

# The Rehabilitation Effect of Water Exercise for Chronic Low Back Pain

Yuhong Wen, Xurui Liu and Yiming Zhang  
*Swimming Section, Beijing Sports University, Beijing, China*

**Keywords:** Chronic Low Back Pain, Water Exercise, Rehabilitation.

**Abstract:** The main purpose of this paper is to analyze the rehabilitation effect of the water exercise for chronic low back pain. 10 subjects aged from 20 to 60 are recruited to do water exercise 60 minutes for 3 times a week through 8 weeks period. 2 tests are executed in the 1st and 8th week. VAS、ODI are filled out by participants. Motion test are tested by protractor. It is found that by 8 weeks of water exercise training, waist pain can be relieved dramatically. Water fitness movement such as squat jump, suspending crouching can effectively extend the muscle and eliminate muscle tension. Waist dysfunction can be relieved effectively. Exercise such as kicking forward, kicking laterally can improve the balance and coordination ability. Waist joint mobility and muscle strength can be increased. Exercises such as hip abduction, hip extension and step walk can enlarge the range of lumbar joints activity. On the other hand the resistance of water can enhance the waist and back muscle strength furtherly, ease back muscle spasm, correct muscle imbalances, so as to increase lumbar motion rehabilitation purposes.

## 1 INTRODUCTION

The Chronic low back pain (CLBP) is a common chronic orthopaedic disease which occurred in about 80% world's population disease thus become a common public health problem. It's difficult to enhance the muscle strength training on land for patients with chronic low back pain for fear of increase of pain degree. However, water exercise can avoid the negative effect because it can take full advantage of the natural characteristics of water. In order to understand the water exercise effect on prevention and control of chronic low back pain, experimental analysis of the water exercise is executed.

## 2 SUBJECTS AND METHODS

### 2.1 Subjects

10 subjects with chronic low back pain aging from 20 to 60 are recruited. Clinical exercise testing, medical examination, special experiment and questionnaire survey are used to specify the subjects from symptoms of serious health problems, the

specificity of the waist (spine spondylolysis, diseases such as scoliosis, birth defects, or specific low back pain remission patients), pregnant women, serious cardiovascular, respiratory, digestive, blood, urinary, endocrine such as rheumatoid immune system disease history.

### 2.2 Methods

#### 2.2.1 Experimental Approach to the Problem

Subjects are instructed to do water exercise for 8weeks, with three times a week for 60 minutes.

Table 1: The phase, load, practice frequency and duration of water exercise.

| Phase             | Load    | Frequency | Duration |
|-------------------|---------|-----------|----------|
| adaptive phase    | 30%-60% | 2/wk      | 1-2 wks  |
| Improve phase     | 70%-80% | 2/wk      | 3-5wks   |
| Maintenance phase | 80%-90% | 2/wk      | 6-8 wks  |

Water exercise are conducted according to the different Phases. Courses are divided into three parts: activity stage, waist practice stage and relax(Steve Tarpinian, Brian J. Awbrey, 1997).

Table 2: The water exercise training programs.

| Practice stage       | Exercise      | Volume                   | Time (min) |
|----------------------|---------------|--------------------------|------------|
| Warm-up              | land warm up  |                          | 10         |
|                      | water walk    | 50m                      | 3          |
|                      | Walk back     | 50m                      | 3          |
|                      | lunges        | 50m                      | 3          |
|                      | water jogging | 50m                      | 3          |
| Waist practice stage | hip in        | 30rep                    | 5          |
|                      | hip out       | 20 rep                   | 5          |
|                      | crouch        | 30rep                    | 5          |
|                      | squat         | 30 rep                   | 5          |
|                      | step walk     | 2*50m                    | 5          |
|                      | high kicks    | 20 rep in each direction | 10         |
| Relax                | stretch       |                          | 5          |

### 2.2.2 Questionnaire Method

Visual analogue score (VAS) and Questionnaire Oswestry disability index (ODI) are used during the experiments.

### 2.2.3 Test Method

Lumbar flexion and extension angles were measured by Square plate protractor (Fan Zhenhua, 1999).

## 3 RESULT AND ANALYSIS

### 3.1 VAS

The VAS pain score at rest, activity and at night have all released after the water exercise ( $P < 0.05$ ).

Table 3: The water exercise training programs (Fan Zhenhua, 1999).

| Pain Degree | Mean      | Feelings  |
|-------------|-----------|---|
| Mild        | 2.57±1.04 | With mild pain, the subjects could bear   |
| Moderate    | 5.18±1.41 | Subjects feel pain and that affect sleep. Though tolerable, should receive clinical treatment |
| Serious     | 8.41±1.35 | Subjects feel more severe pain, or can't stand the pain                                       |

Table 4: The comparison of VAS scores before and after the experiment (N=10).

|          | Pre-experiment | Post-experiment |
|----------|----------------|-----------------|
| Rest     | 2.8±2.0        | 1.8±1.3*        |
| activity | 5.7±2.6        | 3.8±2.2*        |
| night    | 2.7±2.1        | 1.9±1.6*        |

\*:  $p < 0.05$

### 3.2 ODI Dysfunction Index Score

Pre-experiment and Post-experiment in the lab ODI dysfunction index score declined ( $p < 0.05$ ) which showed that water training could release the waist function barrier of people with chronic low back pain.

Table 5: The comparison of ODI dysfunction index score before and after the experiment (N=10).

|     | Pre-experiment | Post-experiment |
|-----|----------------|-----------------|
| ODI | 37.9±2.4       | 32.6±4.3*       |

\*:  $p < 0.05$

### 3.3 Lumbar Spinal Motion Analysis

After experiment, lumbar flexion and extension of motion increased ( $P < 0.05$ ) which showed the joint mobility of the subjects have improved.

Table 6: The comparison of lumbar flexion and extension before and after the experiment (N=10).

|                  | Pre-experiment | Post-experiment |
|------------------|----------------|-----------------|
| Lumbar flexion   | 40.1±8.1       | 43.1±9.8*       |
| Lumbar extension | 19.6±2.2       | 21.3±3.5*       |

\*:  $p < 0.05$

## 4 DISCUSSION

### 4.1 The Characteristics of Water Exercise for Chronic Low Back Pain

Water exercise training is different from the land training. Water buoyancy can help patients to support their own weight, reduce joint muscle tension (Lynda Huey, Robert Forster, 1993). People may move to wider range and each part of body can do exercise for improving balance and coordination. Those feature help people to achieve the goal of rehabilitation therapy without adding burden and pain for body. Submerging body under the water can relax the muscle, change muscle tension, reduce pain. The resistance of water can help people improve muscle strength and endurance, increase the range of motion and restore the ability of control, balance and coordination (Martha White, 1995).

### 4.2 Evaluation Indexes

VAS score, ODI score are recognized as 2 effective index for reviewing low back pain. VAS score is

used for objective feeling of pain level, and ODI score reflects dysfunction caused by low back pain. The combination of these two index can reflect the effect of the treatment of chronic low back pain. Joint motion range is one of the most basic indicators of assessing limb movement function, pain degree and one of the important indicators of the degree of disability. Joints, soft tissue and bone pain and muscle spasm after disease damage and soft tissue scar and adhesion factors will affect the joint activity. Patients with low back pain are usually characterized by decreased muscle endurance and waist activities range (Fan Zhenhua, 1999). Therefore, it is also one of the effective indicator of rehabilitation for chronic low back pain.

### **4.3 Rehabilitation Effect of Water Exercise for Chronic Low Back Pain**

The etiology of chronic low back pain is so complex that there are still dispute about it. Research shows that some factors may aggravating waist and leg pain, including acute lumbocrural pain, bad posture, standing or sitting too long, chronic strain and imbalance of lumbar muscle, and strength decline, etc(Martha White,2004) . These factors make the waist and leg muscle, ligaments and tendons over-pull bones on the attachment points, resulting in fracture state, local, inflammatory reaction, which result in the block of local blood supply (Sun Qilang, 2007). Patients will experience pain over a period of time and thus lead to muscle atrophy, decreased muscle strength, form a vicious circle (Fan Zhenhua, 1999).

#### **4.3.1 The Effect of Pain Controlling of Water Exercise for Chronic Low Back Pain**

The results showed that VAS scores after water exercise was lower compared to Pre-experiment, proving the effect of pain relief. Exercises on land may be harmful since it may make the waist, knees and ankle joints suffer more gravity and tension and may aggravate the damage. However, human body is almost weightless because of the buoyancy of water. Thus the weight-bearing joints of lower limbs can significantly reduce load and prevent hurting.

#### **4.3.2 The Influence of Water Exercise on ODI Dysfunction Index**

ODI is the standardized index recommended to evaluate low back pain condition. So far, the questionnaire has been used abroad for more than 20

years as a gold standard, designed basing on the degree of pain, life care, carrying weight, walking, sitting, standing, sleeping, family life, social life, tourism, and other 10 ways to test the subjects, and lead to comprehensive analysis of the degree of lumbar dysfunction. Training can effectively improve the function of the waist in the water and relieve lumbar dysfunction, because the muscles are more relax in the water to reduce pain level. At the same time, water resistance may help muscles to improve strength and endurance and increase the range of motion and feel of control, balance and coordination. All those feature can effectively improve body flexibility and recovery level.

#### **4.3.3 The Influence of Water Exercise on Lumbar Motion Range**

Lumbar spine is the main joints that hold the body weight and with small range of motion. Lumbar spine is very important in maintaining torso stability and coordination of movement. The motion range of chronic low back pain patients are limited because of the weakness of their waist muscle. Water exercises such as hip flexion, hip rotation and walking can extend the soft tissue and make the motion range larger with the help of water buoyancy (Terry-Ann, Wener Hoeger, 2002). On the other hand, water exercises are good at enhancing waist and back muscles strength by reacting against water resistance and ease back muscle spasm, correct muscle imbalances, so as to increase lumbar motion rehabilitation purposes (Marti C Spinkle, 2013).

## **5 CONCLUSIONS**

By 8 weeks of water exercise training, waist pain can be relieved dramatically. Water fitness exercises such as squat jump, suspending crouching can effectively extend the muscle and eliminate muscle tension.

By 8 weeks of water exercise training, waist dysfunction can be relieved effectively. Exercise such as kicking forward, kicking laterally can improve the balance and coordination ability.

By 8 weeks of water exercise training, waist joint mobility and muscle strength can be increased. Exercises such as hip abduction, hip extension and step walk can enlarge the range of lumbar joints activity. On the other hand the resistance of water can enhance the waist and back muscle strength furtherly, ease back muscle spasm, correct muscle

imbalances, so as to increase lumbar motion rehabilitation purposes.

## 6 SUGGESTIONS

The swimming pools used to do water exercise should be with comfortable temperature ranging from 28 to 30 degrees Celsius. Low temperature may cause muscle tension and restrict movement. T

For the safety of patients, training plan should be set step by step. Practice time, frequency and intensity should increase gradually. Trainers should watch the patients reaction and monitor some useful index to control exercise.

## REFERENCES

- Fan Zhenhua, 1999. *Medical Science of orthopaedics-rehabilitation*. Shanghai Medical University Press.
- Steve Tarpinian, Brian J. Awbrey, 1997. *Water Workouts*. The Lyons Press.
- Lynda Huey, Robert Forster, 1993, *The Complete Waterpower Workout Book: Programs for Fitness, Injury Prevention, and Healing*. Random House.
- Martha White, 1995. *Water Exercise for Therapy and Fitness*. Human Kinetics Publishers.
- Terry-Ann, Wener Hoeger, 2002. *Water Aerobics for Fitness and Wellness*. Wadsworth Publishing Co Inc.
- Marti C. Spinkle, 2013. *Water Wonder Works: A Guide to Therapeutic Water Exercises to Manage Arthritis Pain, Strengthen Muscles and Improve Mobility*. CCB Publishing.
- Martha White, 2004. *The Aging Spine: Water Exercise & Treatment Principles*. iUniverse.
- Sun Qilaing, 2007. *Exercises for lower back pain*. Chinese Clinical Rehabilitation. 202 ,6(22) :3310 –3313.