The influence of the training process on the development of flexibility of the swimmer's shoulder girdle

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Abstract

Objective of the study was to evaluate the influence of the training process on the development of flexibility of the swimmer's shoulder girdle.

Methods and structure of the study. The experiment involved 168 swimmers from the "Ekran" Youth Sports School (86 girls, average age 17 years and 82 boys, average age 18 years). Swimmers were tested for shoulder flexibility in preparation for the winter competitive season. After 6 months, the swimmers were surveyed about pain throughout the season.

Results and conclusions. The findings showed a strong correlation between poor anterior shoulder flexibility and subsequent shoulder pain. Further research suggests that resistance training increases the likelihood of pain in men as a result of tendon hypertrophy. For flexibility, the occurrence of pain was independent of stroke, distance, or gender, with one exception: at a given level of flexibility, butterfly swimmers were more likely to suffer this injury than others.

Keywords: *pain syndrome, swimming, testing, survey, shoulder pain, flexibility in the shoulder joint.*

Introduction. The most common orthopedic injury in competitive swimmers is a shoulder girdle injury. It is believed that the swimmer's shoulder includes mainly the long head of the biceps muscle and the distal end of the supraspinal muscle and that the pain arises from impact. Any mechanical situation (including impact or friction) can be determined by several variables. When studying the mechanical model of a swimmer's shoulder, the following parameters are usually considered: number of movements (number of strokes); freedom of movement of the object (in the coracoacromial arch and head of the humerus); size of the moving object: thickness of the periosteal (supraspinal) muscle and tendon of the long head of the biceps; plasticity of a moving object (flexibility) of the supraspinous (supraspinal) head of the biceps; flexibility of objects surrounding a moving object (flexibility of the coracoacromial ligaments).

They are all interrelated, but the last two are of interest because they both relate to shoulder flexibility and are easy to quantify.

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In October, swimmers underwent shoulder flexibility testing in preparation for the winter competitive season. In this case, a regression equation from an evaluation study was used.

Shoulder girdle flexibility test (SF). The swimmer lies down on an inclined bench. Then he lowers his hands down so as not to experience pain. In the tested swimmers, shoulder pain was not a limiting factor; to increase tension in the biceps periosteal (supraspinal) muscles and tendons, the arms are in an extended position, with the palms facing toward oneself and held in a perpendicular position relative to the body, with the subject's head on the upper raised end of the bench. When the swimmer is unable to move his arms further, the distance between the centers of the styloid processes on the wrists is measured with an accuracy of 1.63 cm. Taking into account the different lengths of the arms, the distance between the wrists is divided by the height of the swimmer, which is also measured with an accuracy of 6.35 cm. The result is the num-

ber is the shoulder flexibility (SF) index, which usually ranges from 0.00 to 0.800. It matches the protractor (extensor) angle in photographs of swimmers taken in the same testing position.

Research has shown that there is a positive correlation between swimmers with poor flexibility (high SF) and swimmers who experienced shoulder pain in the previous season. To understand whether shoulder pain is a cause or consequence of poor flexibility, we used a regression equation from an assessment study to predict the likelihood of shoulder pain in different groups of swimmers [1].

Classification of pain. Although the following system differs from the traditional clinical system, we found that athletes found it easier to answer questions within this classification: 0 – no pain; 1 – sometimes it hurts, but not much; 2 – hurts after training; 3 – pain occurs every time a circular movement is performed with the hand; 4 – it hurts during the day, forcing you to refrain from heavy exercise; 5 – severe pain, difficult to train; 6 – very strong pain that stops only under the influence of ice, medications, etc. It is impossible to train at full strength.

At the end of the competitive season (April-May), each swimmer completed a questionnaire about pain in both shoulders for the period from October after the SF test.

Flexibility. From a coach's point of view, category 4 and above are acceptable. From a doctor's point of view, any type of pain is undesirable. The researcher can choose any category. For the first part of this study (team selection), category 1 is considered to be at the 50% level of "swimmer's shoulder" syndrome, and category 2 and above is considered to be 100%.

Weight training. The third variable in the mechanical model is the thickness of the biceps and supraspinatus muscles and tendons. This factor -duration and intensity of resistance training - was considered on a scale from 0 to 20, with 6 being considered mild, 7 to 13 moderate, and 14 to 20 maximum.

Results of the study and discussion. The results of the study showed that the influence of poor flexibility affected all swimmers without exception, even the youngest.

Weight training. Table 1 shows the percentage of swimmers who trained with weights at three levels. If the forecast is based only on the GP indicator, the percentage of cases of the syndrome can be reduced, but it is necessary to take into account muscle hypertrophy caused by weight training.

Sample questions offered to athletes in the spring after the competitive period:

A. When was your weight training most intense? 1. I hardly trained; 2. From July to September; 3. From September to February.

B. How often did you train and at what intensity? 1. 0-never; 2. Once a week; 2. Twice a week; 3. Three times a week, until tired.

The selected answer options must be circled. By multiplying the numbers circled in sections A and B, the weight training factor was obtained. This provided an intensity/duration scale ranging from 0 to 20.

The higher the factor score, the longer the duration and intensity of the workout. The shoulder flexibility testing position is an excellent gravitational stretch in itself. Stretching, when the muscles are under severe tension, does not contribute to the development of flexibility.

Weight training. Tendon hypertrophy occurs in humans as a result of resistance training. Muscle strength is proportional to tendon thickness, a finding supported by research showing that resistance training is of no benefit as a preventative or therapeutic measure for shoulder pain.

Subluxation. The presence of subluxation was not tested in this study. But since we found a correlation between tension in the front of the shoulder and subsequent shoulder pain, we can expect a correlation with weakness in the back of the shoulder. Slouch-

Table 1. *Percentage of swimmers on each team who trained with weights*

Team	Gender	The weight training factor		
		0-6	7-13	14-20
A	Woman Man	66,6 78,6	22,2 7,1	11,1 4,3
B	Woman Man	10,0 25,0	75,0 43,7	15,0 31,3
C	Woman Man	14,3 42,9	85,7 57,1	0 0
D	Woman Man	8,7 20,0	47,8 30,0	43,5 50,0
E	Woman Man	40,0 4,3	50,0 82,6	10,0 13,1
F	Man	0	40,0	60,0

Table 2. *Prognosis of the appearance of "swimmer's shoulder" syndrome in swimmers specializing in swimming in various ways (women and men)*

Swimming method	Gender	Average crying flexibility	Number of syndrome cases (%)
Freestyle (sprint)	M	638	57,5
Breaststroke	M	630	64,7
On the back	M	617	56,7
Freestyle (stayer)	M	592	50,0
Freestyle (sprint)	W	581	52,1
Freestyle (stayer)	W	568	42,3
Butterfly	M	562	52,8
On the back	W	553	38,0
Breaststroke	W	553	34,2
Butterfly	W	518	47,2

ing, characterized by a forward drooping of the shoulders, often seen in swimmers, indicates stretching of the posterior tendons of the shoulder, causing anterior subluxation. So, in many cases when swimmer's shoulder is diagnosed, the cause is a subluxation. It is believed that this syndrome most often occurs in stayers specializing in freestyle and butterfly swimming (with the exception of highly qualified swimmers, in whom this disease is even more common than in men).

Until now, it has been difficult to predict the risk factor for each swimmer. The work tested the dependence of the appearance of pain in the shoulder on the method of swimming, distance and gender. Data from other studies were used to ensure the sample was sufficiently representative. Swimmers with a shoulder flexibility of 0.700 or greater were excluded. Resistance training was not included because it has not been studied in other studies. Shoulder pain was considered a 100% syndrome starting from point 4. The forecast results are shown in Table 2.

With few exceptions, the prognosis for the onset of the syndrome, as can be seen from Table 2, depends more on the indicator of shoulder flexibility than on the method of swimming, distance or gender. Even if we exclude two groups of subjects swimming in the butterfly style, when the arms work simultaneously and the load on the shoulder joints is higher, 8 groups remain. Their mean still showed a strong correlation between shoulder flexibility and subsequent pain (R=0.9769). The risk factor is especially high in swimmers with poor shoulder flexibility and in men who train with weights at maximum effort.

Conclusions. The shoulder flexibility test was performed before the winter season on 168 swimmers, most of whom did not suffer from swimmer's shoulder syndrome. After 6 months, swimmers answered questions about pain throughout the season. The findings showed a strong correlation between poor anterior shoulder flexibility and subsequent shoulder pain. Further research suggests that resistance training increases the likelihood of pain in men as a result of tendon hypertrophy. For flexibility, the occurrence of pain was independent of stroke, distance, or gender, with one exception: at a given level of flexibility, butterfly swimmers were more likely to suffer this injury than others.

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