

***MEANING OF PROPRIOCEPTIVE TRAINING IN  
PROFESSIONAL BASKETBALL***

Nejc Šarabon, Faculty of Sports, Gortanova 22, 1000 Ljubljana

Oskar Zupanc

Boštjan Jakše

## **Abstract**

In this article we provide statistical data on sports injuries and subsequently on the absences of players from training and competitions in the KD Union Olimpija basketball team during the 2000/01, 2001/02 and 2002/03 seasons. In every analyzed season the senior basketball team had 15 players. The main novelty of the last season was the introduction of proprioceptive training contents to the conditioning process of players. In the 2002/03 season, the number of all players that suffered overuse injuries declined by half, while the sum of all injuries of this type decreased by more than 71 percent. Topologically, most prominent areas were low-back, groin, thigh and knee. The sums of all absences of all the injured players per season were in 2000/01 and 2001/02 approximately 160 percent higher than in 2002/03. During the last season, all the injured players were absent from trainings and competitions for 106 days. Our data confirm the hypothesis that predicted the reduction of level as well as frequency of the lower limb injuries during the training season as a result of proprioceptive training. We strongly believe that health supportive contents such as proprioceptive training and stretching should be part of every strength and condition program in basketball.

## **Introduction**

A very important aim in rehabilitation as well as in the training of a professional athlete is to restore or to develop a neuromuscular control. Proprioceptive training is one of the most researched areas in sport science in the last decade. Many analytical researches have been carried out (Eils, & Rosenbaum, 2001; Osborne, Chou, Laskowski, Smith, & Kaufman, 2001; Richie, 2001), but still, there is a lack of longitudinal studies. There is hardly anything written about the role of proprioceptive training in long-term health prevention in sports.

The purpose of this analysis is to determine the effects of long-term, systematic and progressive proprioceptive training on injury prevention in a professional basketball team. We compared the statistics of sports injuries in Union Olimpija of the 2000/01, 2001/02 and 2002/03 seasons. The main distinction in the training system was the introduction of health prevention contents with special emphasis on proprioceptive training in the 2002/03 season.

## **Novelties in the 2002/03 season**

### **Characteristics of training**

In most cases, the key factor in the conscious and systematic planning of training is the proportion of basketball and condition contents, which also includes health prevention contents, where proprioceptive training is indispensable. Over periods, the proportion of contents, i.e. the number of training units that one content has in one micro-cycle (one-week period), has changed. In the introduction period, which lasted 2 micro-cycles, 4 exercise units were intended for basketball and 6 for conditioning. Average length of one exercise unit was 2 hours. In the preliminary period, which lasted 10 micro-cycles, on average 6 exercise units were intended for basketball and 4.5 for conditioning. In this period, the team also played 12 friendly games, but that did not disturb the training. The core of the season was the competition period, which consisted of 8 micro-cycles before

the team entered the Euroleague to become one of the European Top 16, and 7 micro-cycles after they entered the League with one break in between. Weekly 4.5 exercise units were intended for basketball and 3 for conditioning. 2 games per week played at that time are not taken into account.

In the introduction period, the basketball players carried out proprioceptive training on balance boards in 5 exercise units per one micro-cycle. Each unit lasted at least 25 minutes. The main goal of this period was to get to know different exercise facilities and to learn the basic contents under better circumstances. It was important to conduct the training without basketball shoes or any other external stabilizer, e.g. bandage, brace.

In the preliminary period, proprioceptive training was carried out in 3 to 4 exercise units per micro-cycle, each unit lasting at least 25 minutes. In the room, where the training took place, there were 12 to 14 balance boards of different type and geometry. The players performed precisely defined tasks in 2 series, 30 to 40 seconds each, moving from one to another balance board. The training in the preliminary period was performed as in the previous period: the number of exercise units was maintained, but the exercises became more and more demanding.

In the competition period, 2 exercise units per week (the first as an independent exercise unit and the second as a part of conditioning) were enough to ensure the maintenance of players' capacity. In this period the players were allowed to wear low top basketball shoes. According to topology, the focus of proprioceptive training was on ankle and knee joint, and slightly less on hip and trunk. But every exercise has some impact on the stability of all joints.

### **Proprioceptive training**

Proprioception is the ability of an organism to consciously and reflexively recognize the position of its body parts in a certain room and time (Enoka, 1994, str. 183). When protecting joints from unexpected quick and violent mechanical disturbances, reflex proprioception is important. Conscious contractions are in most cases too slow to prevent

the injury, because their nerve paths are usually longer than that of a reflex and therefore also slower. Proprioception obviously involves different sensory systems of muscles, ligaments, tendons, joints and skin, and organs of vision and balance. The contents of proprioceptive training are very effective, relatively safe, demand little energy and are at the same time very entertaining. Means of such exercise include balance exercises on balance boards and other unstable supporting surfaces, which cause dynamically unstable positions of joints or joint systems. This ability also displays a great degree of connection to the other motor abilities, especially to coordination and agility. The agility of an individual depends on the degree of coordination, whereas the realization of coordination depends on the ability to assure balance. As in motor abilities, it is reasonable to adhere to the principle of gradual progression in proprioceptive training. Each basic exercise can be performed in many different ways. And if we want to make a basic exercise more demanding, we can in addition perform a coordination exercise, or preliminarily disturb the balance organ, or eliminate the organ of sight, etc. (Kisner, & Colby, 1996, str. 493). According to the chosen exercise and corresponding geometry of the facility we can determine most suitable load for each individual. The effects of proprioceptive training are: the increase of muscular activation after the injury, the reduction of reflex-reaction times on stretching, the improvement of inter-muscular coordination, the improvement of poise and balance, the improvement of the awareness of one's body in a room and therefore, the reduced susceptibility to injuries (DeLee, Drez, & Miller, 2003, str. 332).



Photo No 1: Basic exercise performance on the board with “moving cylinder”.



Photo No 2: Squats with additional weight on the board with hemispherical support. More demanding exercise combines strength training and proprioception.



Photo No 3: Maintaining balance on the board with hemispherical support of more complex geometry and alternating touching of remote points.



Photo No 4: One-leg exercise on the cone board, which is unstable at the frontal plane. This exercise is intended to improve the stability of lower hip joint.

## **Analysis of data**

During all three seasons the doctor of the team constantly supervised the players of KD Olimpija. He has kept a record of all health problems of the players. These problems were more or less divided into 2 groups i) injuries with overuse syndromes and ii) traumatic injuries. For each injury of overuse-syndrome group the name of the injured person was registered, which part of body was injured and how many days a player was consequently absent from basketball trainings. Due to their etiological nature the traumatic injuries were not analyzed in detail. Instead, the record of the number of each injury type in the season was kept.

## **Results**

Data on players' injuries and their absences are shown in Tables 1 to 4. In these seasons, the senior KD Union Olimpija basketball team had 15 players. In the 2002/03 season the number of players with injuries of overuse syndromes halved (Table 1), whereas the number of joint injuries of this type declined for 71 per cent in average. Topologically, the following body parts stood out among injuries: the lower back, groin, thigh and knee. The most obvious improvement in the 2002/03 season was a fundamental decrease of knee joint and Achilles tendon problems, which had been among the 4 most frequent overuse syndromes in the last seasons. There was no fundamental difference in the types and in the overall number of injuries between the 2000/01 and 2001/02 seasons. The relative frequency of back pain has paradoxically increased in the last season. The number of the above mentioned pathology cases halved in comparison to the previous season, but at the same time, the overall number of overuse injuries decreased for more than three times.

<b>OVERUSE SYNDROMES</b>	<b>2002/3 season</b>		<b>2001/2 season</b>		<b>2000/1 season</b>	
	<i>number of cases</i>	<i>%</i>	<i>number of cases</i>	<i>%</i>	<i>number of cases</i>	<i>%</i>
<i>back pain</i>	12	50	24	28	20	26
<i>groin pain</i>	4	17	17	20	12	15
<i>hip</i>	0	0	0	0	1	1
<i>thigh</i>	4	17	9	10	5	6
<i>shin</i>	2	8	1	1	0	0
<i>foot</i>	1	4	0	0	10	13
<i>toe</i>	0	0	0	0	3	4
<i>shoulder</i>	0	0	0	0	2	3
<i>Jumper`s knee</i>	1	4	21	24	15	19
<i>Achilles tendinitis</i>	0	0	15	17	10	13
<b><i>altogether</i></b>	<b>24</b>	<b>100</b>	<b>87</b>	<b>100</b>	<b>78</b>	<b>100</b>

Table 1: Group of injuries of overuse syndromes.

In the first two seasons the total number of all absences of all injured athletes was in average for 160 per cent higher than in the 2002/03 season (Table 2). In the last season all the injured players were absent from training and competitions for 106 days. In the table, only the days of absence from basketball sessions are shown. The injured players and their strength and conditioning trainer consistently carried out, at the time of injuries, those contents, which were in accordance with pathology. Also as a consequence to this, the number of discharging days (absence from basketball trainings) increased in the last season. This is true for most key injuries (back and groin pain, thigh, foot and jumper`s knee). By keeping regular contacts with a player, in spite of an injury, the trainer was able to better monitor player`s state of preparation and injury. The probability of a player, not entirely rehabilitated, to return to the complete concept of training was therefore smaller, and this is probably one of the very important reasons for evident reduction of injury reappearance.



The number of days Without training	2002/3 season		2001/2 season		2000/1 season	
	št. dni	%	št. dni	%	št. dni	%
<i>back pain</i>	60	57	80	29	60	77
<i>groin pain</i>	21	20	60	22	50	64
<i>hip</i>	0	0	0	0	5	6
<i>thigh</i>	12	11	27	10	16	21
<i>shin</i>	3	3	6	2	0	0
<i>foot</i>	5	5	0	0	35	45
<i>toe</i>	0	0	0	0	12	15
<i>shoulder</i>	0	0	0	0	20	26
<i>jumper's knee</i>	5	5	65	23	45	58
<i>Achilles tendinitis</i>	0	0	40	14	30	38
<b>altogether</b>	<b>106</b>	<b>100</b>	<b>278</b>	<b>100</b>	<b>273</b>	<b>350</b>

Table 2: Absences from basketball trainings and/or competitions because of overuse injuries.

The number of players with problems	02/03	01/02	00/01
<i>back pain</i>	4	6	6
<i>groin pain</i>	2	4	3
<i>hip</i>	1	0	1
<i>thigh</i>	2	4	3
<i>shin</i>	2	1	0
<i>foot</i>	1	0	2
<i>toe</i>	0	0	0
<i>shoulder</i>	0	0	0
<i>jumper's knee</i>	1	3	5
<i>Achilles tendinitis</i>	0	2	4
<b>altogether</b>	<b>7</b>	<b>14</b>	<b>12</b>

Table 3: The number of players with any health problems in particular season.

Traumatic injuries	02/03	01/02	00/01
<i>ankle joint - sprain</i>	2	4	5
<i>knee - sprain</i>	2	0	2
<i>fracture of the metacarpal bone</i>	2	0	1
<i>fracture of tibia</i>	0	1	1
<i>laceration</i>	1	0	0
<i>thigh bruise</i>	0	1	0
<i>acromio-clavicular joint</i>	0	1	1
<b>altogether</b>	<b>7</b>	<b>7</b>	<b>10</b>

Table 4: Traumatic injuries.

In the 2002/03 season the number of players with health problems halved in comparison to the previous season (Table 3). So, almost every second player was injured during the season. Combined analysis of Tables 1 and 3 shows us that in the first 2 seasons a player has been injured in average 6.4 times per season, but only 3.4 times in the 2002/03 season. This decrease was the most outstanding with Achilles tendinitis.

The number of traumatic injuries does not differ between seasons. The vast majority of these injuries relates to low extremities. These kinds of injuries mainly originate from external factors such as falling, punch, kick, etc.

## **Conclusion**

One of the most important health prevention contents in KD Union Olimpija in the 2002/03 season was definitely the proprioceptive training, which consisted of selected balance exercises with or without balance boards. Proprioceptive training was accompanied by adapted strength training, training for improvement of general and special coordination of legs, and regeneration contents like regeneration running, stretching, nutrition additives, and massages. In comparison to the 2000/01 and 2001/02 seasons, when all these contents were already a part of training, the only novelty in the 2002/03 season was the proprioceptive training. The interpretation of so recently gathered results undoubtedly has its limitations. If the factors influencing the results of analysis are not monitored consistently enough, at least a part of results remains unexplained, be it the intention of the research or inevitable reality. The latter occurs frequently when analyzing professional sports teams.

Proprioception training is used mainly in health care and rehabilitation programs as well as in sports. The possibilities of its employment in sports are namely extremely good, but often not used enough. Primarily the contents were aimed at rehabilitation, but nowadays they take on a role of sports injuries prevention (particularly ankle, knee and shoulder joints) and of quality improvement of movement control in general. The training is suitable for all age groups because of the nature of movement apparatus exertion and physiological mechanisms, which we provoke through such contents. With younger groups the aim is to prepare them for the later, more serious strength training, but for senior groups exercises are more demanding and aimed at injury prevention and development of situational strength and coordination. To achieve effective proprioception training, the authors of this paper developed a type of balance boards, which enabled athletes to carry out planned exercises that fulfilled one of the principles of this training – the principle of gradual progression.

Our data confirm that due to the introduction of the proprioceptive training into the regular training program of the basketball team, the number as well as the frequency of

overuse injuries decreased. The reduction of absences of the injured players from training process in the 2002/03 season enabled the team experts to stick with the continuity of the training program. A comprehensive amount of trainings and competitions, to which players are exposed today, should play a key role in training planning and consequently in careful planning of indispensable health prevention contents. We are firmly convinced that health prevention contents like stretching and proprioception training should be a part of every conditioning program in basketball.

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