PROPRIORECEPTIVE APPROACH FOR UNSTABLE ANKLE

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ABSTRACT

Ankle sprains are the most common injury in physically active people who practice physical activities that requires jumping, changing direction, pivoting. Practically these activities are seen in almost every sport, no matter if it is with professional or recreational purposes. A lot of individuals are at increased risk of ankle sprain. Acute ankle sprain leads to weakening of the passive and dynamic restrains, leaving the joint unprotected, possibility of reinjury, chronic instability leading to long term disability. That is why a lot of authors stopped their attention on looking for proper treatment and prevention for ankle sprain.

The purpose of the present report is to summarize the effectiveness of all treatment methods and to point out the best possible way to manage ankle sprain. It is a systematic review study, based on recent literature of the given topic. The data is sorted out from different sources of information: specific books concerning ankle functional anatomy and kinesiology, physiotherapy in ankle instability rehabilitation; published articles; internet sources – pubmed, medline etc. Some researchers showed the relationship between poor ankle proprioception and balance abilities. Others assessed joint position sense to plantar flexors and the peroneal muscles activity. They all agree that proprioception training plays important role in prevention of chronic ankle instability and it is of a great importance to improve it to reduce ankle sprain accidents.

Key words: *ankle instability, proprioception, postural balance*

INTRODUCTION

Ankle sprains are the most common injury in physically active people who practice physical activities that requires jumping, changing direction, pivoting (Rivera et al 2017). Practically these activities are seen in almost every sport, no matter if it is with professional or recreational purposes. In sports like basketball, volleyball and football, ankle sprains can present reinjury rates around 70-80% (Postle et al 2012, Riva et al 2016), leading to chronic ankle instability in 20-50% of these cases (Verhagen and Bay 2010). A lot of individuals are at increased risk of ankle sprain. Most frequently athletes injure the ankle upon ground contact, when landing with the foot inverted and plantar flexed. Usually both sensory and motor subsystems contribute to generate reactive avoidance motor strategy, to prevent the accumulated strain in the relevant tissues from reaching injurious moment (Lephart and Fu, 2000). But an injury can often occur when the stress applied on the restrictive tissues is greater than they can undergo and at the same time there is a failure on the neuromuscular system to protect the ankle intact. The threshold for sensing joint movement has been changed (Lephart and Fu, 2000). Acute ankle sprain leads to weakening of the passive and

dynamic restrains, leaving the joint unprotected, possibility of reinjury, chronic instability leading to long term disability. A lot of investigators look for an answer why the ankle is so often reinjured, prone to become a chronic condition. Another group of authors stopped their attention on looking for proper treatment and prevention from ankle sprain.

Purpose

The purpose of the present report is to summarize the effectiveness of all treatment methods and to point out the best possible way to manage ankle sprain

METHODOLOGY

It is a systematic review study, based on recent literature of the given topic. The data is sorted out from different sources of information: specific books concerning ankle functional anatomy and kinesiology, physiotherapy in ankle instability rehabilitation; published articles; internet sources – pubmed, medline etc.

The selected studies included followed criteria: the tested subjects were physically active with no

other injury except previous ankle sprain; the experimental group received proprioceptive training only, compared with a control group that received no proprioceptive training, just other suitable exercises.

RESULTS AND DISCUSSION

Some researchers showed the relationship between poor ankle proprioception and balance abilities. For-kin et al. (1996) show that deficits in these area exist following ankle sprain, especially chronic ankle instability. Riva et al. (2016) in their six year prospective study investigating the postural balance in basketball players showed that after high-frequency instability exercises, led to improvements in proprioceptive and postural control and were effective in reducing the incidence of ankle sprains. Moreover they claim that improvement in proprioceptive control could be the key factor for an effective reduction in lower limb injuries.

Posture and balance are important factors in controlling ankle stability, which can be improved with proprioceptive rehabilitation (Leanderson et al, 1996). McGuine et al (2000) have similar hypothesis, an experiment with 210 high school basketball players, who were tested for balance and posture maintenance before and through the season

showed interesting results. The frequency of ankle injury was seven times greater in players with poor balance as compared to the frequencies ankle sprains of the ones with good balance. Another study of McGuine and Keene (2006) with 373 high school players showed incidence of ankle sprains to be lower in intervention group who practiced proprioceptive training (6,13%) as compared to the standard athletic condition exercise group (9,9%). Also the risk of repetitive ankle sprain injuries was reduced by 50% in the same intervention groups compared to the control one. Specific proprioceptive training is routinely recommended for players recovering from ankle sprain during their rehabilitation post-injury (Fu&Hui-Chan, 2005, Schiftan et al, 2015). According to Bernier and Perrin this proprioceptive training should involve early kinesthetic exercises including mirror activities, later with eyes closed and weight bearing proprioception exercises as soon as stance is allowed (Bernier and Perrin, 1998). Of a great importance before starting with weight bearing exercises is to teach the person to keep the neutral stance position of the foot or correction of the pronated position through improving foot plantar proprioception (Houglum 2005). At the beginning sitting position (Figure 1) is an option if standing (Figure 2) is restricted or too painful to maintain.

Figure 1. Foot neutral position in sitti **Figure 2.** Foot neutral position in standing **Figure 3.** Stork stance

Further additional proprioception exercises can be incorporated in the program. Different balance exercises in stork standing position (Figure 3). Eliminating the vision is further progression as well as

changing the stable surface with unstable, like balance board, foam disk, trampoline etc. Single-limb balance training on a foam stability pad (Figure 4) eliminates the risk of ankle sprain associated with

a previous ankle sprain with 77% (McHugh et al, 2007). Before returning to sport activities is good first to progress with more advance balance activities, or perform additional activities with other

body part (Figure 5) or lower extremity (Figure 6) while maintaining balance, which usually is orientated more to type of sport the person practices (Houglum 2005).

Figure 4. Stance on a stability foam pad **Figure 5.** Advance balance activity **Figure 6.** Balance sports activity

When proprioceptive training is with prophylactic purposes the authors from systematic review (Schiftan et al 2015) suggested that programs with proprioceptive exercises of longer length may be more effective. The longer proprioceptive training program usually is best introduced as part of a sport team's warm-up before the main part of physical activity, which is a relatively simple and effective mechanism for a preventive strategy (Schiftan et al 2015).

Although long-lasting programs are recommended, it is important to note that relatively short proprioceptive training programs that used limited equipment have also demonstrated preventive effects (Emery et al 2007, Han et al 2015).

Other investigators assessed joint position sense to plantar flexors and the peroneal muscles activity. It has not been studied as intensively as postural balance in ankle sprains and results are not so coherent, but still authors have their important data.

Glencross and Thornton (1981) found an increase in the error with which the plantar flexor angles were passively replicated in 24 subjects with previous ankle sprain. Also the severe the sprain the greater degrees of replication error was observed. Jerosch and Bischof (1996) found an increased absolute error when replicating 3 inversion angles in 16 subjects, when comparing the stable with the unstable sprained ankle. In contrast Gross (1987)

could not find difference between 14 stable and 14 unstable ankle subjects in an inversion setup of both passive and active angle replications.

Based on results from several studies which look for peroneal muscle reaction time to sudden ankle inversion for functionally ankle-stable and unstable groups, it is still unclear whether or not an increased peroneal reaction time is present in functional ankle instability. (Jhonson & Jhonson, 1993, Lofvenberg et al 1995, Hubert et al 1996).

Other authors (Konradesn & Ravn, 1990, Karlsson & Andeson 1992) clearly showed in their studies that peroneal reaction time is prolonged with injured ankles, 20ms more compared to the uninjured side, indicating proprioceptive deficit. Therefore proprioceptive training should be incorporated into general rehabilitation training after ankle instability due to sprain (Norris, 2004).

In general all authors gathered around the following statement that proprioceptive training is fundamental for kinesthesia (movement threshold) and balance control after ankle sprain (Houglum 2005, McHugh et al 2007, Norris 2004, Riva et al 2016) as well as it is effective in decreasing ankle sprain recurrences significantly, 30-50% (Cumps et al, 2007, McGuine and Keene, 2006, Rivera et al, 2017, Vergahen et al, 2004)

CONCLUSION

Proprioception training plays important and key role in prevention of chronic ankle instability and it is of a great importance to improve it in order to reduce ankle sprain accidents.

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