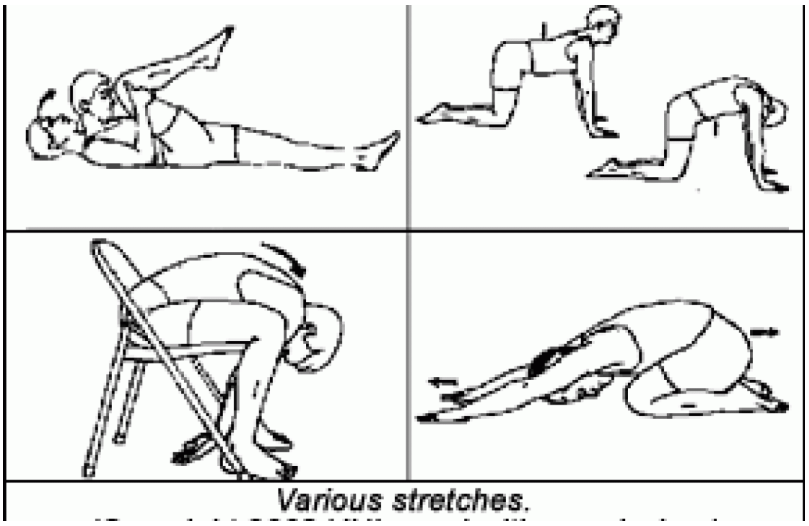
Dynamic Chiropractic



SPORTS / EXERCISE / FITNESS

Flexibility Exercises and the Rehabilitation Program

Kim Christensen, DC, DACRB, CCSP, CSCS

Flexibility training programs help facilitate rehabilitation, prevent injury (or reinjury) and provide a warm-up regimen. When working with a patient requiring rehabilitative care, flexibility or range-of-motion (ROM) exercises are used to establish full range of motion before proceeding to resistive exercises. Prescribed motions are emphasized with ROM exercises for certain conditions, such as calcific tendinitis and bursitis. The patient must execute the correct protocol in a consistent manner to avoid problems.

Preferred Techniques

A flexibility program is designed to improve the range of motion at a given joint by altering the extensibility of the musculotendinous units. Static stretching, once recommended, has now fallen out of favor.[1-4] Proprioceptive neuromuscular facilitation (PNF) techniques are preferred. Both methods are based on alteration of the myotatic stretch reflex. Prentice[5] compared static stretching to PNF stretching by the slow-reversal-hold method for improving the range of hip joint motions in 46 subjects of both sexes, aged 18-34 years, who participated in a 10-week general fitness program emphasizing flexibility and cardiovascular endurance. Flexibility measures were applied three days a week under direct supervision. Only the right hamstrings were stretched, and goniometric measurements were repeated after the 10-week training period. The slow-reversal-hold PNF technique was superior to static stretching. The slight gain in ROM in the control extremity suggested that some training effect took place that improved flexibility.

The efficacy of various stretching methods in improving flexibility may be explained by autogenic inhibition, mediated by afferent fibers that act on the alpha motor neurons supplying a muscle; and also by reciprocal inhibition. The PNF approach denotes any method in which input from peripheral receptors is used for facilitation or inhibition. Static stretching relies on autogenic inhibition, as does the slow-reversal-hold technique. In the latter method, sustained isotonic contraction by the antagonist muscle increases tension in the muscle, again exciting the inhibitory

Golgi tendon organs. The isometric contraction of the agonist is based on reciprocal inhibition. In general, the PNF method is superior to static stretching in improving overall ROM.

Improved Flexibility

Adequate flexibility is necessary for injury rehabilitation and prevention, and for achieving superior performance. Sady, et al.,[6] compared the effects of static and PNF stretching techniques for shoulder, trunk, and hamstring muscles on the flexibility of 65 male college students. Forty-eight subjects (three groups of 16) used the techniques; 17 served as controls. Results were available in 43 subjects. A Leighton flexometer was used to measure the range of motion at the joints traversed by the tested muscle groups. Exercises were performed three days a week for six consecutive weeks.

Only the PNF group had an increase in flexibility greater than the control group (10.6 vs. 3.4 degrees). The hamstrings improved by 9.4 degrees and the trunk by 5.2 degrees. Reliability generally was higher for posttraining scores. Variability between test days was lower for posttraining scores of the shoulder and hamstrings. Significant between-day changes in flexibility were observed before training.

These findings again indicate that PNF is an excellent method of improving flexibility. Flexibility training appears to result in more consistent flexibility scores. The PNF technique could be integrated into any rehabilitation setting and provide increased flexibility relatively rapidly. Further studies are needed to clarify which combination of repetitions, sets, duration and frequency of stretching will result in maximal gains in flexibility.

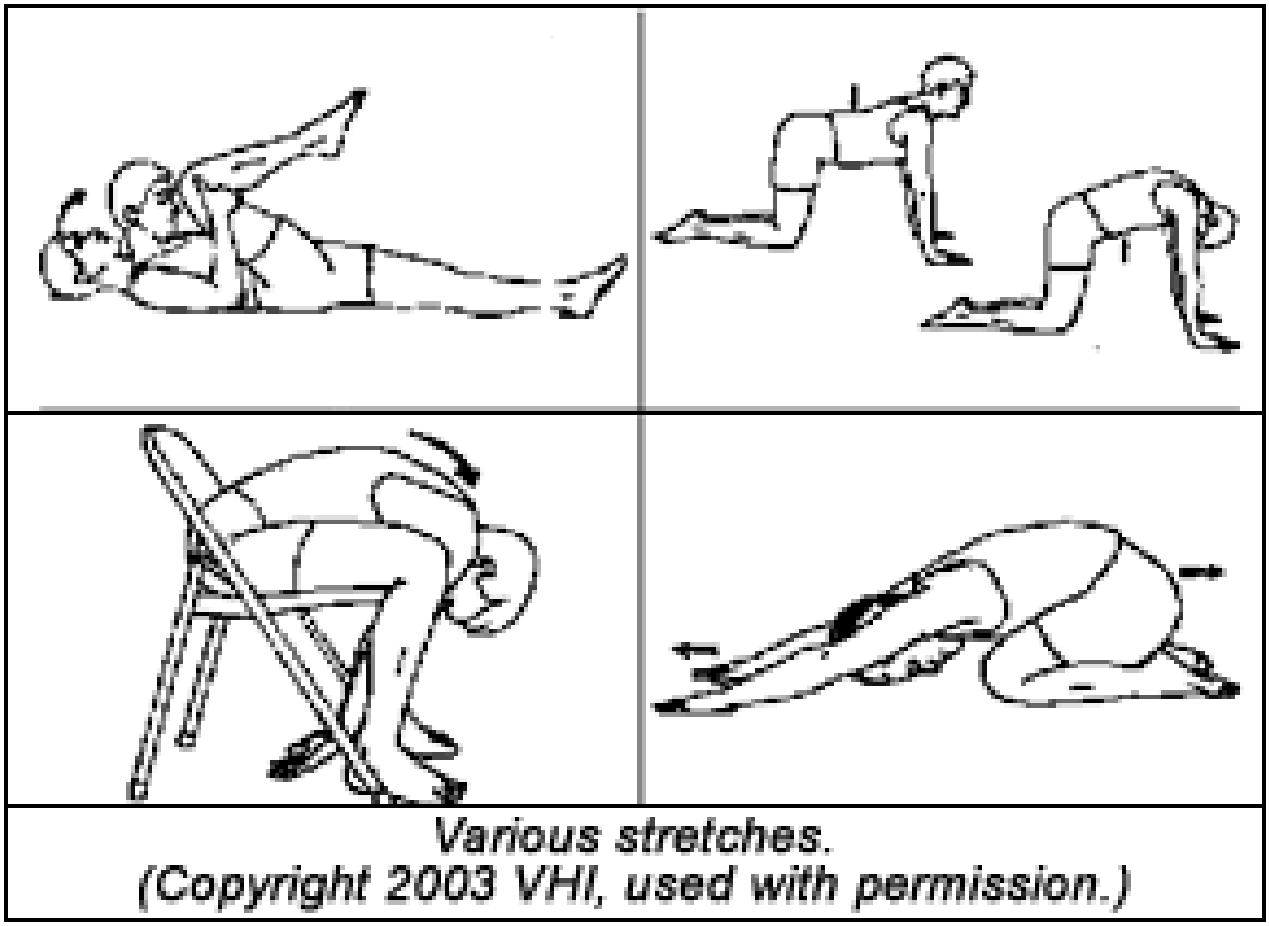
The proprioceptive neuromuscular facilitation mobilization techniques of contract-relax (C-R) and hold-relax (H-R) are commonly applied at the point of limitation of motion; they require active, resisted contractions of the range-limiting antagonistic pattern. ROM may increase contralaterally when these methods are used on an uninvolved extremity. Markos[7] compared the effectiveness of H-R and C-R in increasing range of hip flexion bilaterally during straight-leg raising. Studies were conducted in 30 healthy women with a mean age of 22 years.

Maneuvers were applied to the right leg in two diagonal patterns while electric activity was monitored in the contralateral *rectus femoris, vastus medialis, semimembranosus* and *biceps femoris*. The increase in ROM of the right leg in subjects in the C-R group was significantly greater than in the H-R and control groups. For the unexercised limb, the increase in motion in the C-R group was significantly greater than the control group. All but one of the 30 subjects exhibited electric activity in the contralateral limb when the right leg contracted against resistance.

Both H-R and resistance toward the nonpainful range deserve consideration when planning a treatment program. Contract-relax appears to be of great benefit in increasing the range of motion of tight musculature in both the involved and uninvolved limb.

Cold Therapy

Most musculoskeletal injuries cause some degree of muscle spasm or tightness. Cryostretch therapy[8] combines ice application with the hold-relax technique of proprioceptive neuromuscular facilitation, involving static and isometric stretching of the affected muscle. A brief neuromuscular training session is conducted before the first exercise session, allowing the joint to move through as great a range of motion as possible without resistance. The motion is repeated two or three times.



Various stretches.
(Copyright 2003 VHI, used with permission.)

Each exercise bout consists of a 65-second set of static stretches and isometric contractions; a 20-second rest; and another set of exercises. Three bouts are performed during each treatment session, with two or three sessions completed each day. The muscle is numbed with a large cold pack or by massage with an ice cone. Initially, the extremity or body part is moved until tightness or pain is felt. After holding the body part in a pain-free position for 20 seconds, the patient is told to contract the muscle and try to perform the practiced motion with therapist resistance. Rapid contraction is avoided; contraction should last about five seconds and be as strong as possible. After this, the body part is again moved to the point of pain for 10 seconds. The sequence is repeated, ending with a 10-second stretch, and the 65-second set of exercises is repeated after the limb has rested in the anatomical position for 20 seconds. One must be careful not to overstretch with this method.

Combined cryokinetic and cryostretch therapy is instituted when the spasm is partially relieved - often within two to three days. Cryokinetic exercises should begin with manually resisted muscle contraction through a full range of motion, and proceed to graded activity exercises. Full activity must be resumed gradually to avoid reinjury.

References

1. Funk D, Swank AM, Adams KJ, Treolo D. Efficacy of moist heat pack application over static stretching on hamstring flexibility. *J Strength Cond Res* 2001;15(1):123-126.
2. Pope RP, Herbert RD, et al. A randomized trial of preexercise stretching for prevention of lower-limb injury. *Med Sci Sports Exerc* 2000; 32(2):271-277.
3. Johansson PH, Lindstrom L, et al. The effects of preexercise stretching on muscular soreness, tenderness and force loss following heavy eccentric exercise. *Scand J Med Sci*

Sports 1999;9(4):219-225.
4. Shrier I. Stretching before exercise does not reduce the risk of local muscle injury: a critical review of the clinical and basic science literature. *Clin J Sport Med* 1999;9(4):221-227.
5. Prentice WE. *Athletic Training* 1983;18(Spring):56-59.
6. Sady SP, Wortman M, Blanke D. Flexibility training: ballistic, static or proprioceptive neuromuscular facilitation? *Arch Phys Med Rehabil* 1982;63(6):261-263.
7. Markos PD. Ipsilateral and contralateral effects of proprioceptive neuromuscular facilitation techniques on hip motion and electromyographic activity. *Phys Ther* 1979;59(11):1366-1373.
8. Knight KL. *Physician Sportsmed* 1980;8(Apr):129.

APRIL 2003