the participants were reviewed and approved by Ethics Committee of Xinxiang Medical University, China (NO. 2021045)

Research results

All patients successfully completed the treatment, and the scores of visual pain analog scale, hospital for Special Surgery knee score (HSS) and Barthel index were significantly improved compared with those before treatment ($P < 0.05$). There was no significant difference between the experimental group and the control group when the absolute error angles of knee joint active reduction were 30 °, 45 ° and 60 °; At the 12th week after operation, compared with the 6th week after operation, the knee joint of the experimental group and the control group gradually recovered, and the reduction angle was significantly decreased ($P < 0.05$). There was no significant difference in the scores of the two groups before and after treatment ($P > 0.05$), but there were significant changes in the water exercise therapy group before and after treatment ($P < 0.01$), especially in the walking ability, up and down stairs and the overall score ($P < 0.01$), and there was a significant difference in the swelling score ($P < 0.05$). After the treatment, the experimental group was significantly better than the control group. The reduction angle of the knee joint in the experimental group was smaller than that in the control group ($P < 0.05$). The difference was statistically significant. The comparison of HSS scores between the two groups at the 6th and 12th week after operation is shown in Table 1.

DISCUSSION

From the perspective of anatomy, the knee joint is in a special position in the human joints, and it is also the most complex joint in the human body. It is composed of the articular surface of the lower end of the femur, the articular surface of the upper end of the tibia

Table 1. Comparison of HSS scores between the two groups at the 6th and 12th week after operation.

Group	n	The 6th week after operation	The 12th week after operation
Control group	4	51.49±6.7	70.22±8.54
Test group	4	56.93±7.2	81.49±9.3

and the articular surface of the patella. Because the articular surface of the medial and lateral condyles of the tibia is planar and does not correspond to the curvature of the articular surface of the femoral condyle, there is a meniscus to make the shape match.¹⁴ However, the direct contact area between tibia and femur is very small, which leads to instability of knee joint. After the fracture around the knee joint, it is easy to cause adhesion within and around the joint due to intra-articular or extra-articular injuries.¹⁵ However, long-term bracing will cause poor venous blood and lymphatic return of limbs, serous fibrous exudates and fibrin deposits in tissue gaps, and fibrous adhesions in and around joints. Taking rehabilitation training is a good way to restore the function of knee joint and increase the range of motion of knee joint. Water sports training is a kind of exercise therapy. It is a therapy that uses the characteristics of water to make patients exercise in water to relieve pain or improve function. Water has the characteristics of buoyancy, pressure conduction, heat capacity and resistance. We mainly use the buoyancy of water to carry out early weight reduction training for patients, so that patients can stand early, reduce the time of patients in bed and wheelchair, help patients with motor dysfunction to walk actively in water and complete active joint mobility training that cannot be completed on land. Water sports training is a special rehabilitation treatment method. It is a treatment and training method that uses the characteristics of water to relieve the pain of patients or improve the function of joints. It avoids the problem that the patient's functional exercise is slackened and interfered due to pain, and finally the knee joint function is blocked. The comparison of the active range of motion of the knee joint between the control group and the experimental group before and after treatment is shown in Table 2.

Water exercise therapy has a long history. At present, it has become a popular rehabilitation therapy in many countries. The benefits of water sports are reflected in physical, psychological, internal, external, long-term, short-term and other aspects. The water environment is changing, and it is this unique feature that makes the water sports program diversified. The fluid resistance of water can be used to provide resistance for patients to stand and walk in water, and can be used for anti group training of patients to improve their active exercise ability; During water sports training, the warm and heat conduction effects of water can be used to relieve the pain of knee joint and soften the spasm and contracture of the tissues around the knee; Reduce muscle fatigue after water sports. The specific benefits of hydrotherapy are: the water

Table 2. Comparison of active range of motion of knee joint between control group and experimental group before and after treatment.

Active range of motion of the knee joint	Control group		Test group	
	Before treatment	After treatment	Before treatment	After treatment
Buckling	60.31±5.39	74.28±9.02	53.25±6.25	83.61±12.32
Stretch	-3.87±7.16	-5.73±2.96	-2.91±4.34	-1.53±1.86

can be massaged, the body can relax, and the buoyancy of the mental water can reduce the burden and pressure on joints and connective tissues. Aging and disease can cause tissue relaxation and increased joint mobility, thereby increasing the risk of injury, especially in the hip, ankle and knee joints. This situation can be alleviated by the fact that the water movement has no impact force. This study mainly analyzes the effect of water sports therapy on knee osteoarthritis. Through the treatment of patients with water sports therapy, it can effectively help patients improve the local blood circulation of patients' joints, help patients increase nutrition, promote metabolism, and quickly absorb the local inflammation, edema and effusion of patients.

CONCLUSIONS

This paper designed an experiment to compare the effects of water exercise therapy and physical therapy on knee osteoarthritis. Water sports training therapy has a very good effect on the rehabilitation training of patients with fracture around the knee joint, which can effectively reduce or even temporarily eliminate the pain of the knee joint and optimize the joint function. The treatment results of this group of patients showed that the patients with fracture around the knee joint were rehabilitated with water exercise therapy. Water exercise therapy makes patients more actively participate in rehabilitation training and accelerate joint recovery. It is worth and recommended to be widely used. It is also beneficial to relieve knee pain, improve knee joint motor function and patients' daily living ability, help patients relieve inflammation at the tip of knee joint, promote the relief of muscle spasm, help patients relieve pain and reduce the burden of related joints and connective tissues. To sum up, we should vigorously promote water sports therapy in real life to help patients relieve pain and improve the knee function of patients.

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