Influence of different neuromuscular interventions on dynamic knee valgus during a drop vertical jump in adolescent female athletes

Sonia Deutschmann, Jenna Müllauer, HESAV-Haute École de Santé Vaud
(Physiotherapy, Director of thesis: Kenny Guex)

1. Introduction

Anterior cruciate ligament (ACL) injuries are common in young female athletes from 13 to 18 years old who perform high-risk sports. Moreover, the number of girls participating in contact or pivoting sports is really increasing. The consequences of those knee injuries are very serious. Therefore, many prevention programs already exist and demonstrated a decrease of the incidence of ACL injuries. However, the effects of these interventions on risk factors remain unclear.

The main biomechanical risk factor for ACL injuries is the dynamic knee valgus. It is a momentary increase of the anatomical knee valgus which appears during a side-cutting or landing from a jump.

Hewett & al., (2005) demonstrated a good correlation between the risk of ACL injuries and the dynamic knee valgus during a drop vertical jump (DVJ) (Figure 1).

With these observations we noticed that there was a need of deeper understanding of the effect of prevention programs on dynamic knee valgus.

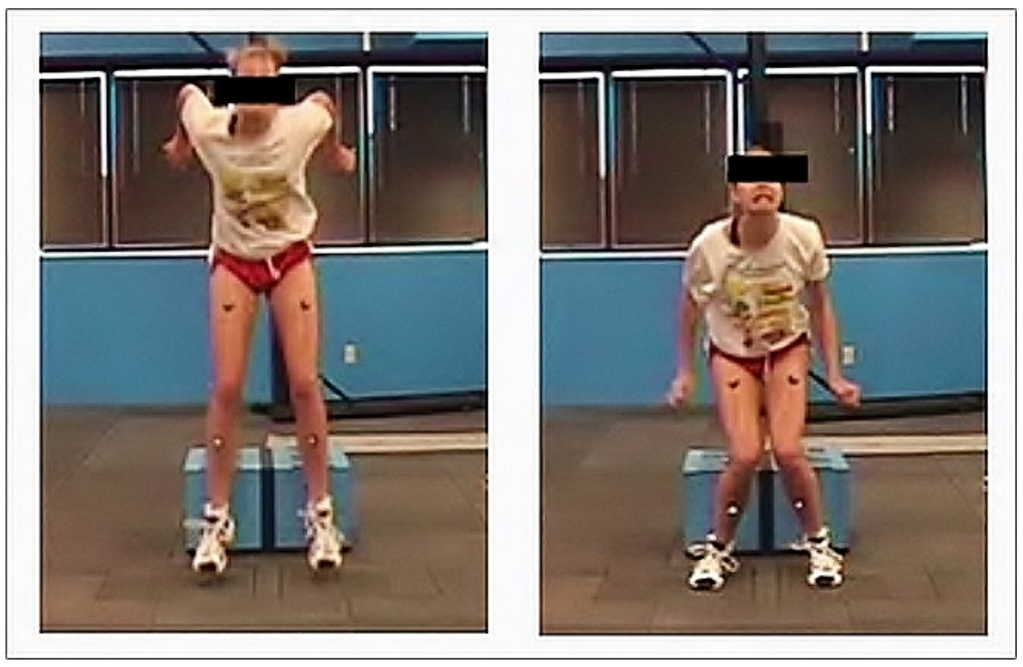

Figure 1: Dynamic knee valgus during a DVJ, Ford et al., 2003

2. Objectives

The purpose of this study was to assess the efficacy of prevention programs or interventions on dynamic knee valgus in female adolescent athletes from 13 to 18 years old who perform high-risk sport during a DVJ. The objective was also to know if a component of the program was better than another to reduce this risk factor.

P	• Female athletes • Adolescent from 13 to 18 years old • Performing pivoting and/or contact sports
I	• Program or intervention to prevent ACL rupture with and without material
O	• Kinetic and kinematic measures of the knee • Angle or moment of dynamic knee valgus
T	• Drop vertical Jump (DVJ)

Table 1: Inclusion criteria, Sonia Deutschmann & Jenna Müllauer, 2016

3. Method

The present study is a quantitative and narrative literature review. A non-systematic search of Pubmed, Pedro, Cinhal and Cochrane was conducted from September 2015 to February 2016. The inclusion criteria were English or French language, adolescent female athletes (from 13 to 18 years old), sports involving pivoting, contact or change of direction, neuromuscular program or its component, measures of dynamic knee valgus (angle or moment) during a DVJ.

4. Results

Five articles were selected. Plyometric, core stability and neuromuscular programs were evaluated in these studies. The results were rather heterogeneous. Overall, it seems that the interventions had only a slight effect on reducing dynamic knee valgus (Table 2). Only two studies which assessed the effectiveness of a plyometric intervention and a neuromuscular program had significant results.

Results : Dynamic knee valgus

Program	Neuromuscular				Plyometric		Core stability	
Study	Brown & al., 2014	Otzuki & al., 2014	Pollard & al., 2006	Myer & al., 2005	Brown & al., 2014	Pfile & al., 2013	Brown & al., 2014	Pfile & al., 2013
Angle of DkV	→	→ (↗)	→		→	→	→	→
Moment of DkV	→(↘)	→ (↗)		↘ LLR → LLL	→ (↘)	↘	→(↘)	→

Table 2: Diagram of the studies' results. Sonia Deutschmann & Jenna Müllauer, 2016. Abbreviations: DkV, dynamic knee valgus; LL, lower limb; R, right; L, left; →, stabilisation; ↗, increase; ↘, decrease; (...), control groups.

5. Conclusion

Neuromuscular programs seem to have lower efficacy on dynamic knee valgus. Many elements can explain this result, such as the differences in interventions' modalities, the simplicity of the task (DVJ), biomechanical changes reserved to the hip and the exposure of the athlete to the dynamic knee valgus at the start of the study.

However, we could bring out some recommendations for practice:

- ✓ Systematic screening of the exposure of the athlete to the dynamic knee valgus to adjust the prevention program.
- ✓ Establish isolated pre season prevention program followed by a warm up prevention program during the season.
- ✓ Incorporate uni and bipodal plyometric exercises. Core stability, balance exercises and strengthening are not to forget if we think about global prevention for ACL injuries.
- ✓ Prefer quality than quantity of exercises with a progression.
- ✓ Specific feedback and adequate corrections of the alignment of the lower limb are very important to increase the effect of prevention programs.
- ✓ Teach the coaches to observe the dynamic knee valgus and give adequate corrections to it.

References

1. Hewett, T.E., Myer, G.D., Ford, K.R., Heidt, R.S., Colosimo, A.J., McLean, S.G., van den Bogert, A.J., Paterno, M.V. & Succop, P. (2005) Biomechanical measures of neuromuscular control and valgus loading of the knee predict anterior cruciate ligament injury risk in female athletes: a prospective study. *The American Journal of Sports Medicine. 33* (4). 493-501.
2. Ford, K.R., Myer, G.D., & Hewett, T.E. (2003). Reliability of dynamic knee motion in female athletes. Access: http://asbweb.org/conferences/2003/pdfs/155.pdf