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ORIGINAL ARTICLE

Effect of acute contract-relax proprioceptive neuromuscular facilitation stretching on static balance in healthy men

Effet d'étirements aigus de type facilitation neuromusculaire proprioceptive par contraction-relaxation sur l'équilibre statique de sujets sains

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Received 26 January 2016; accepted 6 June 2016

KEYWORDS

Stability;
Muscle stretching exercises;
Vision;
Warm-up exercise;
PNF stretching;
Proprioception

Summary

Objective. — Muscle stretching is plenty used prior to training and competition. Considering the importance of balance control in performance, muscle stretching is expected to have positive effects on balance. However, there is a lack of studies investigating the effects of contract-relax proprioceptive neuromuscular facilitation (CR PNF) stretching on balance control. The purpose of this study was to investigate the effects of CR PNF stretching on static postural balance.

Methods. — Fourteen subjects were tested before and after a 5-minute cycle warm-up followed by 10 minutes of CR PNF stretching (stretching condition) and the same cycle warm-up with 10-minute rest periods (control condition). The four muscle groups stretched were the quadriceps, hamstrings, anterior tibialis, and calf muscles of both legs in an alternating manner. Postural balance was assessed in a bipedal static stance before and after each condition with eyes opened (EO) and eyes closed (EC).

Results. — No significant interactions for any postural parameters. However, there was a significant main effect of condition for sway area ($P < 0.05$), and significant main effects of time for sway area ($P < 0.05$) and anteroposterior sway (AP sway) ($P < 0.01$). Sway area and AP sway increased significantly ($P < 0.05$) after stretching and control condition more than before each condition. Furthermore, there were no differences between the stretching and control for all parameters ($P > 0.05$).

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Conclusion. — It appears that the stretching and control conditions impaired static balance control by increasing postural sway. CR PNF stretching was unable to compensate for the warm-up and its effects of induced alteration in postural balance.

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MOTS CLÉS

Stabilité ;
Exercices
d'étirement
musculaires ;
Vision ;
Exercice
d'échauffement ;
Étirements PNF ;
Proprioception

Résumé

Objectif. — L'étirement musculaire est souvent utilisé avant l'entraînement et les compétitions. Compte tenu de l'importance du contrôle de l'équilibre pour les performances, les étirements sont susceptibles d'améliorer le maintien de l'équilibre. Cependant, il y a un peu d'études portant sur les effets des étirements de type facilitation neuromusculaire proprioceptrice par contraction-relaxation (CR-PNF) sur le contrôle de l'équilibre. Le but de cette étude était d'étudier les effets de l'étirement suivant la méthode CR PNF sur l'équilibre postural statique.

Matériels et méthodes. — Quatorze sujets ont été testés avant et après un cycle de cinq minutes d'échauffement suivi de dix minutes d'étirements de type CR PNF (condition de stretching) et le même cycle d'échauffement avec une période de repos de 10 min (condition de contrôle). Les quatre groupes de muscles étirés étaient le quadriceps, les ischiojambiers, tibial antérieur et les muscles du mollet des deux jambes d'une manière alternée. La balance posturale a été évaluée dans une position statique bipède avant et après chaque condition avec les yeux ouverts (YO) et les yeux fermés (YF).

Résultats. — Aucune interaction significative pour tous les paramètres posturaux n'a été relevée. Cependant, il y avait un effet global significatif de la condition pour la surface d'oscillation ($p < 0,05$) et un effet global significatif du temps pour la surface d'oscillation ($p < 0,05$) et les oscillations antéropostérieures (AP sway) ($p < 0,01$). La surface d'oscillation et AP sway ont augmenté de manières significatives après la condition de stretching et la condition de contrôle ($p < 0,05$). En outre, il n'y avait pas de différences entre les deux conditions stretching et contrôle, et ce, pour tous les paramètres mesurés ($p > 0,05$).

Conclusion. — Il semble que les conditions de stretching et de contrôle ont altéré le contrôle de l'équilibre statique en augmentant les oscillations posturales. L'étirement CR PNF n'a pas pu compenser les effets de l'échauffement sur l'altération de l'équilibre postural.

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1. Introduction

Prior to training and competition, athletes perform a warm-up routine, aiming to prepare their muscles to attain maximal power and coordination as well as to increase joint range of motion [1]. Stretching is a common component of pre-performance activities and warm-up for many athletic events [2]. There are various techniques of stretching, including static, dynamic, ballistic, and proprioceptive neuromuscular facilitation (PNF) stretching [3,4].

The most frequently used techniques are the static stretching and PNF stretching techniques [5]. PNF stretching has been reported to be more effective in improving range of motion than static or ballistic techniques [6]. The PNF technique involves a voluntary muscle action of agonistic muscles before a static stretch, with the recommended duration of isometric muscle actions of 3 to 6 seconds [7]. It is a popular method of stretching based on inhibition techniques such as contract-relax (CR), hold-relax, and contract-relax antagonist-contract (CRAC), which are the most commonly used [8]. This improvement is achieved by performing voluntary muscle contraction and promoting muscle relaxation before stretching in order to reduce the reflexive components [5]. The CR method consists of the target muscle (TM) being lengthened and held in that position while the subject contracts the TM isometrically for an allotted amount of time [9].

Stretching and warming-up seem to be key parameters for successfully performing exercises and PNF stretching helps to enhance balance control [5,10]. Data examining the effects of PNF stretching on balance control are scarce. Balance control has been shown to play a fundamental role in many athletic activities and may contribute to a successful performance. Most studies examined the effects of static stretching or dynamic stretching on balance performance [11–14]. Behm et al. [11] and Nagano et al. [14] reported that balance control was impaired after static stretching. In the study by Behm et al. [11], the stretching protocol involved a 5-min cycle warm-up followed by static stretching or rest for approximately 26 minutes. In contrast, Costa et al. [12] reported that static stretching produced a significant improvement in balance compared to the no stretching condition. In addition, Chatzopoulos et al. [13] reported that static stretching has negative effects on balance compared to dynamic stretching.

However, there is a lack of studies investigating the effects of CR PNF stretching on balance control. There is a need to know whether PNF stretching is beneficial or detrimental to postural performance. There are only two studies [5,10] that investigated the effects of CRAC PNF stretch and Hold Relax PNF stretch on postural balance. Ryan et al. [10] suggested that CRAC PNF stretching with or without warm-up improved mediolateral (ML) stability and that CRAC is an useful protocol for improving ML stability [10]. However,

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