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Effects of Static and Dynamic Stretching on Agility Performance in Tennis Players

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Abstract: ***Background & purpose:*** ***Most sports individuals or athletes including tennis players perform stretching during warm-up prior to physical activity in order to prevent injuries and enhance sports performance by improving flexibility. Traditionally static stretching exercises have been a prominent feature of warm up routines. On the other hand, dynamic stretching improves knee joint position sense, increases oxygen uptake and lowers lactate concentration. Hamstring and calf muscle group play a significant role in agility function in tennis players. So the study is conducted to check the effect of static and dynamic stretching of hamstring and calf muscle on agility performance in tennis players.*** ***Objective:*** ***To check the effect of static and dynamic stretch on agility functions in tennis players.*** ***Method:****36 tennis players were taken for the study and the three different stretch protocols (no stretch, static stretch and dynamic stretch) were performed on each of them and time taken for the two agility drills were recorded in a pre and post stretch interventions.* ***Outcome measures:*** ***Shuttle run test, Tennis specific agility test*** ***Result:*** ***Results show that there was a significant decrease in time taken to complete the agility drill for the players performing dynamic stretching than those compared to no stretch and static stretching of the hamstrings and calf muscles.*** ***Conclusion:*** ***Static stretching neither improves nor reduces performance and that dynamic stretching enhances performance of tennis players.***

Keywords: Agility, Tennis, Static Stretching (SS), Dynamic Stretching (DS), No Stretching (NS)

1. Introduction

Most sports individuals or athletes including tennis players perform stretching during warm up prior to physical activity in order to prevent injuries and enhance sports performance by improving flexibility.[1,2,3,4] Various techniques of stretching including static, ballistic, proprioceptive neuromuscular facilitation techniques, dynamic stretching etc. are used for the same.[5,6,7] Static stretching is a type of stretching in which a relaxed position is held without moving for a significant period of time. As opposed to dynamic stretching in which the limb is moved vigorously to stretch.

Traditionally static stretching exercise has been a prominent feature of warm up activities.[7,8,9] But now researches in particular suggest that a regiment of static stretching provides an active inhibition of maximal force production by the stretched muscle.[9,10] The most common held concept for the decrement of performance is that passive stretching causes musculotendinous (MTU) unit to become more compliant.[11,12] These reductions in MTU stiffness leads to acute neural inhibition and decrease in neural drive to muscle resulting in reduction in power output.[11,13]

Practical implication of dynamic stretching (DS) protocols during warm-up are increasing because several investigations have shown that SS degrades performance on vertical jumps, short sprints, task requiring maximal voluntary contraction, muscle strength, endurance performance, balance challenges and reaction time.[7,8,14,15]
DS has shown to improve knee joint position sense, increase O2 uptake, lowers lactate concentration and to improve efficiency of thermo regulation.[7,8,16] Tennis is a sport requiring speed power and functional strength movements over an extended period of time. In tennis players, strength and flexibility of hamstring as well as calf muscle have a significant effect on agility performance. Agility may be defined as requirement of a participant to change direction in response to a given stimuli. So any stretching protocol during warm up needs to be emphasized on these two muscle groups. Objective of this study was to check and compare effects static and dynamic stretching on agility performance in tennis players.

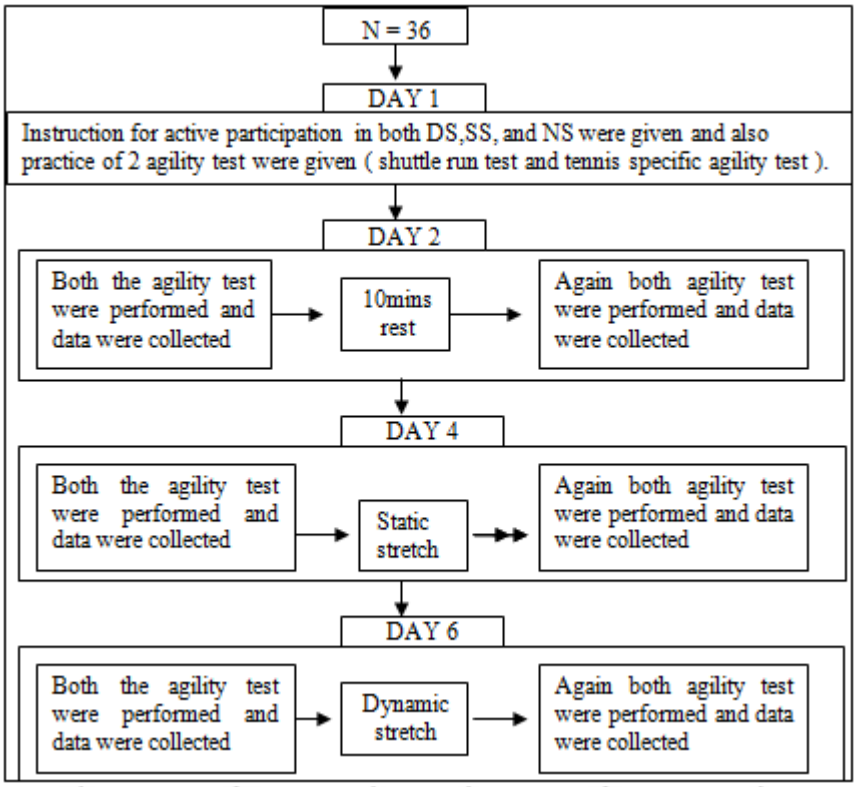
Study Design/Technique – Experimental design/Purposive sampling technique

Samples and Age Group– 36 male tennis players with the age of 12-18 years were selected from Balbhavan, Vadodara

Inclusion Criteria
Subjects have participated in regular training program and had been playing tennis for at least 1 year

Exclusion Criteria
1) Acute impairment of spine or lower extremity.
2) H/O surgery in either lower extremity
3) H/O neurological disorder affecting upper and lower extremities
4) BMI above 25 and below 20

2. Methodology



3. Procedures

All the subjects were assessed on the same tennis court at three non consecutive days to avoid fatigability taking place. Agility test were performed in the morning time only between 8 am – 11 am in the same order on the test days. The individual performed the warm-up stretch for 10 minutes and the time difference between the warm-up session and performance of agility was not more than 2 minutes. 4 subjects were excluded (3 because of any injury and 1 because of fatigue). It was an assessor blinded study. The individuals taking the data of the agility performance were not aware of the different warm up protocols used for the study. Static and dynamic warm-up stretches were performed by the same person who had experience in sports fitness for more than 1 year.

4. Assessment of Agility Function

Shuttle run test[17]: To administer shuttle run we placed 2 cones on the tennis court 5 m apart. Subjects were told to sprint from 1 cone to other, touch it with hands by bending down and sprint back to starting line twice for a total of 20m.

Tennis specific agility test[18]: Players begin at center mark on the base line of tennis court. Upon the command "go" of the assessor, players sprint to doubles side line to touch a cone placed at the center of the line, then they return back to the starting position on centre mark. From the center mark they then run to the singles sideline and again touch the cone before returning to the starting position. Next sprint is to the short diagonal at the intersection of singles sidelines and service lines on the right hand side, again returning back to starting position. Players then spring forwards to touch the net and return back to baseline keeping and eye on their opponent (backward sprint). Long diagonal to the left is the next direction here players sprints from centre to intersection of net and left singles sideline and returns in side sprint to the centre point. It is then along the baseline to the left single sideline and back to the centre point. Finally last sprint is out to doubles sidelines as fast as possible. Stopwatch is stopped as player crosses doubles sideline.

Procedures of static stretching of target muscles: Hamstrings: The experimenter flexes the hip joint while the patient is in supine lying with the knees fully extended. Plantar flexors: the experimenter dorsiflexed the ankle joint of the subject while the subject remained in the supine lying position with the knee fully extended.

Procedure of dynamic stretching of target muscles:
Hamstrings: The subject contracted the hip flexors intentionally with knee extended and flexed his hip joint so that his leg was swung up to the anterior aspect of his body.
Plantar flexors: First, the subject raised one foot from the floor and fully extended the knee. Then the subject contracted his dorsiflexors intentionally and dorsiflexed his ankle joint so that his toe was pointing upwards.

5. Results

Shuttle Run Test:

Table 1: Comparison of means of NS & SS

	PRE (MEAN±SD)	POST (MEAN±SD)
NS	10.07±0.66	10.13±0.70 ¥
SS	9.99±0.60	9.96±0.61 ¥

Table 2: Comparison of means of NS & DS

	PRE (MEAN±SD)	POST (MEAN±SD)
NS	10.07±0.66	10.13±0.70*
DS	9.95±0.63	9.45±0.60*

Table 3: Comparison of means of SS & DS

	PRE (MEAN±SD)	POST(MEAN±SD)
SS	9.99±0.60	9.96±0.61*
DS	9.95±0.63	9.45±0.60*

Tennis Specific Agility Test:

Table 4: Comparison of means of NS & SS

	PRE(MEAN±SD)	POST(MEAN±SD)
NS	33.31±1.60	33.1±1.35 ¥
SS	33.7±1.39	33.89±1.15 ¥

Table 5: Comparison of means of NS & DS

	PRE(MEAN±SD)	POST(MEAN±SD)
NS	33.31±1.60	33.1±1.35*
DS	33.69±1.52	32.35±1.38*

Table 6: Comparison of means of SS & DS

	PRE(MEAN±SD)	POST(MEAN±SD)
SS	33.7±1.39	33.89±1.15*
DS	33.69±1.52	32.35±1.38*

¥ - p value > .0001 (statistically insignificant)
* - p value < .0001 (statistically significant)

Descriptive statistics representing the performance on each dependent variable based on warm-up conditions are presented above in table 1-6. The main effects after application of various warm up protocols were significant. Paired t-test revealed that subjects performed better after application of DS than compared to NS and SS on both agility drills (shuttle run test and tennis specific agility test)($p < 0.0001$). There was no significant difference seen between NS and SS for both the agility drills.

6. Discussion

The purpose of this study was to compare the effects of DS, SS AND NS on selected measures of agility functions. Result indicated that DS conferred a modest performance enhancement for both the two agility test relative to SS and NS. A decrease in performance with the use of SS has been established in a number of studies[8,11,14,19,20] while a positive effect of dynamic stretches, though not researched to the same degree as static stretch, have also been shown.[21] In a review of the warm-up literature, Bishop[22] cites several reasons why an active warm-up such as DS used in this study might improve short term performance. Most factors are related to temperature and include decreased stiffness of the muscles and joints, increased transmission rate of nerve impulses. When sprint running is analyzed, the need for a rapid switch from eccentric to concentric contraction is paramount. Studies found that there was a decrease in muscle activation. This is a vital component in the drop jumps Cornwell et al.[14] explains that the decreased in the performance in the counter movement jumps they employed, caused by SS, was the result of decreased ability of the MTU to store elastic energy. Interestingly the amount of elastic energy that can be stored in the MTU is the function of the unit stiffness [23,24] and so less energy stored in eccentric phase. The phenomenon of DS enhancing performance has been linked to the rehearsal of specific movement patterns, helping proprioception and preactivation, allowing as optimum switch from the eccentric to the concentric muscle contraction required to generate high running speeds.[19,20]

The subjects in this study were young tennis players; male tennis players might respond differently to the warm-up protocols used in this study and also only agility performance was observed, subjects could have also evaluated for vertical jump test etc.

Future clinical research should continue to investigate not only the optimal warm-up parameters for duration and intensity but also the interplay of DS and SS component, based on other sports specific skills, and psychological factors.

7. Conclusion

Static stretching neither improves nor reduces agility performance and that dynamic stretching enhances agility performance of tennis players.

8. Clinical Implementation

The agility performance seems to be optimized by the use of dynamic stretching in warm-up compared to Static Stretching. Static stretching although have shown to improve the flexibility of the subject does not improve or benefit in the sprint performance as done by the dynamic stretching. Thus it can be concluded that for tennis players wishing to optimize sprint performance immediately before starting of a game can perform dynamic stretching and on the other hand during usual warm-up during practice sessions dynamic stretching and static stretching both should be included.

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