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Original article

Therapeutic exercises to compensate postural deformities in handball athletes

Ejercicios terapéuticos para compensar deformidades posturales en atletas de balonmano

Exercícios terapêuticos para compensar deformidades posturais em atletas de Handebol

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ABSTRACT

The work presented refers to the importance of having control of the postural deformities that can be seen in 13-15 year old handball athletes; especially because of the age of these athletes. Its objective is to propose therapeutic exercises for the compensation of postural alterations, treated from the planning of the physical preparation, starting from indications such as the positions and convenient movements, treatment objectives and exercises for each deformity; taking into account the individual characteristics. To carry out the research, theoretical, empirical (Interview, Documentary Review, Measurement) and statistical methods were used, which made it possible to conclude that the adoption of incorrect postures during training and the intensive use of the musculoskeletal and locomotor systems affects the occurrence of postural alterations that negatively impact on the actions of the

athletes under study, highlighting in them kyphosis and knees varuss, hence its compensation and / or correction from the training of physical preparation; therefore, the application of the proposed therapeutic exercises is recommended to verify its effectiveness in order to extend the study to other categories.

Keywords: Therapeutic exercises; Postural deformities; Handball.

RESUMEN

El trabajo que se presenta hace referencia a la importancia de tener un control de las deformidades posturales que pueden apreciarse en las atletas de balonmano de 1315 años; especialmente por la edad de estas atletas. Su objetivo se encamina a proponer ejercicios terapéuticos para la compensación de las deformidades posturales, tratadas desde la planificación de la preparación física, partiendo de indicaciones como las posiciones y movimientos convenientes, objetivos del tratamiento y ejercicios para cada deformidad; atendiendo las características individuales. Para la realización de la investigación se utilizaron métodos teóricos, empíricos (entrevista, trabajo con documentos y medición) y estadísticos lo que posibilitó concluir que la adopción de posturas incorrectas durante el entrenamiento y el uso intensivo de los sistemas osteomioarticular y locomotor incide en la ocurrencia de alteraciones de la postura que repercuten negativamente en el accionar de los atletas objeto de estudio, destacándose en ellos la cifosis, pies planos y varos y varusillas hiperextendidas y varas de ahí que sea necesario su compensación y/o corrección desde el entrenamiento de la preparación física; por lo que se recomienda la aplicación de los ejercicios terapéuticos propuestos para constatar su efectividad con el fin de extender el estudio a otras categorías.

Palabras clave: Ejercicios terapéuticos; Deformidades posturales; Balonmano.

RESUMO

O trabalho apresentado refere-se à importância de ter um controlo das deformidades posturais que podem ser observadas em atletas de andebol de 13-15 anos de idade; especialmente devido à idade destes atletas. O seu objectivo é propor exercícios terapêuticos para a compensação das deformidades posturais, tratados desde o planeamento da preparação física, partindo das indicações como as posições e movimentos adequados, objectivos do tratamento e exercícios para cada deformidade; atendendo às características individuais. Para a realização da investigação, foram utilizados métodos teóricos, empíricos (entrevista, trabalho com documentos e medição) e estatísticos, que permitiram concluir que a adopção de posturas incorrectas durante o treino e o uso intensivo dos sistemas osteomioarticulares e locomotores afectam a ocorrência de alterações posturais que têm um impacto negativo nas acções dos atletas em estudo, salientando cifose, pés chatos e joelhos e varas hiperextensos, daí a necessidade de compensação e/ou correcção a partir do treino de preparação física; Por conseguinte, recomenda-se a

aplicação dos exercícios terapêuticos propostos para verificar a sua eficácia, a fim de alargar o estudo a outras categorias.

Palavras-chave: Exercícios terapêuticos; Deformidades posturais; Handebol.

INTRODUCTION

During the training period, chronic anatomical-physiological effects occur (in the long term) that affect the postural behavior of the athletes, especially in handball, which, being unilateral throws, favors muscular hypertrophy on the dominant side Blasco (2018).

The direction of the rotational action favors an existing rotational scoliosis. The violent actions (hits, falls) make it inadvisable for people with spondylolysis and spondylolisthesis. Also, the abrupt decelerations with rotation of the dorsal spine make it potentially negative for the spine Blasco (2018).

In order to create the bases in Cuban sport and to maintain the achievements reached by athletes in the coming years, it is necessary to have a quarry of young people who have characteristics, the most specific ones possible, depending on the demands of motor, psychological, physiological, somatotype type, which a group of sports or a specific sport requires. However, it is not given the importance that it deserves to the acquisition of postural deformities, since it can attempt against the achievement of sports talents and the results to be reached by athletes.

Sports coaches are also educators, trainers of future generations, which is why in each training session the general objectives and tasks of education must be reflected and fulfilled, developing correct behavior habits" Olaru, Parra, Balius (2006).

Postural assessment is one of the most useful ways to evaluate the state of overall health and is necessary from childhood to prevent major disorders in adulthood Olaru, Parra, Balius (2006).

This element reaffirms the importance of its realization and study especially in handball since it is a sport that implies the adoption of certain postures of the head, trunk, hips, legs and feet that make possible its correct execution to reach greater sport development, which requires the bioadaptation of the muscular-skeletal and locomotive system.

Some researchers have approached the subject referring to therapies and medical treatments in handball athletes, and some have even specifically approached the postural plane (Piñeros, V. A. M., 2019). However, although the morphological and anatomical situation of handball athletes has been a concern of various authors (Arce Reyes, 2016; Gatica Soto, *et al.*, 2016; Ramírez Alarcón, 2017 & Pasco Donayre, 2019), there are limitations referred to the creation of therapeutic exercises to improve the postural deformities of handball athletes.

After analyzing the subject matter addressed in scientific articles and other research reports, it has been confirmed that:

- There is little research related to the treatment of anthropometric indicators and posture.
- Adolescent girls are more frequently injured by postural deformities.
- The most frequent postural deformities in handball are in the back and the knees due to the characteristics of the sport.

In an interview with the Handball coaches of the 13–15-year-old category, it was found that:

- It is a little usual to perform the postural evaluation of the athletes, so it is not part of the physical and pedagogical tests performed during the training process.
- They select the contents and dose the loads for physical preparation without basing it on the results of a postural study.
- The trainers of these athletes consider that it would be important to carry out postural studies on their athletes, but they cannot always count on specialists for this purpose.

For all these reasons, it was decided to perform an exploratory diagnosis on the 10 handball athletes in the 13-15 year-old category, where the presence of postural deformities such as kyphotic back, flat feet, varus and hyperextended knees and varuss was evidenced. Therefore, the authors set themselves the following objective: to propose therapeutic exercises for the compensation of postural deformities in the planning of sports training for 13-15 year-old handball athletes.

MATERIALS AND METHODS

The work was developed by making a compilation of theories about postural deformities in general and specifically in handball sport, performing a postural examination to detect the deformities presented in the athletes studied and selecting therapeutic exercises for the correction and/or compensation of the deformities found. A theoretical-practical and methodological study of handball sport is also made in order to know in which part of the training unit it is more feasible to perform the exercises.

The methods used were:

From the theoretical level: Analysis-synthesis: In the analysis of the aspects that must be taken into account to compensate for the postural deformities that occur in athletes who practice handball so that they can be included in physical preparation during sports training.

Inductive-deductive: in the inferences of the role of therapeutic exercises within the planning of physical preparation in such a way that they contribute to the compensation of postural deformities according to the individual characteristics of each athlete.

Historical-logical: In the study of the most frequent postural deformities in handball athletes, the background as well as the most accessible therapeutic exercises to plan for physical preparation training.

From the empirical level:

Interview: to coaches in order to verify the knowledge of how to treat postural deformities during sports training. Measurement: During the postural examination, carried out at 9:00 a.m. in a large, ventilated and illuminated room, complying with privacy requirements.

Working with documents: in the establishment of the therapeutic exercises to be planned in the training of the physical preparation according to corrective gymnastics programs and specific indicators of the preparation of the athlete for the ages under study.

As statistical methods: descriptive statistics, in the primary elaboration of the data, that is, it allowed to consolidate the data thrown in the different instruments used, with its later processing for its information, using as statistical technique the calculation of relative quantities (%).

For this research, the 10 handball athletes in the 13-15 years category were used as population, and as other sources, eight coaches and one methodologist.

RESULTS AND DISCUSSION

As results in the postural examination carried out, it was obtained the presence of postural deformities such as: kyphotic back 83.3 %, flat foot and varus 23 % and hyperextended knees and varus 19 %.

Eight handball coaches were interviewed, of which more than 50 % have more than ten years of experience working in this sport, obtaining the following information: four of them have no knowledge of deformities, which represents 50% of those interviewed. 80 % of the interviewees do not know the causes that can originate deformities in the sport of handball.

Taking into account the results of the exploratory study carried out, therapeutic exercises are established, which aim to: compensate the postural deformities of handball athletes based on the planning of physical preparation, taking into account their individualities Casanova (2003), Gómez (2004) and Moran (2011).

Para realizar los ejercicios terapéuticos se tendrá en cuenta three etapas: adaptación, Intermedia y mantenimiento.

The adaptation stage aims to: transform the structure of the body in a progressive way, stimulating the muscular system. It lasts eight weeks, with a frequency of 3 times a week, an intensity of 60 % and a duration of 40 minutes. As content are proposed: exercises of varied displacements, exercises of general and specific flexibility, postural control without implements, breathing exercises.

The intermediate stage has as its objective: to strengthen the muscles of the back, especially the dorsal area of the trunk, through progressive movements, considering the physical particularities of each patient. It lasts 12 weeks, with a frequency of five times a week, an intensity of 70 % and a duration of 60 minutes. As content we propose: exercises of displacements on obstacles, exercises of general and specific flexibility, postural control with and without implements, specific exercises with and without leagues and breathing exercises.

The maintenance stage has the objective of maintaining the physiological and motor transformations, especially in the dorsal area of the trunk, according to the physical gains achieved, through the application of varied therapeutic exercises. It lasts 12 weeks, with a frequency of 5 times a week, an intensity of 70 % and a duration of 60 minutes. As content are proposed: stretching exercises, general and specific flexibility exercises, postural control with and without implements, specific exercises with and without ligatures, muscle toning and breathing exercises.

At each stage, you should start with four or five repetitions, gradually increasing until you reach 15 or 20 repetitions, according to the individual characteristics of the athletes.

Neuromuscular conditioning

Objectives: it prepares the body for any activity or exercises of low or high intensity, which helps to counteract a possible injury, because of the postural correction or toning exercises, however it helps to activate the muscles and ligaments that allow maintaining the flexibility of the joints.

Tips:

1. The general conditioning exercises begin with slight movements of the joints, with and without assistance, using demonstrative, explanatory and inductive methods to strengthen the importance of specific exercises in the recovery of their morphology.

Five to ten repetitions are executed in each exercise of articular and respiratory mobility, maintaining the position between 10 and 15 seconds during the stretching.

Neuromuscular conditioning for the three stages:

1. Walking/displacement
a) On tiptoe.
b) On the outer edge.
c) In the heels.
d) Moving between obstacles that allow hyperextension.
2. Standing, legs slightly apart, arms down, perform:
a) Angular swing of arms in front, outside, up, down and back.
3. Standing up, legs separated with hands on the back of the neck, perform posterior flexion of the trunk to touch the opposite leg. Alternate movement.
4. Standing, legs joined, arms horizontal, perform:
a) Point to the front and raise the leg backwards, bringing the hands in rings over the head and looking up, alternate the movement.
b) Pointing across the front and crossing behind with the leg in elevation. Alternate.

Proposal of exercises by stages

Exercises for the first stage

Exercises for kyphosis:

1. Standing with the back to the backrest, grabbing above the head with the elbows slightly bent, standing on the tip of the feet, extending the elbows, hyperextending the head and arching the body forward, until the stretch feels good.
2. kneeling, with a cane behind the scapulas, perform:
a) Bilateral bending of the trunk
b) Bilateral torsion of the trunk.
c) Hyperextension of the trunk.
3. Supine, legs bent, with a pillow or pouch below the waist, arms stretched up, sitting with hands at the back of the neck.
4. Supine, legs joined and extended with a little pad under the waist, hands on the back of the neck, make alternate flexion and extension of the legs, lowering them slowly.

Flat foot exercises grade 1

1. Feet parallel and somewhat apart, slowly raise the inner edge and flex the toes.
2. Feet joined, raise slowly over the tips, squat, remaining over the tips.
3. On a bench, feet parallel, heels on the edge of the bench, forefeet in the void. Bend to the maximum the toes and forefeet.

Exercises for clubfoot

Sitting exercise

1. Sitting, flexion and extension of the fingers
2. External rotation of the feet.
3. External rotation of the feet, combined with pronation of the same insisting on the moment of pronation.
4. External rotation of the feet.

Varus knee exercise

1. Walk keeping the riding position in front, sideways, diagonally and in semicircles.
2. Squatting jumps.
3. Jumps in mixed support in front (carrying the legs behind well extended and gathering in front in each jump) (from 3 to 5 rounds with stretches of 30 to 50 meters)

Exercises for hyperextended knees

1. Sitting, performing simultaneous and alternating leg flexion and extension
2. Standing, maintain the semi-squatting position on your toes for several seconds.
3. Standing perform squatting supported by the toes.

Exercises for the second stage

Exercises for kyphosis:

1. Supine, legs semi-flexed with a pouch below the waist, arms at the sides of the body. Deep breath exhaling. Try not to lift your shoulders off the floor, if necessary to fix them.
2. Mixed support on hands and knees, try to bring your chest close to the ground, by hyper-extending your head and sinking your waist.
3. Hanging from the front of the back, make hyperextension of legs and head, alternating if necessary.
4. Prone, legs joined and extended, arms extended obliquely upwards with a stick between the hands, hyperextension of the head and trunk, in an assisted way.
5. In the same position as above. Bending with alternate hyperextension of extended legs, and later crossing them.

Exercises for the foot flat grade 1

Exercises on the go

These exercises will be done alternately forward and backward.

1. March with his fingertips in adduction.
2. March leaning on the external edges bending the fingers.
3. March leaning on the tips of the feet, crossing the knees.
4. March on the heels.
5. March on uneven ground or sand.

Exercises for clubfoot

Exercises in march

1. Toe walking in external rotation.
2. Walk on the heels in external rotation
3. Walk with the feet at maximum abduction
4. Walk on the inner edges of the foot, without insisting.
5. Jump frog in front, back and in serpentine.
6. March crossing the steps over a line.
7. March exaggerating the steps over a line.

Knee exercise varus

1. Alternating the exaggeration of a step over a line.

Exercises for hyperextended knees.

1. Walk with the knee bent in front (15 to 20 m).
2. Walk trying to touch your buttocks with your heels (15 to 20 m).
3. Walking on tiptoe, without reaching the total extension of the knees (10 to 15 m)

Exercises for the third stage

Exercises for kyphosis

1. kneeling with hands held down and back, perform:
a) Hyperextension of the head back and hold it for several seconds.

b) Bilateral flexion of the head.
c) Bilateral torsion of the head.
2. Walk in circles backwards with arms extended laterally.
3. Walk in a posture with a cane behind the scapulas.

Exercises for the foot flat grade 1

Dexterity exercises

1. Grasp an object with your fingers and place it on a chair.
2. Sitting on the floor, grabbing a ball with your forefoot and throwing it.

Exercises for clubfoot

Dexterity exercises

1. Wrinkle a towel with your big toes.
2. Kicking a ball with the inside of the foot.
3. Pushing out in small steps, hitting with the outside edge of the feet.

Varus knees exercises

1. Sitting, pronation of the feet, moving the soles of the feet as far away from the midline as possible without separating the ankles.
2. Sitting, try to join the knees keeping the ankles together.
3. Sitting, extension of the feet trying to join the knees as much as possible.
4. Sitting, with legs crossed, extend them as much as possible and return to the initial position.
5. Standing with feet parallel, hands-on knees, squat with internal rotation.
6. Standing, try to join the knees.
7. Standing, raising the outer edge of the feet, with a grip on the backrest.
8. Walk on the edges of your feet.

Exercises for hyperextended knees

1. Walk on a downward sloping plane (10 to 15 m).
2. Walk on a semi-squatting plane (15 to 20 m).

General methodological indications

- Monitor correct posture during sessions and establish guidelines for the home.

- Direct supervision of the trainer, whose presence is essential to achieve the proposed objectives.
- In case of the presence of back pain, suggest only neuromuscular conditioning and stretching.
- Use appropriate or comfortable clothing to perform the exercises.
- When moving, consider flat terrain, with grass or mats.
- Stretching should be done without feeling any pain.
- The exercises should be of low impact.
- The exercises should be performed preferably in the morning or afternoon.
- Do not perform exercises on an empty stomach.

From the analysis of the theoretical and methodological background related to postural deformities in the process of physical preparation of handball athletes, it could be seen that the adoption of inappropriate postures can cause changes in posture.

In the exploratory study of the postural deformities of the handball athletes of 13 - 15 years old, it was found that the greatest percentage of the athletes presented a kyphotic back, flat and varus feet and as well as the presence of hyperextended knees and varus which implies their attention from the sports training with a view to their correction and/or compensation.

Therapeutic exercises were selected based on indications for each postural deformity presented in the 13–15-year-old handball athletes, specifying stages, treatment objectives and ways to apply them during the planning of physical preparation, in such a way that they contribute to its compensation. Therefore, it is considered pertinent to apply the proposed therapeutic physical exercises to verify their effectiveness.

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The authors declare not to have any interest conflicts.

Authors' contribution:

The authors have participated in the writing of the work and analysis of the documents.