THE EFFECT OF 8 WEEKS SPECIFIC CORRECTIVE EXERCISE IN WATER AND LAND ON ANGLE OF KYPHOSIS AND SOME PULMONARY INDICES IN KYPHOTIC BOY STUDENTS

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Abstract
The purpose of this study was to compare the effect of 8 weeks specific corrective exercise in water and land on the angle of kyphosis and some pulmonary indices in kyphotic students. Thirty males with increased normal thoracic kyphosis (kyphosis ≥40 degrees, 20.70 ±0.705 years old, height 175.5 ±6.19 cm, weight 64.19 ±8.23 kg) were selected and randomly divided in two groups(n=15): group(1) (corrective exercise in water) and group(2) (corrective exercise in land). The angle of kyphosis measured by using a flexible ruler as a non-invasive and reliable method. Pulmonary indices such as: force vital capacity (FVC), forced expiratory volume in one second (FEV1) and maximal voluntary ventilation (MVV) measured by digital spirometer. The repeated measure test was used to compare the differences between the pre and post-test in both groups. All statistical analyses were performed using SPSS statistical software version 18 and the significance level was set on 0.05.In land group and in water group the degree of kyphosis, FVC, FEV1 and MVV improved significantly (p≤0.05). Finally, between two groups were not observed any significant difference in degree of kyphosis and pulmonary indices (FVC, FEV1, MVV) (p≥0/05).According to the results; we can suggest the performance of both corrective exercises in land and water for kyphotic persons.

Key words*: kyphosis, aquatic exercise therapy, spirometry, corrective exercise*

Introduction

Natural alignment of spinal column depends on the function of its muscle, bone and joint structural. This weakness of spinal column extensor muscles can cause to static, dynamic and stature unbalance in persons that called faulty posture. It is caused unfavourable status on mental, social and physiological Function of person (Nitzschke & Hildenbrand, 1990; Peters, 1987). Physiological disorders caused by unfavourable physical status are serious. Increasing back curve of thoracic area that recognized as kyphosis has the unfavourable result of the respiratory system by the shortness and the inflexibility of chest muscles and also the weakness of expiratory muscles (Taheritizabi et al., 2012). Because shortening weakness in chest muscles of aspiration cause to decreasing ribcage volume, then decreasing lung volume (Rajabi et al., 2008). Therefore it seems effective to improve kyphosis and pulmonary volumes by reformation of muscle-skeletal structure of ribcage and spinal column, by corrective protocols of strengthening back muscles of ribcage and stretching of muscle chest. In the field of rehabilitation, physical attributes of water have many advantages like muscular relaxation, decreasing sensitivity to pain, decreasing cramp, flowing and comfort of joint, increasing muscular power and endurance when a person is very weak. Practice in water in comparison to practice in land is a certain method to achieve mental calmness and has many advantages to quality of life. Many people who have unsuitable organs and look and also have congenital means of physical weakness of illness or even over weight and weak person don't like to do social activities or even if they want, they can't do any exercise whereas aquatic exercise solved this problem (Sato et al., 2007; Tsukahara et al., 1994; Wenger et al., 1984). The purpose of this research is comparing the effect of corrective particular exercise in water and land on changes of kyphosis and some respiratory indices in male students. To find answers to this question, which exercises methods (water or land exercise), has more affection on kyphosis reformation and pulmonary indices? Pulmonary volumes gathered by GAGER spirometry system in following conditions, each object is sitting on lab chair and getting sensor of the system in his hand then cross expiration and inhalation through a replaceable tube. The object should get the tube by lips and uses a particular set for black nose to not go out the air. Each subject done each test three times and the best records were gathered and registered at MVV, FEV1 and FVC. Exercising protocol on land: 1) Warm up: inclusive walking and running slowly about 5 or 10 min. 2) Particular stretching exercises: all static stretching actions were done by him or his assistant, the purpose of static stretching was changing the length of shortened muscles to its natural length in the front chest area and its duration was 20 or 25 min. The period of each stretching action was 10 or 15 second and in 15th sets. In the exercise pain threshold was important. 3) Particular strengthening exercises: It was done single and two times. Exercises were static or isometric and dynamic (isotonic).

The main purpose of the exercises was the retrieval power of weakened back muscles, its duration was 20 or 25 minutes, the duration for each static strengthening action was 10 or 15 seconds in 5th or 10th sets. 4) Cool down period: running slowly and stretching action was done at the end about 5 or 10 min. Exercising protocol in water: all of exercises in land were done in water. But the exercises were proportionate to aqueous area. For example making warm up and cool down exercises include different walking was done in the pool. ANOVA repeated measure test was used to compare the differences between groups in pre & post-test. All statistical analyses were performed using SPSS statistical software version 18 and the significance level was set at 0.05.

Results

As for kyphosis angle interactive effect F (1, 28) =0.102, P≥0.05, isn't significant and group interior effect of the test F (1, 28) =192.92, P≥0.05. So kyphosis angle increase significantly (Fig.1).

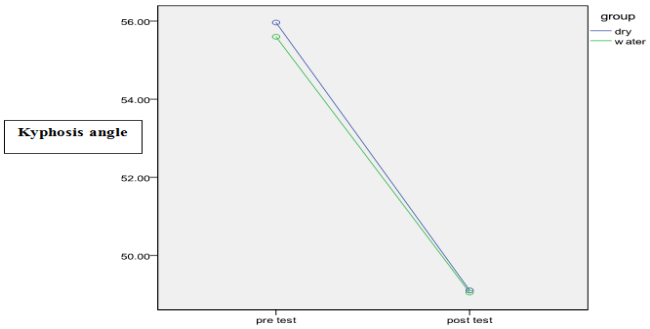

Figure 1. Mean thoracic kyphosis angle (degree)

As for FEV1 interactive effect isn't significant, F(1,28)=0.28/P≥0.05, and inter group test effect are significant, F(1,28)=13.40/P≤0.01, result FEV1 in two groups of aquatic and land increased so much over a period of particular corrective exercises (Fig.2). Also there aren't any significant differences between variations of kyphosis degree in two groups of aquatic and land F (1, 28) =0.001/P≥0.05.

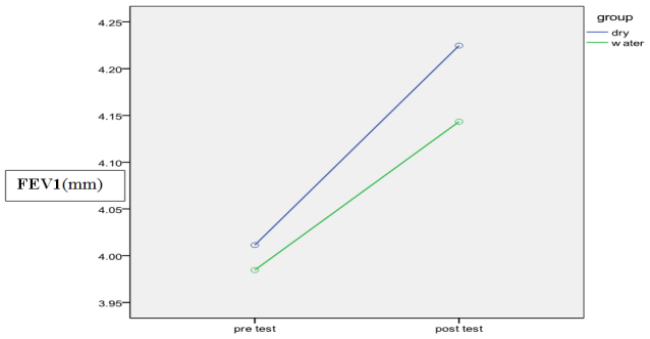

Figure 2. FEV1 values (mm) in groups before and after 8 weeks specific corrective exercise in water and land

Finlay, there is no significant difference in interactive effect F(1.28)= 1.736, P≥0.05 and there is a significant difference in intergroup effect F(1.28)=23.381, P ≤ 0.001, consequently FVC value increases significantly in both groups after 8 weeks specific corrective exercise in water and land (Fig. 3). There aren't any significant differences in FVC between subjects in both groups F (1.28) = 0.001, P≥0.05.

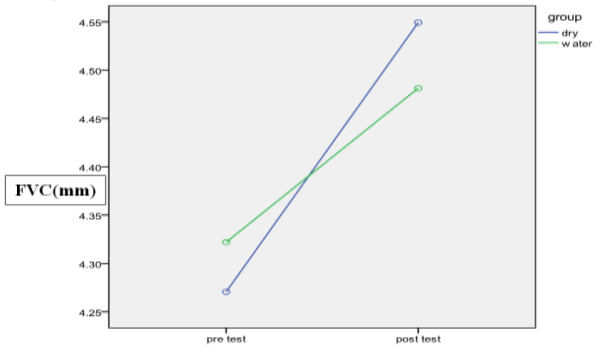

Figure 3. FVC values (mm) in groups before and after 8 weeks specific corrective exercise in water and land

As for MVV the connected effect isn't significant in F (1.28)=0.129/P≥0.05 and the inter group effect of the test F (1.28)=19.55/P≤0.001, results MVV in both aquatic and land group is so much increased over a period of particular corrective exercises (Fig. 4).

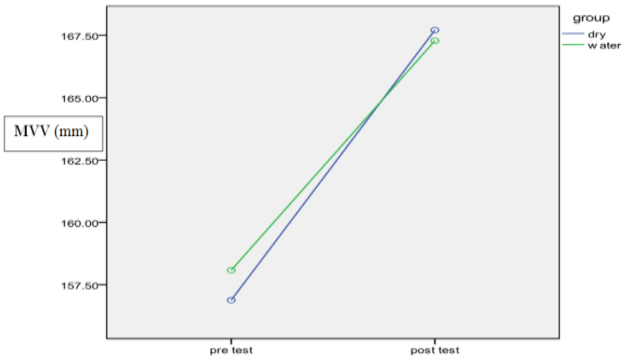

Figure 4. MVV values (mm) in groups before and after 8 weeks specific corrective exercise in water and land

Discussion and Conclusion

The research shows there is an important decrease in both kyphosis angle and important reformation in MVV, FEV1 and FVC after a particular corrective aquatic and land exercise in both groups (aquatic exercise group and land exercise group). Eun-Hee, Haley, Goodman and Fairweather show through corrective exercises to increase power of back extensor muscles, the kyphosis would decrease (Choi et al., 2005; Lynn, 2001; Hrysomallis & Goodman, 2001; Fairweather & Sidaway, 1993), moreover Mika, Sinaki, Briggs also show in their researches there is inverse correlation between power of back extensor muscles and level of kyphosis thus level of back disorders can be result of decrease power of back extensor muscles their results are same to our results (Mika et al., 2005; Sinaki et al., 1996; Sinaki et al., 2005; Briggs et al., 2004), unlike results of Sedlock and Egan are different, they declared that level of back extensor muscles power has slight effect on level of kyphosis (Eagan & Sedlock, 2001; Kim et al., 2006).

Hildenbrand and colleagues performed an aquatic athletic exercise program in water on asthmatic patients for 12 weeks, they didn't observe any significant difference between pre-test and post-test in FEV1 and FVC that was different by the result of this research, but the sample of this research was asthmatic patients (Hildenbrand et al., 2010). Anonymous research's results showed that aquatic athletic treatment lead to important increases in FEV & MVV in 10 weeks in respiratory operation of MR patients in educable group, their results are similar to the current study (Can et al., 2005). The reason of decrease kyphosis angle in samples after a period of land & aquatic corrective exercises is strengthened stretched muscles in the backside of the spinal column (back extensor muscles, through strengthening and endurance corrective exercises in water and land and also flexibility exercises in chest area using help and without help. Samples in water (Flotage principle) and inland causes volubility of the spinal column and reform of shortened muscles too. Regarding to effect of particular corrective land & aquatic exercises on (MVV, FEV1, FVC) and important improvement of them, it's noticeable that probably decrease in kyphosis angle using corrective exercise caused not only increasing in pulmonary ribcage compliance and ventilation but also decreasing in aerial path resistance and lung tissue resistance, and lungs get more capacity so this can reform all pulmonary indices. On the other hand more over these factors, reinforce intercostal muscles and respiratory muscles impress pulmonary indicators (MVV, FEV1, FVC), probably important in all pulmonary MVV, FEV1, FVC is related to this factor by doing aerobic exercises in warm up and cool down exercises. Also hydrostatic pressure made by floating organs or body in water, makes physiological response of the circulatory system. As hydrostatic pressure results leading blood from lower extremity to the trunk and body and cusses of stroke volume level, cardiac output and vo_2max and then the pulmonary volume will increase. It should point that this research is one of few researches that studied the effect of aquatic exercise on kyphosis and pulmonary volumes.

Nevertheless many recommendations of physiotherapist about using aquatic exercise there are few researches in this field. Thereforeit's necessary to more researches about aquatic exercise on posture and disorders. Also in the research method of variance analysis with repeated measure shows there isn't important difference in two groups in each related variables. There isn't any difference between two groups, results showthat the changes in each studied variable isn't related to particular exercise area, but both exercise area (water & land) shows equal effect on this variable statically.

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UČINAK 8-TJEDNOG SPECIFIČNOG KOREKTIVNOG VJEŽBANJA U VODI I NA SUHOM NA KUT KIFOZE I NEKE PULMONALNE POKAZATELJE KOD KIFOTIČNIH STUDENATA

Sažetak

Svrha ovog istraživanja bila je usporediti učinak od 8 tjedana specifične korektivne vježbe u vodi i kopnu na kut kifoze i neke plućne indekse u kifhotičnih studenata. Trideset muškaraca s povećanom normalom prsišta kyphosis (kyphosis ≥ 40 stupnjeva, 20,70 ± 0,705 godina starih, visine tijela 175,5 ± 6,19 cm, težine 64,19 ± 8,23 kg) odabrani su i slučajno podijeljeni u dvije skupine (n = 15): Grupa (1) (korektivne vježbe u vodi) i grupa (2) (korektivne vježbe na zemlji). Kut kifoze mjeren je pomoću fleksibilnog ravnala kao neinvazivna tehnika i na pouzdan način. Pulmonalni indeksi kao što su: forsirani vitalni kapacitet (FVC), forsirani izdisajni volumen u prvoj sekundi (FEV1) i maksimalna dobrovoljna ventilacija (MVV) mjereni su digitalnim spirometrom. Ponovno mjerenje korišteno je radi usporedbe i utvrđivanja razlike između pre i post-testa u obje skupine. Sve statističke analize su izvedene pomoću SPSS statističkog softvera verzije 18 i razina značajnosti je postavljena na 0.05. I kod skupine na zemljištu i skupine na vodi stupanj kyphosis, FVC, FEV1 i MVV znatno su poboljšani (p ≤ 0,05). Konačno, između dvije grupe nisu uočene značajne razlike u stupnju kifoze i plućnih indeksa (FVC, FEV1, MVV) (p ≥ 0/05) Prema rezultatima;. Možemo predložiti izvedbu obje vrste korektivnih vježbi na zemlji i u vodi kod kifotičnih osoba.

Ključne riječi: *kifoza, terapija vježbama u vodi, spirometrija, korektivne vježbe*

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