

# The comparison of tibial torsion angles between elite athletes and sedentary people

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## Abstract

Torsion is described as a rotational deformation where a long bone turns longitudinally around its own axis. Torsion in tibia is the main reason of children's stepping in-toe and out-toe. It not only creates orthopedic problems in the future, but also is a risk factor for lower extremity injuries. This study intends to compare Tibial Torsion Angle (TTA) of sedentary people to the soccer players of a Turkish Super League team. By comparing TTA angles of elite soccer players who train and compete regularly and have high level of muscle power and endurance to the sedentary control group, it is aimed to determine whether high level soccer training effect TTA. The research was conducted between June-October 2015 on 25 elite soccer players and 25 sedentary people by measuring their right and left tibial torsion angles via transmalleolar measurement with a goniometer. Non-parametric tests were used in statistical analysis, Mann-Whitney U test was used for comparisons. There was not a significant difference in right-left measurements within groups. Between groups right TTA showed no significant difference but left TTA measurements varied significantly ( $p < 0.05$ ). These findings suggest that tibial torsion angle differs according to physical activity level. It is understood that regular and long-time exercise programmes can change TTA.

**Key words:** Goniometric measurement, tibial torsion angle, transmalleolar axis.

## INTRODUCTION

Torsion is a rotational deformation where a long bone turns longitudinally around its own axis. The angle between the proximal and distal tibial articular surfaces is called the tibial torsion angle (6).

Various studies have reported averages of tibial torsion angles between 25° and 42° in adults, measured with computed tomography and magnetic resonance imaging changed (4.8.11). Uncompensated high external tibial torsion causes out-toeing, whereas increased internal tibial torsion results in in-toeing. Rotational deformities of the lower extremities, can affect knee disorders such as patella-femoral instability, knee osteoarthritis (1.3.5) and hip osteoarthritis (14).

In this study, it was aimed to compare TTAs of elite soccer players to sedentary people. Soccer players put a lot of load on the tibia during running and jumping compared to sedentary group. With such a comparison, it was aimed to investigate the effects of elite level sports participation on TTA. It is further aimed to optimize the training schedules of

soccer players in order to minimize the musculoskeletal problems that TTA may cause in the future.

## MATERIAL & METHOD

Ethics approval was obtained for this study from Necmettin Erbakan University. An informed consent was signed by each individual participant who volunteered to the study.

In this study Inclusion criteria for the soccer players were as follows: Male, aged between 18-30, no history of surgical operation from the lower extremity, no history of injury to any lower extremity in the last 3 months. 25 elite soccer players from the same team were included in the study. The sedentary group participants were among college students. Inclusion criteria for the sedentary group were as follows: Male, aged between 18-30, not doing any physical activity other than daily life activities, not working in a job that requires physical work, avoiding leisure activities that require high or moderate physical activity, no history of injury to any lower extremity in the last 3 months.

Trans malleolar angle measurement was used and it is a method that is used to measure tibial torsion angle. This method applied in face-down position (Figure 1). The line between the medial malleolus and lateral malleolus is marked, and then the angle between the line we mark vertically on this line and the line in the middle of femur gives us transmalleolar angle (10).



Figure 1. Transmalleolar angle measurement using goniometer to determine TTA.

## INTERPRETATION OF ANALYSIS & FINDINGS

Left and right tibial torsion angles of 25 sedentary and 25 football players have been evaluated. Average age in player group was  $23 \pm 3.55$  (between 19 – 30) while average age in sedentary group was  $21.8 \pm 2.56$  (between 19 – 26). Everyone in sedentary group dominantly used their lower right extremity. However, 23 people used lower right extremity while 2 people used left in football players group.

As shown in Table 1, median of right TTA in sedentary controls was  $20^\circ$  (min: $7^\circ$ , max: $24^\circ$ ), median of left TTA in sedentary controls was  $20^\circ$  (min: $4^\circ$ , max: $26^\circ$ ). Mean right TTA in football players  $16,6^\circ \pm 6.08$ , whereas mean left TTA was  $15,76^\circ \pm 5.95$ .

**Table 1.** Right and Left Tibial Torsion Angle Values of Football Players vs. Sedentary Controls.

	Football	Sedentary	P
Right	$16,6^\circ \pm 6.08$	$20^\circ$ (min: $7^\circ$ ,max: $24^\circ$ )	$>0.05$
Left	$15,76^\circ \pm 5.95$	$20^\circ$ (min: $4^\circ$ ,max: $26^\circ$ )	$<0.05$

Right - left TTA's of sedentary controls showed no significant difference ( $p>0.05$ ), just as right - left TTA comparison of football players ( $p>0.05$ ). Right TTA of sedentary vs football players were of no statistical significance ( $p>0.05$ ), whereas left TTA of sedentary vs football players displayed significant difference ( $p<0.05$ ).

Non- parametric tests were used in statistical analysis, Mann-Whitney U test was used for comparisons. The tests were so squareroot corrected (transformation) and then parametric tests were conducted. The results complied with the results from non-parametric test results.

## CONCLUSION & EVALUATION

Trans malleolar axis measurement method was used in this study. Staheli et al. reported tibial torsion angles of 5-year-old children between  $12-20^\circ$  and of 30-year-old adults as  $23^\circ$  (9).

In this study, TTA's of neither sedentary nor football players showed a significant difference between right-left comparisons. Other researchers have also reported similar findings (4,6,8). Our results of TTA that average TTA of the right side of sedentary group:  $18.24^\circ$  average TTA of the left side of sedentary group:  $19.16^\circ$  average TTA of the right side of soccer player group:  $16.60^\circ$  average TTA of the left side of soccer player group:  $15.76^\circ$ . The mean values of TTA in both groups were within the normal range (4,9,11).

TTA result differ when the tests applied to various ethnicities. People from different ethnicities have several life styles and distinct postures. This is why it was argued that tibial torsion might alter as a result (7,13). The fact that distinctive life styles can change tibial torsion angles has complied with this research.

It is controversial that which muscle type and which exercise is more effective in normalizing TTA. There is a TTA walking analyze study conducted on 5 healthy male subjects for 12 months and a link was found between torsion and activity level of m. gastrocnemius and m. soleus muscles (15).

There is another study in which 29 ballets were compared with 31 university students who were in control group. Increased external tibial torsion angle was found in ballets compared to control group. It is explained that what caused this result is ballets expose their legs to external rotation (12).

As a result, ballet is a sport requiring flexibility rather than muscle power. In a research about this topic, ballets and subjects from various sports have been compared in terms of physical compliance and compliance test results were found to be lower in ballets (2). This indicates what we found in this study that high exercise can change and fix TTA.

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