Effect of Counterforce Brace on Isokinetic Measurements and Myoelectric activity of Wrist Muscles in Lateral Epicondylitis

By

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Abstract:

Counterforce braces are commonly used for treating the symptoms of lateral epicondylitis. The purpose of this study was to the examine the effect of the counterforce brace on the rmyoelectric (EMG) activity and isokinetic measures (torque, mechanical fatigue and agonist/antagonist ratio) of the dominant arm wrist extensors in subjects suffering from lateral epicondylitis. Thirty subjects with an age ranging from 35-50 years participated in this study. Patients were examined with and without using the counterforce brace. The EMG, agonist/antagonist ratio and peak torque were recorded after five maximal contraction using angular velocity of 120 degrees/sec. The post fatigue torque was also calculated after five maximal contraction at120 degrees/sec. The recorded EMG and isokinetic data were collected simultaneously and analyzed using repeated measure MANOVA with alpha level set at $p<0.05$. Results revealed that the counterforce brace significantly reduced the EMG activity and peak torque of the wrist extensor muscles(P=0.01 and 0.02) but had no effect on the mechanical fatigue or the agonist/antagonist ratio.

Keywords: Counterforce brace, Isokinetic measurements, Myoelectric activity, Wrist muscles, Lateral epicondylitis.

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LIST of ABBREVIATIONS

Ag-AgCl:	Silver –Silver Chloride
ANOVA	Analysis of Variance
ECRB:	Extensor Carpi Radialis Brevis
ECRL:	Extensor Carpi Radialis Longus
ECU:	Extensor Carpi Ulnaris
EDC:	Extensor Digitorum Communis
EMG:	Electromyography
IEMG	Integrated Electromyography
Kg:	Kilogram
MANOVA	Multivariate Analysis of Variance
Mm2:	Millimeter Square
MVIC:	Maximum Voluntary Isometric Contraction
N. m:	Newton Meter
ROM	Range of Motion
SD	Standard Deviation
SPSS:	Statistical Package for the Social Sciences
US	Ultrasound
VAS	Visual Analogue Scale
µv:	Microvolt

INTRODUCTION

CHAPTER I
INTRODUCTION

Lateral epicondylitis is the most frequent type of myotendinosis and is defined as a painful debilitating musculoskeletal condition that impacts substantially on society and challenges the health care industry. It can also be responsible for substantial pain and loss of function of the affected limb (DeSmedt et al., 2007). Lateral epicondylitis is much more common than medial epicondylitis occurring up to 20 times more frequently and is associated with an overload of the muscles that extend the wrist and fingers (Gappadona et al., 2002). The onset is either gradual or sudden (Manchanda and Grover, 2008) and the incidence in general practice is approximately 4 to 7 cases per 1000 patient per year with annual incidence of 1% to 3% in general population (Struijs et al., 2003). The characteristic age of onset is between 35-50 years and the overall male/female ratio is usually equal (Morrey, 1999).

Tendinitis, although not life-threatening is an extremely common problem that interferes with an active lifestyle (Tietz et al., 1997). As high as 15% of workers in highly repetitive hand task industries are affected resulting in an average duration of 12 weeks of absenteeism in as many as 30% of all those affected (Bisset et al., 2005). This can have substantial socioeconomic consequences, so it is important to develop effective measures for the prevention and management (Pluim et al., 2006).

The term tennis elbow doesn't adequately describe either the condition or its cause. Various conditions about the elbow have been used to describe lateral elbow pain including lateral humeral epicondylitis, common extensor tendonitis or radioulnar synovitis (Anderson and Rutt, 1992; Peters and Baker, 2003). However, Morrey (1999) defined lateral epicondylitis as the tendinitis of the extensor carpi radialis brevis (ECRB) muscle. Less frequently, the extensor carpi radials longus (ECRL) muscle is affected at its attachment to the supracondylar ridge or sometimes the anterior portion of the extensor digitorum communis (EDC) muscle. According to Ellenbecker and Mattalino (2005), lateral epicondylitis is an extra-articular tendinous overuse injury resulting from both degenerative and inflammatory processes. Repetitive stresses can result in excessive vascular granulation and impaired healing within the injured tendon (Tietz et al., 1997).

Epicondylitis can occur in both athletes and non athletes due to repetitive wrist extension (Gappadona et al., 2002; Miller and Sekiya, 2006). Occupational activity that requires stressful forearm use such as carpentry, plumbing and meat cutting are also related to the occurrence of lateral epicondylitis (Morrey, 1999). Lateral epicondylitis occurs in over 50% of athletes using the overhead arm motions (Field and Savoie, 1998). With the popularity of racquet and throwing sports, the number of individuals seeking medical care for pain and elbow dysfunction is high. Estimates of 50% of elbow injury of athletes using overhead arm motions are suggested (Kulund et al., 1979; Retting, 1998).

Athletes participating on week ends at irregular intervals especially vigorous sports are at risk for both traumatic and overuse injuries because of deconditioning and maladaptation of the bone, muscle and tendon ligament microstructures (Birrer and O'connor, 2004). Novice players are more likely to use repetitive wrist motions to produce strokes (wristy impact) and hence require greater force from wrist extensors (Berhang et al., 2000).

According to Holdsworth and Anderson (1993) & Blackwell and Cole (1994), lateral epicondylitis causes pain at the common extensor origin at the lateral epicondyle and it is one of the most common causes of elbow and forearm problems encountered in clinical practice. Pain is exacerbated by work or recreational activities that involve gripping actions of the hand, such as holding tools, shaking hands and lifting a kettle (Vicenzino et al., 2003). The key to prevention and treatment of these injuries is good coaching and proper stretching and strengthening programs (Kulund et al., 1979).

Since lateral epicondylitis was first diagnosed in 1882, many varied concepts of treatment, ranging from nonsurgical to surgical have been proposed (Kenebel et al.,1999). Lateral epicondylitis can almost be treated nonoperatively with activity modification and specific exercises. If the patient fails to respond to nonoperative treatment after one year, they are candidates for surgical intervention (Field and Savoie, 1998).

A popular nonsurgical treatment for the signs and symptoms of lateral epicondylitis is the use of a counterforce brace. It has several names such as forearm strap, counterforce brace, counterforce armband, circumferential arm band and forearm support and all of which describe a flexible band that fits around the proximal forearm and provides pressure to the underlying tissues during activity (Knebel et al., l999).

In Dutch primary care, 21% of the patients with lateral epicondylitis are prescribed an orthotic device as a treatment strategy and many different types of braces are present (Struijs et al., 2001). The counterforce brace has been used widely to both prevent and treat the symptoms of lateral epicondylitis and brace therapy was effective in improving the ability to perform daily activities (Barclay, 2004). Decreased extensor myoelectric (EMG) activity while hitting a serve or backhand shot in subjects wearing a counterforce elbow brace was also observed (Anderson and Rutt, 1992).

The counterforce brace provides dispersive pressure around the inflammation area by broadening the area of applied stresses; thus lessening the stresses to the muscular attachments at the lateral epicondylar region. This allows the forearm muscles to contract more forcefully within a pain free range of motion. Moreover, there is a need to further examine the efficiency of orthosis on various clinical outcomes for people lateral humeral epicondylitis (Nirschl and Kraushaar, 1996; Chan and Gabriel, 2004).

Various studies mentioned and discussed the common upper limb dysfunctions but didn’t deal precisely with the benefits of the counterforce brace on lateral epicondylitis management. Moreover, biomechanical data on most bracing and protective equipment systems is lacking (Groppel and Nircshl, 1986). Although biomechanical studies show that forearm bracing has a direct effect on reducing the stresses at the origin of ECRB muscle, clinical studies are more equivocal, and further trials are required to determine the usefulness of forearm bracing in clinical practice (Martin and George, 2007). According to Oken et al. (2008), in patients with lateral epicondylitis, a brace has a shorter beneficial effect in reducing pain or improving grip strength.

So, the aim of this study was to investigate the effect of the counterforce brace on the EMG activity and isokinetic parameters (peak torque, mechanical fatigue and the agonist/antagonist ratio) of the dominant arm wrist extensors in subjects suffering from lateral epicondylitis.

Statement of the problem:

Would the counterforce brace affect the EMG activity and isokinetic parameters (peak torque, mechanical fatigue and agonist/antagonist ratio) of the dominant arm wrist extensors of patients suffering from lateral epicondylitis?

Purposes of the study:

The purposes of the study were:

1-To investigate the effect of the counterforce brace on the EMG activity of the dominant arm wrist extensors of patients suffering from lateral epicondylitis.

2- To investigate the effect of the counterforce brace on the isokinetic parameters (peak torque, mechanical fatigue and agonist/antagonist ratio) of the dominant arm wrist extensors of patients suffering from lateral epicondylitis.

Significance of the study: