The use of professional artificial turf for ski slopes as an opportunity to improve the efficiency of the training process of cross-country skiers

UDC 796.9

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Abstract

Objective of the study was to scientifically substantiate the use of artificial turf, which replaces snow, based on the analysis of changes in the kinematic characteristics of the ski course during the movement of an athlete.

Methods and structure of the study. A comparative characteristic of the biomechanical structure of the athlete's skiing was carried out with a change in coverage according to the following criteria: speed, length and frequency of steps, the time of performing the phases of the cycle of movements, angular characteristics during the period of squatting and repulsion of the skier, angular velocities of movement in the joints were calculated. An analysis was made of the change in the kinematic characteristics of the running technique using the example of a simultaneous two-step skating run.

Results and conclusions. When an athlete passes a distance in various modes (training, competitive), there is a slight change in the kinematic characteristics of the course and, as a result, changes in the ratio of various modes of work (inferior (squatting), overcoming (repulsion) of work and relative relaxation). In the training mode under conditions of natural turf, the ratio of biomechanical characteristics has the form - 0.25:0.33:0.40, in conditions of artificial turf - 0.27:0.35:0.46. In the competitive mode, under natural turf conditions, the ratio of biomechanical characteristics is 0.24:0.24:0.36, under artificial turf conditions - 0.24:0.26:0.42. Thus, with the correct location of the ski treatment zones with a gliding compound, the skier / biathlete will not experience critical technical and biomechanical changes in the technique of movement when using artificial turf, which will make it possible to organize the training process at the preparatory stage of training athletes in conditions as close as possible to the competition. preparation stage.

Keywords: *cross-country skiing, artificial turf, snow, biomechanical structure, skiing, highly qualified athlete.*

Introduction. The training of cross-country skiers is characterized by the maximum intensification of the training process, which allows developing special motor abilities and achieving high performance indicators of the functionality of the main energy supply systems, but this is not enough to win the highest awards at major international competitions [1]. The competition in cross-country skiing is currently so high that only a scientifically substantiated, purposeful and individually oriented system of training high-class athletes will achieve the required results in major competitions. The preparatory period becomes especially important with a high intensification of the competitive period. Since it is in the preparatory period that the athlete maximizes the physical, functional and technical potential, which is realized in the competitive period [2]. The reduction of the preparatory period due to the lengthening of the competitive period for highly qualified athletes requires an increase in the intensity of the load during the preparatory period, therefore, the volume of special training increases. But to organize the training process in this form, snow is needed. And many athletes have been skiing for a long time in the summer. But in the Russian Federation there are no specialized bases where there are non-melting snows, and at present our athletes do not have much opportunity to train at such facilities outside our country. Not enough in our country and snow “pipes” (only in St. Petersburg), as well as tracks with artificial snow (only in the Tyumen region). Therefore, a search is currently underway for special coatings for basic ski stadiums. And one of the possible solutions to this problem can

be “SNOWPLAST SKI” - a professional artificial surface for ski slopes and ski slopes, which allows you to triple the seasonality of a sports facility and provide skiers with high-quality training in a non-snowy period. The design is formed from a special polymer composition with a matrix structure and multi-level pile, imitating freshly fallen soft snow. Such a track can be used year-round, in contrast to artificial snowmaking, and provides the possibility of a more effective training process compared to the use of roller skis, which violate the technical structure of the ski course.

Objective of the study was to scientifically substantiate the use of artificial turf, which replaces snow, based on the analysis of changes in the kinematic characteristics of the ski course during the movement of an athlete.

Methods and structure of the study. The study of artificial turf, which replaces snow, was carried out at the state autonomous educational institution of higher education “Moscow State University of Sports and Tourism”. The study involved a highly qualified athlete - an Olympic champion. The participant of the project (reference) had to cover a distance of 300 m, including sections of artificial and natural snow. A comparative characteristic of the biomechanical structure of the ski course was carried out with a change in the coverage according to the following criteria: speed, length and frequency of steps, the time of the phases of the cycle of movements, angular characteristics during the period of squatting and repulsion of the skier, the angular velocities of movement in the joints were calculated. An analysis was made of the change in the kinematic characteristics of the running technique using the example of a simultaneous two-step skating run.

Results of the study and their discussion. The nature of the work of the muscles in a simultaneous two-step course is determined by the degree of muscle fatigue, the state of the route, the length of the distance and the specific ascent. But the biomechanical characteristics of high-class athletes do not differ significantly from each other, they are carefully studied and are characterized by certain kinematic features that distinguish them from athletes of lower sports qualifications [3]. Our studies have shown that the athlete passed the distance on the natural surface with the preservation of the biomechanical characteristics of the ski course, which indicate a high level of his training (see table). In the training mode, the standard showed a speed of 2.64 m/s, the average rate of cycles per minute was 50. The leg was bent at the knee joint up to 108° when performing a step with repulsion, the squat was performed for 0.25 s against the background of an increase in the angle at the knee up to 120°. Before the ski took off from the snow, active repulsion lasted 0.33 s, the angle at the knee joint increased to 157°.

Progress on the artificial turf in the training mode caused a slight change in all of the listed biomechanical characteristics. The speed of movement remained almost stable (4% decrease), but the duration of the cycle increased by 11%. The angular characteristics in the knee joint slightly changed when the cover was changed - while the angle in the knee joint was preserved during the setting of the leg and the end of the repulsion, the angle in the knee joint slightly increased during the squat - from 120° to 123°. An increase in the duration of the repulsion and the period of squatting was also recorded. The ratio of different modes of work (inferior (squatting), overcoming (repulsion) work and relative relaxation) in the course cycle in the training mode on natural surface was 0.25:0.33:0.40. The ratio of different work modes (inferior, overcoming work and relative relaxation) in the course cycle in the training mode on artificial turf was 0.27:0.35:0.46.

The analysis of the kinematic indicators of the ski course during the movement of the standard on different surfaces at competitive speed showed that the dynamics of changes in the biomechanical characteristics of the course remains similar to those changes that were recorded in the athlete when passing the

Kinematic characteristics of repulsion in a simultaneous two-step skating while passing a distance

Indicators		In the training zone		In the competitive zone	
		Artificial turf	Natural turf	Artificial turf	Natural turf
Speed, m/s		2,55	2,64	3,4	3,6
Cycle duration, s		1,08	0,98	0,92	0,86
Angle in the knee joint, degrees	Foot position	109	108	123	123
	Squatting	123	120	119	114
	End of repulsion	157	157	151	150
Duration, s	Squatting	0,27	0,25	0,24	0,24
	Repulsion	0,35	0,33	0,26	0,24

distance in the training area. On artificial surface, the speed decreased by 6%, the duration of the skiing cycle increased by 8%, the angle in the knee joint during the squat increased by 5%, and the duration of the repulsion increased by 8%. The ratio of different modes of work in the stroke cycle (inferior, overcoming work and relative relaxation) in the competitive mode on natural surface had a ratio of 0.24:0.24:0.36. The ratio of different modes of work in the stroke cycle (inferior, overcoming work and relative relaxation) in the competitive mode on artificial turf had a ratio of 0.24:0.26:0.42.

Conclusions. In a comparative visual analysis of the skiing technique during the passage of the standard by the simultaneous two-step skating distances with natural and artificial turf, it was observed that the athlete makes great efforts to maintain the speed of passing the circles, which affected the change in the angles of attack and the time of passage of the technical phases. Such adjustments in the technical phases may be associated with a higher friction of the sliding surface of the ski on the surface of the artificial turf. Therefore, it is necessary to calculate the time after which the athlete needs to reuse a special silicone lubricant to reduce friction, which is applied to the surface of the skis before starting training on artificial turf. The solution to this problem is to install the wetting zones of the sliding surface of the skis on the artificial surface itself with this lubricant.

The results of the initial testing make it possible to conclude that the artificial surface is as close as possible to the natural snow cover. With the correct arrangement of the ski treatment zones with the gliding compound, the skier/biathlete will not experience critical technical and biomechanical changes in the technique of movement, which will make it possible to organize the training process at the preparatory stage of preparation in conditions as close as possible to the competitive stage of preparation.

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