

Original article

Plyometric type neuromuscular exercise is a treatment to postural control deficits of volleyball players: A case study



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ABSTRACT

Objective: The effects of exercise protocols on postural control changes have been supported, but the influence of a common and specific type neuromuscular exercise such as plyometric on postural control is not clear. Therefore, the aim of this study was to examine the effects of plyometric type neuromuscular exercise on balance or postural control performance of young male volleyball players.

Method: Ten professional young male volleyball players participated in this study and performed plyometric exercises including 4 × 10 squat jump, broad jump, tuck jump with knee to chest, and depth jump from 45-cm box high 60 and 90 s rest between sets and exercises, respectively. Before and immediately after completing the plyometric exercise, postural control was assessed by the Star Excursion Balance Test (SEBT) at 8 directions (anterior, A; anteromedial, AM; anterolateral, AL; medial, M; lateral, L; posterior, P; posteromedial, PM; and posterolateral, PL).

Results: The results indicated that plyometric exercise induced deficits in reach directions and greater changes occurred in the M, P and AL directions.

Conclusions: It can be recommend that strength and conditioning professionals in the field of volleyball do not perform other type of landing exercise in plyometric training sessions because of postural control impaired and consequently the probability of lower extremity injuries will increase.

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Ejercicios neuromusculares de tipo pliométrico como tratamiento de déficits de control postural de jugadores de voleibol: a propósito de un caso

RESUMEN

Objetivo: El efecto de protocolos de ejercicios, en cambios del control postural, son bien conocidos, pero la influencia de un sencillo y específico tipo de ejercicio neuromuscular, como los ejercicios pliométricos, en el control postural, no está clara. Por tanto, el objetivo de este estudio fue examinar los efectos de los ejercicios neuromusculares, de tipo pliométrico, en el equilibrio o en el control postural, de varones jóvenes jugadores de voleibol.

Método: Diez varones jóvenes jugadores profesionales de voleibol participaron en este estudio y realizaron ejercicios pliométricos incluyendo 4 × 10 saltos con sentadilla, saltos de longitud, saltos con rodillas al pecho y saltos con rebote desde un cajón de 45 cm de altura, con 60 y 90 s de reposo entre series y ejercicios, respectivamente. Antes e inmediatamente después de completar los ejercicios pliométricos se midió el control postural mediante el *Star Excursion Balance Test* (SEBT) en 8 direcciones (anterior: A; anteromedial: AM; anterolateral: AL; medial: M; lateral: L; posterior: P; posteromedial: PM y posterolateral: PL).

Resultados: Los resultados indican que los ejercicios pliométricos indujeron déficits en las direcciones analizadas y que los mayores cambios se produjeron en las direcciones M, P y AL.

Palabras clave:

Control postural

Ciclo estiramiento-acortamiento

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Conclusión: Se puede recomendar, a los profesionales del voleibol, en el campo del entrenamiento de la fuerza, que no realicen otros tipos de ejercicios de suelo en las sesiones de entrenamiento pliométrico, porque la disminución del control postural podría incrementar secundariamente la probabilidad de lesión del miembro inferior.

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Exercícios neuromusculares do tipo pliométrico como tratamento de déficits no controle postural de jogadores de voleibol: um estudo de caso

R E S U M O

Palavras-chave:

Controle postural
Ciclo alongamento encurtamento
SEBT

Objetivo: O efeito de protocolos de exercícios sobre as mudanças no controle postural é bem conhecido, mas a influência de um tipo de treinamento neuromuscular comum e específico como o pliométrico no controle postural não está claro. O objetivo deste estudo foi examinar os efeitos dos exercícios neuromusculares do tipo pliométrico no equilíbrio e controle postural de jovens jogadores de voleibol masculino. **Métodos:** Dez jovens, jogadores profissionais de voleibol, participaram desse estudo e realizaram exercícios pliométricos que incluíram: 4 × 10 saltos partindo da posição de agachamento, saltos longitudinais, saltos com joelho encostando no peito e salto com rebote sob uma caixa de 40 cm de altura, com descanso entre 60-90 segundos entre as séries e exercícios, respectivamente. Antes e imediatamente após completarem o exercício de pliometria, o controle postural foi medido com as 8 direções do Star Excursion Test (SEBT) (anterior: A; antero-medial: AM; antero-lateral: AL; medial: M; lateral: L; posterior: P; pósterio-medial: PM e postero-lateral: PL).

Resultados: Os resultados indicam que os exercícios pliométricos induziram déficits no alcance das direções do SEBT e as maiores mudanças ocorrem nas direções M, P e AL.

Conclusão: Pode ser recomendado que os profissionais que trabalham com força e condicionamento físico voltado ao voleibol não realizem outro tipo de exercício com carga nas sessões de pliometria, por causa da debilidade no controle postural que o treinamento pliométrico ocasiona e conseqüentemente na probabilidade de aumentar o risco de lesões nos membros inferiores.

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Introduction

Knee ligament injuries occur several times during training and competition in volleyball players. Among some ligaments in the knee, anterior cruciate ligament (ACL) plays a critical role to stability of the joint.^{1,2} ACL injuries account for 50% or more of all knee injuries, making this ligament especially important in any discussion of knee injuries. Most ACL injuries in volleyball players occur when a player lands awkwardly after jumping. Usually ACL tears are associated with a “pop” and immediate knee swelling. Previous authors reported that annual incidence of ACL injury is about 38000 cases in the United States.³

One possible explanation to increase ACL injury could be deficits in postural control. It has been well documented that poor postural control is associated with injury of the joint and therefore enhancing joint awareness and postural control could be a modality to decrease injuries.⁴

The common method of training for power-type athletes (i.e., volleyball players) is plyometric training. It has been reported that plyometric training is an effective training modality for improving joint awareness, balance and neuromuscular properties that used by strength and conditioning professional at pre- and in season of training schedule for athletes.^{5,6} Plyometric training is a form of training techniques which used by athletes in all types of sports to increase performance adaptations.⁷ Plyometrics consists of a rapid stretching of a muscle (eccentric action) immediately followed by a concentric or shortening action of the same muscle.⁷ The stored elastic energy within the muscle is used to produce more force than can be provided by a concentric action alone.⁷

Although, with review in literature, plyometric training could be an effective training method for enhancing balance and postural control in athletes,^{5,6} the acute effects of plyometric training on

postural control are poorly understood. Deficits in postural control after several fatigue protocols (i.e., running and resistance exercise) has been supported by previous authors,^{8–14} but the influence of plyometric exercise on balance performance is not clear. To the authors' knowledge, only Twist et al.¹⁵ examined the influence of 200 countermovement jump plyometric exercise on unilateral balance performance by using the Biodex Stabiliometer and found deficits at 24 h post exercise. Since, plyometric training can be used in some sport teams (i.e., volleyball) and those athletes perform plyometric training for increasing muscle explosiveness, determining the acute effects of plyometric exercise on balance and postural control is vital.

Compared with previous study that used Biodex Stabiliometer to analyze balance changes after plyometric exercise,¹⁵ Gribble et al.¹⁶ reported that Star Excursion Balance Test (SEBT) should be considered a highly representative, noninstrumented dynamic balance test for physically active individual. The SEBT has been shown to be a reliable measure and has validity as a dynamic balance test to predict risk of lower extremity injury, to identify dynamic balance deficits in patients with a variety of lower extremity conditions, and to be responsive to training programmes in both healthy people and people with injuries to the lower extremity and this note have been confirmed by clinicians and researchers that employed the SEBT for the lower extremity functional test.

With regard to importance of plyometric training on athletes training schedule and highly representative of SEBT to determine the deficits in postural control, no study has focused on the analysis of a specific plyometric exercise programme on postural control performance in volleyball players. Therefore, the aim of this study was to examine the effects of plyometric type neuromuscular exercise on postural control (SEBT) in volleyball players. It was hypothesized that a session of plyometric exercise would impair

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