



On determining factors affecting injury and recovery in athletes

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Abstract

The aim of the study is to develop a comprehensive model on the risk factors of injury/re-injury and factors affecting the recovery process.

Material and methods. Systematic analysis and scientific generalization of the latest theoretical and analytical studies on the factors affecting risk of injury, assessment, prevention and recovery of injuries in athletes.

Results. The conducted comprehensive analysis allowed to build a theoretical model on the injury-recovery cycle. The model includes 3 main groups of factors affecting the risk of injury, namely: internal, caused by physiological processes; external, caused by training conditions and equipment; fear, which is related to the personal psychological and emotional characteristics and external surroundings. At the same time, implementation of preventive measurements can reduce the risk of injuries. The model highlighted the positive impact of social support and interactions between a patient and a therapist in the process of injury recovery.

Conclusions. In order to minimize the risk of injury and stimulate the recovery process in athletes the following recommendation should be taken in place: to promote the spreading of information on possible ways of injury prevention; to provide educational services for those who are involved in sports and other physical activities; to spread the information about the main types of injury and the treatment approaches to make athletes familiar with that, which can increase their competence and reduce the fear of injury; to encourage communication and interaction between teammates, with their trainers and coaches during the period of recovery to eliminate the level of isolation of injured athletes.

Keywords: risk factors, injury, recovery, preventive measures, social support, interaction.

Анотація

Паріш Мохаммад Реза. Про визначення факторів, що впливають на травми та відновлення у спортсменів

Метою дослідження є розробка комплексної моделі факторів ризику травмування / повторного травмування спортсменів та факторів, що впливають на процес одужання.

Матеріал та методи. Систематичний аналіз та наукове узагальнення теоретичних та аналітичних досліджень щодо факторів, що впливають на ризик отримання травм, оцінки, профілактики та відновлення спортсменів.

Результати. Проведений комплексний аналіз дозволив побудувати теоретичну циклічну модель травмування - відновлення спортсменів. Модель містить 3 основні групи факторів, що впливають на ризик отримання травм, а саме: внутрішні, зумовлені фізіологічними процесами; зовнішні, зумовлені умовами та засобами тренування; страх, пов'язаний з особистими психологічними та емоційними характеристиками та зовнішнім середовищем. Також проведення профілактичних заходів дозволяє знизити ризик травмування. Модель вказує на позитивний вплив соціальної підтримки та взаємодії між пацієнтом та терапевтом на процес відновлення спортсменів.

Висновки. Для мінімізації ризику отримання травм та стимулювання процесу відновлення спортсменів слід наслідувати наступні рекомендації: сприяти поширенню інформації про можливі способи запобігання травмуванню; надавати освітні послуги тим, хто займається спортом та іншими фізичними активностями; поширювати інформацію про основні типи травм та методи їх лікування серед спортсменів з метою підвищення їх компетентності та зменшення рівня страху перед травмуванням; заохочувати спілкування та взаємодію між товаришами по команді та тренерами у період відновлення, щоб знизити рівень ізоляції травмованих спортсменів.

Ключові слова: фактори ризику, травма, відновлення, профілактичні заходи, соціальна підтримка, взаємодія.

Аннотация

Париш Мохаммад Реза. Об определении факторов, влияющих на травму и восстановление у спортсменов

Целью исследования является разработка комплексной модели факторов риска травмирования / повторного травмирования и факторов, влияющих на процесс выздоровления.

Материал и методы. Систематический анализ и научное обобщение теоретических и аналитических исследований, направленных на изучение факторов, влияющих на риск травматизма, процесса оценивания, профилактики и восстановления спортсменов.

Результаты. Проведенный комплексный анализ позволил построить теоретическую модель цикла травматизм - восстановление. Модель включает в себя 3 основные группы факторов, влияющих на риск травмирования, а именно: внутренние, вызванные физиологическими процессами; внешние, обусловленные условиями обучения и оснащения; страх, который связан с личными психологическими и эмоциональными характеристиками и внешним окружением. Также проведение профилактических мероприятий может снизить риск травмирования. Модель показывает положительное влияние социальной поддержки и взаимодействия между пациентом и терапевтом в процессе восстановления после травмы.

Выводы. Чтобы свести к минимуму риск получения травм и стимулировать процесс восстановления у спортсменов, необходимо следовать таким рекомендациям: способствовать распространению информации о возможных способах предотвращения травм; предоставлять образовательные услуги тем, кто занимается спортом и физическими активностями; распространять информацию об основных видах травм и подходах к лечению среди спортсменов с целью повышения их компетенции и снижения уровня страха перед травмами; способствовать общению и взаимодействию между участниками команды и тренерами в течение периода восстановления, чтобы устранить изоляцию травмированных спортсменов.

Ключевые слова: факторы риска, травмы, выздоровление, профилактические меры, социальная поддержка, взаимодействие.



Introduction

The issue on the injury factors in sports is attracting attention of scholars for last decades, the authors have studied preventive measures [1, 2, 3], the main risk factors of injury [4, 5, 6] and efficiency of recovery in athletes [7, 8, 9, 10]. Moreover, especially the social and psychological factors were examined, and their impact was proven.

The continuous interest in studying the factors affecting the risk of injury is related to the contemporary approach to the way of organizing everyday life style of population, meaning that the majority of population performs sports on the regular basis and mostly avoiding trainers or other coaches' instructions, which arises the need to analyse the common risk factors of injury and other closely related concerns.

It should be mentioned that one out of five Americans was engaged in sports and exercise each day in 2017, the wiliness of doing sports is explained as following: 54 percent were engaged in sport or physical activities in order to improve their health, 47 percent - to improve their fitness, 38 percent - to relax [11]. Moreover, among the most popular sports activities are: running, Jogging and Trail running. Such a high level of involvement in sports among ordinary people requires the further study of risk factors in order to rise the awareness of public and share the knowledge.

Taking into account the overall importance of the issue on the risk factors and types of injury in athletes and in order to reach the aim of the paper the analysis of modern scientific literature was conducted, which allowed to identify three groups of common injuries based on the nature of injury, namely:

- obtained directly as a result of an external blow or force, a crash with another player or an object/equipment etc.;
- caused indirectly by internal forces formed as a result of physical actions, including: overstretching, mistakes in technique of performance, poor fitness; injuries occurred slightly away from the impact zone (while jumping, running or other activities the ankle can be moved out its normal position, that results in sprained ankle);
- injuries happened due to heavily overuse of bones, joints, muscles, and other connective tissues of the body when intensive and frequent strength is applied to them. At first, there is no pain or other symptoms of injuries are noticed and the individual continues to train and put pressure on the same injured areas. Thus, the time needed to heal the injured zones is eliminated, which leads to further damage and injured areas turn out to be swollen and

hurting. Among the key reasons of these overuse injuries are related to the change in the training program, poor planning of trainings, where the recovery time is not included [1, 2, 3];

- secondary injuries, that can occur when the previous injuries are not treated well or the athlete is not fully recovered, under these conditions, there is a high risk of frequent secondary injuries in future [12, 13, 14].

In this context the most traumatic types of sports should be mentioned. Thus, according to the data presented by National Safety Council (figure 1), the highest quantity of injuries was caused by doing exercises, playing basketball, riding bicycles and playing football, at the same time, the lowest amount of injuries is associated with water skiing, boxing and ski activities.

In order to examine the specific features of the injury, to spread the knowledge and raise the awareness, the main factors causing injury should be studied. The generally accepted classification of factors can be presented as following:

1. External:
 - Factors related to the sustainability of equipment in educational and training processes, during the competitions. Improperly selected sport equipment such as shoes leads to a higher risk of the foot and ankle injuries, inefficient dissipation of forces. Under the conditions of failing to ensure the effectiveness of the personal protective equipment athletes put themselves at a high risk of potential injuries. Moreover, the usage of poorly selected size and weight of the equipment makes all movements biomechanically instable and ineffective, which puts more pressure on joints, muscles and connective tissues;
 - Factors related to the design and organization of training program. The properly organized training program should count for the time for healing tissues as overloading of tissues is required for successful adaptation, thus, disobeying this principle can lead to the failing to adapt. At the same time, sudden rises in frequency, intensity and duration of trainings, modifying training approaches put additional pressure on joints, muscles and connective tissues and exceed the failure tolerance level of tissues, increasing the risk of injuries. Additionally, inadequate performance of sports and exercise-specific techniques put superfluous tension on the tissues;
 - Factors related to the training environment conditions, such as: temperature and the surface. Thus, the sport activities and trainings on very hard or very soft surfaces cause excessive forces to pass through the athlete's body and raise the risk of sprains. At the same time, the usage of rough surfaces such as cambered paths lead to enlarged force being located on one side of the body [4, 16, 17, 18, 19].

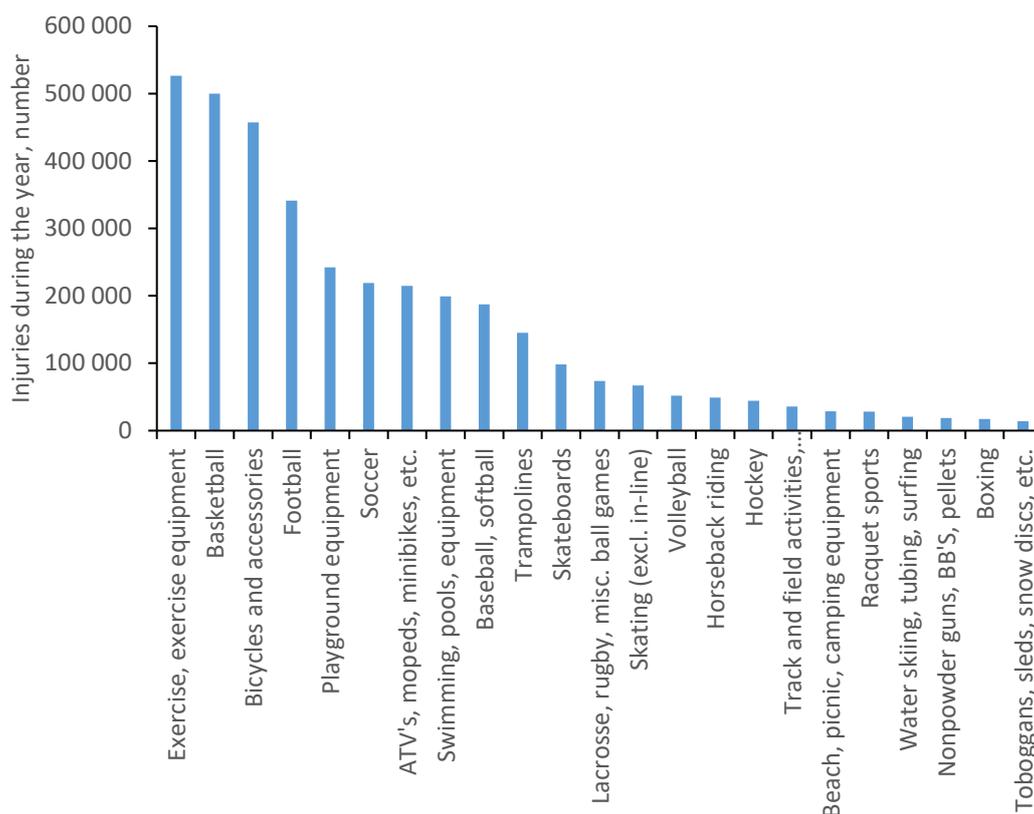


Fig. 1. Injuries by sports and activities, 2017. Source: [15]

2. Internal:

- Psychological factors that are caused by the competition among athletes and the requirements that individuals face during their trainings, the ways of responding and coping with these psychological issues. Moreover, the psychological state of athletes during the competition can be defined as over exiting and in a way aggressive in their behaviour that can affect the prompt process of making decisions by sportsmen during the competition, as the results not the best decision can be made that increases the risk of injuries;

- Nutritional factors, such as: glycogen stores, hydration, and protein intake. These factors are extremely important as having adequate glycogen stores lead to a raise in the time period taken to get exhausted. Additionally, the correct level of hydration cuts the effect of dehydration, prevents hypernatremia and overheating of the body. Moreover, the right level of protein intake is essential for healing and adoption of soft tissues. Thus, disorders in the nutritional behaviour of athletes can lead to fast tiredness, problems in soft tissues healing and adoption, dehydration and hypernatremia, that combined increase the risk of harming [5, 6, 20, 21, 22, 23];

- Fear of injury is common among athletes and increases the risk of harming themselves by extending muscle tension and bracing, tentativeness in execution, disruption of attention from the essential issues. Moreover, fear motivates to develop a healthy reaction of sportsmen and the sense of respect of potential dangers to ensure proper response [24]. Also, it should be mentioned that fear of injury is caused by internal (physiological characteristics of an athlete and previous experience) and/or external factors (environment, training conditions etc.).

The aim of the paper is to develop a comprehensive model on the risk factors of injury/re-injury and factors affecting the recovery process.

Material and methods

Systematic analysis and scientific generalization of the latest theoretical and analytical studies on the factors affecting risk of injury, assessment, prevention and recovery of injuries in athletes.

Results

allowed to build a theoretical model on the injury-recovery cycle, presented on figure 2.

The conducted comprehensive analysis of the present scientific literature and recent studies

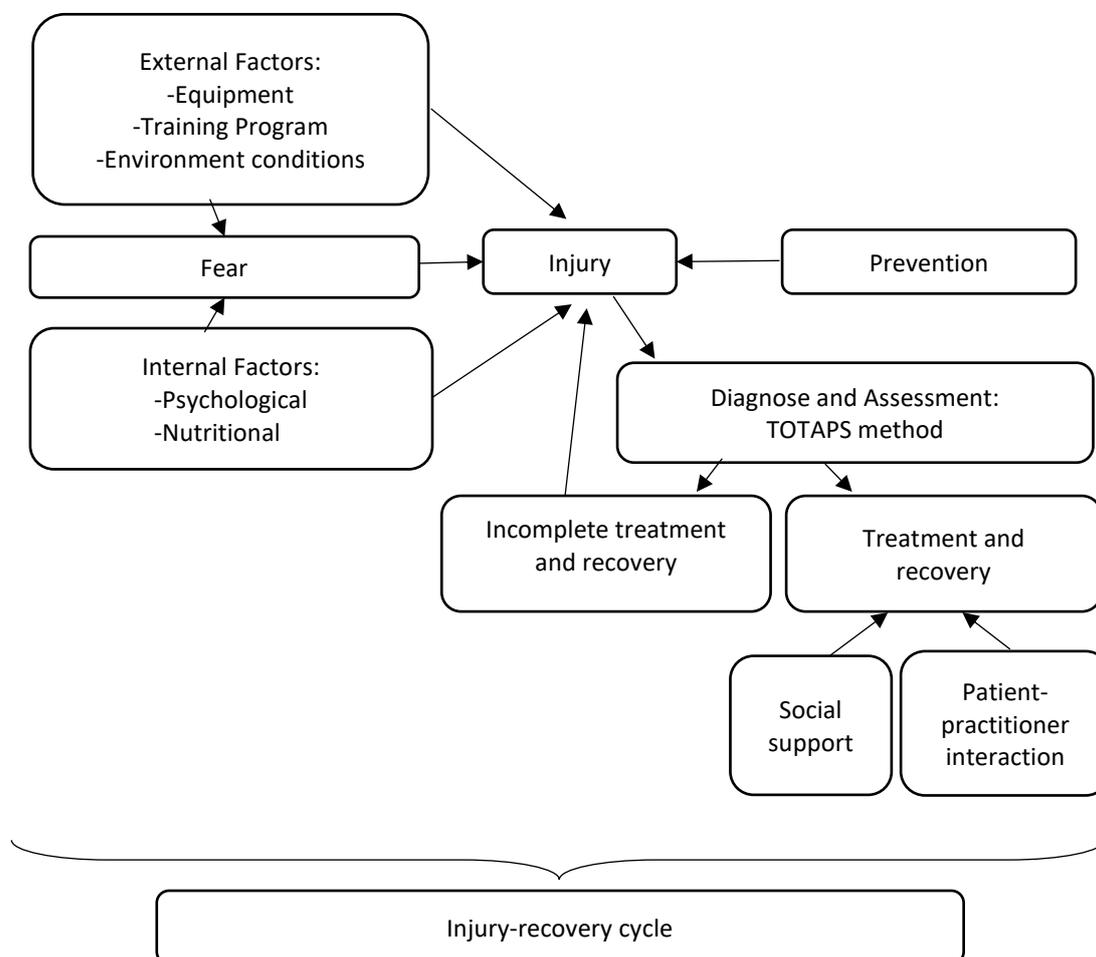


Fig. 2. Injury-recovery cycle. Source: Designed by the author

The model includes 3 main groups of factors affecting the risk of injury, namely: internal, caused by physiological processes; external, caused by training conditions and equipment; fear, which is related to the personal psychological and emotional characteristics and external surroundings. At the same time, implementation of preventive measurements can reduce the risk of injuries. Next stage of the model is to complete the assessment using the TOTAPS method in order to select the adequate method of treatment and recovery. In this context, it should be mentioned that the use of incorrect recovery approach or incomplete recovery of injuries lead to increased risk of injury in athletes. Additionally, as recent studies highlighted the positive impact of social support and interactions between a patient and a therapist in the process of injury recovery, these factors were added to the model. Thus, the presented model covers the main factors that affect the risk of injury and its recovery,

while inadequate recovery program can lead to secondary injury.

Discussion

It should be mentioned that according to the existing literature, TOTAPS method is commonly accepted for checking if an athlete is injured, to evaluate the extent of the injury and the correct way of further treatment. TOTAPS stands for: Talk; Observe; Touch; Active movement; Passive movement; Skills Test. The mentioned approach can be used through taking the following actions:

- To talk and discuss the cause and location of the injury, previous injuries, the nature of the pain etc.,

- To conduct a visual observation of the athlete and the injured area, checking for deformity, swelling and redness, comparing two sides of the body. If some deformity was found, it indicates a



fracture or serious ligament/tendon damage and the medical treatment should be given immediately;

- To perform palpation with hands and fingers on the injured area without moving it and healthy side to compare and identify the differences in bone shape and skin temperature. Also, the pain evaluation of touching the injury should be done, if the pain is intensive, the injury is serious and medical assistance is essential. If the pain is slight, the next stage of diagnosis should be followed;

- To test the athlete's ability to move the injured part and observe the extent of the movement and the intensity of the pain, compare it with the movement of the healthy part, feel the injured part while moving for checking for any clicking or grating. If the movement is highly painful and minimum in its extent the medical assistance is needed;

- Reaching this stage means that the injury is not serious, next the first aider should move the injured area of the athlete to evaluate the level of pain, if the range of pain-free movement is normal the injured athlete should be asked to stand;

- To test the required skills for a particular sport and estimate the level of pain, if all required actions can be done by the athlete, he can be resumed to the game or competition [1, 2, 3].

Thus, knowing the types of injuries and the assessment approach, for further development the preventive measures and the treatment program of injuries should be stated. The generally accepted within scholars, practitioners and used for different types of soft-tissue injuries RICER treatment program includes the stages of rest, ice, compression, elevation and referral.

The rest stage states that the first 48 to 72 hours the injured area should remain relatively inactive, the duration of this stage depends on the nature of the injury.

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the injured areas. The next stage is to elevate the injured area higher than the level of the heart, which will decrease the volume and pressure of blood flow resulting in minimizing the possible inflammation. The final stage of the treatment program is on the referral that states that medical assistance should be given to the athlete to examine the injured part and to provide appropriate rehabilitation [25].

Ankle sprains: sportsman with an ankle sprain will benefit by using walking boot to strengthen the support of the ankle, also the exercises aimed at restoring the strength, range of motion and flexibility, balance should be done. Normally the recovering time ranges between 1-3 weeks (lateral ankle sprains) and 3-6 weeks (high ankle sprains). In addition, applying taping on the ankle and a brace for support lead to a risk reduction of an ankle sprain and prevent re-injury [1, 2, 26].

Anterior cruciate ligament of the knee injuries: to develop the proper nerve/muscle control of the knee by applying plyometrics, balance and strengthening/stability exercises. Plyometrics exercises aim firstly on lengthening a muscle then on shortening it in order to increase the muscular power of an athlete. Balance exercises can be done with the use of wobble or balance boards or by doing some movements required for a particular sport while balancing on one leg. Strength and stability oriented exercises can be performed by as jumping and landing on one leg with the knee flexed and later immediately holding that position. The mentioned exercises can prevent or reduce the risk of noncontact anterior cruciate ligament of the knee injuries or re-injuries [26].

Overuse injuries: the treatment program for overuse injuries includes: reducing the intensity, duration and frequency of trainings; applying a hard/easy workout scheme and cross trainings with other activities to keep the fitness level; providing educational activities on proper trainings and techniques; applying proper warm-up activities before and after the main trainings; using ice for treating minor aches and pain. In order to prevent the overuse injury the following recommendations should be taken into account, namely: the training program can be increased by maximum 10 % per week, otherwise, the athlete's body will not have enough time to recover and respond in the adequate way; to start the training with warm up activities and to finish with cool down activities; to include strength training, increasing flexibility, and improving core stability activities in the training program; to discuss the risks of getting the overuse injuries with a trainer and a sports medicine specialist; to modify the training program to maintain



the fitness level during the period of recovering from the previous injuries [12, 13, 26].

Superior labrum anterior posterior (SLAP) tears: SLAP tears can be prevented by improving the balance within the shoulder by applying exercises focused on strengthening the muscles around the shoulder blade and stretches aim on preventing a tight posterior shoulder [27].

A stress fracture: the treatment of a stress fracture starts with a rest period (1 to 6 weeks) with limited weight bearing activity increasing to full weight bearing. While returning to normal load of activities low-impact sports such as swimming and biking can be used to remain the cardiovascular conditioning. When the low-impact activities can be performed for longer period of time comfortably and without pain, the athlete can turn back to the high-impact activities. As a rule, the athlete is gradually increases the duration and intensity of low-impact activities till reaching the state, when the athlete can perform the high-impact activities without any pain. According to the American Academy of Orthopaedic Surgeons, there are practices that help to prevent stress fractures, namely: starting a new sport the athlete should set up goals gradually depending on the personal characteristics; following the cross-training principles of training by combining different activities that accomplish the same fitness goals mixing with some strength training and flexibility exercises; ensuring having the healthy diet, consuming calcium and vitamin D rich foods; using of proper equipment; to stop the activities and to have a rest for a few days if the athlete has some pain or swelling occurs; the athlete should be aware about the risk of injuries and be able to recognize the symptoms early in order to start treatment on time and ensure the successful returning to sports at a normal level [6, 20, 23].

In the context of the methods of treatment and prevention of injuries the two main social factors affecting injury recovery should be studied in details. The first one is the patient-practitioner interaction, in particular between the athlete and the trainer/ sport physiotherapist. The studies have shown that building trustful relationship by keeping regular contact, showing acceptance, genuineness, and empathy between an athlete and a sport physiotherapist increases the efficiency of the treatment. Moreover, the realistic expectations of the physiotherapist based on the pace of recovery is important in developing the athletes' rehabilitation motivation, the clear communication on the methods,

ways to control the pain is also crucial in motivation and forming optimistic feelings [7, 28, 29, 30, 31].

The second factor is the social support, according to the studies, social support and assistance from sport medicine practitioners, trainers, teammates and family is vital in building the athlete's flexibility and stimulating adaptive coping. As a rule, the social support is giving while communicating and listening, discussing the advances in rehabilitation process, providing emotional support and encouraging positive coping and future rehabilitation goals, sharing the practitioner's/trainer's own experience. Moreover, the continuing contact with the team members allows injured athletes to feel confident and belonging to the team and do not feel isolated and falling out of the previous normal sport routine, which provides emotional support to go through the recovering process [8, 9, 10, 32, 33].

Conclusions

The systematic analysis of current scientific literature allowed to develop an injury-treatment cycle model, which highlights the importance of a proper implementation of each presented stage, namely: acknowledgment and following the existing preventive measures reduce the risk of injury; well-developed training program and training conditions can minimize the risk of injury; an adequate assessment approach helps to identify the type of injury and to select the needed recovery program; correct and complete recovery eliminates the probability of re-injury of athletes.

The study shows that the impact of psychological and emotional factors on the risk of +8injury and the recovering process is in the stage of developing and additional empirical studies are required to enrich the existing literature.

Among the key recommendations in order to minimize the risk of injury in athletes are: to promote the spreading of information on possible ways of injury prevention; to provide educational services for those who are involved in sports and other physical activities; to spread the information about the main types of injury and the treatment approaches to make athletes familiar with that, which can increase their competence and reduce the fear of injury; to stimulate communication and interaction between teammates, with their trainers and coaches during the period of recovery to eliminate the level of isolation of injured athletes.



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