

Swimmer's Shoulder in Athletes: Comparison between Efficacy of Aquatic versus Dry-land Concentric-Eccentric Exercises

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ABSTRACT: *The purpose of the present study was to examine the level of pain gets reduced whether by dry-land based concentric-eccentric exercises or by the equivalent type of aquatic exercises in the elite swimmers complaining of chronic shoulder pain. Elite swimmers from India of both genders with an age group of 16-30 years were chosen having pain rated as ≤ 7 on visual analog scale with an exception of Bak's Grade E provided with an absence of past shoulder surgeries and acute injuries. 46 of swimmer's shoulder athletes were randomly divided in a group of two. 23 in each group were provided with respective sets of dry-land and aquatic concentric-eccentric exercises for 3 times/week for a period of 4 weeks. Outcome was measured using three parameters which included visual analog scale (VAS), 50m freestyle sprint and shoulder pain and disability index (SPADI) scoring before and after the treatment in relation to freestyle and backstroke pattern of swimming. In results, the descriptive statistics of swimmers with aquatic and dry-land exercises; for VAS 0 sessions to the 12th session were measured. The swimmers with dry-land exercises had the higher mean values than the swimmers with aquatic exercises, showing statistically significant differences ($p \leq 0.05-0.001$). Whereas in case of before and after 50 metre sprint, no significant differences were there between these two sets of populations. In case of before and after SPADI scoring, swimmers with aquatic exercises had the lower mean values than those with the dry-land exercises, showing statistically significant differences ($p \leq 0.001$). In conclusion, it may be stated that the aquatic concentric-eccentric exercises proved to be efficient for swimmers suffering from swimmer's shoulder condition and early prognosis can be brought with aquatic rehabilitation as compared to the dry-land concentric-eccentric exercises.*

Keywords: Elite Indian swimmers. Freestyle and back stroke. Aquatic exercises. Dry-land exercises. Shoulder pain and disability index.

INTRODUCTION

Swimmer's shoulder syndrome is painful and commonest injury found in swimmers due to repeated impingement of shoulder joint (Kennedy and Hawkins 1974). Freestyle stroke which is the speediest, common and widespread is often used during the training (King 1995, McMaster 1999). Swimmer's shoulder is an inflammatory condition caused by the repetitive overhead arm motion of the freestyle stroke. Rotator cuff muscles, the long head of the biceps tendon, and the sub-acromial space are mostly related with swimmer's shoulder pain (Fowler and Webster-Bogaert 1994).

It was reported earlier that swimmer's shoulder pervasiveness was 3% (Kennedy and Hawkins 1974) and has risen to 42% (Richardson et al. 1980), 40% to 69% (Whitney et al. 1994), 91.66% (Bak and Faunl 1997) and has reached to 80% (Contreras et al. 2010). In India, around 17% amongst the group of 161, where 7 state level, 18 national level and 3 international level swimmers came up with the shoulder impingement syndrome (Bansal et al. 2007). Age, the years of practice and the level of competition was related to number of swimmers suffering from shoulder pain (McMaster and Troup 1993).

A combination of hypo-vascularity, fatigue, poor stroke mechanics, and progressive instability in hypermobile joint results in impingement and this eventually lends up with swimmers' shoulder. Shoulder instability is likely a primary cause of impingement symptom in young athletes. Repeated impingement usually leads to rotator cuff tendinitis and bursitis. These two conditions eventually aggravate the impingement symptoms. Swimmer's shoulder impingement is rated according to the Bak's grade (Bak 2010). The pain associated with swimmer's shoulder may be caused by impingement either during the pull-through phase or during the recovery phase of freestyle. Within eighteen weeks of swimming training sessions substantial eccentric stress lead on the external rotators due to disproportionate internal rotation causes soft tissue modification which ultimately points to muscular inequity.

Swimmer's shoulder athletes have more risks of having rotator cuff rupture if they refrain from the treatment which causes them to struggle more to return to their initial level of performance with a loss from their regular training sessions and competitions (Bansal et al. 2007). An amalgamation of various types of exercises like concentric, eccentric, endurance, and agility training can better accentuate the distinctive motions of a competitive swimming session as compared to practicing one technique (Pepe and Rodosky 2001). From a psychological point of view, it is better to rehabilitate an athlete with the team than to carry on the sessions isolated from everyone (Jones 1999).

A good dry-land program should help swimmers to develop muscular symmetry and that can be accomplished by training opposite muscle groups. Areas that are weak or less flexible can be targeted more specifically with the dry-land exercises. Movements in water are easier to perform than their counterparts on land. It enables people with disabilities those who are unable to achieve optimal function capabilities on land treatment, to be able to succeed. With aquatic therapy, most of the individuals have felt an escalation in relaxation, range of movement of a particular joint and strength of the respective muscle with a reduction in pain

(Joanne 1996). After undergoing thorough functional rehabilitation, approximately 95% swimmers regain the strength and are capable of competing at their initial respective levels, whereas the other 5% do well after surgical intrusion (Bak 1996, Pink and Jobe 1993). Two main strategies have been developed in training methods for swimmers: in-water and dry-land methods. Specific aquatic training proved to be more beneficial for swimmers as compared to the dry-land training (Tanaka and Swensen 1998).

Corroborating a complete and an effectual rehabilitation curriculum for the athletes, it is essential to comprehend the dissimilarities between land-based and water-based exercises (Thein and Brody 2000). Since the researches are done on treatment for swimmer's shoulder and comparison between aquatic and dry-land rehabilitation differently, but it lacked an intervention study on swimmer's shoulder. Therefore, this study implies to host an advantage to swimmer's shoulder athletes an early recovery as they are bound with time for treating their conditions.

MATERIALS AND METHOD

Participants

The present comparative study is based on randomly selected 46 elite Indian swimmers (28 males and 18 females) aged 16-30 years from different states of India which included Punjab, Delhi, Maharashtra, Gujarat, Karnataka, Andhra Pradesh, Kerala, Goa, Madhya Pradesh, Assam, Manipur and Mizoram. VAS was ≤ 7 and Bak's grade was A and B. A written consent was obtained from the subjects. The study was approved by the local ethical committee.

Tools

Theraband and therband loop for the dry-land exercises, noodle, dumbbells, connector, nose plug, snorkel, hand paddles, ball, kickboard and pull push device for aquatic exercises were used in the present study.

Outcome measurements

It was measured on Visual Analog Scale (VAS scoring), 50 metre freestyle performance with respect to time and SPADI scoring (Shoulder Pain and Disability Index), before starting with the treatment and after completion of the treatment.

Protocol

Randomly divided Group A (dry-land) and Group B (aquatic) were given respective concentric-eccentric exercises for 3times/week for a period of 4 weeks. It included warm up for 5 minutes where marching or elliptical was for dry-land exercises and walking, running, hopping, marching or cycling in deep water was for aquatic exercises. Concentric-eccentric exercises with a progression from 6 sets of 5 counts then 5 sets of 9 counts to 3 sets of 10 counts then 3 sets of 15 counts for a total count of 30-45 was carried with respective tools of dry-land and aquatic exercises for shoulder girdle muscles and scapular stabilizers for a period of 30 minutes. Daily sessions were ended with cool down which included applying

cool pack at the site of pain for group A and immersing in the pool till the level of neck for group B for a period of 10 minutes.

Precautions

Proper balance of fluids, avoiding imbalance of exercises and performing exercises in the pain free ranges was practiced. No other treatment was permitted during the period of research study. Depending on the conditions, the suitable exercises have to be selected, progressed and modified.

RESULTS

Data was analysed using SPSS (Statistical Package for Social Science) version 17.0 provided by the Department of Computer Science, Guru Nanak Dev University, Amritsar. Student's t test was been applied for the comparison of all the variables between different sets of populations, and one way analysis of variance (ANOVA) was also applied, followed by Bonferoni post hoc test.

Graph 1 showed the backstroke-wise descriptive statistics of swimmers with aquatic exercises and dry-land exercises for VAS 0 sessions to the 12th session was analysed. Swimmers with dry-land exercises have higher mean values as compared to swimmers with aquatic exercises with no statistically significant differences ($p > 0.05$) were noted. Whereas, graph 2 showed the freestyle-wise descriptive statistics of swimmers with aquatic exercises and dry-land exercises for VAS 0 sessions to the 12th session was analysed. Swimmers with dry-land exercises have higher mean values as compared to swimmers with aquatic exercises, showing statistically significant differences ($p \leq 0.05-0.001$) between them.

Graph 3 and 4 showed backstroke and freestyle-wise descriptive statistics of swimmers with aquatic exercises and dry-land exercises respectively. In case of 50 metre freestyle sprint, no significant differences ($p > 0.05$) were found between before and after the treatment.

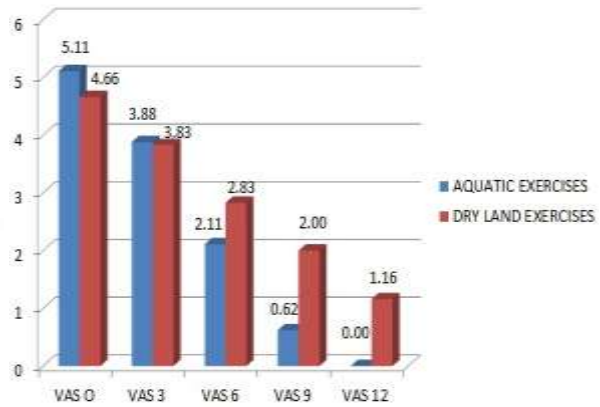
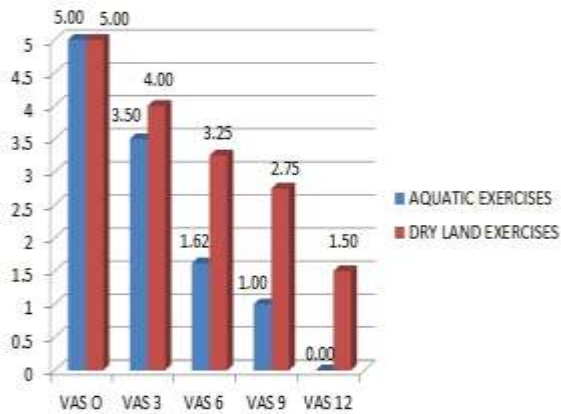
In graph 5 and 6 respectively, the backstroke and freestyle-wise descriptive statistics of SPADI scoring before and after the treatment was analysed in swimmers with aquatic exercises and dry-land exercises. Swimmers with aquatic exercises had the lower mean values than the swimmers with dry-land exercises. However, statistically no significant differences ($p > 0.05$) were noted between them.

DISCUSSION

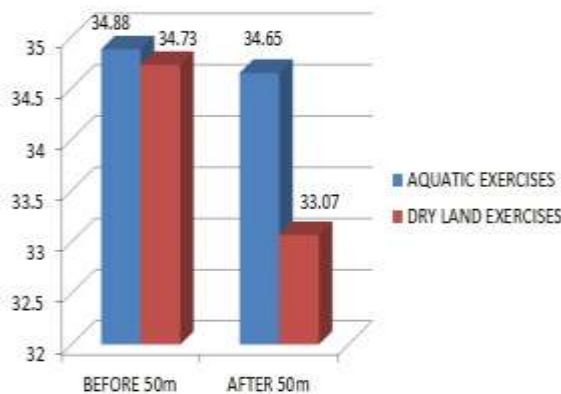
In this study the descriptive statistics of swimmers was done on the basis of stroke pattern which included backstroke and freestyle in which swimmer's shoulder was observed to a higher extent. The findings of the present study reported that the swimmers with dry-land exercises had higher mean values as compared to swimmers with aquatic exercises, showing statistically significant differences ($p \leq 0.05-0.001$) for VAS. Whereas no significant differences were there between the swimmers having the exercises, viz. 50 m sprint and SPADI.

Swimmers are recognizable by the shape of their broad shoulders and taper to narrow waists and hips. The length of events varies from 164ft (50m) to 4,921ft (1,500m). There are a surprisingly high number of shoulder injuries occur in youth swimming. The elite swimmers may log up to 8000-20000 meters per day average, using the freestyle arm stroke for most of the distance. At an average of 8-10 arm cycles per 25 meters, an elite swimmer completes 2500 or more shoulder revolutions per day.

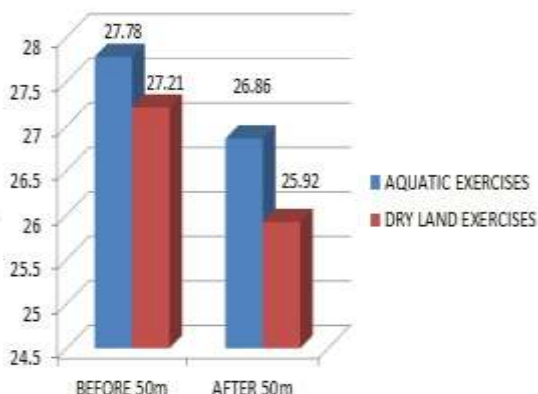
Graph 1: Swimmers with backstroke for VAS Graph 2: Swimmers with freestyle for VAS



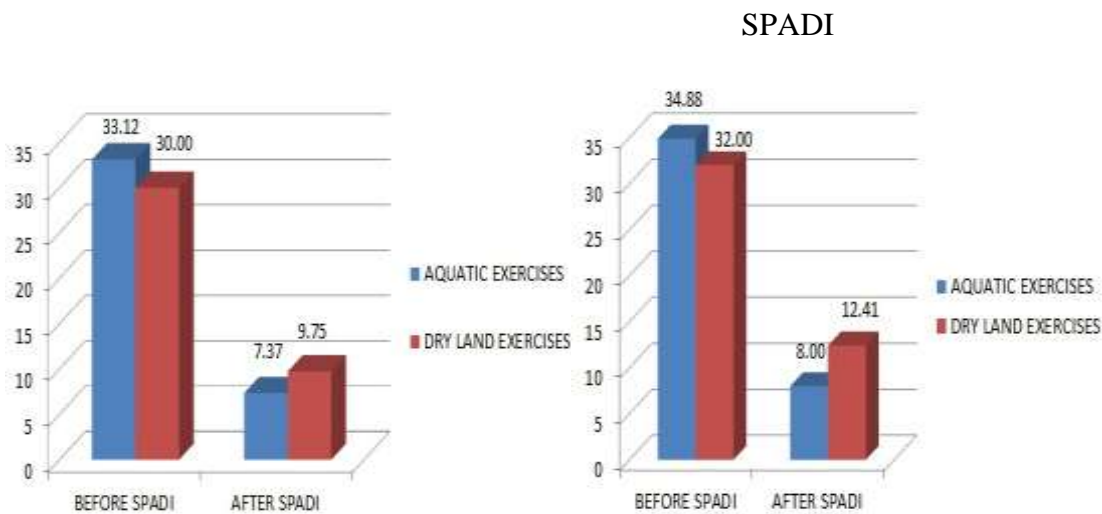
Graph 3: Swimmers with backstroke for 50 m sprint



Graph 4: Swimmers with freestyle for 50 m sprint



Graph 5: Swimmers with backstroke for SPADI Graph 6: Swimmers with freestyle for



Shoulder pain is directly related to the age, amount of training, and the proficiency of the swimmers with respect to their ranks, training interval and ages of preparation (Murphy 1994). Swimmers often demonstrate relative strength imbalance between their internal rotators, which are strong and their weaker scapular stabilizers and external rotators (>3:2 ratio). In the training period, muscular hypertrophy starts occurring after six weeks and muscular strength starts after 2-3 weeks whereas it requires four weeks if there is an injury (ACSM's guideline 2000, Detloyos et al. 2000, McArdle et al. 2000).

The present study stated that the concentric-eccentric exercises performed in the water increased the strength of the scapular and shoulder girdle muscles in less time as compared to the dry-land exercises. Thus these exercises decreased the instability and pain, therefore making the swimmer's shoulder athletes more fit for a longer duration of time. Subsequently it may reduce the reoccurrence in the athletes with swimmer's shoulder.

The limitation of the study was an absence of the temperature regulated pools for aquatic rehabilitation which could be taken in account for future studies.

CONCLUSION

The results of the present study concluded that the aquatic concentric-eccentric exercises were efficacious with early prognosis in athletes suffering from swimmer's shoulder as compared to the dry-land concentric-eccentric exercises. Pain abridged with aquatic exercises sooner as compared with the dry-land exercises. Change was noticed in the SPADI scoring which decreased gradually and even the timing of 50metres freestyle sprint was lessened as compared to their initial timings with both the type of exercises. But there wasn't a significant change noticed while comparing the timings and correspondingly SPADI scoring with relation to aquatic and dry-land exercises. The data accessible in the present study carry colossal practical application and should be inculcated in the rehabilitation program of swimmer's shoulder for the development of swimming sport.

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