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PREVENTION OF MUSCULO-SKELETAL TRAUMAS IN COMPETITIVE SPORTSMEN

(Aspects regarding trauma incidence in volleyball and basketball teams)

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ABSTRACT

Traumas occur frequently in the competitive sportsman's life.

The causes and the mechanisms of musculo-skeletal traumas vary with every sport.

Objectives

1. To identify the factors that favour/determine traumas caused by overstress.
2. To determine the trauma incidence in the studied sportsmen.
3. To develop and implement prophylactic training protocols.
4. To detect musculo-skeletal traumas early, using modern investigation methods: musculo-skeletal ultrasound scan, MRI, CT.
5. To determine the main musculo-skeletal traumas occurring in sports practising.
6. The functional rehabilitation of the injured segment so that the sportsman can resume his/her competitive activity at best possible parameters and without the risk of relapse.
7. To create (clinical, imagistic and prevention) algorithms to monitor the sportsmen.
8. To keep trauma-affected sportsmen under a three-year monitorisation period and to draw the conclusions.

Material and methods: the study batch included 107 sportsmen of the volley, basketball, handball and football teams, league A1 and A2, from Timisoara and Lugoj, in the competition period 2006 -2009.

Research methods: bibliographic study, observation, inquiry, questionnaire, the statistical-mathematical method, the graphic method, radio-imagery methods (CT, MRI) of investigating sportsmen with musculo-skeletal traumas.

Treatment and prevention:

The rehabilitation therapy is complex and intensive. It should be correlated with the sportsman's training level, his/her performance level at the time the trauma occurred, and the functional level the sportsman should reach in order to resume his competitive activity.

Relaxation, cryotherapy, anti-inflammatory and myorelaxing drugs, compressions, adjuvants are the first means to apply as soon as trauma has occurred.

Means of rehabilitation: massage, kinetotherapy, electrotherapy, thermotherapy, balneotherapy.

This paper brings forward several complex physical exercises focusing on groups of muscles and joints involved in specific types of motility required by different sports. The exercises were chosen so as to increase articular mobility and improve muscle and ligament flexibility.

In theory, all traumas can be prevented through training that is initiated and performed correctly, proper physical and psychical training and preventive imagistic monitorisation.

Key words: sportsmen, musculo-skeletal traumas, prevention, radio-imagery diagnosis, rehabilitation

Introduction

Injuries are a common fact in the competitive sportsman's life. They are caused by too short warm-up periods, faulty training, improper equipment, specific trauma, aggression on the court etc. The detection and treatment of the preclinical forms, the therapeutic conduct and the sportsman's rehabilitation are only a few of the directions to pursue in finding viable solutions to sport performance related problems.

Prevention includes specific exercises as part of the training programme. Such exercises are meant to increase articular and periarticular structure flexibility, ligament resistance and muscular elasticity. They provide biomechanical joint consolidation, stability and maximum use of joint movement limit.

In addition to the above, massage and self-massage may be applied corresponding to the effort, the training period, and the protection of the trauma-exposed articular areas through taping and stretching (primary prevention) and proper treatment and rehabilitation (secondary prevention).

Objectives

1. To identify the factors that favour/determine traumas caused by overstress.
2. To develop and implement prophylactic training protocols.
3. To determine the trauma incidence in the studied sportsmen.
4. To detect musculo-skeletal traumas early, using modern investigation methods: musculo-skeletal ultrasound scan, MRI, CT.
5. To determine the main musculo-skeletal traumas varying with every sport, longevity in sport practising, the anatomical and clinical

condition, the uni/bilateral location of the affection, the number of days of partial/total rest required by the diagnosed clinical condition..

6. To establish clinical, imagistic and prevention algorithms to monitor the sportsmen.
7. To keep trauma-affected sportsmen under a three-year monitoring period and to draw conclusions.

Working hypotheses

This paper starts from the premise that high trauma incidence among the studied competitive sportsmen is caused by controllable factors. A distinction is made between extrinsic factors that are unrelated to the sportsman (improper state of the field, training errors, risk of sport-specific traumas, inadequate equipment) and intrinsic factors (the sportsman's anatomic and biomechanic characteristics, previous traumas treated improperly, Ca and Mg deficits, etc.). Primary and secondary prevention will lead to a decrease in the incidence of trauma.

Material and methods

The study batch included 107 sportsmen of the volleyball, basketball, handball and football teams in Timisoara and Lugoj, league A1 and A2, in the 2006-2009 competition period.

Given the necessity of cases that should benefit from an investigation protocol including CT, MRI, treatment and rehabilitation, we cooperated with the Radiology and Medical Imagistics Clinic of the Victor Babes University of Medicine and Pharmacy Timisoara, the Sanotim CT scan centre and a kinetic therapy and medical rehabilitation centre.

The sportsmen were monitored both while training and during games, with the help of medical sportsmen and kinetic therapy experts, and the medical staff representative for training camps and away games. The incidence of trauma was reported for all training stages.

Research methods: bibliographic study, observation, inquiry, questionnaire, statistical-mathematical methods, graphic methods and radio-imagery methods (CT, MRI) for investigating sportsmen with musculo-skeletal traumas.

Registered data, results and interpretations

The distribution of the study subjects on sports

No	Sport	Teams	Number of sportsmen	Total of subjects with traumas	%
1.	Volleyball	Lugoj League A 1 W	14	14	100 %
2.	Volleyball	Poli Tm League A 2 W	11	9	82%
3.	Volleyball	University of the West League A2 M	14	13	92.9%
4.	Basketball	Elba Timisoara League 1 M	12	12	100%
5.	Basketball	University of the West League A2 M	12	12	100%
6.	Basketball	University of Medicine and Pharmacy Timisoara M	12	11	90.91%
7.	Basketball	University of Medicine and Pharmacy Timisoara W	12	11	90.91%
8.	Handball	University of the West League A2	14	12	86%
9.	Football	C.F.R. Timisoara	18	16	89%

Injury prevention involves the identification of the first signs that can be noticed and analysed by the coach, the doctor and the sportsman.

Causes of injuries:

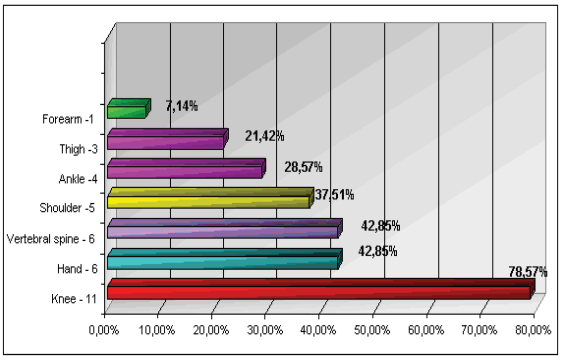
- lack of energy or torpidity that does not disappear after the first minutes of warming-up, indicating an overstress of the muscle-bone system structures
- the thought of giving-up and unexplainable poor performance
- chronic fatigue
- a 10 beats/minute increase of the heart rate
- lack of appetite, irascibility and/or depression, indicating overtraining
- too short
- wrong training methods
- movements not reaching the maximum movement amplitude
- tendon or joint overtraining
- articular imbalances
- weight gain
- insufficient rest
- lack of concentration
- tendon and ligament overstretching
- ignoring acute and localised pain

Results - Volleyball - Women - League A1

No	Name & surname Initials	Year of birth	First year of competitive sport practising	Player category	Player specialisation	Height (cm)	Weight (kg)
1.	B.S.	1988	1998	League A1	spiker	180	65
2.	C.L.	1987	2002	League A1	spiker	188	74
3.	S.A.	1989	1998	League A1	spiker	174	63
4.	B.D.	1988	1998	League A1	setter	172	63
5.	C.L.	1988	1998	League A1	spiker	177	65
6.	M.C.B.	1967	1980	League A1	setter	173	56
7.	M.I.	1989	2000	League A1	spiker	183	70
8.	H.A.M.	1988	1998	League A1	spiker	180	76
9.	L.D.	1986	1995	League A1	spiker	175	67
10.	S.M.	1988	1996	League A1	libero	167	65
11.	F.A.M.	1984	1995	League A1	spiker	183	68
12.	M.D.	1983	1994	League A1	libero	169	64
13.	C.G.	1985	1993	League A1	spiker	181	63
14.	C.A.	1989	1999	League A1	libero	169	59

Distribution of traumas based on the affected area Volleyball (a team of 14 sportswomen)

No	Area affected by musculo-skeletal trauma	Sportswomen with traumas	TYPE OF TRAUMA
1.	Knee	11 *(78.57%)*	Meniscal tears, fissures, sprains, tendinites, collateral and cruciate ligament injuries
2.	Ankle	4 *(28.57%)*	Sprains, fractures
3.	Shoulder	5 *(35.71%)*	Tendinites, rotator cuff tear
4.	Spine	6 *(42.85%)*	Cervical spondylosis, lordosis, scoliosis
5.	Hand	6 *(42.85%)*	Sprains, strains, fractures
6.	Thigh	3 *(21.42%)*	Muscle ruptures
7.	Forearm	1 *(7.14%)*	Fracture



Result interpretation: volleyball

The most frequent traumas within the volleyball team were knee injuries: 11 cases (78.57% of the players). Among these, meniscal injuries were the most common (degeneration, fissure, tear). One sportswoman underwent meniscal tear surgery.

The musculo-skeletal trauma distribution within the volleyball team was as follows:

≥ 3 traumas -10 players

< 3 traumas - 4 players.

A number of 46 musculo-skeletal traumas were registered in the CSM Lugoj volleyball team of League A1 in September 2006 - April 2009. Most injuries were caused by falls and ball hits.

The injuries are associated with blocking and attacking, as both involve jumping. Both the upper and the lower part of the locomotor system are permanently strained. Injuries of the superior part account for over 50% of the traumas. Overstress injuries account for 80% of the traumas, while 20% are accidental lesions. Example: in the volleyball team, C.L. suffered from ankle sprain relapse and S.A. had right knee sprain and cruciate ligament injury.

The pathology in the volleyball team included the following affected regions:

- ✓ shoulder joint complex (impingement syndrome, rotator cuff pathology, acute or chronic instability)
- ✓ back (effort-related lumbar pain and paravertebral muscle contraction)
- ✓ knee joint (sprains, strains, collateral ligament injuries and meniscal tears
- ✓ tibio-tarsal joint (sprains by inversion or eversion, strains, acute or chronic instability);
- ✓ hand phalangeal sprains and overstress traumas
- ✓ frequent tendinitis, tenosynovitis, enthesitis of Achilles tendon, kneecap tendon, shoulder, muscle ruptures and myositis.

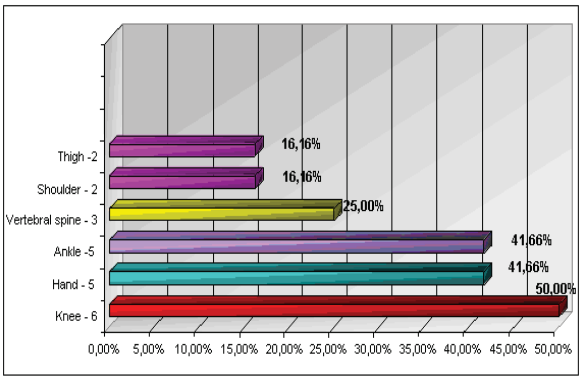
Other injuries in the volleyball team were contusions (which occur most frequently, but most of them are minor) and effort-related lumbar pains that cause pain and paravertebral muscle contraction.

ELBA Timisoara Municipal Basket Club

No	Name & surname	Age (years)	Height (cm)	Weight (kg)	Player specialisation	Age of debut
1.	S.B.	21	196	92.5	Small forward	13
2.	T.D.	21	181.5	81	Point guard	12
3.	D.R.	28	185	82	Point guard	13
4.	V.U.	25	189	77	Shooting guard	9
5.	P.M.	24	203	102	Small forward	10
6.	V.N.	22	194	86	Shooting guard	9
7.	M.N.	27	196	94	Small forward	7
8.	P.D.	29	208	114	Centre	15
9.	G.B.	28	211	112	Centre	16
10.	C.P.	29	202	91	Small forward	12
11.	T.A.	25	202	112	Centre	14
12.	P.F.	21	194	76	Shooting guard	10

Basketball (a team of 12 sportsmen)

No	Area affected by musculo-skeletal trauma	Sportsmen with traumas	TYPE OF TRAUMA
1.	Knee	6 (50%)	Ligament injuries, anterior cruciate ligament ruptures, bone edema
2.	Ankle	5 (41.66%)	Sprains
3.	Shoulder	2 (16.66%)	Tendinitis
4.	Spine	3 (25%)	Lumbar sciatica
5.	Hand	5 (41.66%)	Strains, tendinitis, fractures, sprains
6.	Thigh	2 (16.66%	Muscle ruptures



Result interpretation: basketball

In the basketball team, knee injuries were also the most frequent: 6 cases (50% of the players). Of these, the most common were ligament injuries (collateral and cruciate ligament affections).

The musculo-skeletal trauma distribution among the twelve basketball players was the following:

≥ 3 traumas – 6 players

< 3 traumas – 6 players.

A number of 40 musculo-skeletal traumas were registered in the Elba Timisoara basketball team

in September 2006 - April 2009. Most lesions were caused by direct contact with the opponent, unreasonable violence and aggression on the basketball court and ball contact and hits.

The pathological aspects concern mainly the ligaments and the joint system.

The most common injuries are sprains of the ankle (tibio-tarsal sprains), knee and phalange, overstress traumas, tendinitis, tenosynovitis, enthesitis (Achilles and kneecap tendons, elbow and shoulder), muscle ruptures and myositis.

Other injuries were contusions (which occur frequently, though most of them are minor) and effort-related lumbar pains that cause pain and paravertebral muscle contraction.

The results of our study have revealed a larger number of traumas in the players than the literature of the field. The high trauma incidence is caused by an association of controllable factors:

- insufficient effort capacity
- hypocalcemia
- kyphosis, lordosis
- improperly treated previous traumas
- errors in the training methods
- inadequate basketball court

Given the importance of primary and secondary prevention, this paper brings forward a coherent programme of complex exercises focusing on the groups of muscles and joints involved in specific types of motility required by different sports.

The exercises were chosen so as to increase muscular balance, articular mobility and improve muscle and ligament flexibility (major factors in trauma prevention).

A complex of exercises

❖ **Warming-up** - 10 minutes' running (cross-over steps, backward running)

❖ **Stretching** (for the cervical region, the body, the arm and forearm muscles, the shoulder muscles, the inferior limb muscles and joints; they can be done individually or with a partner).

1. Bend your head forward, backward, to the right, to the left. Turn your head to the right, to the left (3 x 7-10 seconds, 2-4 seconds break).
2. Stand with your legs apart and stretch your right arm to the left. Place your right arm across your body at shoulder height and gently pull it toward your body with your left hand, holding your left forearm at the right elbow level. (3 x 7-10 seconds, 4 seconds break). Repeat for the left arm.
3. Stand with your legs apart and hands behind your back. Clasp your right wrist with your left hand and pull it downwards while bending your head to the left (2 x 10-15 seconds, 4 seconds break). Switch arms and repeat.
4. Stand with your legs apart and raise your right arm. Clasp your hands at shoulder blade level. (2 x 10-15 seconds, 2-4 seconds break). Then raise your left arm and do the same.
5. Stand with your legs apart; bend your trunk with arms raised and palms on the stall bar. Keep your back straight. Then bend your trunk with hands on your hips. (2 x 15 seconds, 4 seconds break).
6. Stand with your legs apart, bend your trunk and touch the ground with your palms. Keep your back straight (2 x 15 seconds, 2-4 seconds break).
7. Stand with your legs apart. Bend your trunk to the left, raise your right arm, keep your left arm relaxed on the ground (2 x 15-25 seconds, 2-4 seconds break). Then bend your trunk to the right.
8. Sit down, bend your left knee and cross it over your right knee, with your sole on the ground. Turn your trunk to the left while touching your left knee with your right elbow and leaning your left arm behind on the ground (2 x 15-25 sec, p 2-4 sec). Then bend your right knee and repeat.
9. Lie down on your abdomen and raise your arms. Do trunk extensions (3 x 10-15 seconds, 2-4 seconds break).
10. Forward lunges alternating right and left foot (3 x 15-25 seconds, 2-4 seconds break).
11. Stand and take a step to the right, flexing your right leg and stretching the left one. (3 x 15-25 seconds, p 2-4 seconds). Switch sides and repeat.
12. Lunge forward, stretch your leg behind, and turn your trunk to the right with your right hand on your right knee and your left hand on the ground. Switch legs and repeat.

❖ **Non-specific fitness exercises**:

- Running and jumping (pawing drill, high knees drill, heel kicks, skipping), 2 x 30 m, 30 seconds break.
- Standing with your legs apart, jump with your hands over your head, bend your trunk laterally, and rotate your trunk, 2 x 8 times, 10-15 seconds break.
- Sit-up jumps for lower limb extension and contracting abdominal muscles, 2 x 8 times, 10-15 seconds break.

❖ **Warm-up exercises typical of every sport following general warm-up.** They warm-up those parts of the body that are used mostly while practising a certain sport.

- Volleyball: shoulder rolls (headers), passing, receiving, attacking, blocking, and serving.
- Basketball: dribbling, passing, shooting etc

❖ **Weight lifting and resistance exercises.** This programme takes place weekly and involves isotonic and isometric exercises.

❖ **Taping and strapping**

The following **rules** will be obeyed**:**

- exercise to be repeated 3-4 times only
- slow speed
- for weight lifting, 80% maximum lifting load.

OBSERVATIONS

The stretching exercises became part of the training sessions to prepare the body for effort. They have a positive effect on the amplitude of the movements (make movements easier) and the muscle groups that are involved in common warm-up (intervertebral, intercostal, scapulo-humeral and abdominal oblique muscles).

These exercises have both an immediate effect and a cumulative effect in time, improving articular mobility and muscle and ligament elasticity – major factors in trauma prevention.

Conclusions and suggestions

Sport games are a chain of individual and collective movements involving high speed, force and precision. Body stress is variable: short periods of maximum stress followed by reduced effort, using a metabolic model of aerobic and anaerobic exercises.

The locomotor system (the knees, the ankles, the upper limbs, the scapulo-humeral and interphalangeal joints, the spine, especially the lumbar region) is subjected to overstress.

In addition to specific training, basketball and volleyball players need strong, mobile joints and well-developed muscles that allow a high level of quality movements both for performance and injury prevention.

The final conclusion will be drawn by monitoring the trauma incidence of the study teams after the suggested programmes have been applied.

The results of our study underline the importance of both primary prevention that eliminates factors causing injuries and secondary prevention, in the case of injury relapse (elastic contention, proper and total trauma rehabilitation and gradual training resume).

Suggestions

Given the importance of primary and secondary prevention, this paper brings forward a coherent programme of complex physical exercises focusing on the groups of muscles and joints involved in specific types of motility required by different sports. The exercises were chosen so as to increase muscular balance, articular mobility and improve muscle and ligament flexibility (major factors in trauma prevention).

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