

**Le tecniche riabilitative: gli esercizi di coordinamento neuromotorio  
Neuro-motor Exercises**

*S. Lephart - U.S.A.*

Reestablishing neuromuscular control is a critical component in the rehabilitation of pathologic joints. The objective of the neuromuscular control activities are to integrate peripheral sensations relative to joint loads and process these signals into coordinated motor responses. This muscle activity serves to protect joint structures from excessive strain and provides a prophylactic mechanism to recurrent injury. Neuromuscular control activities are intended to compliment traditional rehabilitation protocols, and the objectives of many researchers and clinicians are to identify the neuromuscular control characteristics that compensate for mechanical insufficiencies in the ACL injured knee and encourage adaptations for the restoration of functional stability.

Four elements crucial for reestablishing neuromuscular control and functional stability include; joint proprioception and kinesthesia, dynamic stability, preparatory and reactive muscle characteristics, conscious and unconscious functional motor patterns.

This presentation will define the sensory receptors and neural pathways which contribute to normal joint stabilization. With respect to ACL injured patients, deficits in joint sensation and muscle activity will be presented, as well as the mechanisms where by diminished neuromuscular control may compromise functional stability.

The theoretical framework for reestablishing neuromuscular control will be presented, followed by specific activities designed to encourage peripheral, spinal, and cortical adaptations crucial for increasing functional stability. These include promoting proprioceptive and kinesthetic awareness, eccentric training, plyometrics and biofeedback. In addition dynamic joint stabilization exercises encourage preparatory agonist/antagonist co-activation.

Efficient co-activation restores the force couples necessary to balance joint forces and increases joint congruency, thereby reducing the loads imparted onto static structures. Reactive neuromuscular training focuses on stimulating the reflex pathways from articular and tenomuscular receptors, to skeletal muscle. Although preprogrammed muscle stiffness can enhance reflex latency, the objective is to induce joint perturbations which are not anticipated that will stimulate reflex stabilization. The last element requires preprogrammed adaptations to functionally specify motor patterns and joint loads. These activities incorporate all of the available resources for stimulating peripheral afferents, muscle co-activation, reflex control, and motor programming.

Emphasis should be placed on sports specific techniques, including positions and maneuvers where the ACL is vulnerable. With repetition and controlled intensity, muscle activity (preparatory and reactive) gradually progresses from conscious to unconscious motor control.

---