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Injuries in swimming sports: prevention and treatment methods

Lesões em esportes de natação: métodos de prevenção e tratamento

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Abstract

Swimming is a unlike sport that mix upper and lower extremity strength exercises with aerobic energy training in a weightless environment. There are four kind of strokes are officially know: freestyle, butterfly, backstroke, and breaststroke. The highly repetitive motion that occurs in the normal swimming stroke can predispose elite swimmers to musculoskeletal injuries of the upper limb, knee, and spine. In swimming upper body injurie is oftenly happened. Shoulder injuries are the most common injuries, with prevalence between 40% and 91%. Studies in the literature show that injuries can be experienced in swimming sports, and there are also methods of protection from these injuries. In this study, to explain where and how injuries occur in swimming and how they can be protected from these injuries.

Keywords: Swimming. Injuries. Muscle Imbalance. Anthropometric Features.

Resumo

A natação é um esporte diferente que mistura exercícios de força das extremidades superiores e inferiores com treinamento de energia aeróbica em um ambiente sem peso. Existem quatro tipos de braçadas oficialmente conhecidas: estilo livre, borboleta, costas e peito. O movimento altamente repetitivo que ocorre na braçada normal pode predispor nadadores de elite a lesões musculoesqueléticas nos membros superiores, joelhos e coluna. Na natação, lesões na parte superior do corpo acontecem com frequência. As lesões no ombro são as lesões mais comuns, com prevalência entre 40% e 91%. Estudos na literatura mostram que lesões podem ocorrer

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na natação, existindo também métodos de proteção contra essas lesões. Neste estudo, pretende-se explicar onde e como ocorrem as lesões na natação e como podem ser protegidos dessas lesões.

Palavras-chave: Natação. Lesões. Desequilíbrio Muscular. Características Antropométricas.

Introductıon

Since elite athletes do heavy training to keep their performance at the top level, for example in wrestling (Halloran, 2008; Tatlici et al., 2021), boxing (Loosemore et al., 2015; Tatlici et al., 2022), football (Koutures et al., 2010) injuries are inevitable. In swimming sports, where symmetrical or asymmetrical movement skates can be, too many physical and physiological needs (muscle strength, anaerobic power, neuromuscular skill and coordination, aesthetic and artistic movements and aerobic endurance) can cause serious injuries (Pyne & Sharp, 2014). Athletes who display elite performance in this sport are people who started sports at the age of 7-8 and performed heavy training throughout their careers (Kammer et al., 1999). Apart from the injuries caused by physical and mental fatigue after continuous heavy training, many internal and external factors can actually affect as well. While some of the studies focused on poor swimming technique, flexibility or force imbalance other than fatigue, others dealt with the situation in psychological dimensions. One of the reasons why contradictory results are reported in the studies is that the specific movement patterns and physiological needs of the swimming branches are different and the injuries differ depending on these conditions (Wanivenhaus et. al., 2012).

Swimming sports cover all branches that move in the water, and each swimming branch can have its own water resistance density (Wanivenhaus et. al., 2012). Water polo game is intermittent in nature, requiring avariety of different, intense bursts of activity, each lasting <15 seconds (Smith 1998). Explosive loading is a type of loading that lasts less than 6 seconds and primarily relies on the high-energy phosphagen system of the main energy metabolism pathway, with some involvement of glycolysis and oxidative phosphorylation (Taşkuyu 2020). Apart from sports such as water polo, where complex movements can occur in the water, sportive swimming includes strokes and foot movements and repetitive performances. Sports swimming is also defined as the athlete's ability to travel a certain distance in the water in the shortest time possible (Özyilmaz, 2018). Sports swimming is a sport that requires both aerobic and anaerobic endurance, strength, power, balance, flexibility,

quickness and rhythm coordination (Günay, 2007; Pyne & Sharp, 2014). .Swimming activities are performed in 4 main styles: freestyle, butterfly, backstroke, and breaststroke (Karpovich & Millman, 1944). Since these branches have completely different motion kinematics, the contents of athlete injuries also differ.

Some swimming activities consist repetitive movements (Costill 1992). Injuries in the swimming branch are seen at a low rate, but injuries in the swimming branch can take a long time and are exemplified by repetitive micro-traumas . Many injuries result from faulty techniques or mechanisms, and an assessment of the swimming biomechanics of any injured athlete should be performed to identify errors that may contribute to injury. Injuries in swimming should not only be taken into account by competitive swimmers, but also by the many recreational, master and fitness athletes who participate. Most injured swimmers are adults, bringing with them additional age-related factors that the junior competitor does not have that can contribute to injury. Injuries of swimmers should be considered not only while swimming, but also other factors in land training. Rest and other measures are taken to reduce the symptoms of injuries and increase injuries (McMaster 1996).

In free swimming style (crawl), different muscle contractions occur in each phase of the movement, and the repetition of these phases should be coordinated. These phases are; arm entry, reach forward, traction, traction mid phase, arm exit, and mid recovery (Pink et al., 2011) (Figure 1). These phases need to be done continuously and with a specific technique (Pink et al., 2011) (Figure 2). Technically, deterioration will increase the risk of injury, and working with more than 20% of the serratus anterior continuous maximum force, which is one of the major muscles in this swimming style, can also cause injuries (Özyilmaz, 2018). Especially in long-lasting freestyle swimming performances, the decrease in the strength of this muscle due to fatigue causes the rhomboid muscles to work more (Pink et al., 2011). When the performance is long enough to cause fatigue in the rhomboid muscles, the shoulder area is particularly vulnerable and the risk of injury is greatly increased.

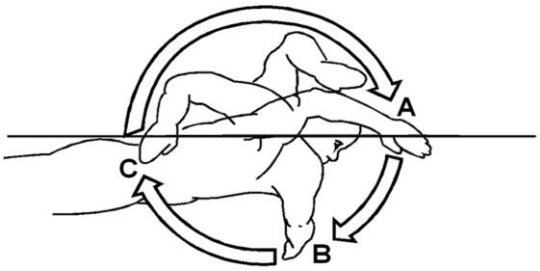

Figure 1: Free Swimming Phases
Source: Wanivenhaus et. al., 2012

It is also known that supraspinatus and deltoid, which work as relators especially in the recovery phase, may cause some damage in that area after a while (Yanai & Hay, 2000). During the recovery phase, scapular retraction and elevation should be performed in combination with humeral abduction and external rotation movements (Özyilmaz, 2018). In this style, the arms form the propulsion mechanism, and lower extremity injuries are very rare. The area that dominates the movement is the shoulder and 80% of injuries occur in this area. Similarly in breaststroke style, although the legs are more active than the arms, the shoulder area dominates the movement. The arms start and progress simultaneously with full flexion and internal rotation movement, and body movement is centered around the hip (Özyilmaz, 2018). In the butterfly and supine styles, as in the free style, it is a bilateral activity, not in a reciprocal, unilateral pattern. In water diving, both shoulders are flexed, abduction and internal rotation, extension and recovery in the traction phase, while the arms are in abduction-internal rotation, and the arms are brought back to extension from the water (Özyilmaz, 2018).

As can be seen, in all swimming sports, varying degrees of internal and external rotation, scapular retraction and protraction shoulder movements cause injury, irritation, inflammation, rotator cuff tears-tendinitis, shoulder impingement syndromes, tears around the shoulder cartilage in that area (Ciullo and Stevens, 1989) (Figure 2).

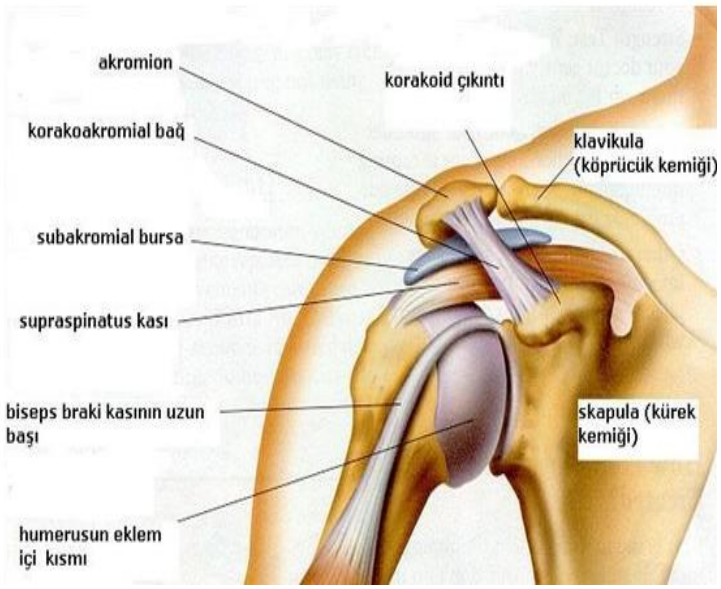

Figure 2. Areas where injuries occur in the shoulder
Source: Web 1 - http://www.sinankaraoglu.com/omuz-eklemi-omuz-agrisi/

2.1 Shoulder Injuries (Prevention and Treatment Methods)

Studies have shown that shoulder injuries are inevitable in elite performance, regardless of young or adult swimmers (Kammer et al., 1999). Impingement is the leading cause of these injuries. It occurs when the pinching tendons rub against the acromion located on the roof of the shoulder joint. Most elite swimmers experience the impingement syndrome also known as "swimmer shoulder". Although it is common in all sports branches such as basketball, volleyball, handball and water polo, it is mostly seen in swimmers. In this syndrome, inflammation occurs in the tendons (tendinitis) and severe pain may also be centered on the neck or waist outside the shoulder. It is possible to be protected from this syndrome depending on many factors. The most important of these is to make stretching movements. However, there are factors that need to be considered while performing the movements, and the practices may differ from person to person. Stretching applications should be done in the same proportions to the back and front capsules. Greipp (1985) showed that shoulder pain will increase in cases of bad flexibility in the anterior shoulder region. However, keeping this flexibility at an optimum level is especially important for swimmers who are genetically prone to these injuries (Johnson et al., 1987).4

In addition it is very important to strengthen the shoulder area with rotator cuff exercises (Wanivenhaus et. al., 2012). However, the right exercise choices should be made. Especially in free swimming, stroke strengthens the inner rotator muscles in the shoulder; In free swimmers, the inner rotator muscles are significantly stronger than the outer rotator muscles. Considering the role of strength imbalance in athlete injuries, it can be said that resistance training to strengthen the external rotator muscles of free swimmers can be beneficial. However, it is a fact that during swimming, muscle contractions and contraction rates will differ according to swimming style and this will result in different physiological adaptations (Ünlü et al., 2019). Attractions of resistance training should be considered to be for the purpose of considering this matter. Apart from this, non-functional shoulder strength training may have some drawbacks. Exercises that increase shoulder range of motion and stabilize scapula are also beneficial. If machine strength training is to be done, there are some points to be considered technically. For example, the "pull-down" exercise is more functional compared to the "shoulder press" exercise in terms of strengthening the rotator cuff region muscles. However, in practice, the reel should be pulled towards the front of the chest, not towards the neck. In the "bench press" study, the deltoid region can also be strengthened in

addition to the pectoral region. However, the elbows should be kept at shoulder level and the bar should be held with the palm facing to the face.

Movement should be avoided when injuries occur and any pain is felt in the shoulder because degeneration from this syndrome can progress rapidly (Bansal, Sinha, & Sandhu, 2007). The majority of patients can be treated without surgery. Anti-inflammatory drugs and cold application are among the first things to be done in line with the doctor's recommendation. After the pain is reduced to a certain extent, rotator cuff rehabilitation exercises can be started with the doctor's recommendation. If the pain does not decrease, the history of the athlete can be addressed with an MRI examination and surgical applications can be performed. In the first stage, it tries to reduce the pain with cortisone injection. Interventions such as subacromial decompression, resection arthroplasty, and arthroscopic intervention are considered.

90 percent of swimming performance originates from the upper extremity, and almost all of these injuries occur in the shoulder area (Pink & Tibone, 2000). In line with this inference, Weldon III & Richardson, (2001) reported that 90 percent of the problems of swimmers who applied to a doctor with different complaints were shoulder-related. Especially professional athletes should take good care of themselves to avoid these injuries. During periods of heavy training, good rest and nutrition are the most important principles of protection from these injuries. Sufficient amounts of carbohydrates to replenish glycogen stores, protein to recover muscle damage, and vitamin-supplemented nutrition to replace lost minerals. In some cases, taking sports supplements under the supervision of an expert may be beneficial. Supplements are known to increase performance as well as prevent injuries (Tatlici & Cakmakci, 2019). Another important measure is to keep the flexibility of the shoulder area at an optimum level (Beach, Whitney, & Dickoff-Hoffman, 1992) . Imbalance in the shoulder muscles can lead to deterioration of posture, and postural deterioration can cause injury risks (Kluemper, Uhl, & Hazelrigg, 2006). In this direction, both flexibility and strength should be exercised together with functional training. In free, butterfly and supine swimming performances, the swimmer manages the upper extremity strength by adduction and internal rotation of the shoulder, and this often causes agonist-antagonist force imbalance (Birrer, 1986). Pink & Tibone, (2000) reported in their study that adduction-abduction force imbalances in the shoulder were 2.05: 1 in swimmers and 1.53: 1 in non-swimmers. This is the physiological adaptation that long-term swimming training shows in the body, and it is known that physical differences can be seen, especially in elite athletes, according to the sports branch (Popovic et al., 2013). Swimmers, this situation is more pronounced in the shoulder

area and occurs with force imbalance (Kluemper, Uhl, & Hazelrigg, 2006). Considering that strength imbalance is one of the factors that affect injuries in sports such as flexibility (Isık, Unlu, Gozubuyuk, Aslanyurek, & Bereceli, 2018), it is thought that swimmers may need special training programs in the shoulder area.

2.2 Injuries of the Knee (Prevention and Treatment Methods)

In swimmers most common injuries are ocur in shoulder and the second one is happend in knee joint. The prevalence of knee problems requiring an orthopedic consultation was 34% among the 35 members of the 1972 Canadian Olympic swimming team. Most of the knee pain problems are complained by the breaststroke swimmers (Wanivenhaus et. al., 2012). The other styles are also complained but not as much as breaststroke swimmers. According to a survey 86% breaststrokers swimmers at least one time knee pain (Rupp 1995).

Breaststroke swimmers have a fivefold higher risk of knee pain (relative risk, 5.1), although most occurs in the medial compartment, whereas freestyle has a reduced relative risk (0.5) for knee pain (Wanivenhaus et. al., 2012). The biomechanics of the breaststroke generates high valgus loads due to the adducted hip position. Extreme hip abduction angles at kick initiation can be detrimental. For example, a study of 21 competitive swimmers reported that hip abduction angles of less than 37° or greater than 42° were associated with a higher knee injury rate (Wanivenhaus et. al., 2012).

Conclusıon

Musculoskeletal pain caused by heavy training from swimming is very common. Proper swimming techniques can prevent injuries and pain. Coaches should identify and change the wrong hitting techniques that cause pain. It is important to add the necessary strength and stretching movements to training to prevent pain. Lower extremity muscle strengthening and flexibility exercises should be routinely included for breaststroke swimmers. As soon as the athlete feels pain, the training intensity, distance and frequency should be adjusted.

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