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## Questioning the Concept of General Falling Techniques (GFT)

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### Abstract

**Background and Study Aim.** Many martial artists and some scholars point out that acquiring martial arts and combat sports falling techniques can prevent injuries in daily life. They have articulated that historical experience and tradition in falling led to the advancement of safe falls. However, safe falls are an inseparable part of many non-combative sports like games or gymnastics. Movement patterns for falling techniques differ from one sport to another, while they are still safe and serving the purpose.

**Material and Methods.** Athletes fall quite often in lot of sports, but research in this area is scarce. In some sports, falling techniques is a part of basic curriculum. Can we presume, that knowledge of falling can be easily transferred from sports to everyday life? Is there any diagnostic tool for that?

**Results.** In this theoretical essay we will clarify terms fall and falling technique as two different movements. Next we will go through the current research about falling in sports. We will find out what the danger of falling is and what benefit we can gain from falling techniques in sports. At the end of the article a look to possible transfer of falling techniques to general physical activities from children to elderly will be given. The scope is to give suggestion for basic principles for General Falling Techniques (GFT).

**Conclusion.** In general, falls and falling techniques can be recognised in sports as well as in everyday working or leisure time. Respect the nature of respective sport, falling techniques differ. This is way it is not possible to use them as general skill to avoid injury.

**Keywords:** safe falls • biomechanics of falls • injuries in sports • falling in sports • injury prevention

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## INTRODUCTION

We can encounter falls in many areas of life. Not only in sport and physical education, but also in everyday situations. Despite the fact that the concept of fall is intuitively clear for every human being, its definition is not clear. Even in the Holy Bible, according to Christian theology, the fall of man is connected to original sin. Fall is perceived as something evil. Falling down, loss of balance is a metaphor to all unhappy things, when no hope can be seen as far as a man can rise up. What is the difference between that who remain on the ground and that who could rise again and again?

In the ontogenesis, ground movement and falling are necessary for future standing and walking. On other side, falling causes many injuries and can cause death. People, especially elderly, but also athletes, can feel fear of falling. This is also frequent topic for researchers, as physical and psychological health is part of quality of life.

Athletes fall quite often in lot of sports, but research in this area is scarce. In some sports, falling techniques is a part of basic curriculum. Can we presume, that knowledge of falling can be easily transferred from sports to everyday life? Is there any diagnostic tool for that?

## MATERIAL AND METHODS

In this theoretical essay we will clarify terms fall and falling technique as two different movements. Next we will go through the current research about falling in sports. We will find out what the danger of falling is and what benefit we can gain from falling techniques in sports. At the end of the article a look to possible transfer of falling techniques to general physical activities from children to elderly will be given. The scope is to give suggestion for basic principles for General Falling Techniques (GFT).

## RESULTS

It is necessary to distinguish between the concepts of the fall in its various semantic meanings in the area of physics, philosophy, medicine, political science, and of course, in sport. Multiple meanings of the concept of fall assures us that it is necessary to distinguish the concepts of the fall and the falling technique.

Multiple meanings of the concept of fall (as well as the movement of the human body) assures us that it is necessary to distinguish the concepts of:

- the fall: any movement of the body as a whole and its segments in the direction of the gravitational force

- falling technique: acquired movement skill

Based on theoretical analyses of the problem [1], as well as findings from practice, we propose to define the falling technique as a sudden change of the movement structure caused by the loss of balance in the direction of the gravitational force. The movement structure of the falling technique is an acquired movement skill, which is demonstrated by a safe balance restoration by creating a new support area by other parts of the body than feet.

The biomechanical structure of falling techniques is based on the biomechanical structure of falls in particular according to Straus [2] and Carter [3], who examined falls from the forensic and biomedical point of view. In our point of view, the phases landing and landing position are the most emphasized ones at falling technique.

Here we have to think about four stages of the falling technique. At first it is a violation of the balanced state that from the mechanical point of view occurs by the impact of gravitational forces, eventually other forces until the fall itself. Furthermore, it is a phase of the contact with the ground and the phase of stopping the motion, which is terminated when the falling one stands up or stops in the landing position. Even though the falling technique is a complex phenomenon, in which the individual phases relate to each other, each phase is caused by the previous one. The reason of the fall, imbalance, is phase of initiation, which can be caused by endogenous or exogenous factors. At the stage of initiation, there is external or internal stimulus to fall, or their combination. Intentional fallings are initiated by inner impulse to fall. Unintentional fallings are accidental, caused through a fault of a person, or due to another person or an object. Falling, as second phase, is accelerated one. One can fall in controlled or uncontrolled way. Next phase, is the most dangerous one. Contact with the ground is called impact. This phase is characterised by quick deceleration. Impact seems to be crucial, because this is the phase in which the falling one is vulnerable to injuries. We distinguish the impact, and thus also a traumatic injury, as primary and secondary. The primary impact arises in the first contact of the body with the mat at the moment of impact (interaction). Secondary impact arises by the subsequent impact of other parts of the human kinematic chain after the primary impact. The last phase, after-impact position is often underestimated. Fallen person usually stay in a lying position till checking possible injuries. Balance restoration can be made also in a standing position when using kinetic energy of fall.

In different sports, falls are not only an important physical skills affecting the sports performance, but also a means to make the sports discipline more attractive. For example, in volleyball considers Roque [4] falls as part of the game and the most exciting part of the game. As an example of a team sport Reguli [5] analysed potential danger of falls in volleyball and highlighted falling techniques as necessary skill in it. Falls are not the basic skills in volleyball. However, they allow to manage game situations in which would have been otherwise granted a point to the opponent. The most important part of the technique is considered to be the ability of the players to maintain the momentum gained by the fall and use it to roll the body away and to get back to the standing position. Complete season for one of the best Czech men's volleyball team was examined. The monitored situations were as follows: a) what falling was performed; b) the post of the player who performed the falling or combative activity. Authors found that average frequency of fall was one per 81 seconds. The number of particular combative activities out of ten monitored matches was 65.4 in one match, which is one falling technique in every 1 min 21 sec. Players successfully received ball in the number of 36.1 in one match with using falling down. But only half of receiving ended with scoring a point. The character of a volleyball game is created by sport rules that allow to use falling techniques as collapse, sprawl, dive, shoulder or barrel roll, etc. Falling techniques have an irreplaceable position in volleyball nowadays and their mastering is an important part of team performance. The team that is not fully prepared for physically and mentally demanding active style of volleyball has a worse position in contrast to teams that mastered falling and combative techniques well. Well performed falling techniques are crucial for scoring a point in a danger situation. Similar results were found in football [6], where falling techniques are in close connection with other combative activities as pushing.

After-impact position in falling techniques used in games allow to continue in a game successfully and without an injury. When the speed is quick, falling can lead to injure, which is main acute and concludes chafing, cataclasis, sprain and contusion. Hua and Hua [7] examined basketball and learned that falling and spraining (due to collision with other player) injures are common in this game.

As for individual sport, Philippe et al. [8] give example answering question "How frequent and why are skiers and snowboarders falling?" in 1436 recreational male and female skiers and snowboarders from all age groups. For last decade the incidence of

falls among skiers and snowboarders was substantially lower. But still, injuries in winter sports are mainly caused by falls. It confirms previous findings of Vives [9]. The incidence of falls among skiers was in Philippe et al. study (8)  $0.076 \pm 0.21$  per hour and that among snowboarders was  $0.429 \pm 0.70$  per hour. Age (OR: 0.96; CI: 0.95 - 0.97), soft snow conditions (OR: 4.1; CI: 1.9 - 8.8) and poor skiing skills (beginners and intermediates) (OR: 2.6; CI: 1.2 - 8.1) were predictive for falls during skiing. Poor snowboarding skills (beginners and intermediates) (OR: 8.3; CI: 3.1 - 27.4), wearing a helmet (OR: 2.3; CI: 1.2 - 4.6) and alcohol consumption (OR: 2.1; CI: 1.2 - 3.9) were predictive for falls during snowboarding. We can assume, that in competitive skiing and snowboarding a fall leads to failure in competition. For safety reasons skiers and snowboarders should perform in good conditions, with good protective equipment, but they also should learn how to fall down and how to stabilise the body after the impact to avoid secondary fall and secondary injuries.

It is believed that martial artists and combat sports athletes mastered falling techniques [10]. Especially in competitive combat sports like judo or wrestling. On other site, even practising combat sports can make an serious injury, or can cause a death [11] The ultimate aim in combat sport is to win competition according to the rules. We assume that the structures of the falling techniques taught in competitive combative sports are based on this goal. The falling technique used in combat sports influenced the understanding of the falling technique as a prevention against injury. The fact that the decisions of the referees on the evaluation of the tossing ones is indirect by nature of the fall of the tossed opponent naturally developed in the effort to learn how not to fall according to the rules, so that the rivals aren't given positive assessment. The judoists started at first informal and later a targeted repeat training of such a physical structure of falls that prevented a positive evaluation of the tossing opponent. If an athlete falls on his back, his opponent is announced to be winner. In judo this effort culminated especially in the second half of the eighties of the twentieth century.

Some coaches even went so far as not to teach correct falling techniques at all, so that the trainees did not learn wrong habits for the competition. In training they use only physical structures disturbing the control of the tossing one over the tossed one, the so-called unorthodox falls, turnouts [12], which include turns, handstands, flips on the elbows, and flips on the head to avoiding contact with the back.

Lafon next state there are several reasons why a training process should contain turns instead of the classic falling technique. They are based on the premise that today's judo is primarily a competitive sport discipline modified by rules and does not fulfil the self-defensive or other functions. Even when the sportsmen are specifically preparing for performing turns for a long time, some authors doubt the correctness of their inclusion in training instead of the falling technique. Lee [13] refers to many cases of injury (exceptionally even death), which were caused by an intentional or unintentional fall on one's head. He objects to training of turns:

- turns can be dangerous and cause serious injuries
- turns contradict to the principles of judo, which can be punished by the referees according to the competitive order of judo
- judo is also a martial art (not only a competitive sport) and carries traditions that should be kept

Despite these objections the turns are constantly used in sports fighting.

Position in the bridge with a support on the head is common even in wrestling according to the United World Wrestling (FILA). Head bridge is an often trained position in wrestling and the wrestlers practice development of various specific exercises for strengthening of all muscle groups involved in this position, particularly the muscles of the neck and back. In addition, in judo and wrestling, injuries can be prevented by mats. Soft surface partially absorbs the impact of a fall.

The analysis of the usage of techniques in judo and wrestling implies that the falling techniques that are now used in competitive combative sports, are not suitable as models of general falling techniques. Falling techniques practiced by wrestlers and judo players extensively changed motion patterns because of the rules of sports. The examination of falling techniques in combative sports leads to state that sports rules specify that the winner is that who throws the opponent. The falling technique is, therefore, the secondary, often overlooked skill. These sports are practiced on a soft surface. It prevents injuries and allows athletes to fall in such a way that it could have fatal consequences in a situation outside of the sport. To do a correct falling technique means to loss a fight. Correct falling techniques are undesirable in a sports fight.

Indirectly, we can learn a lot about unsuccessful falls from research about injuries in sports. More than half injuries is caused by falls in some Olympic sports

[14]. Injuries are typical for any particular sport. If there is no proper falling technique, small joints as wrists can be easily injured. If that injury is not treated, even serious can occur [15]. Also other joint injuries are caused by falling down as acromioclavicular joint or elbow, as Tauber [16] state.

Athletes are applauded for their courage when returning to the game after fall. Podell [17] pointed out that even if there is no injury of movement apparatus, sports-related concussion is one of the biggest health concerns today for athletes. Prevention and education are discussed as well as wearing protective device or teaching falling techniques.

There is no doubt that falling techniques help to prevent injury. Falling technique is a skill that should be tested or evaluated. The question here is what criteria limits the good falling technique. Simply, we can consider that correct falling technique performed who felt down without causing an injury. But it is not possible to test anybody like that, or with some possible errors as it can be demonstrated in evaluation of susceptibility to injuries during fall (STBIDF) [18]. This indirect method uses controlled task of lying down from standing position, which can be considered as no fall. Also it must be used in safe environment (using mats), precluding the real injury.

There are also various evaluation methods for falling techniques. Traditionally, evaluation of falling techniques is an element of lower kyu tests in various Japanese budo, for example. More sophisticated way to various motor abilities and skills related to falls was developed and used by Kalina and Michnik [19–22] as well as effects prognosis of safe falls education (predictive validity. Some specific scales were developed by Zvonar and Reguli [5,23]. These scales were built on the basics of biomechanics of respective falling techniques. This is way it is not possible to use them for evaluation any other falling technique. Nor traditional, not modern methods of evaluation are answer to the structure of General Falling Techniques.

## CONCLUSIONS

In general, falls and falling techniques can be recognised in sports as well as in everyday working or leisure time. Respect the nature of respective sport, falling techniques differ. This is way it is not possible to use them as general skill to avoid injury.

In accordance with previous research [1], we propose unifying principles of General Falling Techniques as follows:

- The distribution of the impact force largest possible surface area of the body. Only that parts protected by a layer of muscles should be in the contact with the ground.
- Convert sliding friction, eventually a direct impact, to rolling friction (rolling motion) to avoid bruises, especially when falling on abrasive ground.
- Dampening of the fall in the longest possible time. Striving for gradual deceleration.
- The use of kinetic energy of a fall to retake the standing position.
- The use of natural/functional movement allowing to utilize developed motor abilities according to functional anatomy of the human body.

Each falling technique should follow as much principles of General Falling Techniques, as possible. However, some situations do not allow the use of all principles. The causes may be different, endogenous and exogenous depending on their nature. Endogenous factors include especially contra

motivation, tactical behaviour, and exogenous the terrain, equipment, another person, and so on.

It is necessary to practice the technique of the falls with regard to its future use. It is not advantageous to practice for example, judo falls in football players, volleyball players, or the general public to avoid injuries. It is necessary to adapt the falling technique for each group. Due to the nature of suddenness, and unpredictability of the fall, it is necessary to master the falling technique perfectly, which will be eventually maintained lifelong. We suggest falling technique as one of three component in avoiding injury as partly Gerrard indicated [23]:

- Proper falling technique in the meaning of GFT;
- Strength training to develop motor abilities and protective layer of muscles;
- Injury prevention as inseparable part of education.

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