

ANKLE SPRAINS IN VOLLEYBALL HIGH-PERFORMANCE ATHLETES: AN EPIDEMIOLOGICAL STUDY

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SUMMARY

The purpose of this research is to characterize the most recent ankle sprain episode occurred with volleyball high performance athletes. From January 2003 to March 2004, 114 male athletes from 9 adult category teams of the Special and First Division of São Paulo State Volleyball Championship were included on this study. From the 114 athletes assessed, 21 have reported no ankle sprains, therefore, by following the exclusion criteria, the last 93 episodes of ankle sprain from 93 athletes were assessed. They have been individually in-

terviewed by the researcher, following a pre-established sequence of the questionnaire. A significant difference was found in the correlation between the competition phase and the ankle sprain cause, as well as for the correlation between the athlete's acting position and the movement made at the injury moment. The opposite position was the most affected and the blocking movement was the one showing the highest incidence of injuries.

Keywords: *Sprains and strains/epidemiology; Athletic injuries; Men; Ankle injuries/ epidemiology; Sports; Ankle.*

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INTRODUCTION

The interest for sports practice has increased in recent years, thus resulting in an increased incidence of sports-related injuries.

The sportive gesture performed in a given sport may predispose athletes to experience ankle sprains.⁽¹⁾

To better understand the incidence of high-performance sports-related injuries, we need to clarify that this is characterized by rationalization, amount of drills, competitions and media presentation.⁽²⁾

High-performance volleyball presents a high incidence of injuries, including ankle sprains. Many times, these injuries are resultant from a lack of concern regarding preventive programs.⁽³⁾

The fundamental movements of blocking and attacking are the ones that cause the highest number of trauma injuries and it is not surprising that landing and jumping are the major risk factors.⁽⁴⁾

In literature, many authors describe that, in volleyball, most of these sprains occur when landing after a jump, after a block or attack.⁽⁵⁻⁷⁾

For developing researches targeting ankle sprains prophylaxis, the study of the characteristics of this injury incidence is necessary.⁽⁸⁾

The objective of this study was to characterize ankle sprains in high-performance volleyball athletes from the most recent occurrence and to correlate this sprain episode with:

- An athlete's position on the court and the fundamental movement performed at the moment of injury;

- The phase when this injury occurred;
- An athlete's position on the court;
- The cause of trauma;
- The fundamental movement performed at the moment of sprain;
- The mechanism of this injury.

CASE SERIES

Initially, 114 athletes practicing volleyball were included on the study from January 2003 to March 2004, whose ages ranged from 17 to 36 years old (mean age: 24.3 years), all of them playing the adult league and belonging to nine different teams of São Paulo State Volleyball Championship Special Division or First Division. Of the 114 initially assessed athletes, 21 reported no ankle injuries; therefore, according to the exclusion criteria, the most recent 93 ankle sprain episodes on 93 athletes were assessed.

The inclusion criteria were the following:

- a) Male high-performance athletes, enrolled and participating in the São Paulo State Volleyball Championship Special Division or First Division.
- b) Athletes who experienced ankle sprains during a high-performance volleyball competition.
- c) Only the last sprain episode could be assessed.

Study conducted at the Orthopaedics and Traumatology Institute, University of São Paulo

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The exclusion criteria were the following:

Athletes reporting not to have experienced ankle sprains before. The deployment of athletes enrolled in the study, according to their positions on court are shown on Table 1 and Figure 1.

POSITION	TOTAL	%
HITTERS	31	33.3
MID-COURT	22	23.6
OPPOSITE	21	22.6
SETTER	14	15.1
LIBERO	5	5.4
TOTAL	93	100

Table 1 – Distribution of athletes according to positions

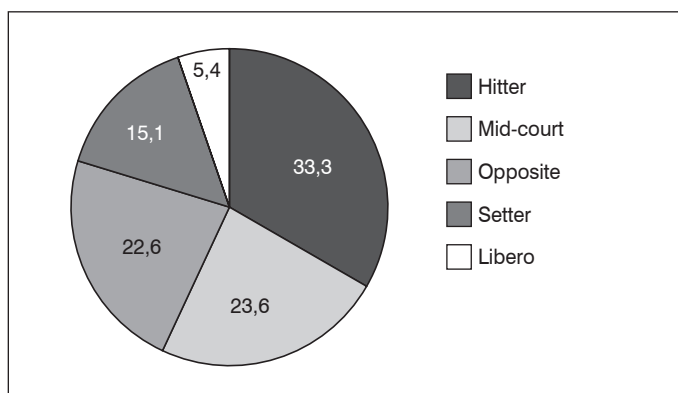


Figure 1 – Distribution of athletes according to positions

Data concerning the use of protection against ankle sprains, before the last occurred injury episode either during training or games, are shown on Table 2 and Figure 2.

PROTECTION	TOTAL	%
YES	43	46.2
NO	50	53.8
TOTAL	93	100

Table 2 – Use of ankle protection before the most recent injury episode

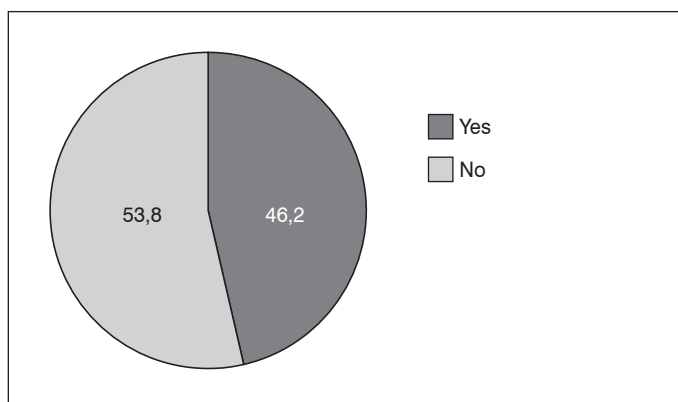


Figure 2 – Use of ankle protection before the most recent injury episode

The competitive background of these high-performance volleyball athletes showed 139 ankle sprain episodes on the right ankle and 124 episodes on the left ankle. We only included in the study those 93 athletes who experienced a recent ankle sprain, with only 42 as first injury episode.

The distribution of ankle sprains is described on Table 3 and Figure 3.

EPISODE	TOTAL	%
FIRST INJURY	42	45.2
RECURRENT	51	54.8
TOTAL	93	100

Table 3 – Distribution of ankle sprains

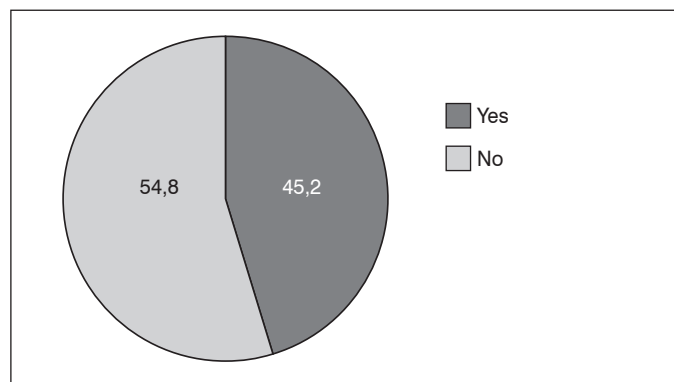


Figure 3 – Distribution of ankle sprains

METHODS

The instrument employed to collect data was a questionnaire intended to provide a statistic survey on the incidence and every other factors related to these athletes' ankle sprains. On this questionnaire, the following items were included:

- a) personal data
- b) position on court
- c) use of protective orthosis on ankle joint
- d) previous injuries
- e) relapse history
- f) phase of the competition when the last injury occurred
- g) volleyball fundamental movement performed at the moment of last injury
- h) cause of the last sprain associated to the presence or absence of a second athlete
- i) last injury's mechanism of trauma
- j) person responsible for the early health care
- k) use of protective orthosis after injury

Data collection was made in cities of the state of São Paulo, at the pre-selected team headquarters that allowed athletes to participate on the study. After the research design was approved by Cappesq, Research Protocol # 262/03, a consent term was given to and signed by each athlete included in the data collection.

We traveled 3318 km for visiting clubs to conduct data collection. The interviews were verbally and individually applied by an active investigator, following the pre-established questionnaire sequence.

DATA ANALYSIS AND STATISTIC ASSESSMENT

The data obtained from the application of the questionnaire on athletes were statistically distributed and presented as tables and graphs with percentages and descriptive analysis of the answers, enabling quantitative grouping.

In order to compare the studied variables involving ankle sprains, the Chi-squared and the Pearson's Correlation tests were used. A 5% significance level was adopted ($\alpha \leq 0.05$).

RESULTS

The data correlating position in court and the mechanism of injury of the ankle sprains are shown on **Table 4** and **Figure 4**. Described on **Table 5** and **Figure 5**, the blocking fundamental movement was the one showing the highest number of sprain episodes. A small percentage of the mechanisms of injuries was rated as "undetermined".

Data correlating the phase of the competition and cause of sprain are presented on **Table 6** and **Figure 6**.

Data correlating sprain cause with athlete's position are shown on Table 7 and Figure 7.

Table 8 and **Figure 8** show the correlation between the position on court and the fundamentals performed at the moment of sprain.

Data concerned to the phase of competition and the responsible for primary health care are presented on **Table 9** and **Figure 9**.

Table 10 and **Figure 10** show the frequency in which protection devices were used after the last injury episode as a function of athlete's position.

DISCUSSION

In literature, some researches using similar approaches are found addressing the incidence of sports-related injuries,^(5,7) with the difference here is that this study was uniquely addressed to ankle sprains.

We didn't find in literature specific studies that could be used

Position on court	Mechanism of Injury							Total	%
	Inversion	%	Eversion	%	Undetermined	%			
Setter	9	9.7	4	4.3	1	1.1	14	15.0	
Mid-court	17	18.3	4	4.3	1	1.1	22	23.7	
Opposite	18	19.3	3	3.2	0	0	21	22.6	
Hitter	20	21.5	8	8.6	3	3.2	31	33.3	
Libero	5	5.4	0	0	0	0	5	5.4	
Total	69	74.2	19	20.4	5	5.4	93	100	

p = 0.55

Table 4 – Correlation between position on court and mechanism of injury of ankle sprains in professional volleyball players

Fundamentals	Mechanism of Injury							Total	%
	Inversion	%	Eversion	%	Undetermined	%			
Attack	19	20.4	2	2.2	1	1.1	22	23.7	
Block	35	37.6	13	14.0	3	3.2	51	54.8	
Reception	0	0	0	0	0	0	0	0	
Defense	12	12.9	3	3.2	1	1.1	16	17.2	
Service	0	0	0	0	0	0	0	0	
Setting	3	3.2	1	1.1	0	0	4	4.3	
Total	69	74.1	19	20.5	5	5.4	93	100	

p = 0.98

Table 5 – Correlation between fundamental movements and mechanism of injury of ankle sprains in professional volleyball players

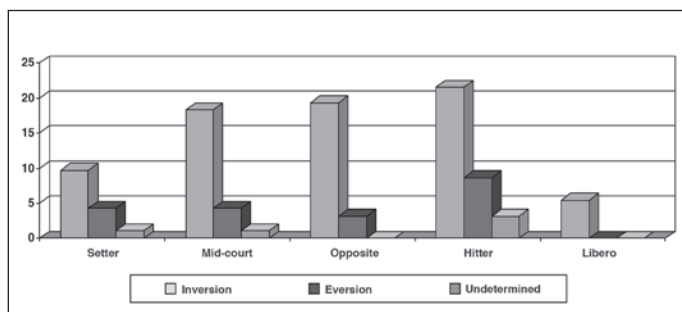


Figure 4 – Correlation between position on court and mechanism of injury of ankle sprains in professional volleyball players

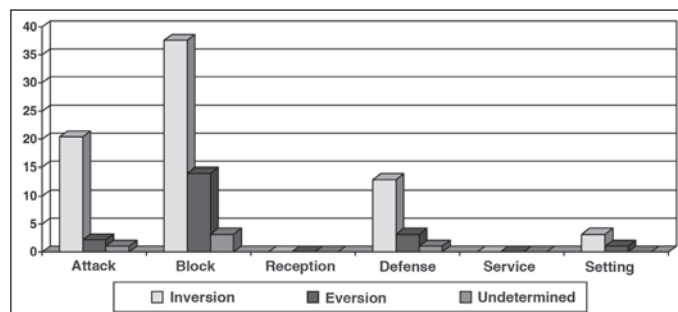


Figure 5 – Correlation between fundamental movements and mechanism of injury of injury

Sprain cause	Competition phase					
	Training	%	Game	%	Total	%
Stepped on a second athlete's foot	40	42.8	26	28.2	66	71.0
Alone	23	24.7	4	4.3	27	29.0
Total	63	67.5	30	32.5	93	100

*p = 0.02

Table 6 – Correlation between competition phase and sprain cause in professional volleyball players

Sprain cause	Position											
	Setter	%	Mid-court	%	Opposite	%	Hitter	%	Libero	%	Total	%
Stepped on opponent's foot	4	4.3	6	6.5	12	12.9	13	14.0	0	0	35	37.7
Stepped on teammate's foot	3	3.2	11	11.8	4	4.3	10	10.8	3	3.2	31	33.3
Alone	7	7.5	5	5.4	5	5.4	8	8.6	2	2.1	27	29.0
Total	14	15.0	22	23.7	21	22.6	31	33.4	5	5.3	93	100

p = 0.18

Table 7 – Correlation between ankle sprain cause and athlete's position on court in the competition

Position	Fundamentals									
	Attack	%	Block	%	Defense	%	Setting	%	Total	%
Setter	2	2.2	6	6.5	3	3.2	3	3.2	14	15.1
Mid-court	5	5.4	17	18.3	1	1.1	0	0	23	24.8
Opposite	4	4.3	11	11.7	4	4.3	1	1.1	20	21.4
Hitter	10	10.7	15	16.1	6	6.5	0	0	31	33.3
Libero	1	1.1	1	1.1	3	3.2	0	0	5	5.4
Total	22	23.7	50	53.7	17	18.3	4	4.3	93	100

*p = 0.01

Table 8 – Correlation between professional volleyball player's position and the fundamental movement performed at the moment of ankle sprain

Primary care	Competition phase					
	Training %		Game %		Total %	
Physical therapist	21	22.6	16	17.2	37	39.8
Physician	6	6.5	2	2.2	8	8.7
Masseur	3	3.2	0	0	3	3.2
Other	33	35.4	12	12.9	45	48.3
Total	63	67.7	30	32.3	93	100

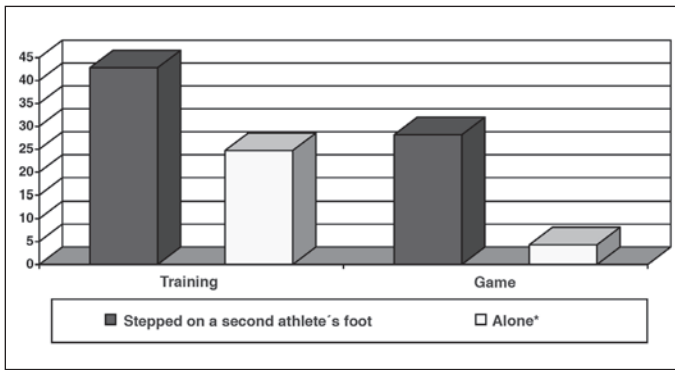
p = 0.38

Table 9 – Correlation between competition phase and the person responsible for primary care in cases of ankle sprains on professional volleyball players

Position	Post-injury protection use					
	Yes	%	No	%	Total	%
Setter	8	8.7	6	6.4	14	15.1
Mid-court	17	18.3	5	5.4	22	23.7
Opposite	15	16.1	6	6.4	21	22.5
Hitter	23	24.7	8	8.6	31	33.3
Libero	1	1.1	4	4.3	5	5.4
Total	64	68.9	29	31.1	93	100

p = 0.10

Table 10 – Frequency of post-injury protection use on the ankles of professional volleyball players associated to athlete's position on court



Alone*: Experiencing a sprain without the involvement of a second athlete.

Figure 6 – Correlation between competition phase and sprain cause

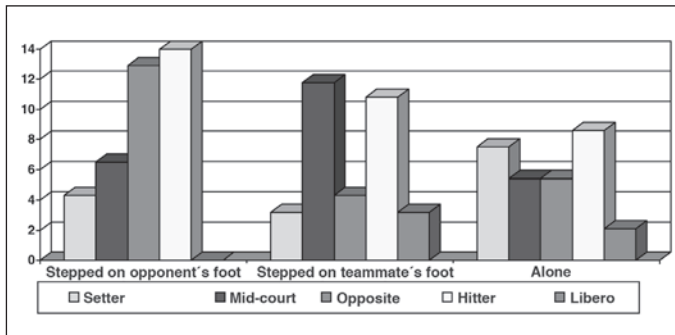


Figure 7 – Correlation between ankle sprain cause and athlete's position on court

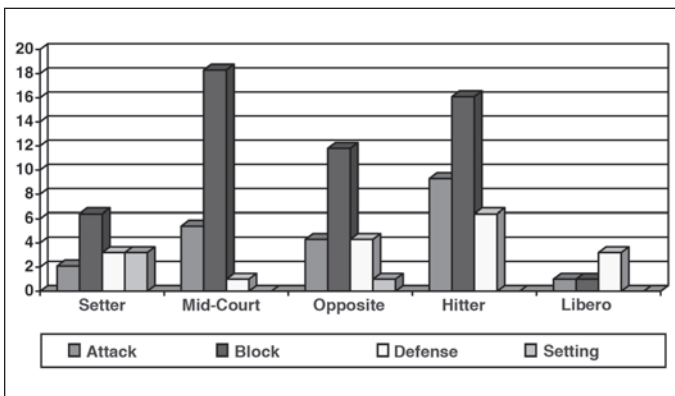
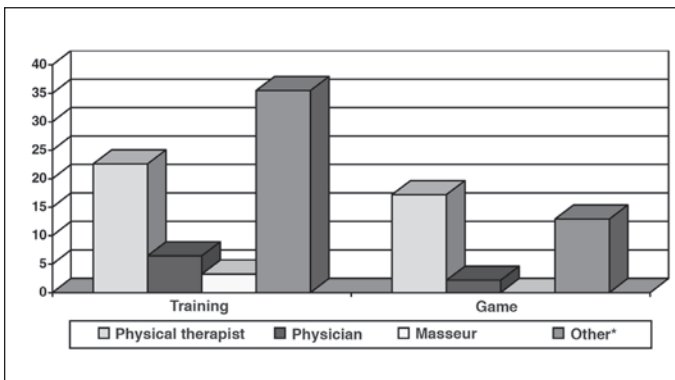


Figure 8 – Correlation between professional volleyball player's position and the fundamental movement performed at the moment of ankle sprain



Other*: teammates or non-professional individuals present that the moment.

Figure 9 – Correlation between competition phase and the person responsible for primary care

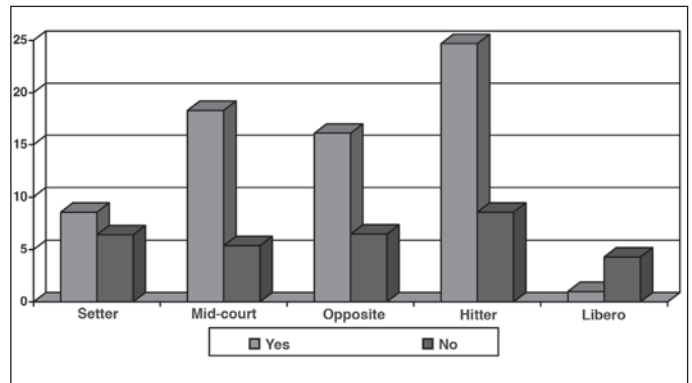


Figure 10 – Frequency of post-injury protection use on ankles as a function of athlete's position.

as models for evaluation. Therefore, based on the knowledge about sportive gestures and the characteristics of this sport, we prepared a questionnaire that could determine the key aspects involved on athletes' ankle sprains.

Despite of not having presented statistically significant difference, in this study, sprains caused by mechanisms of inversion were proved to be the most frequent among athletes (Table 4 and Figure 4), consistently to the studied literature.^(1,9)

When sprains were correlated to the athlete's position on court, no statistically significant difference was found (Table 4 and Figure 4); however, side front positions are shown to present the highest number of ankle injuries: 33.3%. By assessing the characteristics of a volleyball match, concerning the number of athletes on court, we notice two athletes on front positions (right and left), two mid-court athletes, a setter and an athlete at an opposite position, all of these acting simultaneously. From this analysis, we can highlight that, proportionally in our study, the opposite athletes were the ones most frequently affected by ankle sprains, accounting for 22.6% of all cases. No study correlating sprains with athlete's position on court was found in the studied literature.

At the moment of blocking, the opposite positions' role is to intercept an opponent hitter's action, and most attacks occur at the side positions, thus increasing opposite positions' risk of landing on an opponent's foot, or even on the foot of a teammate who is participating on a double block formation.

Although we found no statistically significant difference (Table 5 and Figure 5), the blocking fundamental was shown to be the occasion when most sprains occur. Similar results have been described in literature.^(4,6,7,10,11)

Usually, when blocking, an athlete intends to intercept an opponent hitter's action. Because this dispute may happen at jumping, imprecision may occur from both sides, leading to balance loss, thus increasing the chances of a blocker to fall on an opponent's hitter foot. The risk of touching an opponent increases when athletes, when landing after a jump, enter into the so-called conflict zone, of approximately 50 cm, on the ground beneath the net.⁽⁶⁾

When the competition phase, divided into training and game, is correlated to sprain cause, a statistically significant difference is found, with the highest frequency of sprain occurring during training, accounting for 67.5% (Table 6 and Figure 6). Among

the athletes experiencing sprains during training, 42.8% were injured when stepped on a second athlete's foot, while 24.7% happened alone, without involvement of a second athlete. In the studied literature, we found a study with similar correlation and results.⁽⁶⁾

The high incidence of sprains during training can be explained by the fact that athletes are more exposed to risk factors inherent to this competition phase, since, during training, some situations are exhaustively repeated, in an attempt to achieve maximal performance. These characteristics may explain the high rate of sprains occurring during this phase of the competition.

By correlating sprain cause and athletes' position on court, no statistically significant difference was found (Table 7 and Figure 7). We didn't find similar studies in literature. However, taking the cause of trauma into account, the opposites had 12.9% of the injuries by stepping on an opponent's foot, proportionally reporting the highest rate considering all positions.

Blocking has been previously shown to be the fundamental movement causing most of the sprains. Considering that one of the defensive functions of an opposite is to block an opponent hitter's attack, and that most of the attacks are usually made by a side player, the high rate of sprains resulting from a player's stepping on an opponent's foot can be explained for athletes at the opposite position.

When we studied the correlation between an athlete's position on court and the fundamentals performed at the moment of ankle sprains, we found a statistically significant difference (Table 8 and Figure 8). Based on the two fundamentals that caused most of the sprains, we verified that, during attack, the hitters were the most affected players; possibly, as previously described, because the athletes in that position are more often requested for attack movements. At blocking, opposites with only one representative throughout a match, proportionally, were the ones showing the highest rate of ankle sprains.

By correlating the competition phase to the person responsible for primary care after sprains, no statistically significant differences were found (Table 9 and Figure 9). However, during games, primary care in cases of ankle sprains was provided, most of times, by physical therapists. We also found a relevant

fact during the training phase, when most primary care was provided by non-professional individuals (not Physicians and not Physical therapists). This finding may be a result of scarcity of sponsorship funds among sports categories to expert professionals. On the other hand, the absence of experts may directly affect an athlete's performance, changing the time and outcomes of treatments, as well as their return to the courts.

Concerning the use of ankle protection with orthosis before the last sprain episode, 46.2% of the athletes reported a consistent use, as presented on the Case Series (Table 2 and Figure 2). After the last injury episode, 68.9% of the athletes started using protection (Table 10 and Figure 10). We didn't find studies with similar correlation in literature.

We suggest that, in future studies, a higher number of athletes is used, because some correlations made here were shown to be close to reach significance level.

Further studies are warranted in order to characterize the key injuries experienced by high-performance volleyball athletes, including ankle sprains, thus increasing the interest on developing specific prophylactic techniques, intending to eliminate or minimize the severity of the injuries, enhancing and powering performance, as well as extending a professional athlete's career.

CONCLUSION

We found statistically significant differences on the following items proposed on our objectives:

- The hitter position was the most affected one during attack while the opposite position was most frequently affected during blocking movements;
- Most sprains occurred during the training phase.

We didn't find statistically significant differences for the remaining items. However, when considering the percentages, we noticed some prevalence with a higher number of sprains:

- in athletes at opposite position;
- related to cause of trauma, with the involvement of a second athlete, stepping on an opponent's foot;
- in blocking fundamental movement;
- in the inversion mechanism.

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