

Determine the Effects of Long Term Playing Soccer on Lumbar Spine Degeneration: A Preliminary Study

Uzun Süre Futbol Oynamanın Bel Omurlarındaki Dejenerasyona Etkisi: Başlangıç Çalışması

Araştırma Makalesi

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ÖZ

Bu çalışmanın amacı uzun süre futbol oynamanın bel omur dejenerasyonu üzerine etkisini araştırmaktır. Bu çalışmaya 56 kişi katılmıştır. Katılımcılar aktif futbolcular, veteran futbolcular ve bu grupların kontrol grupları olmak üzere dört gruba ayrılmış ve bel omur dejenerasyonları ölçülmüştür. Katılımcıların bel omurlarındaki dejenerasyon izokinetik gövde kuvveti, bel esneklik ve radyolojik bel ölçümleri yapılarak saptanmıştır. İzokinetik gövde kuvveti Biodex Sistem Dinamometresi ile ölçülmüştür. Bel omurlarındaki dejenerasyon yan yüzey röntgenleri Kellgren ve Lawrence puanlaması kullanılarak ölçülmüştür ve bel esneklik ölçümü ise modifiye edilmiş Schober test aracılığıyla yapılmıştır. Veteran futbolcuların bel omurlarında aktif futbolculardan daha fazla dejenerasyon görülmüştür ($p<0.05$). Fakat her iki grup

ABSTRACT

The purpose of this study was to investigate the effects of long term playing soccer on the lumbar spine degeneration. Fifty six subjects participated in this study. Four groups which were active soccer players, veteran soccer players and their control groups were organized to measure their lumbar spine degeneration. Isokinetic trunk muscle strength, radiological examinations of lumbar and spinal flexibility were measured in order to examine the degree of degeneration of subjects. Isokinetic trunk strength was measured with the Biodex System Dynamometer. Plain lateral radiographs were performed by using Kellgren and Lawrence score to determine the presence of degenerative changes of each lumbar vertebra and spinal flexibility was measured by a modified Schober test. Results

kendi kontrol grupları ile karşılaştırıldığında bel omur dejenerasyonları için anlamlı bir fark bulunmamıştır. Buna ek olarak, aktif futbolcuların 60°/sn. ekstansiyon kuvvetlerinin diğer gruplardaki futbolculardan daha fazla olduğu bulunmuştur ($p<0.05$). Çalışmanın uzun süre futbol oynamanın bel omurları üzerinde dejenerasyona sebep olabileceği tartışması; futbol grupları ve kontrol grupları arasında anlamlı fark bulunmadığı için desteklenmemektedir.

indicated a significant difference between the active soccer players and the veteran soccer players in terms of lumbar disc degeneration ($p<0.05$) in favor of veteran soccer players. Among these groups, veteran soccer players displayed greater lumbar disc degeneration. However, there was no significant difference between both soccer player groups and their control groups in terms of lumbar disc degeneration. Active soccer group players' showed greater trunk extension strength at 60°/s. than the other groups in the study ($p<0.05$). Findings of the current study did not support the idea that playing soccer at high intensity training at a long period of time may cause lumbar spine degeneration since the getting a non-significant difference between control and active group.

Anahtar Kelimeler

Bel omur dejenerasyonu, izokinetik bel kuvveti, futbol

Key Words

Lumbar disc degeneration, Isokinetic trunk muscle strength, Soccer

INTRODUCTION

Soccer is a popular, complex strategically game of physical and mental challenges. At least 200 million licensed players participate in soccer and 20 million soccer games are arranged each year in the world (Witvrouw et al., 2003). Skilled movement must be executed under the situation of match related conditions of restricted space, limited time, physical and mental fatigue and opposing players. Soccer players have to possess moderate to high aerobic and anaerobic power, have good agility and joint flexibility, and be capable of generating high torques during fast movements (Reilly et al., 2000).

Soccer is characterized by high intensity, intermittent, noncontinuous exercise, and peak physical condition is required (Reilly et al., 2000). To gain peak physical capacity, weight lifting and running for a long period is essential. Such high intensity and long duration training can cause acute and chronic injuries. Due to the nature of the game, acute injuries are common. According to the reports of epidemiologic investigations, the incidence of injuries during male's elite soccer matches is between 13 and 35 injuries per 1000 player/hours of competition (Dvorak and Junge, 2000; Giza et al., 2003). The result of sharp and force-

ful back movements which are necessity for soccer can cause acute and chronic injuries at the lumbar spine. Videman et al. (1995) presented a higher rate of degenerative changes in the upper lumbar spine due to training. However, soccer players suffer from their lower lumbar discs. Bono also stated that sports which require high intensity and long duration training can cause lumbar spine degeneration (LSD). Raty et al. (1997) mentioned that team sports, such as soccer, may cause LSD. However, players do not suffer of back pain in general. Moreover, many asymptomatic individuals also demonstrate degenerative disc disease on radiological image (Boden et al., 1990).

There have been two main factors, weight training for muscular development and running for a long time, which can cause the LSD (Leatt et al., 1986). Weight training is often arranged as a circuit with weight lifting exercises and this type of activity has been shown to cause degenerative findings at the lumbar spine (Bono, 2006). Other factor that causes LSD is running for a long duration. Woolf and Glaser mentioned that back problems are more often chronic or episodic instead of acute injuries among runners (Woolf and Glaser, 2004). The quantity of intra-abdominal pressure

changes increasing the speed of running bear out this intra-abdominal loading pressure is related to lumbosacral loading (Grillner et al., 1978). During a soccer game, players run about 11 km at an average intensity (Calbet et al., 2001). Such a loading may create a pressure on the spine causing LSD. Videman et al. (1995) found that the degree of disc degeneration and bulging in the L4-S1 region could be seen at the soccer players.

Generally, the risk factors of LSD can be categorized as two groups; the first one is intrinsic (person-related), and the latter one is extrinsic (environment-related) risk factors (Chomiak et al., 2000). In this study, intrinsic risk factors of LSD; lack of spinal flexibility (SF), trunk muscle strength (TMS) were examined. SF has been conjectured to be a crucial part of spinal health. It was found that while comparing the adults who had been engaged in leisure physical activity for more than five years with sedentary individuals, they slightly had less lumbar mobility which is dependent on spine abnormalities (Stokes et al., 1981; Burton and Tillotson, 1991). Raty et al. (1997) mentioned that soccer or weight lifting imposed greater compression or torsional forces on the spine that reduced spinal mobility. This was directly related with heavy work and disc height narrowing. In the study by Niosi and Oxland (2004), SF was changed with the effects of the geometry consisting of the disc height and end plate cross-sectional area. The alterations in spine geometry that result from degeneration should decrease the flexion-extension spinal mobility; and the material property changes should increase the spinal axial rotation.

Not only SF but decrease in trunk muscle strength (TMS) is the other intrinsic factor that can cause the LSD. Insufficient TMS and endurance combined with decrease of mobility of the spine are among that can lead to low back pain risk factors that can cause low back trouble (Hodges and Richardson, 1996). Pope and his colleagues (1985) have shown that in the males with low-back complaints a decrease in flexor and extensor strength was determined. TMS, balance between agonist and antagonist muscles and coordination are proposed to present low back pain (Hod-

ges and Richardson, 1996). Cholewicki and McGill (1996) reported that muscle co-activation is essential to equalize the healthy spine around a neutral spine position.

Acute injuries to the lumbar spine in soccer have been closely investigated since they immediately intensely draw attention. However, chronic injuries of the lumbar spine investigated sparsely. The aim of this study was to investigate the effects of long term playing soccer on the lumbar spine degeneration.

METHODS

Participants: Four groups were created in order to examine the lumbar disk degeneration for this study. The first group of soccer players consisted of 14 subjects between the age of 20-25 who were active players at least for 5 years in the first and second division amateur soccer teams. For the second group, 15 people who had never participated in any kind of sport actively in general were selected as the control group of the first group. The third group was composed of the veteran soccer players consisting of 14 players between the age of 30-35 who played soccer at the first and second division amateur soccer teams for at least 10 years. The fourth group as a control group of the third group included 13 ages matched sedentary controls who had never participated in any kind of sport actively in general. The physical parameters of the participants were presented in Table 1. The subjects were all healthy males who had no history of back pain and any other serious injuries. The exact nature of the studies' aim was explained to each voluntary subject and written consent was obtained. Physical measurements such as trunk muscle strength were discussed with the professional experts in order to check the safety issues.

Body weight was measured with the subject dressed only underpants with the sensitive balance. The body mass index (BMI) defined as the ratio of body weight in kilograms to the square of the standing body height in meters (kg/sq m), was calculated. All the examinations were performed in the afternoons.

Before the measurements of physical performance, the subjects warmed up on a bicycle ergometer for 5 minutes and then they participated in the test. In all the physical performance tests, a neutral verbal command was given to each subject. Before the study, all participants were informed about the aim of the study and written consent forms were obtained.

Trunk Muscle Strength: Isokinetic trunk muscle strength data, peak torque to body weight, were recorded with the Biodex System Dynamometer (Biobex Medical Inc, Shirley, NY). For torso flexion and extension testing, participants were positioned semi-standing on the seat in down position approximately 15° and 15° flexion in knee joint. The axis of rotation of the dynamometer resistance adaptor was adjusted with the ASIS. Torso straps, the clavicle pads on the torso straps, and lumbar pad were formed and applied firmly for maximum patient restraint and comfort. The participants' pelvis and thighs were steadied with straps designed to minimize extraneous body movements and momentum. Subjects performed torso flexion and extension for 5 repetitions at 60°/sec and 10 repetitions at 120°/sec with a ten-second rest between the testing speeds.

Radiological Measurement: Plain lateral radiographs were performed as the radiological measurements. The presence of degenerative changes of each lumbar vertebra was determined by using the Kellgren and Lawrence Score. The scores have four levels explained as follows.

Kellgren and Lawrence Score

- Grade I: Minimal osteophytosis only
- Grade II: Definite osteophytosis with some sclerosis of anterior part of vertebral plates
- Grade III: Marked osteophytosis and sclerosis of vertebral plates with slight narrowing of disk space
- Grade IV: Large osteophytosis, marked sclerosis of vertebral plates and marked narrowing of disk space

All radiographs were independently assessed by three professional experts two times at different times.

Spinal Flexibility Measurement: A modified Schober test was used to measure lumbar flexion. The test method required only a plastic tape measure and a pen to make three markings on the skin overlaying the lumbosacral spine. With the subject standing erect, the first mark was placed at the lumbosacral junction as indicated by the dimples of Venus. A second mark was placed at 5 cm below the lumbosacral junction; and the third, at 10 cm above the junction. The subject then was asked to bend forward as far as possible. As through to touch the toes and the new distance between the marks two and three was measured. Lumbar flexion was expressed as the difference between this measurement and the initial distance of 15 cm.

Data Analysis: Statistical Package for Social Sciences (SPSS) was used for statistical analyses. In the first step, multivariate analysis of variance (MANOVA) was performed to compare the results of the soccer players and controls, whereas the post-hoc test was used to define the variations between the groups. Using the Bonferroni method, each ANOVA was tested at the .05 level.

The second step was to test the correlation between the lumbar spine degeneration and spinal flexibility, trunk strength in amateur soccer players. Pearson coefficients were used for the correlation calculations.

RESULTS

Table 1 shows the demographic characteristics of groups in terms of age, weight, height, experience and body mass index (BMI). There were no significant differences among the groups regarding their age, height, weight and BMI. In terms of LSD, the MANOVA results indicated that there was a significant difference between veteran soccer players and active soccer players in favor of veteran soccer players having greater disk degeneration ($p < 0.05$). However, there was no significant difference between the active soccer players and their control group, and between the veteran soccer players and their control group.

Table 1. Demographic Characteristics of the Subject

	N	Age	Weight	Height	BMI	Experience
Active Soccer P.	14	21.5 ± 1.6	73.3 ± 6.1	175.7 ± 5.2	23.8 ± 1.5	7.7 ± 1.9
Sedentary P.	15	22.6 ± 1.5	70.5 ± 11.7	175.0 ± 7.8	23.0 ± 2.9	
Veteran Soccer P.	14	31.9 ± 2.4	76.0 ± 12.3	174.4 ± 4.1	24.9 ± 3.6	15.2 ± 3.7
Sedentary P.	13	31.0 ± 1.7	77.3 ± 13.2	176.6 ± 5.8	24.7 ± 3.4	

Table 2. Trunk Strength, Spinal Flexibility and Lumbar Disc Degeneration Results for Soccer and Control Groups

GROUPS	Trunk Fle@60		Trunk Ext@60		Trunk Fle@120		Trunk Ext@120		Trunk Rat@60		Trunk Rat@120		Spinal Flexibility		Lumbar Disc Degeneration	
	Md.	Sig.	Md.	Sig.	Md.	Sig.	Md.	Sig.	Md.	Sig.	Md.	Sig.	Md.	Sig.	Md.	Sig.
Active Soccer Players	27.6	.39	81.8*	.005	34.4	.95	50.71	.32	-4.90	1.0	2.09	1.0	.40	1.0	1.33	1.0
Control Group																
Veteran Soccer Players	11.8	1.0	36.6	.85	-8.6	1.0	28.70	1.0	-1.86	1.0	-4.44	1.0	-.22	1.0	7.36	1.0
Control Group																
Active Soccer Players	45.4*	.02	69.4*	.03	49.3*	.006	43.92	.59	.64	1.0	5.10	1.0	.21	1.0	-.16*	.04
Veteran Soccer Players																

p* < 0.05

rol group in terms of lumbar disc degeneration (Table 2).

The MANOVA results also revealed that there was a significant difference between active soccer players and their control group, and between veteran soccer players and active soccer players in terms of trunk extension strength at 60°/sec (p < 0.05). In addition, a significant difference was found between the active soccer players and the veteran soccer players in terms of trunk flexion strength at 60°/sec and 120°/sec (Table 2) (p < 0.05). Representation of the peak trunk strength in the isokinetic test for the groups (active soccer players, control group of active soccer players, veteran soccer players, & control group of veteran soccer players) was presented at the Figure 1. For the lumbar flexibility, a non-significant difference was found between the soccer groups

and their control groups. Figure 1 shows the trunk extension strength, and Figure 2 shows the trunk flexion strength in two speeds (60°/s and 120°/s).

DISCUSSION

Playing soccer for a long period of time may cause acute and chronic injuries leading to LSD. In this study, the risk factors for soccer players that might cause LSD were investigated. Results of the present study were discussed in the framework of lumbar disc degeneration, trunk strength and trunk flexibility for active and veteran soccer groups and their controls.

The findings of this study were not consistent with the study of Videman and his colleagues conducted in 1995 which demonstrated that former elite athletes, unlike control groups, demonstrated less back pain or no symptoms in later adulthood.

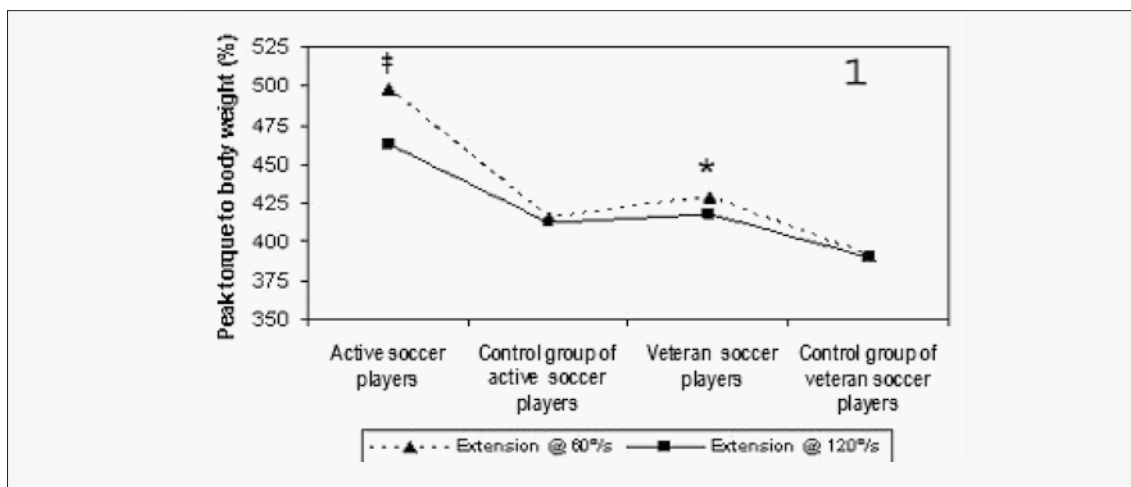


Figure 1. Peak Trunk Extension Strength at the Isokinetic Test Results for All Groups

Note. Peak torque to body weight refers to isokinetic trunk muscle strength.

†demonstrates statistical difference between active soccer players and their control group @ 60°/s.

*demonstrates statistical difference between active soccer players and veteran soccer players @ 60°/s.

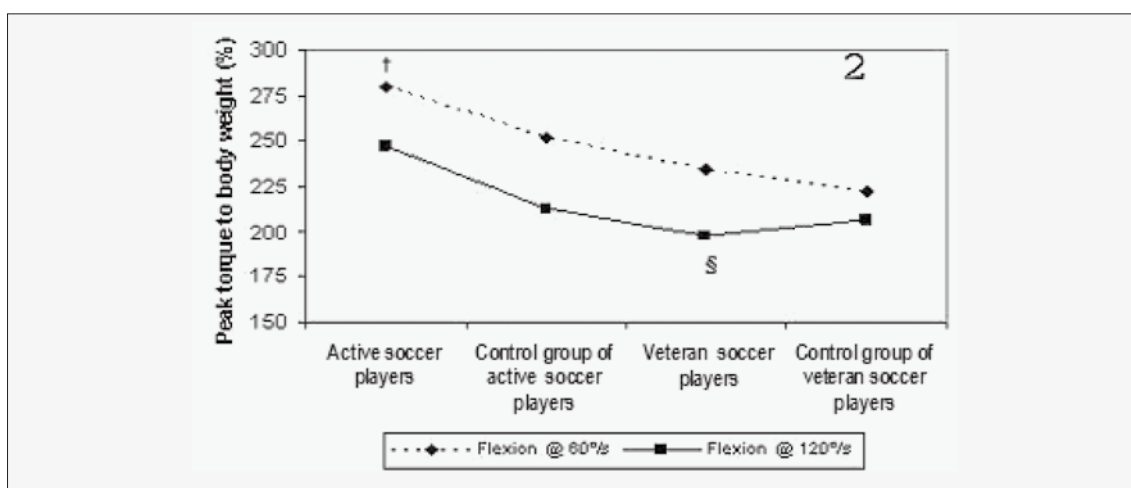


Figure 2. Peak Trunk Flexion Strength at the Isokinetic Test Results for All Groups

Note. Peak torque to body weight refers to isokinetic trunk muscle strength.

†demonstrates statistical difference between active soccer players and veteran soccer players @ 60°/s.

§demonstrates statistical difference between active soccer players and veteran soccer players @ 120°/s.

However, they revealed an increase in the lumbar disc degeneration throughout the entire spine in former weight lifters and in the lower lumbar levels in soccer players when compared to controls. Another study by Kaneoka et al.(2007) also found that elite competitive swimmers had lumbar disk degeneration at different levels of lumbar disks. Youth elite athletes in baseball and swimming sho-

wed higher disk degeneration than having non-athletes (Hangai et al., 2009). Having knowledge from the previous studies, it might be argued that certain forceful athletic activities may accelerate the degenerative process. However, the degenerative changes seen on imaging studies do not correlate well with clinical symptoms such as low back pain. High intensity training programs such

as soccer training might cause the disk degenerative changes.

The aerobic requirements and muscle strength are the physiological demands of soccer players explained by Reilly et al. (2000). The researchers also declared that many activities in soccer were forceful and explosive (Reilly et al., 2000). The power output during such activities might be related to the strength of the muscles. Most of the researchers declared that trunk extension strength was stronger than the trunk flexion strength, and this finding was also accepted with in the current study for similar model of isokinetic measurement (Mayer et al., 1985; Hasue et al., 1990) However, Pope et al. (1985) claimed that trunk flexion strength higher than extension strength measures in males. There were also various results in the trunk agonist/antagonist ratio. These findings are contradicted in the literature related to disk degeneration. This may explained by the different methods of measurement technique and the parameters used in the analysis of the studies (Beimborn and Morrissey, 1987). More research is needed to explain the role of trunk flexion and extension strength on the lumbar disk degeneration.

Another findings of the current study presented that there was no significant difference between soccer groups and sedentary groups in terms of lumbar flexibility. The result of the current study was not consistent with the study of Raty et al. (1997) who investigated the long-term effects of different loading conditions in sports and worked on spinal flexibility. The researchers emphasized that different kinds of exercises such as weight-lifting or soccer, which impose greater compression or torsional forces on the spine, do not lead to a decline in spinal flexibility (Raty et al., 1997). It is cleared that longitudinal studies should be designed to clarify the relationship between spinal flexibility and back problems (Batti'e et al.,

1987). There were some researches about a general decrease in spinal mobility associated with low back pain complaints (Beimborn and Morrissey, 1987; Biering-Sorensen, 1984). Being different from previous studies; in this research, no difference between groups in spinal flexibility is a considerable finding. This result showed that the importance of the flexion exercise which should be performed during warm-up and cool-down in trainings was not properly assigned in studied group.

In summary, results of these investigations provided support that playing soccer at high intensity training at a long period of time may cause degeneration at the lumbar spine. Disk degeneration of the lumbar spine may be observed in active soccer group players in later years since this degeneration has been observed in veteran group soccer players. On the other hand, veteran players' higher LSD can also be explained on the basis of age and activity level. In addition, having abnormal trunk extension strength and less spinal flexibility while playing actively may cause lumbar disc degeneration on the spine at later years. Therefore, well-balanced trunk muscle strength and spinal flexibility exercises should be emphasized in training program. It should be noted that it was a preliminary study to examine LSD in soccer players and the findings of present study are not fully clear, for this reason, future research studies should be necessary. For future studies, high number of participants should be included in examining lumbar disk degeneration. The effects of a variety of sports on lumbar disk degeneration should be determined for both male and female athletes.

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