TECHNIQUES OF P.N.F. IN ATHLETIC TRAINING

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Among the many types of programs that have been implemented in the reconditioning and rehabilitation of athletes is a concept that is gaining increasing acceptance among athletic trainers; that concept is the program of proprioceptive neuromuscular facilitation (P.N.F.).

The techniques of P.N.F. are based on established fundamentals regarding the physiology of the nervous system; properly applied P.N.F. techniques result in an increased excitation of neural pathways within the central nervous system, especially at the anterior horn cell synapses. The increase in excitation impulses of the proprioceptive afferent nerves produces an increase in excitation in the anterior horn cells which, in turn, produces an increased efferent response; the end result is an increase in the number of motor units being discharged which has an overall effect of a greater motor response in the muscle. (2)

There are five basic techniques of proprioceptive neuromuscular facilitation which are combined to form several methods that may be used in accordance with the athletic trainer's preference and the athlete's specific problem. These techniques include maximal resistance, stretch, mass movement patterns, reflexes, and reversal of antagonists. (2, 3)

The maximal resistance technique is based on the well-established principle that the response of a contracting voluntary muscle is increased with resistance. Using resistance for neuromuscular re-education also makes it possible to accelerate the training of essential movement patterns through the application of proprioceptive stimulation. Manual resistance, rather than mechanical resistance, is the key to producing both a maximal response and a proper pattern within the muscle group; with the use of manual resistance, the resistance provided for the muscle group can be varied as required throughout the range of motion, and the possibility of substituting inappropriate muscle groups can be controlled. In other words, going through a carefully guided manual resistive motor sequence can increase the number of discharging motor units to produce a stronger muscle contraction and more accurate movement patterns. This particular technique is used to increase strength by increasing the number of motor units being facilitated. (2)

The stretch technique is used to attain an increased muscle response as well as to initiate motion in the extreme ranges of a movement pattern. (3) This technique utilizes the act of a maximal stretch applied to major muscle groups in a lengthened range of movement. Stretch applied to a muscle group facilitates the stretch reflex mechanism of the Golgi tendon organs within the musculo-tendon junction to produce a stronger muscle contraction.

In the mass movement pattern the opportunity for optimal contraction of muscle groups is provided. Inman, Saunders and Abbott as well as Beevor have demonstrated that motion is almost never produced through stimulation of an isolated muscle. (2) Patters of movement are not produced through one muscle contraction, but, rather, involve the central nervous system's stimulation of muscle groups to produce movement through mass patterns. The directions of these patterns are in a spiral and diagonal motion, not in isolated planes. Proprioceptive neuromuscular facilitation, therefore, utilizes movement patterns of an entire extremity in diagonal and spiral mass movement patterns.

Studies have been done regarding the facilitation of motor responses through electrical stimulation of the cortex. Gellhorn and his associates demonstrated on monkeys that threshhold electrical stimulation of a single area on the motor cortex results not in an isolated motion but in a mass movement pattern. (2) Mass movement pattern studies have also been done on human subjects with similar results. It then follows from results of these studies that it can be assumed that natural motion consists of patterns of movement that are carried out by muscle groups and components rather than individual and isolated muscles. This factor serves to point out the importance of proprioceptive neuro-

muscular facilitation over the more traditionalmeans of rehabilitation, such as progressive resistive exercises, since neuromuscular facilitation offers the athlete the opportunity to develop group strength and coordination in a manner which is in accord with natural cortical stimulation.

Some of the body's reflexes can be used in P.N.F. to produce the desired voluntary neuromuscular response. The reflex, such as the stretch reflex previously mentioned, is utilized to initiate the facilitated response, but the voluntary component of the response must be the prime result of the facilitation.

The last basic technique is the reversal of antagonists. In numerous sports activities the normal sequential motion involves the agonistic motion which has been immediately preceded by the antagonistic motion; the swimmer's whip kick, baseball pitching, javelin throwing, running, and a golf swing are just a few examples. The contraction of the antagonistic muscles produces an increased facilitation of the agonistic muscles; therefore, providing resistance against contraction of antagonistic muscle components immediately preceding resistive agonistic exercises will assist in increasing facilitation of those agonists. (2)

There are a number of specific techniques that are contained within the reversal of antagonist technique:

1) Rhythmic stabilization is a method in which maximal resistance is given during isometric contraction of the antagonist and agonist in a rapidly alternating manner. This technique is generally used in conjunction with other facilitation techniques so that a greater response may be attained. It is used to increase range of motion, stimulate agonistic components, develop stability of the part, and increase circulation. (3)

2) Isotonic reversal of antagonists involves the alternating of motion between the antagonist and agonist, both of which are moved against maximal resistance. This technique is utilized to stimulate and increase in range of motion and improve endurance and strength. (3)

3) Isotonic reversal of antagonists with isometric contraction is similar to that technique just mentioned except for the addition of an isometric hold at the shortened range of both the antagonist and the agonist. Again, the activity is carried out against maximal resistance. The objectives of this technique are to increase power and endurance. (2)

4) Quick reversal of antagonists involves active motion of the antagonist carried out slowly against maximal resistance, followed by a sudden reveral of motion so the agonist is contracted to the shortened position and immediately followed by an isometric contraction of the agonist against maximal resistance. This technique allows for relaxation of antagonists and develops stability, strength, and coordination. (2)

All of these techniques are basic. Any additional techniques are variations and/or combinations of these. Oftentimes it is found that trainers who utilize proprioceptive neuromuscular facilitation do, in fact, use combinations of these basic techniques to produce their desired results.

As stated previously, the primary objective of proprioceptive neuromuscular facilitation is to increase motor response through increased stimulation of the afferent nervous system. In **Proprioceptive Neuromuscular Facilitation: Patterns and Techniques**, Margaret Knott and Dorothy Voss point out additional concepts which increase the number of firing units within the central nervous system and, when utilized correctly, add to produce optimum results in P.N.F.:

1) The placement of the trainer's hands on the athlete's extremity is important and should be on the surface side of which the extremity will be directed. This will assist facilitation of the deep touch and pressure receptors.

2) Verbal action commands are generally given in a moderate tone of voice when the athlete is producing his or her maximal output. When an increase in effort is required, strong, sharp verbal commands are given to produce a reflex response since the nervous system will interpret such a tone as a stress stimulus; discretion must be used to avoid over rushing strong commands since adaptation within the nervous system may occur. It is essential to remember that verbal action commands should be short, accurate and most importantly, timed to the physical demands in order for the athlete to produce good initiation of the action and for the trainer to maintain control of the motion.

3) The techniques used should not elicit pain since pain will produce a withdrawal response and result in inhibition rather than facilitation of controlled voluntary motion.

4) A passive demonstration of teh desired motion before the activity is performed will enable the athlete to carry out the activity more accurately and without confusion. It wil also increase the athlete's confidence in the trainer's techniques; this is an important element, particularly if pain is a factor.

5) The primary motion in each mass movement is rotation and is initiated before the additional motions in all the patterns. The rotation factor begins distally and progresses towards the proximal muscle groups as the movement pattern progresses from the beginning to the end of the range of motion.

6) If the stretch technique is used it is applied immediately before the movement pattern begins; if a prolonged stretch or delayed initiation of movement following the stretch is used, adaptation within the central nervous system may occur and will render the technique ineffective.

7) The use of traction, which is the separation of joint surfaces, and approximation, which is the compression of joint surfaces, stimulates the joint's proprioceptive nerve endings. In the facilitation exercises, when the athlete uses the extremity in a pulling action, traction is applied to the joint; and when the athlete uses the extremity in a pushing action, approximation is applied to the joint. Except in an acute stage of injury where traction and approximation may be contraindicated, this technique is used throughout the range of motion, especially in a weak extremity.

In the administration of neuromuscular facilitation it is essential that the trainer have a knowledge and understanding of the principles of the techniques of P.N.F. It has not been within the scope of this article to present all the information that is required to carry out these techniques properly; its purpose is only to serve as an introduction. The athletic trainer who is considering implementing proprioceptive neuromuscular facilitation into his or her athletic training program must first attain an adequate background in its techniques and practices. With understanding and experience in the techniques of P.N.F. comes proficiency and skill. The techniques can be confusing and complicated, but in order to produce effective results they must be carried out accurately.

An analysis of the athlete's specific problem must first be made before it can be decided which neuromuscular facilitation technique would be most beneficial. What problems does he or she have? What is the goal with this athlete? What will be the most efficient and most effective way to attain that goal? With the answers to these questions will come the establishment of an appropriate proprioceptive neuromuscular facilitation program.

Although there has been an increase in the number of trainers utilizing the P.N.F., there has been minimal documentation and research done on neuromuscular facilitation as it relates to athletic injuries. What evidence there is, however, points towards a promising development of proprioceptive neuromuscular facilitation techniques as a part of the athletic trainers' rehabilitation concepts and practices.

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