

Proprioceptive and strength endurance training prevent soccer injuries

Treinamento proprioceptivo e de força resistente previnem lesões no futebol

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Abstract

Objective – Injuries may exclude athletes from important games and competitions and abbreviate their careers. Then, the aim of this study was to analyze the effect of proprioceptive training and strength endurance on the incidence of ankle sprains and muscle injuries in soccer.

Methods – Thirteen athletes who played in the Paulista Championship in first division (U20) participated. The incidence of muscular injuries in lower limbs and ankle sprains that did not proceed from direct trauma was recorded during two seasons. Besides the normal training, the analysis was divided into two situations: in the first season (S1) were involved with proprioceptive exercises (twice per week and before games in the warm up) and strength endurance (twice a week for the muscles thigh). The following season (T2), these works were not performed and served as controls. For statistical analysis the non parametric test McNemar (paired observations) for season comparison (before and after) was used with 5% significance. **Results** – The incidence of muscle injuries was higher ($P < 0.05$) in the nonintervention period S2 when compared to the preparation period with muscular and proprioceptive S1 (6 x 1 lesions) with the same occurring with the ankle sprains (4 x 1).

Conclusion – We conclude that simple exercises of proprioception and muscular endurance decreases the incidence of injuries in soccer players, and are therefore preventive.

Descriptors: Proprioception; Soccer; Muscle strength; Sprains and strains; Muscles/injuries

Resumo

Objetivo – Lesões afastam atletas de jogos e competições importantes, podendo abreviar a carreira de futebolistas. Assim, o objetivo deste estudo foi analisar o efeito do treinamento proprioceptivo e de força resistente sobre a incidência de entorses de tornozelo e lesões musculares em futebolistas. **Métodos** – Treze atletas que disputavam o Campeonato Paulista da 1ª divisão (sub-20) participaram. A incidência de lesões musculares nos membros inferiores e entorses de tornozelo que não decorreram de traumas diretos foram registrados durante duas temporadas. Além dos treinamentos normais, a análise foi dividida em duas situações: na primeira temporada (T1) houve intervenção com exercícios proprioceptivos (duas vezes por semana e antes dos jogos no aquecimento) e treinamento de força resistente (duas vezes por semana para a musculatura da coxa). Na temporada seguinte (T2) esses trabalhos não foram realizados e serviu como controle. Para análise estatística foi utilizado o teste não paramétrico de McNemar (observações pareadas) para comparações entre as temporadas (pré e pós) com significância adotada de 5%. **Resultados** – A incidência de lesões musculares foi maior ($P < 0,05$) no período sem intervenção T2 quando comparado ao período com preparação muscular e proprioceptiva T1 (6 x 1 lesões) com o mesmo ocorrendo em relação aos entorses de tornozelo (4 x 1). **Conclusão** – Conclui-se que exercícios simples de propriocepção e de força resistente diminuem a incidência de lesões em futebolistas e são, portanto, preventivos.

Descritores: Propriocepção; Futebol; Força muscular; Entorses e distensões; Músculos/lesões

Introduction

About 3.2 million spectators in stadiums and billions of television viewers around the world followed the 64 matches of the 18th world cup soccer FIFA in 2006, Germany¹. Moreover, it is estimated that more than 265 million people play soccer in the planet². Either in amateur competitions, professional tournaments or leisure activities, as a form of physical activity, these numbers make this sport probably the biggest phenomenon of all time. Additionally, the absolute number of injuries resulting from his practice is also great and shows the need for strategies for its prevention.

Most lesions that affect the players are not considered serious and, 70% of them occur in the lower limbs, even by the nature of sport that requires movement of this body region²⁻⁴. Interestingly in young athletes, knee problems are more common in females, while the ankles are most affected in men³⁻⁵. Moreover, with increasing age the adolescents start to suffer more injuries in the thigh muscle, especially in adutors⁶. However, science-based protocols, in order to prevent injury during soccer practice are scarce.

Among injuries in soccer, we highlight sprains knee, ankle and muscle ruptures⁷. The ankle sprain is characterized by sudden lateral or medial movement of this joint, thus leading to distention or even rupture of the ligaments. In turn, the muscle breakdown occurs when muscle fibers are stretched beyond its natural length to

an abrupt and violent. It is believed that preventive behavior, besides the normal physical training, such as specific work of proprioception as balance, muscle strength in its various manifestations, flexibility⁸ and reaction time of close muscles⁹ may assist these problems¹⁰.

Nevertheless, few studies have been conducted on competitive category teams, in special with longitudinal follow to establish the actual effectiveness of these preventive procedures. Thus, the purpose of this study was to analyze the effect of specific proprioceptive training to the ankle joint and strength endurance to the thigh muscle on the incidence of ankle sprains and muscle injuries in soccer. Whereas soccer requires constant change of direction, acceleration and deceleration with frequent high demand for muscular power, our hypothesis was that the period of intervention with preventive exercises promote a lower incidence of these injuries during the competitive season.

Methods

Inclusion/exclusion procedures

To participate in this work, the volunteers should have a minimum age of 18 and maximum of 20 years at the time of the study. The athletes were subscribed in the Paulista Soccer Federation by Esporte

Clube XV de Novembro de Jaú, and to attend regular training sessions (minimum 5 times per week) the club (at least 1 year) and a consent form had been signed. Moreover, throughout the research athletes who were dismissed for other reasons such as technical failure, transfer to another club or lesions than those studied in this work, would be excluded from the analysis.

Subjects

Twenty-three athletes have applied voluntarily to this survey, but only thirteen met the above criteria and were selected for this study. Table 1 presents the characteristics of the volunteers.

Table 1. General characteristics of the subject (N = 13)

Age (years)	Body weight (kg)	Height (m)	Time of traing (years)
18.8 ± 0.7	67 ± 6.1 [≠]	1.77 ± 0.1 [≠]	4.2 ± 0.9

Data are expressed as mean ± standard deviation
[≠] body mass and height values did not significantly changed after time analysis and, therefore are not presented/discussed

General procedures and characterization of the activities

The study was divided into two seasons, here called the first season (T1) and season 2 (T2), each one of them began on the first day of March and ended on December 20. Between the end of a season and the beginning of another, the athletes were released from training supervised by the committee members were instructed to technical and physical training, but alone (without the accompanying presence of the technical committee).

During the research period the athletes trained normally guided by the technical committee and participated in competitions, and this study did not modify the specific training. The players trained in two shifts (morning and afternoon) on most days of the week and played as the calendar of competitions of the season (usually on weekends, with few exceptions in the middle of the week as well). The frequency of activities ranged from 5 to 6 times a week.

The official championships for both seasons were the regional games, games inside and open the Paulista Championship U-20's first division. The team also participated in some friendly games in both seasons.

Injury records

Were considered only lesions arising from non-traumatic situations (those caused by contact with another individual athlete in the games or in training were not considered). The incidence of specific injuries of ankle sprains and muscle (contractures, ruptures muscle) have been duly registered by the physiotherapy department of the club.

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a) Proprioceptive training

Rested twice a week and in the warm up process for the games/collectives, athletes performed the following exercises while walking forward, backward and to either side by a distance of about seven meters (twice each direction): support on my toes (plantar flexion), in support of heel (dorsiflexion), support the internal parts of the foot (eversion) and support the external parts of the foot (inversion). These movements were performed with sneakers or cleats in their own training pitch and guided by the physiotherapist and fitness coach of the club.

b) Strength endurance training

This protocol was performed twice a week under the three sets of 30 to 50 seconds each series and 1 minute rest between them. The exercises took place after the physical training always normal and fitness coach performed the control and guidance.

For this purpose, surgical elastic thickness of ± 20 mm and a length of ± 60 cm were used with one end being supported (fixed) on the

leg of the athlete (± 10 cm above the ankle joint) and the other end attached (fixed) in a metal base so that the elastic resistance exerted against the motion as it was pulled in the opposite direction to the end where it was fixed. A folded towel was placed between the elastic and the contact with the leg to avoid discomfort to the athlete.

All exercises were performed on foot, in a unilateral way. The athlete rested on the leg that did not perform the movement and also the upper limbs in another partner to ensure their balance.

The exercises were: flexion, extension, abduction and adduction of the thigh. All of which were executed with the leg extended. The range of exercise movements was ± 45o and was determined after a pilot study, conducted with the same participants, who found that this resistance of the elastic amplitude was considerable ability to stimulate strength endurance capacity.

Statistical analysis

McNemar paired test was used to comparisons between seasons. Statistical significance was established at the P < 0.05 level.

Results

To athletes selected for analysis, the total number of friendlies and competitive games of the season was higher (P < 0.05) for T1 compared to T2 (32.5 ± 1.3 vs. 31 ± 2 games).

The incidence of muscle injury (1 vs. 6) and ankle sprains (1 vs. 4) was higher in T2 compared to T1 (Figure 1).

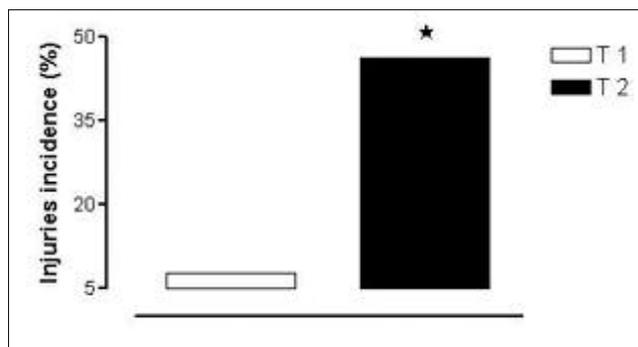


Figure 1. The percentage incidence of injuries was higher in T2 (second season) than in T1 (first season). N = 13
 * Indicates statistically significant difference (P < 0.05)

Discussion

The most important fact in this study was that simple activities of proprioception and strengthening prevented major injuries to players, with minimum weekly sessions that did not interfere in the routine training of athletes, not the programming of the technical committee.

The intervention time and the level of the volunteers who participated in the current study, solidify the methodology employed. First, the duration of the survey took place over two full seasons which denotes both the uniqueness in terms of longitudinal and the feasibility of such procedures to comply with the important task of preventing injuries. Second, the team investigated was a competitive first division of the Paulista Championship U-20, which shows the direct applicability of our findings to similar teams.

The total number of games played was higher for T1 season compared to T2. Whereas that the two seasons were identical in terms of competitions and preparation, except the intervention of this research, this result seems obvious, because injuries excludes the player for a few games. Nevertheless, we know that more games in a season are related to higher incidence of injuries in soccer players¹¹. However, in the case of this work, even with a larger amount of games played throughout the season, when athletes performed the recommended preventive protocol they had fewer problems with muscle and joint systems which confirms the effectiveness of our protocol and corroborates recent studies⁸.

The incidence of ankle sprains and muscle was much lower for the seasons that were involved with the training protocol proprioceptive and strength endurance (Figure 1). As competitions and training methodology (physical, technical and tactical) were identical in the two seasons examined, despite the methodological limitations, it seems that such procedures can and should be used to avoid injuries that excludes athletes usually for relatively long periods of games and trainings. Especially in youth, the incidence of these lesions is greater¹² and hinders the formation of the athlete. Such problems may even shorten the lifespan of the young sportsman in the future. So simple and effective measures, as used in this work, are valuable.

Any move by the lower limbs demand of muscles given percentage of their maximum strength condition¹³. The enhanced capacity of the strength endurance muscle (caused by specific stimuli), results in reduction of fatigue for the same absolute activity¹⁴. Considering that fatigue is a major mechanism that provide injury^{10, 15} and that it has increased in the final minutes of the games¹⁶, the greater muscular endurance may explain the lower number of injuries in season with the strength training intervention. Probably the stimuli generated by different motor units, due to several movements during training, allowed the alternation of active muscle fibers. This fact would lead to greater muscle load support.

Furthermore, the increased capacity of the body part trained to perceive yourself in this position (angle) in the space and speed of changing its motor schema (proprioception) may explain the lower incidence of injuries in season with the intervention adopted here. This explanation has been confirmed in literature by the idea that the risk of injury in sports is associated with parameters of proprioception, neuromuscular control, flexibility, skills, strength and balance. Thus, prevention strategies are recommended and implemented primarily to modify these risk factors^{8,17}.

Conclusion

Our results suggest that simple works of proprioception (during training and before games) and endurance strength held regularly decreases the incidence of muscle injuries and ankle in soccer players. Thus, our initial hypothesis was corroborated, and therefore such activities must be recommended for preventing injuries.

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