THE BIOMECHANICAL BASIS OF CHANGING DIRECTIONS OF MOVEMENT BY PARALLEL TURNS IN SKIING

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(Professional paper)

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Abstract:

Change the direction on parallel placed skis, occurs by influence of external and internal forces. During the skiing, the skier-equipment system is affected more physical forces. One each for himself and all together, create the movement of skiers and cause the direction, speed and other characteristics of the movement. Action force is mainly related to the skiers desire to perform specific movements. During the execution of the above developments, some of the force at a certain point would negatively affect the stability and thus the safety of skiers moving down the slope, as will the next time they just enable the successful execution of movement. At a time when the relevant muscle groups get involved, occurs a change of direction of movement.By changing the direction of movement on parallel skis, lateral resistance is minimized, since the extremely reduced cross-sectional area (which is direct to the direction of movement), which is created during the removal of the longitudinal axis from the direction of the previous ski movement. This way of skiing (parallel christiania) requires an engagement of adequate muscle groups, while the strain is minimal.

Keywords: *lateral resistance, centrifugal force, friction, air resistance, internal forces*

Introduction

The tendency of the ski has always had the meaning that for the shortest time of movement, overcomes a certain distance.The time required to overcome a certain distance, is extended even more, because there are more change of direction of movement and vice versa. Assuming that the skiing in the relative straight line was correct from the technical point of view, the main causes of reduction of speed lies in method of change the direction of movement, and depend on the technical capabilities of candidates, ski equipment, snow quality and others. Change of direction of movement in the technique of performing ski elements or overcoming gate is the most complex ski movements. In the development of techniques of change the direction on skis, evident tendency is observed to reduce surface resistance.In performing parallel turns in skiing (change of direction of movement) it seems that the entire body is in total lateral flexion. Human movements are a set of movements in the horizontal plane. In the science literature, this method has appeared in Austria's ski school, and if the truth must be told that long ago many students overcome their teachers.

The subject of this paper presents the application of biomechanical basis for more successful overcoming the change of direction of movement in parallel turns.

The problem of this work is the use of external and internal forces for the successful overcoming of changing direction of movement in parallel

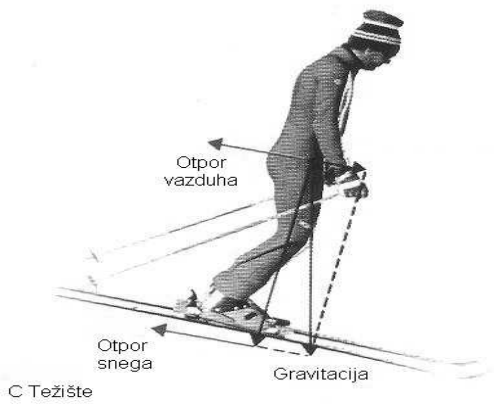
turns.

The aim of this paper is that with the implementation or use of biomechanical basis as well as specific methods that effectively overcome ski turn technique respectively change the direction of movement by parallel turns.

Biomechanical basis of the parallel turns

The performance technique of changing direction on parallel placed skis has a number of advantages and occurs by direct muscular action. At a time when the relevant muscle groups excluded from active operations, changing of direction of movement stops. If the swing is not adequate, change of direction would be insufficient or too large, which in both cases causes unnecessary muscle tension, which would reflect negatively on the speed of movement on parallel placed skis. This method of performance of change direction of movement on parallel placed skis requires the engagement of a small number of muscles and low strain intensity, where the lateral resistance is minimized.

During the skiing, on ski-skier equipment system is affecting more force: inertia, air resistance and resistance to snow, the focus of gravity, centrifugal and centripetal force of friction or resistance of snow surface (Figure 1).



Changing the direction of movement on parallel placed skis, causes a small intensity of the base resistance force, but the strength of resistance depends on:

- Radius of the path of movement
- The focus of skier-equipment system
- Mass and speed of movement (skiing equipment) and
- The quality of the snow.

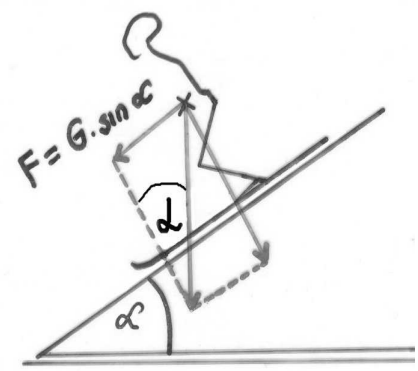
Intensity of the base resistance force grows to relatively large values, causing reduction of speed of skier-equipment system. Changing the direction of movement on parallel placed skis, is the result of effects of majeure force, which must be aligned so that occur naturally move in the curve line.

To make the system moving in curved line, on the focus (tt) of the system it should act two forces, whose lines each other closes angle that is greater than zero and less than twice the 90 degrees angle (0^0 180^0).

Of these two forces one needs to produce approximately the same motion, and the second equally accelerated motion.

Figure 2. The force, which produces approximately the same motion

Component of gravity force, which caused the slip of system of material dots down slope towards the longitudinal axis of skis (Figure 1). This force (F = G) produces a rapidly moving, but the acceleration gradually decreases due to friction with the ground and air resistance.



Acceleration of movement in the direction of longitudinal axis of skis depends on the acceleration of gravity and trigonometric functions sine angle, which closes the ramp with the horizontal.

Another force that produces equally rapid movement is also a result of gravity. It occurs with slope of system of material points, in the direction of the arc path at which will move the focus of the system during execution in the direction of parallel skis. The direction of action of this force is direct to the longitudinal axis of the skis, or direct effect on the direction of the first force.

It is similar the forced movement on the curve line, but in the natural movements (running) is much easier, for the simple reason that the leg

which is perform resistance could lead to a period of swing in the required space and correctly placed in the area of the new support, which is located in the area of the arc path.

However, during the parallel turn is not possible to separate legs of the substrate especially if the movement speed is high, and that this separation does not threaten the equilibrium position of material points during the parallel turns.

Moving skis on arc path, without separation of sliding surface of the substrate, can be done only if the longitudinal axis of the skis removes from the previous direction of movement.

Theoretically, this removal can be done in several ways:

Moving the tops of skis to the center of arc path;

Departure the tails of skis from the center of arc path; Due to the construction of ski places where the skies directly attached to the body skiers

And the fact that the moving down slope is almost always necessary forward incline, and third way is most economical.

Departure the tails of skis from the center of arc path.

The removal of the longitudinal axis of the skis from direction of the previous ski movement is executed using the external and internal forces. External forces, whose active influence departure the tails of skis from the center of arc path are gravity and centrifugal force.

Gravity (G), which acts to focus the body (TT), when you perform the slope of the material points to the center of the arc path, breaks down to two components: one component (R = G. SON) acts toward the center of support (A) of the skier and produces pressure on the ground, and the second (T = G. COS) operate with a tendency to overthrow in the direction of the center arc path (Figure 4).

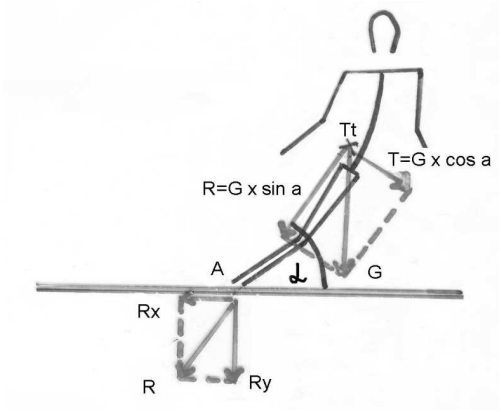
If the pressure component (R) past the point of support (A) and decompose into two projections, then one projection (Ry = R.sin) will be perpendicular to the steep surface and represent pressure on the surface, while the other (Rx = R. COS) will be parallel to the steep surface and with centripetal direction.

As the tops of skis is more loaded, with centrifugal force projection (Rx) is acting in terms of sliding and the more the tails of skis, which are less loaded, it just allows the movement of the skis on the curve line. From the form it is obvious that the sliding force will be greater if the ski slope is smaller, or ski slope in the direction of the center arc path higher.

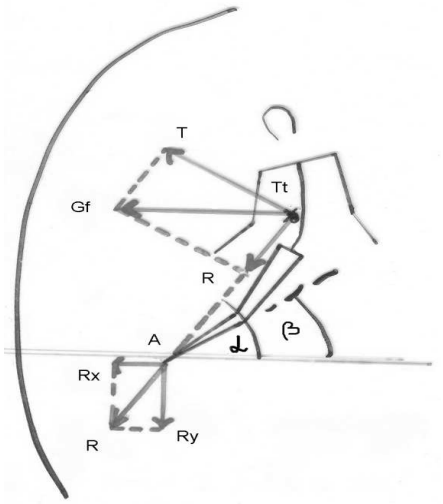
Simultaneously with decreasing slope angle increases and the component (T), this seeks to overturn a system of material points in centripetal direction. During the execution of christiania the basic problem is how to increase sliding of ski tails, and that the inclination of the body does not increase. Basically, this problem is solved by direct muscular action, but there is a possibility that external forces are used rationally in this respect.

If, when viewed in the front plane, the system of material points brake, i.e. if you later make a total flexion of locomotor device, then the individual choice of components of sliding, which are determined separately for each body part, be greater than if it is determined sliding component, which is due to effects of gravity, from the point of attack in the center of gravity

This is interpreted by the angle between the last segment of the locomotor device (lower leg) and the ground is smaller the angle between the line connecting the focus with the center of support and ground.Another external force that is able to actively influence departure ski tails from the arc path is centrifugal force.



This force is appears simultaneously with the appearance of body incline toward the center of the arc path and the appearance of centripetal force, which is a direct consequence of the incline. Centrifugal force (CI) is acting on the focus of the body (TT) parallel to the plane in which is perform change the direction of movement, with a tendency estrange from the arc path. Centrifugal force comes into play depending on how the edges increase or reduces the force of friction and pressure on the sliding surface of the substrate. The centrifugal force is due to the existence of support at the point



(A), breaks down the components of movement (T = Ci.sin) and component of pressure (R = Ci.cos)

As pressure is not equally distributed on a sliding surface, the centrifugal effect will be greater in the part of the surface of support, where the pressure is lower and that is part of the area of support that has been designated ski tails.

If the locomotor system is in the total side deviation, then the individual effect of centrifugal force on body parts appear more components of the pressure, i.e. a horizontal projection, which is the sum greater than the value of horizontal projection (Rx), which is determined by components of pressure (R), and caused the breakdown of centrifugal force.

Such muscular action (M) at the same time relieves the part of the sliding surfaces of skis, where there is direct contact body and the ski, as a result of the radial component (R), and estranges same part of the arc path, which is again a consequence of tangential components (T).

This unique movement started in the sagittal plane (compared to the locomotor device), continued in the front, and ends in a horizontal plane. Movement in the horizontal plane is made coordination more synergistic muscle groups and that with active influence of muscle which is turning inside in hip and knee external legs and muscle which is turning into the scope of hip and internal leg knee. At the same time in the external leg ankle supination is performing, and in the external leg ankle pronation is performing. It should be noted that the movement of supination and pronation in ankles is related to the movement of revulsion and attraction so that these movements are made unique effect of synergistic muscles.

By this ski tails are departed from the arc path, and the ski tops are approached the center of the path, but as the front of the ski pressure is fixed to the surface so that the side sliding is quite difficult, shall be made only change the direction of removing tails of skis.

Inner leg does not have so significant and immediate function in chaining of direction of movement, so that the effect of muscle basically reduced to maintain a parallel relationship with the outer ski.

In relation to training, to keep in mind that the caudal part of the body open end of the kinetic chain, and all the muscles above whose influence exercised pressure with your feet in the scope and turning in the horizontal plane, act with concentric contraction with the central support, which is determined by the basic characteristics of exercise, who need to prepare the body in order to access or training to change the direction on parallel placed skis or for the purpose of training.

Conclusion

Successfully overcoming of changing directions of movement by parallel turns is cause by of technical, tactical and physical abilities and mental firmness with the necessary knowledge of the specific biomechanical forces, acting on the skier-equipment system (gravity, the force of friction, centrifugal and centripetal, equally rapid movement, etc.). Harmonization of these forces can be successfully overcome of changing directions of movement by parallel turns

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БИОМЕХАНИЧКИ ОСНОВИ НА ПРОМЕНАТА НА ПРАВЕЦОТ ПРИ ДВИЖЕЊЕТО НА ПАРАЛЕЛНИОТ ЗАВОЈ ВО СКИЈАЊЕТО

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(Стручен труд)

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Апстракт:

Промената на насоката на движењето на паралелно поставените скии се појавува дејството на надворешните и внатрешните сили. Во текот на скијањето, на системот скијачопрема дејствуваат повеќе физички сили. Тие секоја за себе и сите заедно го создаваат движењето на скијачот и ја условуваат насоката, брзината и другите карактеристики на движењето. Дејството на силите, главно се поврзани со желбата на скијачот за изведување на одредено движење. За време на тоа движење, некои од силите во одреден момент негативно се одразуваат на стабилноста, а со тоа и врз сигурноста на движењето на скијачот низ падината, додека во следните моменти, заправо тие овозможуваат успешно изведување на соодветниот скијачки елемент. Во моментот кога соодветните мускулни групи се ангажирани, се создава промена на насоката на движењето. Притоа, кај паралелно поставените скии, бочниот отпор е сведен на минимум, бидејќи изразено се намалува површината на попречниот пресек. Овој начин на скијање (паралелна кристијанија) бара ангажирање само на адекватните мускулни групи, додека напрегнувањето е минимално.

Клучни зборови: *тежиште на телото, земјина тежа, бочен отпор, центрифугална сила, триење, отпор на воздухот, внатрешни сили*