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Effect of Deep Transverse Friction Massage Versus Stretching on Football Players' Performance

Procedure

In order to recruit the participants, gyms and football clubs across South-Lebanon and Damascus-Syria were visited and information sheets were distributed. These sheets, (1) explained the study purpose, (2) stressed on the voluntary participation and the free will to withdraw from the study, (3) described the experiment process and its duration; (5) stated possible risks and benefits, (6) stressed over confidentiality and (7) provided investigators contact methods.

To start with the experiment, each enrolled participant signed a consent form. Then, an independent examiner who was not involved in the enrollment process had systematically allocated participants into one of the three intervention groups, by withdrawing names randomly out of a bowl. The first draw was assigned to the static stretching group; the second draw assigned to the dynamic stretching group; the third draw assigned to the DTFM group, and so on. In addition, the investigator who entered eligible participants in the study was not aware of which group they were allocated.

The experiment took place in July 2017, over a four weeks period, and participants in each group followed their intervention protocol three times a week, for a total of 12 sessions.

Static stretching group. Static stretching was chosen for its effectiveness in increasing both acute and chronic extensibility.[23] All participants laid on the floor in a supine position with both feet pointing upwards. The tested limb was in full knee extension and the foot in a relaxed position and was moved up passively to a point of slight pain or discomfort at the posterior aspect of the thigh. This technique puts the

hamstrings muscle at its greatest possible length. According to the American College of Sports Medicine (ACSM), this position should be held for 30 seconds and was performed three times for a total of one minute and 30 seconds, 15 minutes after a match or training. The contralateral leg was stabilized by means of another collaborator in order to prevent compensation by rotation or elevation of the pelvis.[15,21]

Dynamic stretching group. The dynamic stretching technique was included for its positive effects on agility and muscle strength.[26] Participants in this group, swung their tested leg actively into hip flexion while keeping their knee fully extended and their ankle fully plantar flexed, until a stretch was felt in the posterior thigh. This was repeated over 30 seconds and included in the participant's warm-up phase.[23]

Deep transverse friction massage group. Participants were taught by one of the examiners how to sit and perform pre-exercise self-massages on their tested leg MTJ. The procedure consisted of applying friction massage by fingertips transversely to the hamstrings tendon, in a sitting position. The tendon was located over four finger widths proximal to the medial and lateral epicondyles of the femur. One examiner carefully monitored how the technique was performed to assure the precision of the application. This massage technique was applied over a duration of 30 seconds.[10]

Data Collection Methods

Measurements took place on three occasions, (1) baseline, on the first session; (2) 15 minutes, after the first intervention (acute phase); and (3) after four weeks (chronic phase). In addition, (1) age, (2) height, (3) weight and (4) and injury occurrence rate was recorded for each footballer. On the other hand, flexibility, agility and maximal

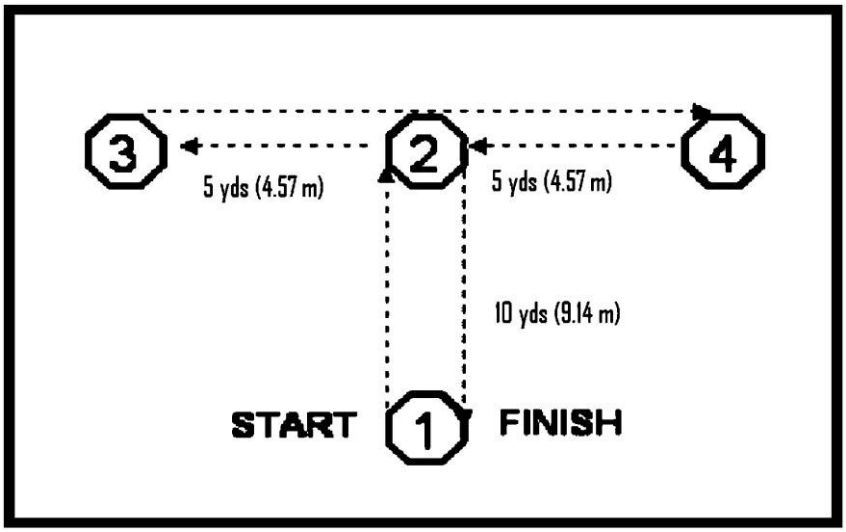
voluntary muscle strength measures were taken in the same manner and time for all participants across groups.

All measurements were taken by one assessor who didn't know at the time of testing to what group the data belonged to. In addition, this assessor was not involved in the implementation of any of the techniques in this study.

Flexibility. Extensibility of the hamstrings muscle represented knee flexibility.[20] Hamstrings muscle injury is common in sports requiring running. It is usually, the result of a muscle imbalance where the quadriceps muscle is strong and hamstrings are weak and inflexible, what puts a great deal of pressure on the hamstrings leading to injury and strain.[31] Straight leg raise (SLR) is a widely used outcome measure used to assess the extensibility of the hamstrings muscle, where its high reliability makes it an easy and reliable method ICCs of 0.96, and high SEM values (2.2^{o}) and MDD (6^{o}).[20] SLR was first applied to all participants across the groups. All football players laid supine and taught to relax during testing. The tested limb was raised by a volunteer therapist with the knee in full extension and the foot in a relaxed position. The other lower limb was stabilized in a neutral hip rotation and full knee extension by another volunteer. The test was stopped once the therapist felt a strong resistance, or when the pelvic rotation was noted. Then, the assessor placed the goniometer over the greater trochanter, with one arm aligning the lateral femoral condyle, and the other arm aligning parallel to the ground, in a direction to the mid-axillary line and recorded the hip angle. The scores were recorded as degrees of range of movement.[20]

Agility. Agility was chosen to represent the footballer's performance. This athletic event involves elements of speed, change of direction, and varying types of movement.[28] After the measurement of the extensibility, agility was measured by the T-Drill test. The T-Drill has been proven to be a highly reliable testing measurement, ICC (0.95 with 95 % confidence interval).[12,25] Footballers were instructed on how to perform the T-Drill and on the test procedures. Then, they were instructed to jog for 2 min to warm-up. The participants performed the T-drill twice and the trial with the best time was taken for analysis by the mean of an alert assessor with a stopwatch. Results were measured in seconds and scores were interpreted as (1) excellent, < 9.5; (2) good, 9.5-10.5; (3) average, 10.5-11.5; and (4) poor, > 11.5.[25,28] A diagram of the T-Drill with its dimensions are shown in (Figure 2).

FIGURE 2. Diagram of T-Drill procedure.



Strength. Finally, maximal voluntary muscle strength was measured by one repetition maximum (1RM) tests. The ICC for 1-RM test-retest measures was (0.983, 95% confidence interval= 0.964–0.997.[4] After a rest time of 5 min, participants were

guided to the knee flexors strengthening machine (hamstrings curl machine). Resistance was placed just proximal to the posterior part of the calcaneus bone. Footballers performed first specific warm-up, consisting of a set of ten repetitions of knee flexion, with a light load. Afterwards, for safety reasons, an estimation of hamstring 1RM was calculated using Brzycki formula [Weight lifted ÷ (1.0278 - (0.0278 × Number of repetitions)]. This formula exhibited a relatively low level of bias (1.6 to 0 kg) and had an ICC above 0.97 and the lower end of the 95% confidence interval was above 0.94.[17] Maximal voluntary strength was recorded in kilograms.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 21.0 for Windows. Descriptive statistics (mean, standard deviation) were calculated to characterize participants' age, weight, and height. Means of the main key variables of the study were also calculated. The Shapiro–Wilk test was used to check the normality of the data distribution. A probability (p) value of >0.05 means that there was no significant difference between groups.

To check for any difference in the incidence of muscle injury between each of the intervention groups, Fisher exact test was used because expected cell count was less than 5.

Dependent t-tests were used to determine any significant differences between the acute and chronic phases of extensibility, agility and muscle strength, and to check the difference between the baseline and chronic phases of these dependent variables.

Analysis of variance (ANOVA) test was used to check for any significant difference between the interventions groups and each of the extensibility, agility, and strength. This test was repeated for three different phases (baseline, acute and chronic). Moreover, after a statistically significant difference was shown between the variables, Tukey's Post Hoc test was used to show where the differences occurred between intervention groups.