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The deadlift form analysis system using Microsoft Kinect

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Abstract

Weight training leads to muscle injury for inexperience exercise. The deadlift form is one of high risk posture of weight training. Therefore, the prevention of incorrect deadlift form needs an expert trainer. Some people are not be able to effort the private trainer cost. This research presents the deadlift form analysis system using Microsoft Kinect. Microsoft Kinect can be applied to detect the deadlift form with its full body motion capability the Chaffin's biomechanical modeling. The Chaffin's model is used to calculate two forces, compression force and shear force, on lumbosacral disc (L5/S1). Results of this research can help the people to practice the corrected deadlift form and reducing injuries on lumbosacral disc (L5/S1) using Microsoft Kinect. The accuracy of this system is 80.9%.

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Keywords: Microsoft Kinect; weight training; deadlift; Chaffin's model

1. Introduction

The weight training is popular and one of exercise[1]. Kerr at al[2] found 90.4% of the weight training injuries cause by free weight. The deadlift form is one of free weight form. The incorrect deadlift form causes more compression force (F_c) and shear force (F_s) on lumbosacral disc (L5/S1) or herniated discs[3].

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The proposed system can detect the human posture who dose deadlift in real time to prevent the incorrect posture and to avoid the injuries of the lumbosacral disc (L5/S1). The system calculates the compression and the shear force on the lumbosacral disc using the Chaffin's model.

2. Research hypothesis

2.1. Injuries of deadlift

Tony Leyland[3] studies a biomechanical model of the deadlift and considers the compression force (F_c) and shear force (F_s) acting on the lumbosacral disc (L5/S1). The line of action of the erector musculature must pulls on the spine with hundreds of pound of force to lift common loads and creates compression between them. If the incorrect deadlift form is used the erector musculature cannot pull on the spine. The risk of lumbar spinal injuries are increase.

To reduce the risk, the deadlift is modeled using a commercially available biomechanical computer modeling program, 4DWATBAK[3] . The 4DWATBAK uses height, weight, sex and weight of load of participant as parameters. The model calculates the compression and the shear force cause by the corrected deadlift and the incorrected deadlift. Experimental results show that the incorrected deadlift generates more compression force and shear force at the lumbosacral disc (L5/S1) than the corrected deadlift. A suggested safe cutoff point at 3,433 Newtons was established by NIOSH (National Institute for Occupational Safety and Health) in 1981[5]. The University of Waterloo ergonomic research group has suggested 500 Newtons as a safe limit and 1,000 Newtons as a maximal permissible limit.

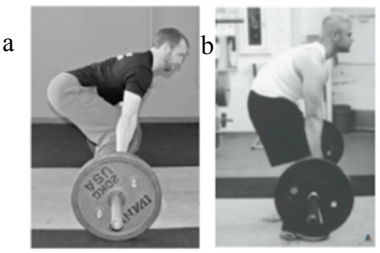

Fig. 1. (a) The correct deadlift; (b) The incorrect deadlift.

2.2. *Chaffin's model*

The Chaffin's model[5] is used for calculating compression force and shear force acts lumbosacral disc (L5/S1) as shown in Fig. 2.

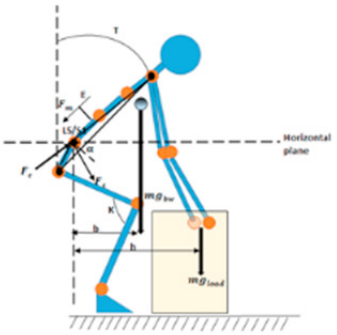

Fig. 2. The Chaffin's model.