



Proprioception Training



Prevention of ACL Injuries with Proprioception Training

Introduction

Proprioception training can be used by youth soccer coaches and college soccer coaches to reduce the incidence of ACL injuries in soccer players. The training needed can be provided as a small part of daily soccer fitness activities with very little or no training equipment. When equipment is used at home or at the field, only modestly priced equipment such as balance pads, wobble boards, or fitness bands will be needed.

See also...

[Beep Test](#)

[Fitness Activities in Season](#)

[Five Dot Training](#)

[Improving Footwork](#)

[Fitness Articles](#)

Disclaimer

These articles were intended to be read by your orthopedic surgeon your club ATC, or your sports medicine physician, and were not intended to provide the coach with exercise or rehab assignments. The articles suggest that clubs should engage professionals to advise coaches and to establish and maintain rigorous training programs for the prevention of joint injuries, and for the improved recovery from those injuries that do occur. It is important for the coach to be aware that these preventive

Sports Medicine Research on ACL Injuries

First, you may find that the two sports medicine articles referenced here provide you some additional understanding to current best practices for ACL prevention in soccer and ACL rehabilitation in order to help you communicate with or better understand what your club's trainer and sports medicine doctor is trying to accomplish for your players.

- Prevention of anterior cruciate ligament injuries in soccer: A prospective controlled study of proprioceptive training, A. Caraffa, G. Cerulli, M. Progetti, G. Aisa, A. Rizzo, in *Knee Surgery, Sports Traumatology, Arthroscopy*, chapter 4, pp. 19-21, Springer-Verlag 1996. (Order this article online at [SportsQuest.com](#)).

The first article summarizes a controlled study completed by four orthopedic surgeons at S. Maria hospital at the University of Perugia in Terni, Italy. At the start of the study, it was known that proprioceptive training had been shown to reduce the incidence of ankle sprains, and to speed rehabilitation from ACL injuries. The purpose of the study was to determine whether or not proprioceptive training could reduce the incidence of ACL. The subjects, 600 male soccer players from 40 different semiprofessional and amateur teams, the effectiveness of a 5 phase proprioceptive training program was assessed. A control group of 300 players from other, comparable teams was selected, and both groups went through training, with the 600-member group receiving special balance training. Both groups received clinical examinations, KT-1000 measurements, MRI and CAT, and arthroscopy where indicated. In summary, an incidence of 1.15 ACL injuries per team per year was experienced in the control group, but only 0.15 injuries per team per year in the treated group, producing a highly significant statistical finding.

- Refining Rehabilitation With Proprioception Training: Expediting Return to Play, Edward R. Laskowski MD, Karen Newcomer-Aney MD, Jay Smith MD, *The Physician and Sports Medicine*, Volume 25 Number 10 October 1997. (Read this article online at [The Physician and Sports Medicine](#)).

This second article explains the theory and mechanics of proprioceptive training, and describes exercises, exercise tools, tailoring of training programs, and sport-specific training that can be accomplished to speed return to play. Proprioception - sense of joint position, is defined, and the effect of injuries on proprioception is explained. There are some subtle concepts mixed in with the basic ideas that should not be overlooked by coaches. Specifically, a reference quoted indicates that as little as 20mL knee infusion can cause a loss of as much of 60% of the capability of the vastus medialis (at the bottom of the quadriceps). The coach should infer from this that serious damage, such as lateral patellar dislocation or tears in the VMO, or even more serious ligament damage within the joint, could result from loss of proprioception caused by a previous injury that causes swelling above or near the knee.

In the following article, the author suggests that although proprioception training has

Video
role
play
MX Skill
Master /
Mobile
Video
training
platform

measures exist and have been studied, and to appreciate the potential value to the players. See also [web site disclaimer](#).

been demonstrated benefits for injury prevention and rehabilitation, it may be possible that the exercises used for this purpose do not actually improve proprioception as it is most technically defined. The authors suggest that, in fact, proprioception training may accomplish other physical or neurological changes that account for beneficial effects observed. However, the authors performed no experiments to test their hypothesis.

- Can Proprioception Really be Improved by Exercise?, James A. Ashton-Miller, Edward M. Wojtys, Laura J. Huston, Donna Fry-Welch, *Knee Surgery, Sports Traumatology, Arthroscopy*, Volume 9, pp 128-136, 2001. (Read [full text](#) of this article online.)

The Evidence for Proprioception Training for ACL Prevention

To conclude, it appears that there is a great deal of practical and clinical evidence to suggest that exercise programs that center around proprioception training help reduce the incidence of certain types of knee and ankle injury, and that the training can also provide for quicker return to play after injury. There is some doubt that the exercises actually provide the benefits in the specific pathway as originally postulated. However, to the sports coach, it probably is sufficient that the exercises do seem to be effective, regardless of the exact mechanism by which they work.

Start an ACL Prevention Program for Your Team

Top youth and junior soccer clubs have been hiring certified athletic trainers, physical therapists, and strength and conditioning specialists to work with their top teams. Good results have been achieved, with reductions in ACL incidence and improvements in leg strength and agility. Unfortunately, all teams U12 and older need their own program, and most are not getting the training they need to be athletically competitive and healthy. In practical terms, training to be healthy at U14 should start at U12.

A complete set of topics are covered, including

- Dynamic warm-ups
- Leg strength
- Plyometrics
- Proprioception Training
- Stopping Technique
- Agility
- Movement

Proprioception Knee and Ankle Exercises

An interesting slide show authored by [Leslie Russek](#), PhD, PT, OCS, Assistant Professor, Department of Physical Therapy, Clarkson University and the Canton-Potsdam Hospital described a variety of knee and ankle conditions for which proprioception training is appropriate.

Dr. Russek suggested that athletes with knee problems

- ACL deficiency
- Generalized internal derangement
- Patellofemoral instability
- Certain other conditions

can benefit from

- single leg balance
- soft/unstable surfaces
- eyes closed
- dynamic balance
- plyometrics
- functional activities

The slide show also suggested that appropriate treatment for athletes with ankle problems such as recurrent ankle sprains and other injuries should include a series of exercises including

- dorsiflexion/plantarflexion (DF/PF)

- inversion/eversion (inversion / eversion)
- circles
- alphabet with foot
- BAPS board
- partial weight bearing
- single leg balance starting on stable surface, and progressing to
- soft/unstable surfaces (such as trampoline)
- eyes closed
- dynamic balance (such as while throwing ball)
- plyometrics (jumping)
- functional activities: running, cutting, sports-specific exercises

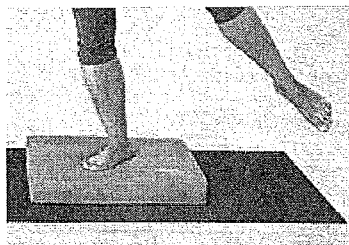
Some of these exercises can apparently be combined as therapy moves forward. For example, the "dynamic balance" exercise that mentions throwing a ball can in practice be advanced to an exercise that has the athlete standing without shoes on a balance pad, balancing on one foot, and throwing a small heavy ball against a rebound device.

Proprioception and Strength Program for ACL Injury Avoidance

Over the last several years, we have had good luck in avoiding ACL injuries in girl soccer players with a simple program outlined here. It's not based on clinical trials, but on practical experience and guesswork. The key components are shown in the table below.

Exercises	Why	Examples
Closed eyes standing balance	Improved proprioception and strengthening of muscles supporting knee and ankle joints from a static situation	Stand on one leg, put foot from other leg behind knee of standing leg, close eyes. Balance for 60 seconds. Repeat with other leg.
Balance pad exercises	Improved proprioception and strengthening of muscles supporting knee and ankle joints from both static and dynamic situations	Single leg squats on Airex Balance Pad. Double leg squats. Single leg standing balance eyes open, eyes closed. Two players, each standing on a balance pad with one leg, throw a small heavy ball back and forth.
Band work for hamstring development	High school age players often have quads that are much more developed than hamstrings. Some studies suggest that this is a contributory factor to incidence of knee injury.	Band exercises, individual and with partner, providing band resistance to movement of ankle to buttocks. Can be done standing, leaning, or on hands and knees with one leg extended horizontally.
Stopping technique	A large proportion of ACL injuries witnessed in girls in match play have come at the end of runs where the player was slowing down after crossing the ball or making a run.	Players train to use two and three step stopping from runs instead of making wrenching single step stops. After practicing the technique in isolation, literally by walking through the steps, a variety of stopping games can be used, such as red light - green light.
General leg strength	Presumption that strong and symmetric leg muscles will provide better support for knee and ankle joints and make it possible for the athlete to recover from momentary lack of attention to joint position or from stepping on another player's foot or in a hole.	Monster walk with Gamba bands. Side to side (sideways) walking with bands. Backward walking with bands. Carioca and slalom runs. Plyometric exercises for the legs. Single and double leg hops. Footwork exercises. Running hills. Harness work with partner providing resistance. Carrying partner on back over 40 yard course.
General aerobic fitness	Presumption that players with higher aerobic fitness will be less likely to experience momentary mental lapses late in matches leading to a poor one-step stop or poor slowdown at the end of a run.	Increased practice intensity, additional ball skill relays with running, end of practice team running competitions at match realistic distances, interval runs (also known as doggies or suicides). Post scrimmage match-related running to build and demonstrate fitness that could extend into overtime periods.

Balance Pad and Bands



The Airex Balance Pads we have been using were purchased through M-F Athletic Supply, doing business as **Perform Better**, on the web as performbetter.com. PerformBetter can also provide regular bands, larger Gambetta bands, lighter Therabands (use after injury or during early rehab), and videos such as Vern Gambetta's Legs Legs Legs video. We have often used M-F Athletic, and deliveries have been on time as advertised. This is also a good source for resistance devices such as harnesses and parachutes, as well as ladders, cones, hurdles, hand weights, and Swiss balls. Netfitco.com also advertises the Airex Balance PAD.

We have received a catalog from **Power Systems** showing many of these products. The catalog doesn't seem to show the Airex balance pad, but it's on their web site. We have not ordered from the company, which mails its catalogs from Knoxville, Tennessee.

Although wobble boards and similar products have been around a long time, some newer and less well known products have appeared. A typical product of this type is the **Jump Sole**. This is basically a shoe with a special unstable surface that installs under the sole. We don't have any reports on the effectiveness of these shoes.

Why a Balance Pad?

Balance pads appear to be made of multiple layers of foam rubber, each layer of varying density. The outer shell of the balance pad is made of closed cell foam or a similar synthetic product that does not adsorb water.

Although wobble boards were well established and have shown proven benefits, balance pads may be more appropriate for soccer coaches and their players. First, the entire balance pad is flat, and its action or reaction to the athlete's movements will not dismount the athlete forcefully. Second, because the pad is flat and soft, it can be introduced and used regularly at the soccer field on the turf, yet still be used daily at home on carpet, linoleum, on the back deck, or in the basement fitness area.

Sports Medicine Links about Proprioception and ACL Reconstruction

There are quite a few interesting links on the web describing appropriate sports fitness training to improve proprioception or to assist with rehabilitation following injury. A few representative links of interest to soccer coaches, parents, and soccer players follow.

- [Neoprene sleeve as effective as functional brace for average players](#)
- [Stone Clinic: ACL Rehab Schedule](#)
- [Mayo Clinic: ACL Injury Decision Guide](#)
- [Johns Hopkins Guide to ACL Reconstruction](#)
- [New York Online Access to Health: ACL Injury Links](#)
- [Fitness Management Magazine: Training for Proprioception and Function](#)
- [Knox College: Typical Ankle Rehab Exercise Checklist](#)
- [Knox College: Typical Knee Rehab Exercise Checklist](#) (see proprioception exercises at bottom of form)

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