

Relationship between postural changes and injuries of the locomotor system in indoor soccer athletes

Cintia Zucareli Pinto Ribeiro¹, Paula Marie Hanai Akashi¹,
Isabel de Camargo Neves Sacco¹ and André Pedrinelli²

ABSTRACT

Nowadays, the sport practice has been initiated precociously. These precocious beginning of competitive sports may result in changes on the young athletes' posture alignment, because the child's bone and muscle systems are still developing and these systems are more susceptible to stress and injuries. The purpose of this study was to verify the indoor soccer (Futsal) injuries and the changes of posture alignment in players between 9 to 16 years old. We examined the posture of 50 volunteers young futsal male players, volunteers, from a first division club team. These athletes were divided in two different groups: the group one (G1) was formed by those players who have suffered injuries related to Futsal; and group two (G2) was composed by athletes who did not have injuries related to futsal. First, the athletes or their parents answered a questionnaire about anthropometric characteristics of the subjects, player position, how long they have been practicing Futsal, how often they practiced Futsal and previous injuries related to Futsal practice. Then, we evaluated the postural alignment using an specific protocol to check the postural alterations. Both groups showed changes on the body alignment. The most common changes seen were in ankle and knee in both groups. The changes of the alignment in lumbar spine was more common in group 1. Considering injuries in group 1, the most common injury was in ankle (45.2% of all injuries) and the second most common injury was in knee (19% of all injuries). Considering the kind of injury, sprain and

fracture/dislocate were the two most common (26.2% each one) and muscle injury comes in second with 21.4% of all kinds of injuries. We could discuss the relationship between the changes of posture alignment and sports injuries, once the changes of posture alignment result in stress in muscle and ligaments and it may result in injuries. We couldn't find a relationship between the cause and the consequence of these factors.

Key words: Sport injury. Futsal. Children. Posture.

INTRODUCTION

Indoor soccer (futsal) is a sport more and more practiced worldwide, with increasing number of practicing athletes. By being easier to find spaces where it can be practice, differently from field soccer¹, this is one of the most disseminated sports in Brazil, played by over 12 million Brazilian, according to the Brazilian Federation of Indoor-Soccer (*Confederação Brasileira de Futebol de Salão – CBFS*²). Futsal meets the requirements of the International Olympic Committee to be considered an Olympic modality^{2,3}. The raising popularity of futsal has lead to a significant increase in number of children and teenagers who practice it⁴. Injuries from its practice are increasing and have been object of interest from health professionals. This sport is traditional in Brazil, being practiced by boys and girls from a very early age on.

At the Futsal Federation of São Paulo there are categories that include children 5 years old (initiation I category). However, according to Carazzato⁵ the ideal age for the competitive practice of this sport is from 14 years old onwards, and in spite of the benefits the practice of sports may bring, its practice in early, unsuitable ages may lead to injuries and bone-muscle-joint unbalance. Thus, there could be postural changes and changes in the growth and development of these children.

Intense and repetitive training of a sports modality leads to muscular hypertrophy and decreased flexibility, unbalancing agonist and antagonist muscles, thus favoring postural changes to occur⁵⁻⁷. Moreover, excessive training may

1. Depto. de Fisioterapia, Fonoaudiologia e Terapia Ocupacional, Faculdade de Medicina da Universidade de São Paulo, São Paulo, SP.

2. Depto. de Ortopedia e Traumatologia, Faculdade de Medicina da Universidade de São Paulo, São Paulo, SP.

Received in 20/9/02

2nd version received in 22/12/02

Approved in 12/4/03

Correspondence to:

Cintia Zucareli Pinto Ribeiro
Rua Raul Pompéia, 269, apto. 121, Pompéia
05025-010 – São Paulo, SP, Brasil
E-mail: cintia.ribeiro@uol.com.br

cause lesions due to overuse, such as micro-trauma from a continuous friction between two or more structures, leading to conditions of chondromalacia, tendinitis, bursitis, back pain, and even fractures⁸.

Finch et al.⁹ reported the incidence of sports injuries in children in Australia, and noted that injuries in soccer athletes are among the 10 most common ones, being 8.1% do total.

In face of this scenario, the purpose of this study is to investigate the relationship between postural changes in futsal players and incidence of injuries in them while they play. This study was based on a postural assessment of athletes and an epidemiological study on injuries, from February to December 2001, when the Metropolitan and the Paulista futsal championship tournament took place. The investigation of such relationship is quite important to identify risk factors in futsal practice, to allow for a future design of therapeutic programs to prevent such injuries.

METHODS

The studied population included 50 volunteers, male futsal athletes from a first-division club from São Paulo, age ranging from 9 to 16 years, registered by the futsal federation of São Paulo to take part in championship matches. Athletes were distributed within the following categories, according to CBFS: 15 athletes from pré-mirim category, 14 from mirim category, 12 from infantil category and nine from infante category. These children played futsal at least twice a week, for one hour and a half each training session.

The assessed athletes were divided in two groups, according to the presence or not of futsal-related bone-muscle-joint injuries through the period the athlete has practiced the sport (ranging from 3 to 11 years of practice). The first group (G1) included athletes who suffered futsal-related bone-muscle-joint injuries, and the second group (G2) included athletes who did not suffer such injuries.

The experimental protocol was approved by the Ethics Committee of the *Hospital das Clínicas* and included two stages: (1) an initial assessment, and (2) a postural assessment. The subjects and their parents came to know the experimental protocol by reading an informed consent, which was signed upon their agreement in taking part of the study.

Exclusion criteria included the present of anatomic deformities of any sort, such as congenital diseases or traumas; the presence of back pain in the past six months, or any other musculoskeletal pain that lead to an antalgic position, different than his normal posture.

The first stage of the experimental protocol consisted on an interview with each athlete or his parents, with the use of a questionnaire adapted from Baptista et al.¹⁰. This questionnaire included questions on anthropometric data of each

athlete, his field position, time he has been practicing the sport, training time, previous injuries and persistent sequelae. These data were used to characterize the studied sample.

The second stage of the experimental protocol included a postural assessment of each athlete, in accordance with the postural alignment assessment method proposed by Kendall et al.¹¹, which takes into account anterior and posterior frontal planes, right and left sagittal planes. This postural assessment was made using a previously designed protocol based on Daniels et al.¹², Kendall et al.¹¹, and Lapierre¹³, and it was always performed by the same evaluator.

Kendall et al.¹¹ states that the assessment of postural alignment requires a standardization of posture. For this author, the standard posture is the one involving a minimal amount of effort and overload for maximum body efficiency.

In the standard posture, on an anterior view and moving towards the skull, hallux should be aligned with the first metatarsus; the forefoot should be aligned with the center of the foot; foot arches should be preserved; ankles should not be bent and should be in the same distance that the medial verge of the knees; tibias should be straight, with no arching; the knees should not touch one another, and should be at the same distance than the medial malleolus of the tibia; patellas should be on the same height and face forward; the pelvis should be at the same height in both sides, which is measured by the height of the anterosuperior iliac spines; the trunk should be straight, with no rotation or inclination; shoulders and clavicles should be on the same height; clavicles should be symmetric; head and neck should be straight, with no rotation or inclination.

On side view, alignment is based on an imaginary line of reference that, in the ideal posture, passes through the following path: slightly anterior to the lateral malleolus of the fibula, slightly anterior to the center of knee joint, slightly posterior to hip joint; approximately in the middle of the trunk, through shoulder joint (as long as the arms are stretched down according to a normal alignment in relation to the chest), through the cervical vertebra and ear lobule. It is important to observe the patient from both views, right and left. The tarsal-tibial angle should be of approximately 90 degrees; knees bent should range from 0 to 5 degrees; pelvis should be aligned in such a way that posterosuperior and anterosuperior iliac spines should be on the same horizontal plane; the spine should show normal anteroposterior curves of lumbar lordosis, thoracic kyphosis, and cervical lordosis; elbows should not present overflexion or overextension; shoulders should not be protracted.

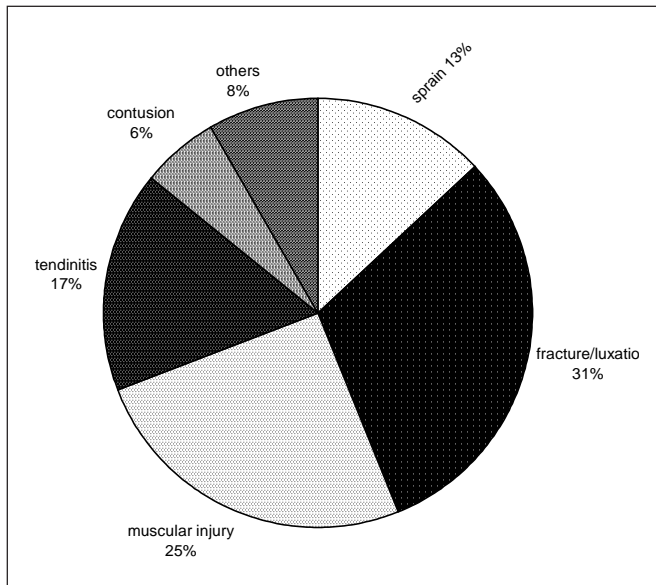


Fig. 1 – Classification of injuries according to their etiology

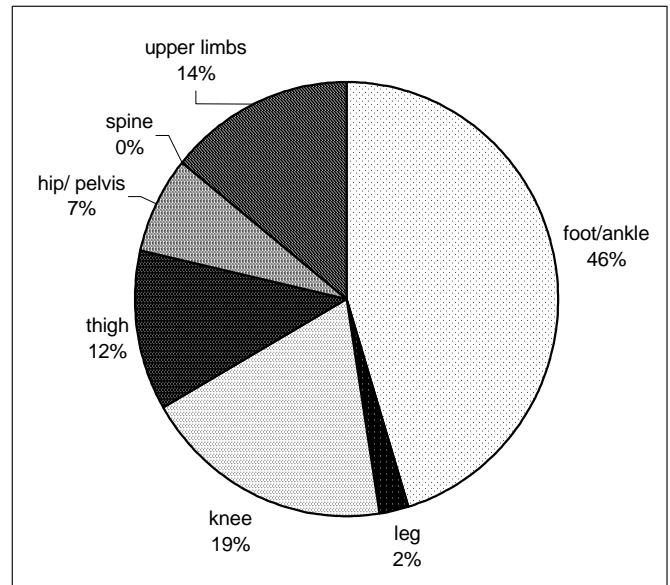


Fig. 2 – Classification of injuries according to site

On posterior view, assessment is also based on an imaginary line that starts halfway between the heels, moves upward between lower limbs, passes on the pelvis mid-line, spine and head. Left and right sides should be symmetrical, both in structure (skeletal structure) and superficially (muscular structure). Retrofoot should have symmetrical support, not too medial or too laterally; calcaneus should be vertically aligned with Achilles tendon; medial malleolus should be of the same height in both sides; popliteal fossa, and pygal plica should be of equal height; pelvis should be of equal height for both sides, with posterosuperior iliac spines leveled on the horizontal plane; the spine should be straight, with no side deviations; Thales triangles should be symmetrical in both sides; scapulas should be at the same distance from the spine and flat against the compages thoracis; the lower angle of the scapulas should be leveled on a horizontal plane; shoulders should be on equal height; head and neck should be straight, with no inclination or side rotation.

Given this definition of standard posture, any deviation will be considered postural change, which is not necessarily considered a disease.

As to the injuries, they have been divided, after Cohen et al.¹⁴ and Pedrinelli¹⁵, in accordance with their etiology in: sprain, tendinitis, muscular injury, contusion, fracture/luxatio. Injuries that do not fit this classification were considered as other types. As to the anatomical site, the identified injuries were at: foot/ankle, leg, knee, thigh, hip/pelvis, spine, and upper limbs.

Postural changes found in group 1 athletes were related to injuries suffered by these athletes according to the site of the body that was injured. From then the relationships between postural changes and injuries from the practice of sports were established.

Statistical analysis of data was based on the comparison between the two groups investigated as to postural changes due to futsal-training related injuries. For analysis of these data, non-parametric tests for variables of categories, with a significance level of 5% ($p \leq 0.05$). Chi-square or Fisher's exact test were used when frequency at the tables were smaller than 5. For this, the softwares Statistica v.5.1 and Excel 97 were used.

RESULTS

Forty-two bone-muscle-joint futsal-related injuries were found in 27 athletes, defined as group 1 (G1). The group of athletes who did not suffer futsal-related injuries was called group 2 (G2), and included 23 athletes.

The most frequently found injuries are presented in figure 1.

Body sites most commonly injured during the practice of Futsal are mentioned in figure 2.

As to postural assessment, there was no statistically significant difference in changes found in foot/ankle and knee for groups 1 and 2, as tables 1 and 2 show.

In the assessment of lumbar spine alignment, it was noted that only 3.7% of group 1 athletes (with injuries) had

lumbar spine aligned, whereas the same feature was present in 21.7% of athletes in the no futsal-related-injury group, a statistically significant difference ($p \leq 0,05$) between the two groups, as shown in table 3.

In table 4, group 1 subjects are distributed according to the type of injury and postural changes related to the injured site. Fracture/luxatio and contusions were excluded from the table, as these injuries derive from traumas (contact injuries), and are not related to postural changes.

The injuries were grouped according to type, site or type and site, in accordance with their frequency. Postural changes group postural malalignment of the mentioned sites. An athlete with just one of all assessed sites malaligned was considered to present postural changes (tables 1, 2 and 3).

Injuries were related to changes in their sites of adjacent sites whenever there was a relationship between them, as muscular chains are not divided according to sites.

DISCUSSION

Being futsal a somewhat recent sport, there are few studies on its practice. However, in studies on injuries from sports, those occurred in soccer matches are among the most common ones. Maffulli et al.¹⁶, in a study on the incidence of sports injuries in children, has noted that injuries in soccer players are among the most common ones (12% of the total), being second to injuries in basketball players (15% of the total).

TABLE 1
Postural assessment of foot and ankle (in %)

		Foot (%)			Tarso-tibial angle (%)		
		Aligned	Cavus	Flat	Normal	Higher	Smaller
Group 1	R	37	7.4	55.5	44.4	3.7	51.9
	L	44.4	3.7	37	59.2	3.7	37
Group 2	R	34.8	4.3	60.8	47.8	0	52.2
	L	47.8	0	52.2	52.2	0	47.8

TABLE 2
Postural assessment of knee on anterior, transversal and longitudinal axis (in %)

		Anterior axis (%)			Transversal axis (%)			Longitudinal axis (%)		
		Aligned	Valgus	Varus	Aligned	Hyperextension	Semi-flexion	Aligned	Medial rotation	Lateral rotation
G1	R	25.9	55.5	18.5	63	11.1	25.9	70.4	18.5	11.1
	L	25.9	55.5	18.5	74	14.8	11.1	70.4	18.5	11.1
G2	R	26.1	60.9	13	52.1	8.7	39.1	87	13	0
	L	26.1	60.9	13	69.6	4.3	26.1	78.3	13	8.7

TABLE 3
Postural assessment related to lumbar spine alignment (in %) (* $p \leq 0.05$)

	Lumbar spine (%)			
	Aligned	Hyperlordosis	Rectified	Thoracolumbar hyperlordosis
Group 1	3.7*	63	11.1	22.2
Group 2	21.7*	60.9	0	17.4

TABLE 4
Distribution of group 1 athletes who suffered injury, and its relationship with postural change in the injured site

Type/site of injury (total of athletes)	Site with postural change	Number of athletes with postural change	Number of athletes without postural change
Ankle sprain (9)	Foot/ankle	9	0
Knee injury (5)	Knee	5	0
Knee injury (5)	Lumbar spine	5	0
Muscular injury (9)	Lumbar spine	8	1
Muscular injury (9)	Knee	8	1
Ankle tendinitis (5)	Knee	5	0
Ankle tendinitis (5)	Foot/ankle	4	1

Data related to injuries are similar to those found by Lindenfeld et al.¹⁷ in a study with soccer players age range between 19 and 24, where they observed the site more often affected was foot/ankle, followed by knee.

As to postural alignment, Razo et al.¹⁸ investigated this feature in 48 children age range 7 to 14 years, field soccer players, and noted that 31.2% of the children had changes in arches of feet, being Friedreich's foot (*pes cavus*) more frequent than flat foot. They mention that the incidence of *pes cavus* or flat foot is associated to chronic lesions or from microtraumas in sports practitioners, as changes in foot support due to sports motions may be considered as risk factor for injuries.

Watson¹⁹ studied athletes of different sports, with age ranging from 17 to 20 years, and noted that only 3.75% of soccer and hockey players had no feet abnormalities. Watson²⁰ investigated the relationship between sports injuries and postural changes in soccer, rugby and Welsh football players age range 18 to 24 years. This author observed that ankle changes were most common in subjects who suffered any sort of injury in this joint.

As to results of the transversal axis, they are similar to those found by Watson¹⁹. This author found a low incidence (less than 5%) of knee hyperextension in soccer, rugby and Welsh football athletes. However, only 23% of the subjects had knee changes, either to varus or valgus. In the same study, comparing these changes with the incidence of musculotendinous injuries in athletes, the group with injuries had higher incidence of changes in knee alignment.

Watson²⁰ observed that only 26.5% of soccer, rugby and American football players investigated had their lumbar spine alignment preserved. He also found an incidence of 51.9% soccer players with enhanced lumbar lordosis. He reported that 67% of players with this postural change suffered muscular injuries, while in the group without postural changes, only 36% suffered the same injury. This author

showed that there is a relationship between enhance of lumbar lordosis and incidence of injuries.

The data discussed above suggest that postural changes are related to increased risk of injuries, once postural malalignment causes an extra overload and demands more effort from the joint; there is an improper biomechanical action on the joint, creating an unnecessary stress on, and stretching soft tissues of the subject, decreasing muscular and ligamental efficiency that maintains balance of the joint²¹. Even though it is not possible to make a direct correlation between these factors, i.e., to establish a cause-effect relationship, one can establish the existence of a relationship between these parameters.

Furthermore, it was observed in table 4 that, among the subjects who suffered injuries, there is a higher number of athletes with some kind of postural change in the injured site than athletes who suffered a similar injury but do not present postural change in the injured site.

Because of the small number of subjects who suffered each type of lesion, it was not possible to establish a statistical relationship among the data, but upon a qualitative assessment, it can be observed that as for athletes who suffered ankle sprain and those who suffered any sort of knee injury, they all had postural change in the injured site (foot/ankle, knee, and lumbar spine, respectively). This suggests there is a relation between postural change and incidence of injuries associated to typical characteristic of sports (overtraining, repetitive motions, direct contact among athletes) and to the individual features of each athlete, which may make this athlete more prone to suffer injuries than an athlete who does not present any postural change.

CONCLUSIONS

A relation between postural changes and incidence of lesions among futsal players age 9 to 16 years has been observed, the rationale being that a postural change causes

an added mechanical overload in bone-muscle-joint structures, making the involved site prone to injury. However more studies are necessary to prove such statement, and if such cause-effect relation exists.

Ankle sprain was the most frequent injury in the group of athletes with some sort of futsal-related injury, and the high presence of flat feet and high incidence of knee injuries may be related to a high proportion of athletes with valgus knees.

It is suggested that an early physical therapy intervention in these young athletes may be a potential solution for postural correction of the observed changes, and also for postural guidance. These measures could decrease the risk of injuries from postural changes, and also provide a proper rehabilitation after an injury has occurred, decreasing the time the athlete must be away from practice and improving the performance of the team as a whole.

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