MUSCLE BALANCE DIAGNOSIS

Stanley Plagenhoef
Exercise Science Department
University of Massachusettw
Amherst, MA 01002

Postural mal-alignment due to non-symmetrical use of the body from birth, is a result of the muscular imbalances developed. Any habitual movement pattern, whether performing a job or playing a sport, produces muscular imbalances over a period of time. Accidents or surgery produce imbalances immediately. One sided sports such as golf, bowling, baseball and racket games result in unbalanced development of the musculature due to the specific patterns of motion required.

Unbalanced musculature becomes visible when the shoulder girdle and pelvic girdle are tilted from the horizontal or twisted relative to each other. This usually results in low back stress on one side which can become debilitating. If the imbalance is uncorrected over several years, the body accomodates to the changes and weak muscles become weaker while the strongest muscles become stronger. Eventually physical performance becomes sub-maximal and finally disfunction and pain causes the person to seek help. Disfunction can occur within months if a specific movement pattern is at a high force level and performed frequently.

Two methods may be used to diagnose muscular imbalance as a preventative measure before a problem becomes obvious to a person. The first method utilizes Nautilus machines where the strength of each body segment can be tested through the full range of joint motion. Selected machines will detect the skeletal mal-alignment of the shoulder and pelvic girdles. The second method utilizes high speed motion pictures or high speed video (200 f/s) by filming a person running at a moderate pace from the front, back and side. These two methods, a slow strength testing method and a dynamic functional motion pattern, complement each other for the early diagnosis of muscular imbalances.

All Nautilus machines may be used to measure strength differences between each arm or each leg segment, but the duo machines are best designed for immediate comparison because each segment is moved independent of the other. It is obvious that corresponding segment strengths are different when using the Duo Biceps, Duo Triceps, Duo Hip and Back, Duo Pullover and the new Duo Squat machine. It is also obvious on other machines where each arm movement is independent of the other, though moved simultaneously. (Double Shoulder, Double Chest and Rowing machines.) Certain other machines, which are designed for simultaneous motion of both limbs, require that each limb be tested separately. (Leg Extension, Leg Curl, Abductor, Adductor and Pullover machines.) Other machines compare two sides of the body because they require duplication of the motion in the opposite direction. (Rotary Torso and Four Way Neck machines.)

The Leg Curl machine is generally a good indicator of pelvic girdle imbalances and the Torso Arm a good indicator of shoulder girdle imbalances. The hips are often shifted to one side or twisted when doing leg curls, which indicates an imbalance problem. The feet also take many varied positions to accommodate to particular strengths and weaknesses. For example, a turned out foot favors the Biceps Femorus and helps to avoid using the hamstrings on the inside of the thigh. The shoulders are often tilted from the horizontal when using the Torso Arm sitting upright and pulling the handle straight down to the front. Both machines are excellent for early detection of imbalances.

It is important that differences in strength testing are not misdiagnosed. The body must aid the stabilization of the part in motion, and often a weakness in an adjoining segment is responsible for lack of strength in the part being tested. For example, a low back problem affects the leg strength when using the Hip and Back, and Leg Curl machines. All the new Nautilus computer machines are designed to record the strength of one body segment at a time through a full range of motion. They are ideal for showing strength differences in comparable muscle groups, but they also show that the body segment weaknesses are specific to a portion of the range of motion.

Strength testing should be done for prevention of physical problems, but the tests also aid rehabilitation from injury. An example is a water skier who broke her leg and did rehabilitation exercises for ten months. Monthly tests showed that her rebuilding leg was almost as strong as her other leg, but the computerized recordings of the full range showed a particular portion was still sufficiently weak to preclude the return to skiing. Without the testing, she may have returned to skiing too early, as the strength levels felt about equal to her during normal daily living. More importantly, a test and retest before and after a workout showed that her injured leg fatigued much more rapidly than her normal leg. This shows the importance of returning to a sport at the lowest force levels possible, and for a limited time of practice. Both the force levels and the length of time must be increased in small increments when returning to a sport just as they are over the period of rehabilitation.

The second method of diagnosing imbalances is a check on the muscle testing method and, in reverse, is a method of showing there is a problem, and then doing the muscle testing for the diagnosis. The high speed pictures clearly show asymmetry of motion. Non-symmetrical motions of the arms, legs, feet, twisting of the trunk, and shoulder and pevic levelness are all indicators of imbalances which can be measured. Sometimes the problem is obvious from the running pattern, while other times the problem is recognized but muscle testing is necessary for the diagnosis. Selected exercises are given to restore muscular balance and then both the running tests and muscle tests are repeated for comparison. The important point is that these tests be done before serious problems develop and the body deteriorates to the point of affecting movement patterns. The running test has been helpful in diagnosing problems of athletes in many different sports. Together, the tests of strength and asymmetry are very useful in the areas of both prevention and rehabilitation.

THE EFFECT OF SELECTED STRETCHING PROGRAMS ON ACTIVE AND PASSIVE FLEXIBILITY

Laurence E. Holt
Dalhousie University
Halifax, Nova Scotia
Canada B3h 3J5

Robert K. Smith

Flexibility is a fundamental component of physical fitness and is required in all sport activities to varying degrees. While different methods of enhancing flexibility have been developed, researchers cannot agree as to which is superior; Hartley, (1977); Jacobs, (1976); Song and Garvie, (1976); Tanigawa, (1972); Turner, (1977).

The purpose of this study was to determine:

1) Which method of flexibility training, Scientific Stretching for Sport (3S), Slow Stretch (SS) or Isometric Contractions Only (ICO) is superior in developing flexibility of a specific joint, (hip) in one direction (flexion).

2) The immediate effects of flexibility training.

3) A time at which the effects of flexibility training may begin to diminish.

METHODS

Selection of Subjects

Subjects (S's) were delimited to 40 males with a mean age of 17.1 years (S.D. = 2.9; range: 11-22); a mean height of 173.0 cm. (S.D. = 12.2cm; range: 150-201); and a mean weight of 67.6 kg. (S.D. - 14.1; range: 41-105). All S's were free from musculo-skeletal impairments, and demonstrated active right hip flexion of 25° - 120°. All were undergoing a swimming program at Memorial University of Newfoundland or the Aquarena in St. John's, Newfoundland.

Design

Prior to treatment sessions, each prospective S underwent a pre-test employing a goniometer especially designed for this study (Figure 1). Any S showing active right hip flexibility of less than 25 degrees or more than 120 degrees was immediately eliminated from the program. It was decided that less than 25 degrees was not in the normal range, and more than 120 degrees would not permit any significant increases in flexibility.

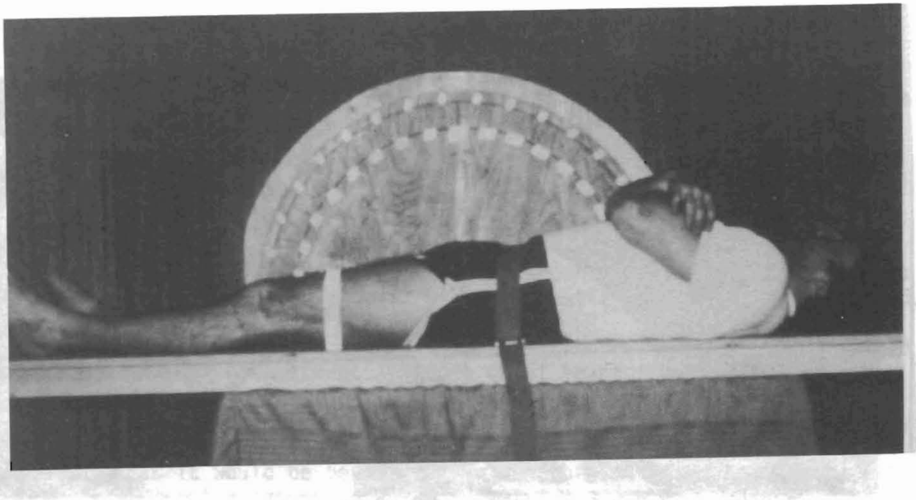

Fig. 1
Goniometer Designed for the Study

Following this initial pre-test which measured active flexibility of the right hip (Figure 2), the remaining S's underwent a further test which measured passive flexibility of the right hip (Figure 3).

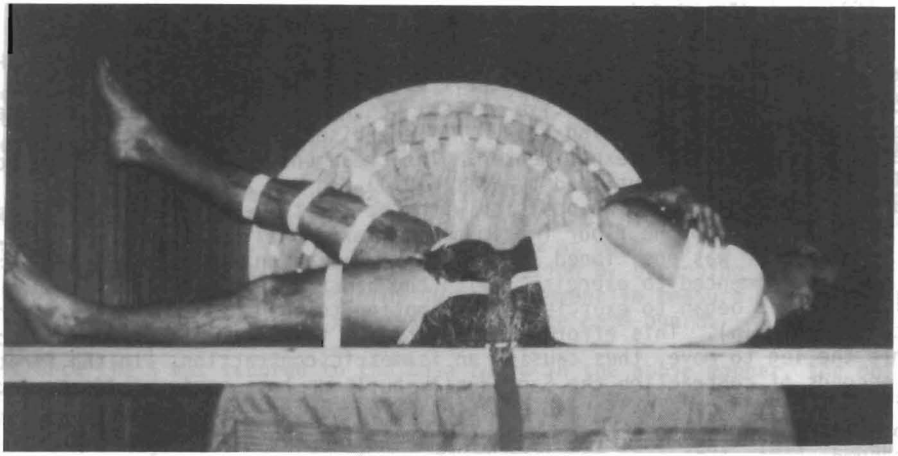

Fig. 2
Active Flexibility Measurement

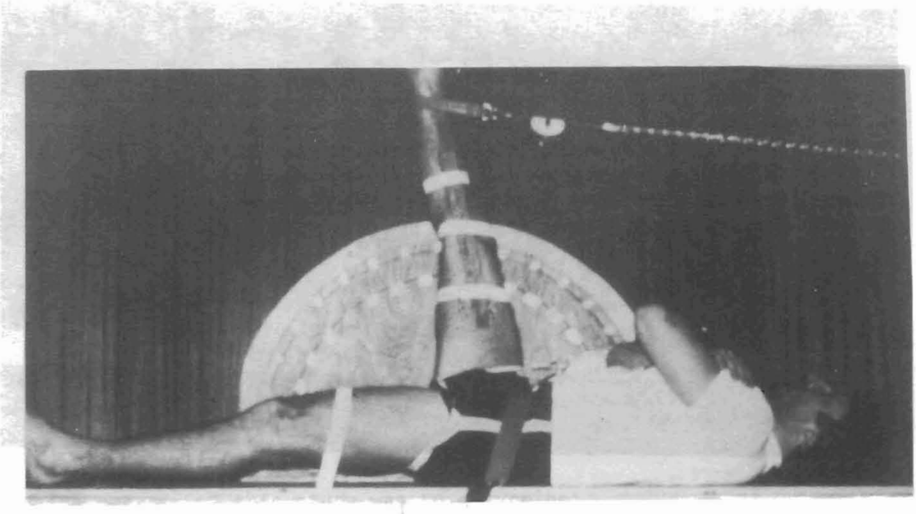

Fig. 3
Passive Flexibility Measurement

Following these pre-tests, S's were then randomly assigned to one of four groups: 1) Control group (C); 2) Scientific Stretching for Sport group (3S); 3) Slow Stretch group (SS); and 4) Isometric Contractions Only (ICO) group.

Treatment Procedures

Each S in the three experimental groups reported to the experimenter (R. K. Smith) prior to commencement of their regular swimming training Monday through Friday for two consecutive weeks. Control S's did not report to the experimenter except on testing days. All exercises and testing procedures were administered by the experimenter. The treatment employing the 3S method followed the procedure outlined by Holt (1974) and was as follows: The S began by lying in the supine position with the leg to be stretched lifted as far as possible from the floor (maximum hip flexion) with the knee extended. The experimenter was positioned so that he served as an immoveable object when the athlete commenced to exercise. With the hamstring in the lengthened position, the S began to exercise by attempting to push his leg to the floor (extend right hip). This effort was resisted by the experimenter who did not permit the leg to move, thus causing an isometric contraction. In the first two seconds of contraction the S gradually built up to a maximum effort, and sustained the contraction for an additional four seconds. The entire six seconds was counted aloud by the experimenter with the assistance of a metronome.

Following this initial six second effort, the S lifted (flexed right hip) the leg toward his head by contracting the opposite muscle group. This concentric contraction pulled the leg to a new position as the result of increased flexibility of the hamstring muscle group and surrounding connective tissue. This maneuver was aided by slight pressure from the experimenter. Each repetition of this exercise took a time interval of ten seconds (six second contraction, four second antagonistic contraction) followed by a ten second rest. Each S in the 3S group was exercised in this manner for a total of five repetitions for each exercise session.

The SS group adhered to the following procedure for exercising hip flexion: The S's commenced the exercise in the same position as the 3S group. The S lifted his right leg, as far as possible, keeping his knee straight and the ankle in dorsi flexion. The S held the position for ten seconds. The exercise was followed by a ten second rest. Again, each S was exercised in this manner for a total of five repetitions per exercise period.

It must be noted here that each S in this group was verbally encouraged to flex his hip during treatment sessions to at least the angle which he scored during the pre-test measurement. Every possible effort was made to ensure that the S was not "cheating" or being "lazy" throughout the exercise period. Since part of the 3S technique utilizes isometric contractions, it was decided that it would be beneficial to add the ICO group to the study in order to determine the extent to which isometrics alone may enhance flexibility.

S's belonging to the (ICO) group exercised in a similar manner to the 3S group during the isometric contraction phase. That is, the leg to be exercise was lifted to the S's pre-test hip flexion angle (checked by the Goniometer), and the S's then performed a series of 6 second isometric contractions. Throughout the treatment sessions, S's in this group were not permitted to flex the hip and then perform further isometric contractions above the pre-test levels, they simply performed 5 isometric contractions, with each followed by a 10 sec. rest.

Data Collection Procedures

Data was collected on three separate testing days and consisted of the pre-test (test Day 1); post-test (test Day 2); post-test plus twenty minutes (test Day 2); post-test plus one week (test Day 3). Active and passive flexion of the right hip were measured and recorded at each testing session.

Each S to be tested for active flexibility, lay in the supine position with his arms folded across his chest and his right hip adjacent to the center mark of the goniometer. In order to eliminate as much pelvic tilt as possible, the hips were secured to the foundation by strapping a belt over the anterior superior iliac spines. As further preventive measure against pelvic tilt, the left leg of each S was fastened to the base board.

Once the S was secured to the base board in the above manner, the pointer was secured to the right leg. At this point, a reading was taken which was subtracted from the measurement reading. The S then actively flexed his right hip and the angle as measured by the goniometer was recorded. This procedure was followed for the post-test, post-test plus twenty minutes and post-test plus one week. Following the post-test, the S's sat quietly for 20 minutes, then were remeasured. Following the two week treatment period the S's were instructed to go about their regular activities with no flexibility training.

Measurement of passive flexibility was similar to that of the active measurment. Each S was secured to the base board in exactly the same manner. A hand held cable tensionmeter with an attached cuff was employed at an angle of 90° to the ankle. Each S was instructed to actively flex the right hip to the greatest possible angle and directed to relax. The hip was kept at this angle by the attached cuff and a reading was obtained from the tensiometer. The experimenter then applied an additional fifteen pounds of tension in the direction of active hip flexion, always ensuring that the angle of the cuff was 90° to the ankle. Upon reaching the additional fifteen pounds, the angle of passive flexibility of the right hip was noted and recorded.

DATA ANALYSIS

The experimental data was treated by applying one way repeated measures analysis of the variance to compare within group means and analysis of covariance to compare among group means. Tukey's honestly significant difference (HSD) method for post hoc testing of the differences between paired means following a significant analysis of variance or covariance F ratio was utilized in this study (Clarke and Clarke, 1972).

RESULTS

Active Flexibility

Comparisons of within group means for active flexibility (Table 1) yielded a significant increase only in the 3S group. The computed F ratio of 4.27 exceded the F of 2.86 which was needed for significance at the .05 level (Table 2).

Table 1

Group Means-Active Flexibility

		Hip	Flexion	(Degrees)
	3S	SS	ICO	C
Pre test	90.4	88.2	88.1	92.6
Post test	105.2	96.6	89.7	92.8
Post + 20 min	99.1	95.8	88.4	92.4
Post + 1 week	92.7	91.8	87.8	92.1

Table 2
Repeated Measures Anova for 3S Group (Active Flexibility)
Measured in Degrees

Variance	SS	df	MS	F-ratio
Between Sets	1395.8	3	465.27	
Within Sets	3918.1	36	108.84	4.27

The Tukey HSD method was applied to locate the significant differences between paired adjusted final means for four test periods (Table 3).

Table 3
Ordered Active Flexibility Means and
Differences for the 3S Group

Test Means (Degrees)				
Pre-test	Post-test	Post-test + 20 min.	Post-test + one week	Mean Difference
90.4	105.2			+14.8*
90.4		99.1		+ 8.7
90.4			92.6	+ 2.2

* an HSD difference of 12.61 degrees was required for significance at the .05 level.

Only one difference between means for active flexibility of the 3S group was found to be significant at the .05 level, that being a 14.8° difference between the pre-test and post-test means.

Post-test analysis of covariance comparing post-test active flexibility means of the three experimental and one control group revealed an F-ratio of 7.24 which exceeded the F of 2.87 which was required for significance at the .05 level (Table 4).

Table 4
Analysis of Covariance for Active Flexibility (Post-Test)
Measured in Degrees

Source of Variance	df	SSx	SSy	SSxy	SSy.x	MSy.x	SDy.x	F-ratio
Between Means	3	60	962	104	1369	456		
Within Groups	35	1938	3771	4192	2210	63	7.93	7.24*
Total	38	2968	4733	4088	841			

Tukey's HSD method was employed to locate the significant differences between the paired adjusted means. It revealed significant differences between the 3S group and the SS, ICO, and C groups at the .05 level. Further, a significant difference between the SS and ICO was found, while no significant difference was found between the other groups (Table 5).

Table 5
Ordered Adjusted Active Flexibility Means and Differences Between Post-Test Means for Control and Experimental Groups

Group Means (Degrees)								
A.	3S	B.	SS	C.	ICO	D.	Control	Mean Difference
	106.3		96.8					9.5*
	106.3				87.2			19.1*
	106.3						93.3	13.0*
			96.8		87.2			9.6*
			96.8				93.3	3.5
					87.2		93.3	6.1

* an HSD Difference of 9.5 degrees was required for significance at the .05 level.

An analysis of covariance of the post-test plus twenty minutes means of the experimental and one control groups yielded an F ratio of 3.70 which exceeds the F of 2.87 which was required for significance at the .05 level (Table 6).

Table 6
Analysis of Covariance for Active Flexibility (Post Plus Twenty Minutes) Measured in Degrees

Source of Variance	df	SSx	SSy	SSxy	SSy.x	MSy.x	SDy.x	F-ratio
Between Means	3	60	725	85	648	216		
Within Groups	35	2938	3003	1634	2094	59	7.71	3.70*

The Tukey HSD method was applied to the four differences between final adjusted means (Table 7), and it was found that the mean of the 3S group was significantly higher than the ICO group at the .05 level. No other differences proved to be significant.

Table 7
Ordered Adjusted Active Flexibility Means and Differences Between Post-Test Plus Twenty Minutes Means for Control and Experimental Groups

Group Means (Degrees)								
A.	3S	B.	SS	C.	ICO	D.	Control	Mean Difference
	98.7		96.3					2.4
	98.7				89.1			9.6*
	98.7						90.2	8.5
			96.3		89.1			7.2
			96.3				90.2	6.1
					89.1		90.2	1.1

* an HSD Difference of 9.3 degrees was required for significance at the .05 level.

Analysis of covariance of the post-test plus one week adjusted means of the four groups revealed an F ratio of .64. Thus there were no significant differences among the four final adjusted means which measured one week retention of active flexibility.

Passive Flexibility

Comparisons of within group means for passive flexibility (Table 8) yielded a significant increase only in the 3S group. The computed F ratio of 3.87 exceeded the F of 2.86 which was needed for significance at the .05 level (Table 9).

Table 8
Group Means - Passive Flexibility
Hip Flexion (Degrees)

	3S	SS	ICO	C
Pre-test	108.4	99.9	103.9	107.7
Post test	122.0	103.4	108.0	107.7
Post + 20	118.2	101.6	106.0	92.1
Post + 1 week	111.3	100.9	104.2	106.3

Table 9
Repeated Measures Anova for 3S Group (Passive Flexibility)
Measured in Degrees

Variance	SS	df	MS	F-ratio
Between Sets	1185.3	3	395.17	3.87
Within Sets	3671.3	36	101.98	

The Tukey HSD method was applied to locate the significant differences between paired adjusted means for the four test periods (Table 10).

Table 10
Ordered Passive Flexibility Means and
Differences for the 3S Group

Test Means (Degrees)				
Pre-test	Post-test	Post-test + 20 min.	Post-test + one week	Mean Differences
108.3	122.0			13.7*
108.3		118.2		9.9
108.3			111.2	2.2

* an HSD difference of 12.2 degrees was required for significance at the .05 level.

Only one difference between means for passive flexibility of the 3S group was found to be significant at the .05 level, that being the difference between the pre-test and post-test periods. No significant difference was indicated between the other test periods.

Analysis of covariance was utilized to compare the post-test adjusted means of the four groups to determine if there was any significant change in passive flexibility of the right hip due to treatment effects. Analysis of the data (Table 11) revealed an F ratio of 82.9 which was significant well beyond the .05 level.

Table 11
Analysis of Covariance for Passive Flexibility (Post-Test)
Measured in Degrees

Source of Variance	df	SSx	SSy	SSxy	SSy.x	MSy.x	SDy.x	F-ratio
Between Means	3	269	1723	484	1020	340		
Within Groups	35	3060	3056	2986	141	4.1	2.01	82.9*

* an F-ratio of 2.87 was required for significance at .05 level.

The Tukey HSD method was utilized to locate the significant differences between final adjusted means for the four test periods (Table 12).

Table 12
Ordered Adjusted Passive Flexibility Means and
Differences Between Post-Test Means for Control
and Experimental Groups

Group Means (Degrees)				
A. 3S	B. SS	C. ICO	D. Control	Mean Difference
119.4	108.5			10.9*
119.4		110.1		9.3*
119.4			106.3	13.1*
	108.5	110.1		1.6
	108.5		106.3	2.2
		110.1	106.3	3.8*

* an HSD of 2.4 degrees was required for significance at the .05 level.

The HSD method revealed significant differences between the 3S group and the SS, ICO, C groups. Further a significant difference between the ICO and C group was indicated.

Analysis of covariance of the post-test plus twenty minutes adjusted means of the four groups was utilized to determine if there was any significant retention of passive flexibility of the right hip. An F-ratio of 20.9 was obtained, indicating that the difference among the four final adjusted means were significant well beyond the .05 level (Table 13).

Table 13
Analysis of Covariance for Passive Flexibility (Post-Test Plus Twenty Minutes) Measured in Degrees

Source of Variance	df	SSx	SSy	SSxy	SSy.x	MSy.x	SDy.x	F-ratio
Between Means	3	269	1300	469	646	215		
Within Means	35	3060	3004	2845	359	10.3	3.2	20.9*

* an F-ratio of 2.87 was required for significance at .05 level.

The Tukey HSD method was applied to determine which of the four differences between final adjusted means (Table 14) was significant.

Table 14
Ordered Adjusted Passive Flexibility Means and Differences Between Post-Test Plus Twenty Minutes Means For Control and Experimental Groups

Group Means (Degrees)				
A. 3S	B. SS	C. ICO	D. Control	Mean Difference
115.6	106.2			9.4*
115.6		108.1		7.5*
115.6			105.4	10.2*
	106.2	108.1		1.86
	106.2		105.4	.84
		108.1	105.4	2.7

* an HSD of 2.8 degrees was required for significance at the .05 level.

The HSD method showed significant differences between the 3S group and the SS, ICO, C groups. No significant differences were found between the other groups.

Analysis of covariance of the post-test plus one week adjusted means of the four groups revealed an F-ratio of .45 indicating that there were no siginificant differences among the four final adjusted means.

Within group differences were found only in the 3S group for both active and passive flexibility, with the significant differences noted only in the immediate post test. Twenty minutes after the immediate post test 47% of the gain in active range was lost, whereas 18% of the gain in passive range was lost during this time of inactivity.

It is clear that active and passive range of motion measures as carried out in this study are considerably different with passive range being approximately 18° more than active on the pre test, post test, and post + 20 min measures for the 3S group. The SS group showed a small difference between active and passive measurements at the immediate post test (6.8°).

While active flexibility changes of the right hip is limited by the strength of the hip's flexor muscles to overcome tension produced by the extensor muscles and surrounding connective tissue, passive flexibility measurement permits the measurement of range of motion to the limit of the individual. One thing is certain, an individual is capable of flexibility well beyond the active range. Thus, enhancement of passive flexibility should be greatly desired by athletes competing in so-called ballistic events where limbs are forced into extreme ranges by rapid contraction of the antagonists, or in events under which he/she may undergo flexibility changes not of his/her making, e.g., wrestling. Greater passive flexibility may not only reduce the incidence of injury but may add to an individual's repertoire of moves and strategy.

Among group differences consistantly favoured the 3S group over the others with statisitical significance in the active mode being found at the post test, and in the passive mode in both post test and post + 20 min.

Theoretically, the success exhibited by the 3S group may be attributed to two mechanisms inherent in the procedure: 1) autogenic inhibition; 2) isometric contraction.

While no concrete physiological information exists at this writing explaining autogenic inhibition, it is theorized that the action of the golgi tendon organs (G.T.O.'s) may explain the neurophysiological mechanism involved in the process. Following extreme stretch or tension, G.T.O.'s transmit impulses to an interneuron located in the spinal cord which inhibits the alpha motor neuron of the muscle being stretched. These transmissions block muscle spindle impulses resulting in muscle relaxation. Further, in a study by Houk et al. (1967), it was shown that G.T.O.'s were extremely responsive to active contractions of muscle. Thus, during the isometric contractions of the hamstrings in the lengthened position, the increased tension placed on the G.T.O.'s may have resulted in the hamstring muscle group relaxing reflexively.

Another possible explanation for the success of the 3S group is that during the isometric contraction phase of the 3S procedure, the resulting tension may have altered the elasticity of the muscle group and/or the associated connective tissues (ligaments; fasciae; tendons) which are extensible to a limited degree (Best, 1966). However, the ICO group did not have the same results as the 3S group, which indicates that an antagonistic contraction and/or slight partner pressure are necessary ingredients for the improvements in both active and passive range of motion.

Comparison of within and among group means both actively and passively measured indicate that no group retained flexibility gains over the long term. It seems that if an athlete wishes to maintain optimum flexibility of a specific joint, then he/she must incorporate flexibility training into his/her daily training regime, and should perform these exercise as close as possible to the beginning of the competitive event and consider doing them at selected points throughout the competition.

CONCLUSIONS

On the basis of the findings within the limits of this study, the following conclusions may be drawn.

1. Only the 3S method of flexibility training significantly improved active flexibility of right hip.

2. The 3S method for increasing active range of motion yielded significantly greater flexibility scores on the immediate post-test when compared to the SS, ICO and C groups.

3. The SS method for increasing active range of motion yielded significantly greater flexibility scores when compared to the ICO group on the immediate post test.

4. Only the 3S method of flexibility training significantly improved passive flexibility of the right hip.

5. The 3S method for increasing passive range of motion yielded significantly greater flexibility scores on the immediate post-test and the post test + 20 min. when compared to the SS, ICO and C groups.

6. The ICO method for increasing passive range of motion yielded significantly greater flexibility scores on the immediate post-test when compared to the C group.

7. No group showed significant long term retention of active or passive flexibility of the right hip.

Best, C.H. et al. The Physiological Basis of Medical Practice. Baltimore: The Williams and Wilkins Co., 1966.

Clarke, H.H. and D. H. Clarke, Advanced Statistics with Applications to Physical Education. Englewood Cliffs, N.J. Prentice-Hall Inc., 1972.

Hartley, J.H. A comparison of six methods of stretch on the active range of hip flexion. 1977, Unpublished Master's Thesis, Universtiy of British Columbia.

Holt, L.E. et al. The influence of antagonistic contraction and head position on the responses of agonistric muscles. Archives of Physical Medicine and Rehabilitation, 1969, May, 279-283.

Houk, et al. Responses of golgi tendon organs to active contraction of the soleus muscle of the cat. J. of Neurophysiology, 1967, 30, 366-481.

Jacobs, M. Neurophysiological implications of slow, active stretching. Amer. Corr. Ther. J., 1976, 30, (5), 151-154.

Song, M.D. and Garvie, G. Wrestling with flexibility. Capher Journal, 1976, 43, (1), 18-26.

Tanigawa, M.A. Comparison of the hold relax procedure and passive mobilization on increasing muscle length. Physical Therapy, 1972, 52, (7), 725-735.

Turner, A.A. The effects of two training methods on flexibility. 1977, Unpublished Master's Thesis, Lakehead University.