1. Introductions: The posture is understood today as base of every functional understanding, orientating therapeutic procedures in the dysfunctions muscle-skeletal, neuron-muscular or cardio-breathing-circulatorily (SOUCHARD, 1990). During the activities of daily life, including the recreational or sporting physical activities, the individual uses inadequate postures, or with spare angles, in which the musculature becomes tense and or weak, causing a discord agonist-antagonist that by repetition of the activity or simply for permanence in this posture takes to unbalances articulate (SMITH et al, 1997; HAMILL & KNUTZEN, 1999).

The stretching and the force are the main physical capacities to obtain a more balanced body and with better life quality (WEINECK, 1990). This way the kinesiological anatomy study and biomechanical supports the angles and specific postures that they use when executing a stretching.

2. Materials and Methods: This research was accomplished in three stages, in the Clinic of Physiotherapy of the Universidade Tuiuti of Paraná, in the city of Curitiba, Paraná. First stage: the physiotherapy sessions were observed, during 60 (sixty) days, in 200 individuals. Where 50 were sedentary women, 50 sedentary men, 50 feminine athletes and 50 masculine athletes; age, sex, profession and varied pathologies, and each individual accomplished treatment in different articulations, which are: shoulder, hip, column, knee and ankle. Still in this first stage, all of the stretching exercises were lifted up in a list. In the second stage these exercises were submitted to an kinesiological anatomy and biomechanical study with base in the literature. In a third stage the most important points of the previous stage were elaborated stretching exercises through with angles and correct postures.

3. Results

Orientations about the initial posture

After the kinesiological anatomy and biomechanical study, it was based on the stretching exercises being suggested angles and justified postures.

In Foot Posture - initial Posture (I.P.): parallel feet in the width of the shoulders, knees semi flexion maintaining a larger angle than 110°, pelvis retroversion, retro versioned shoulders maintaining the adduction of the scapulas, to point out whenever possible the rotation expressions of the shoulders in the longitudinal axis or in the front plan with 90° of abduction. EX (Execution): sitting on three points, the seating posture of the superior members suggested the leading flexion of the knee, of the toes, with the pelvis retroversion, to avoid the unnecessary pelvis scale. However to vary this posture it can be used with much care, always staying the abdomen and glutes avoiding being left the lateral deviations and of inclination of the trunk, when stretching mainly the superior members (MMSS). For the in foot exercises, with the feet one ahead of the other and the inflected previous knee, you don’t inflect it a lot, to follow the line of the foot maintaining a flexing of the knee of more or less 90° (HALL 1993; SMITH et al, 1997; ANDREWS et al, 2000; ENOKA, 2000).

Sat down Posture - P.I.: Sitting down with the knees inflected more or less 90°, Indian position, however, more extended to avoid the patellar hyper pressure. To sit down on the isquiatic’ swelling maintaining the erect column, adduced scapulas and cervical rectification. EX: It is a quite stable posture to accomplish stretching exercises for superior members, cervical and thoracic column high. To avoid the deviations for the lateral and inclinations, however more stable than the in foot posture (HALL, 1993; SMITH et al, 1997; ANDREWS et al, 2000; ENOKA, 2000).

Posture of cats - P.I.: Feet and knees moved away in the width of the hip, abdomen and contracted glutes avoiding scale of the pelvis, erect column, aligned head with the chin inside, the against-lateral arm the leg to be worked should be inflected being supported in the elbow while the other arm on the same side the worked leg makes light semi flexion. EX: With feet and knees moved away in the width of the hip have larger stability in this position, abdomen and contracted glutes maintains fastens the pelvis and it helps to avoid the curved back. The exercises for Cox femoral should follow the normal goniometrical; mainly they should not exceed the 45° in the extension, avoiding like this the lumbar hyperlordosis. For stretching exercises mainly of iliopsoas and quadriceps, to avoid to do excessive flexing or increase of knee pressure as in the adapted positions: to sit down on the heels or barriers exercise: the knee flexing reaches its maximum width with great part of the weight of the body about this articulation, the patella is pressed for against the femoral facet causing hyper pressure patellar, lawsuits and degeneration of the cartilage (HALL, 1993; SMITH et al, 1997; ANDREWS et al, 2000; ENOKA, 2000).

Posture back decubitus - P.I.: Lying of backs, aligned head, chin inside, adduced scapulas, if possible shoulders in abduction with rotation express, pelvis retroversion, extended knees and ankle back flexion.

EX: The rotation expresses of the shoulder in abduction of 90° for the stretching postures in back decubitus, it avoids the adduction and rotation interns of the shoulder that you/take the lineaments and thoracic cefosis. The retroversion of the pelvis in isolated stretching or simultaneous of members avoids the lumbar hyperlordosis. The dorsiflexion of the feet aids in the stretching of the gastrocnemius that are with stronger and retracted incidence that the musculature previous tibial (SOUCHARD, 1990; HALL, 1993; SMITH, 1997; ANDREWS et al, 2000; ENOKA, 2000).

Posture ventral decubitus - P.I.: Lying with the leaning abdomen on a cushion, also maintaining the abdominal contraction and gluten, the superior members abducted in 90°, turned externally with the elbows inflected in 90°. Head turned for one on the sides, relaxed legs. For position of relaxation the superior members should be relaxed stretching the body, the shoulders in rotation intern and palms of the hands upward, elbows relaxed with light flexing. EX: Stretching in this position is difficult to accomplish. Taking care of the stretching of the abdomen in this position, because it increases the lumbar hyperlordosis. The iliopsoas stretching and quadriceps when pulled back by the superior members increase the lumbar hyperlordosis and the patellar high pressure (scale exercise) (HALL, 1993; SMITH et al, 1997; ANDREWS et al, 2000; ENOKA, 2000).

Angles and postures in the stretching:

Cervical: For the movements of cervical stretching the normal goniometric of this articulation should be respected, requiring inclination movements, flexing, combined rotation to the flexing and just as relaxation the cases of extension cervical.

Shoulder: The stretching for superior members need to obey to the angle of larger lineaments and avoid them. The movements above 90° of abduction with extension back don’t need to cross the arms, it is enough the hands to be leaned the exaggerating movement causes ligament laxity of the shoulder as in the swimming athletes’ case. The abduction or maximum retropulsion is of
180° there is no need to force the shoulders to pass of this normal angle (KAPANDJI, 1980; SMITH et al, 1997). Lumbar Column: Very affected articulation during the EXof stretching exercises should always be protected being avoided the excessive and unnecessary scales, through the simultaneous contraction of the abdomen and glutaeus and semi flexion of the knee to guarantee stability. The lumbar column and the pelvis need many stretching presenting in most of the cases weakness and retraction, unlike the abdomen that is usually flaccid and prolonged and their stretching exercises take the lumbar compression. The reeducation of this articulation Knee: One of the articulations more harmed by stress and traumas. We needed to take a care a lot even in stretching exercises. The knee should never be taken to repetitive efforts with high through pelvic rebalance is fundamental (SON, 1986; SOUCHARD, 1990; SMITH et al, 1997). Pressure or force in angles of patellar high pressure or to articulate. For the appropriate stretching of this articulation still more than another needed to attempt to the deviations valgus, I pierce, hyperextension or flex a lot. But in all of the quadriceps stretching cases that cross 110° of knee flexing with 45° of extension femoral thigh will go biomechanically to cause lumbar hyperlordosis and patellar high pressure due to maximum extension of the patellar tendon and of the patellar ligament pushing the patella against the femoral facet and still associate to the weight of the body and the compensations (GOLD, 1993; HALL, 1993; SMITH et al, 1997; HAMILL & KNUTZEN, 1999; ANDREWS, 2000; ENOKA, 2000). A correct angle between 90° and 110° and the patellar ligament avoiding the maximum pressure of the patellar tendon and of the patellar ligament pushing the patella against the femoral facet and still associate to the weight of the body and the compensations (GOLD, 1993; HALL, 1993; SMITH et al, 1997; HAMILL & KNUTZEN, 1999; ANDREWS, 2000; ENOKA, 2000). Orientations about the EXof stretching exercises: The knees should be inflicted when the individual is in the in foot position, because the patella slides caudally Stretching the line intercondylar. If the patellar movement is restricted, this interferes with the width of the flexing of the knee and it can contribute to an extending rest in the extension of the knee, being able to lesion the articulation of the knee (KISNER & COLBY, 1992). To accomplish the pelvic retroversion and the stabilization of the pelvis in the front plan. Any disturbance from muscular balance harms the erect position and the locomotion functions sensibly. (FILHO, 1986; WEINECK, 1990; KISNER & COLBY, 1992; SMITH et al, 1997;). Should not execute knee flexing above 110°, because the excessive flexing increases eight times more the corporal weight increasing the tension causing patellar compression (KISNER & COLBY, 1992; HALL, 1993; SMITH, 1997). The posterior tibialis muscles are highly susceptible to the traumas, for it (EX) one of the articulations more harmed by stress and traumas. We needed to take a care a lot even in the same movement and most of the time in eccentric contraction (GOLD, 1993; HALL, 1993; SMITH et al, 1997; HAMILL & KNUTZEN, 1999; ANDREWS, 2000; ENOKA, 2000). The simultaneous occurrence of contraction and distention can take the muscular distortion and the other types of lesions, on everything if the heating exercises and preliminary stretching have been insufficient. (DANTAS, Other typical mechanism that can take in muscular lesions; it’s the exaggerating distortion of the posterior tibialis muscles, which settles during the forced flexing that before, being the knee in extension. (WEINECK, 1990). The tendons of the knee are destined to support great tension forces, and not force of compression or attrition. (SMITH et al, 1997; POCHOLLE et al, 1986). Not to execute quadriceps stretching exercises for the flexing of the knee, because it can happen cramp in the thigh’s subsequent area and also patellar compression increasing the lordosis and also lumbar pressure (SMITH et al, 1997). According to literature, extension exercises complete of trunk with extension femoral cripple, the angle of the lumbar column is accentuated in this position (in foot) and the articulation is submitted to plenty previous shearings by the weight corporal superposition (KISNER & COLBY, 1992; SMITH et al, 1997). Stretching exercises take place, respecting the normal goniometry of the shoulder, because they should stay the normal width of the articulation so that they don’t cause lesions (KISNER & COLBY, 1992). In the stretching exercises for the column should be avoided that the high thoracic column in surplus causing the subsequent lesions of the column, because they can cause lumbar compression increasing the lordosis and also lumbar pressure (SMITH et al, 1997). The stretching when used in the warming-up before competition or after exercises of force avoids the formation of muscular nodes. If used associated with the muscular activity work will obtain a developed musculature and prolonged, capable of excellent performances and of superb aesthetic appearance (RODRIGUES, 1986; DANTAS, 1989; GUYTON, 1989; McARDLE et al, 1998). The prolongation when executed incorrectly can happen in the cervical column divert postural, contracture, precocious wear and tear and cervical hyperlordosis; in the thoracic column the individual can come to have thoracic hypercifosis, pain and when it is retracted by the biomechanical unfavorable it presents rotation internas and adduction of the shoulder needing lesions in the shoulder (KAPANDJI, 1980; HALL, 1993; ANDREWS, 2000). In the lumbar column determined muscular retractions for bad posture and postural deviations, associated, as cifosis and scoliosis, they are associating lumbar hyperlordosis, muscular retractions for bad posture and weakness, for bad orientation in the activities of daily life, as well as the lumbarbago can be present in the individuals that develop their activities with bad posture. The tibialis posterior retracted tibiae's make patellar high pressure and it has a participation in the appearance (RODRIGUES, 1986; DANTAS, 1989; GUYTON, 1989; McARDLE et al, 1998). Should not execute knee flexing above 180° there is no need to force the shoulders to pass of this normal angle (KAPANDJI, 1980; SMITH et al, 1997). The high thoracic column bends in surplus causing hypercifosis. The hand should notice in the height of two hands in the head, inflect the cervical column. (KISNER & COLBY, 1992; SMITH et al, 1997; HAMILL & KNUTZEN, 1999; ANDREWS, 2000; ENOKA, 2000).
Observación: Para mantener la columna y la pierna extendida, el tratamiento debe ser efectuado prioritariamente en el momento del estiramiento del tórax. Ejercicio 11 - (Stretching) Paraespinoso - I.P.: número decúbito, piernas inflexidas. EX: para ejecutar flexión femoral y de la cadera con los pies en el suelo, ambos, observamos la flexión de la columna, manteniendo las piernas extendidas.


Observación: Para mantener la flexión de la columna y el tratamiento de la cadera, el ejercicio debe ser efectuado prioritariamente en el momento del estiramiento del tronco. Ejercicio 13 - (Stretching) Previous and Brefesquatorial - I.P.: postura decúbito, piernas flexionadas. EX: para ejecutar flexión femoral y de la cadera con los pies en el suelo, ambos, observamos la flexión de la columna, manteniendo las piernas extendidas.
4. Discussion: "The stretching has as objective mobilizes the articulation considered in all its width to allow the use of every arch to articulate and to stretch the musculature the one that is dropped for water and contraction catabolites or stiffened by the rest, sleep or it lowers temperature". The stretching will act in the muscular elasticity, giving like this for the individual a better condition in their activities, to move around and if it mobilizes, propitiating the maintenance of the flexibility and better life quality (RODRIGUES, 1986; DANTAS, 1991; GUYTON, 1989; McARDLE, 1998). The biomechanics of some exercises accomplished erroneously causes retractions and imbalances in some muscular groups, they increase the tension and muscular contractures, they elevate the high pressure and lineaments articulate causing consecutive lawsuits, degeneration and/or precocious artrosys (HALL, 1993; SMITH, 1997; McARDLE, 1998). The notion of the muscular balance is old and very known by the biomechanics. The established muscular balance around an articulation guarantees the good operation of that articulation (HALL, 1993; SMITH, 1997; POCHOLLE et al, 1999). It is not enough to accomplish stretching exercises, it is necessary do them with correct biomechanics with prevalence in the posture.

5. Conclusion: The prolongation exercises for this research studies had an anatomical deepen, kinesiological and biomechanical. Resulting in exercises more elaborated, with correct postures in his/her execution, defined angles as the biomechanics to articulate and still with preventive prevalence that you/they will also be able to be used as scientific complement support for the professionals of health.

6. Bibliographical references


Addresses: Rua Ântino Vezozzo, 952 Cambará-PR, ZIP: 86390-000
Contacts: (41) 9916-0000 / (43) 3532-2073 rbbernardelli@faefija.br

KINESIOLOGICAL ANATOMY ANALYSIS AND BIOMECHANICS OF STRECHING EXERCISES

Abstract

It is related to a field research and bibliographical revision with deepened study of anatomy, kinesiology and biomechanics. It has as an objective to suggest postures and specific angles during the accomplishment of stretching exercises, which are accomplished as part of classes of physical activities and/or supporting in the treatment of several pathologies related to the great articulations of the human body. Initially in a first stage two hundred patients of the Clinic of Physiotherapy of the University Tuitui of Paraná were observed, in the orthopedics areas, traumatology and sport accomplishing preventive exercises or in treatment. Among the two hundred patients: fifty were feminime sedentary, fifty feminine athletes and fifty masculine athletes. They were lifted up all of the stretching exercises that were accomplished inside of a period of sixty days. In a second stage these stretching exercises were studied thoroughly with base in kinesiological anatomy and biomechanics. In the third stage, stretching exercises were elaborated with some angles and correct postures, where there was the concern with the prevention of articulate compressions, decrease of tendon and muscular tensions and also with the posture deviations caring with the posture during the EXof the stretching exercises. The skin, muscles, face, ligaments, cartilage and bone answer to great applications of pressure and tension starting from the normal growth and functional hypertrophy or through the physical activity well guided (SMITH et al, 1997). The muscular participation in the stability of an articulation is essential. The antagonist relationship defines the muscular balance gotten by force exercises and of stretching (POCHOLLE & CODINE, 1999).

Keywords: stretching, exercise, biomechanics.

ANALYSE ANATOMOCINESIOLOGIQUE ET BIOMÉCANIQUE D’EXERCICES D’ALLONGEMENT

Résumé

Il s'agit d'une sondage et de révision bibliographique avec étude approfondie d'anatomie, cinesiologie et biomécanique. Il a objectif suggérer des positions et angles spécifiques pendant la réalisation d'exercices d'allongement qui sont réalisés comme partie de leçons d'activités physiques et/ou coadjuvants dans le traitement de plusieurs pathologies rapportées aux grands joints du corps humain. Initialement dans une première étape ont été observé deux cents patients de la Clinique de Physiothérapie de l'Université Tuitui du Paraná, dans les secteurs d'orthopédie, traumatologie et sportive en réalisant des exercices préventifs ou dans traitement. Entre les deux cents patients: cinquante étaient sédentaires féminins, cinquante sédentaires masculins, cinquante athlètes féminins et cinquante athlètes masculins. Ils ont été soulevés tous les exercices d'allongement qui étaient réalisées à l'intérieur d'une période de soixantes jours. Dans une seconde étape ces exercices d’allongement ont été étudiés minutieusement avec base anatomocinesiologique et biomècanique. Dans la troisième étape, ont été élaborés des exercices d’allongement avec angles et des positions correctes, où il y avait la préoccupation avec la prévention...
de compressions articulaires, diminution de tensions tendineuses et musculaires et encore de détours de postures avec des soins dans la position pendant l'exécution des exercices d'allongement. La peau, les muscles, la fascia,( couverture fibreuse) les ligaments, la cartilage et les os répondent à des applications excellents de pression et de la tension à partir de la croissance normale et de la hypertrophie fonctionnelle ou à travers l’activité physique bien guidée (SMITH et al, 1997). La participation musculaire dans la stabilité d’un joint est essentielle. La relation agoniste/antagoniste définit l’équilibre musculaire réussi par des exercices de force et d’allongement (POCHOLLE et CODINE, 1999). En étant ainsi, s’il justifie une étude anatomocinesiologique et biomécanique des exercices d’allongement présentés par ce travail.

Mots Clés: Allongement, Exercices, Biomécanique.

ANÁLISIS ANATOMOCINESIOLÓGICA Y BIOMECÁNICA DE EJERCICIOS DE ESTIRAMIENTO

Resumen
Se trata de una investigación de campo y revisión bibliográfica con estudio profundo de anatomía, cinesiología y biomecánica. Tiene como objetivo sugerir posturas y angulaciones específicas durante la realización de ejercicios de estiramiento, los cuales son realizados como parte de actividades físicas y/o coadyuvantes al tratamiento de varias patologías relacionadas a las grandes articulaciones del cuerpo humano. Inicialmente en una primera etapa fueron observados doscientos pacientes de la Clínica de Fisioterapia de la Universidad Tuiuti de Paraná, en las áreas de ortopedia, traumatología y deportiva realizando ejercicios preventivos o en tratamiento. Entre los doscientos pacientes: cincuenta eran sedentarias femeninas, cincuenta sedentarios masculinos, cincuenta atletas femeninas y cincuenta atletas masculinos. Fueron levantados todos los ejercicios de estiramiento que eran realizados dentro de un período de sesenta días. En una segunda etapa estos ejercicios de estiramiento fueron estudiados minuciosamente con base anatomocinesiológica y biomecánica. En la tercera etapa, fueron elaborados ejercicios de estiramiento con angulosidades y posturas correctas, donde había la preocupación con la prevención de compresiones articulares, disminución de tensiones tendinosas y musculares y también de desvíos posturales con cuidados en la postura durante la ejecución de los ejercicios de estiramiento. A piel, músculos, fascia, ligamentos, cartilagos y huesos responden a aplicaciones óptimas de presión y tensión a partir del crecimiento normal e hipertrofia funcional o a través de la actividad física bien orientada (SMITH et al, 1997). La participación muscular en la estabilidad de una articulación es esencial. La relación agonista/antagonista define el equilibrio muscular conseguido por ejercicios de fuerza y de estiramiento (POCHOLLE & CODINE, 1999). Siendo así, se justifica un estudio anatomocinesiológico y biomecánico de los ejercicios de estiramiento presentados por este trabajo.

Palabras clave: estiramiento, ejercicio y biomecánica.

ANÁLISE ANATOMOCINESIOLÓGICA E BIOMECÂNICA DE EXERCÍCIOS DE ALONGAMENTO

Resumo
Trata-se de uma pesquisa de campo e revisão bibliográfica com estudo aprofundado de anatomia, cinesiologia e biomecânica. Tem por objetivo sugerir posturas e angulações específicas durante a realização de exercícios de alongamento, os quais são realizados como parte de aulas de atividades físicas e/ou coadjuvantes no tratamento de várias patologias relacionadas às grandes articulações do corpo humano. Inicialmente em uma primeira etapa foram observados duzentos pacientes da Clínica de Fisioterapia da Universidade Tuiuti do Paraná, nas áreas de ortopedia, traumatologia e desportiva realizando exercícios preventivos ou em tratamento. Entre os duzentos pacientes: cinqüenta eram sedentárias femininas, cinqüenta sedentários masculinos, cinqüenta atletas femininas e cinqüenta atletas masculinos. Foram levantados todos os exercícios de alongamentos que eram realizados dentro de um período de sessenta dias. Em uma segunda etapa estes exercícios de alongamentos foram estudados minuciosamente com base anatomocinesiológica e biomecânica. Na terceira etapa, foram elaborados exercícios de alongamento com angulações e posturas corretas, onde havia a preocupação com a prevenção de compressões artulares, diminuição de tensões tendinosas e musculares e ainda de desvíos posturais com cuidados na postura durante a execução dos exercícios de alongamento. A pele, músculos, fásica, ligamentos, cartilagem e osso respondem a aplicações ótimas de pressão e tensão a partir do crescimento normal e hipertrofia funcional ou através da atividade física bem orientada (SMITH et al, 1997). A participação muscular na estabilidade de uma articulação é essencial. A relação agonista/antagonista define o equilíbrio muscular conseguido por exercícios de força e de alongamento (POCHOLLE & CODINE, 1999). Sendo assim, se justifica um estudo anatomocinesiológico e biomecânico dos exercícios de alongamento apresentados por este trabalho.

Palavras-chave: alongamento, exercício, biomecânica.