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PRESENT AND PERSPECTIVES OF CLASSICAL TECHNIQUES IN CROSS-COUNTRY SKIING

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Abstract

In the last few years has been observed a progression of riding techniques in the cross-country skiing race, which cause to speeding up this kind of skiing. Technical changes are recorded especially for the classic cross-country skiing techniques, specifically for double poling. The article surveys the history and current status of classical techniques, it describes the significant researches which are dealing with progression of double poling and it's trying to forecast future developments at the same time. The result is an ascertainment that prestige of double poling is growing and with a development of training and increasing speed of run will grow also its share in overall usage of race track.

Key words: cross-country skiing, classic technique, double poling

Souhrn

V závodním běhu na lyžích dochází v posledních několika letech k progresi techniky jízdy a tím i ke zrychlování běhu na lyžích. Technické změny jsou zaznamenávány zejména u klasické techniky běhu na lyžích, a to u soupažného běhu prostého. Článek mapuje historii a současný stav klasické techniky, popisuje významné výzkumy zabývající se problematikou progrese běhu soupažného prostého a současně se snaží o prognózu dalšího vývoje. Výsledkem je zjištění, že nadále roste význam soupažného běhu a že

s rozvojem trénovanosti a rychlosti běhu se nadále bude zvyšovat i jeho podíl v celkovém použití závodní trati.

Klíčová slova: běh na lyžích, klasická technika, běh soupažný prostý

Introduction

In the last few years we have witnessed a great progression of double poling and kick double poling in cross-country (XC) skiing races and increasing proportion of their utilization on race track. Top long-distance runners use double poling for more than 80% of a track - depending on length and profile of a track. For example run of Vasaloppet or Marcialonga, where racers use ski without rising wax and they use double poling even in parts of track where the average uphill is overreaching 12% (Larsson, 2011). Also standard track runners use double poling during their races more. The question that arises is: what will be the development of using these two styles of classic technique run and will the diagonal stride appear in ski races even after year 2020? This article tries to reflect the current status of classic technique and perspective of utilization of diagonal stride and double poling on race track.

Methodology

The method we chose to compile our overview article was content analysis of available literature dealing with ski running issue. We concretely aimed at sources dealing with classic technique.

Classic technique

When cross-country skiing, it is necessary to overcome various terrains. Being able to overcome it, it is required to handle a number of abilities, which we expertly call XC technique. This also includes basic ski running styles, where classic technique and skating belongs (Gnad, 2006).

In our report we aim at classic style of ski running, which is also professionally called classic technique. The classic technique was developed from primary human locomotion – walking and it related to origins of ski sport (Bolek, Ilavský, & Soumar, 2008; Kulhánek, 1989). The classic technique is characterized by parralel skies position during bounce and slide. In classic technique there are used two basic styles. It is diagonal stride and kick double poling.

During diagonal stride the bounce is executed from the whole rail track. The prop to realization of the bounce is the middle part of the rail track, so called kick zone, which is furnished by rising wax. When the ski is fully weight, crystals from kick zone get through the snow and allow the realization of bounce. When using this cross-country technique, legs work in turns with alternate tapping of poles. (Bolek, Ilavský & Soumar, 2008; Gnad, 2006).

The kick double poling us used especially on flat terrain and downhill trail. When using this cross-country skiing, double pole take turn with bounce of one leg, with synchronic alternating of slide in one-prop and two-prop stand (Ilavský & Suk, 2008; Gnad, 2006).

Double poling

Double poling is a special XC technique which is closely associated with classic technique and it is used very often during ski races. Some authors (Bolek, Ilavský, & Soumar, 2008; Gnad, 2006) classify double poling as an accelerating technique. On the other hand Linnamo, Komi & Müller (2007) consider double poling as a part of XC technique. Dynamics of skier is created by involvement of arms and torso muscles, which is typical for this cross-country technique (Linnamo, Komi, & Müller, 2007). The latest researches (Holmberg, Lindinger, Stöggl, Eitzlmair, & Müller, 2005; Zory, Vuillerme, Pellegrini, Schena & Rouard, 2009) prove, that importance of

double poling in ski races is still increasing and that also muscles of hip joint and downer limbs are involved.

The importance of double poling in modern ski races is increasing approximately last twenty years. In 1997 Saltin adverts to progressive development of speed in ski races when using particular cross-country techniques (Saltin, 1997). It is caused by several important factors. Above all, it is caused by better preparation of ski rails, improving technical and technological attributes of skies and poles and improving attributes of waxes (Hoffman & Clifford, 1992; Smith & Holmberg, 2010). The most significant influence had, according to number of studies (Hoffman & Clifford, 1992; Smith & Holmberg, 2010), the the creation of new technique – skating and also subsumption of sprinting disciplines. These sprinting disciplines brought changes not only in training of muscle abilities and endurance (Hoff, Gran, & Helgerud, 2002; Smith & Holmberg, 2010), but also in technique of performing, for example skating V2- one state double pole and classic technique double poling (Holmberg, Lindinger, Stöggl, Eitzlmair & Müller, 2005; Sandbakk, 2011).

Double poling and its progression

As it was mentioned above, the first changes in double poling technique were recorded on a turn of 20th and 21st century. At first were technical differences noticeable at sprint ski racers and then also at long run ski racers (Jakl, 2009). It was claimed, that it is so called “sprinting form” of double poling, which was used after start, on a flat terrain, when forerunning an opponent and when finishing. The sprinting form differs from double poling in higher frequency of poles tapping, more upright torso stand in tapping phase and mainly in developing a greater force in a shorter time period and earlier tapping phase finish (Ilavský & Suk, 2005; Nilsson, Tveit & Eikrehagen, 2004).

Some pieces of knowledge about the “sprinting form” of double poling were brought also by Holmberg, Lindinger, Stöggl, Eitzlmair and Müller (2005) study. A group of 11 swedish junior representatives was divided on the basis of performed double poling technique into two groups. One group was made of skiers who use traditional double poling – outstretched arms in phase of tapping with participation of torso without significant flex of lower limbs joints. The second group was made of skiers who use sprinting form of double poling – elbows slightly away from the body when starting a phase of tapping, more significant flex in elbow, knee and astragalar joints in phase of main stroke. The group that used the sprinting form of double poling reached better results in measured tests. These racers had much more effective start and first third of double pole cycle than the group that used traditional double poling technique. The difference was also in flexion and extension of elbow joint in the phase of tapping the pole and directing it. Racers who used sprinting form of double poling digged their poles with an elbow angle 90° and then, in a phase of tapping, it reduced to 45° which allowed them to give more power to their pole and therefore gain better acceleration than racers who use traditional double poling. (Holmberg, Lindinger, Stöggl, Eitzlmair & Müller, 2005). The application of this double poling technique is demonstrated on picture 1.

Picture1 Sprinting form of double poling (Nosek, 2012)

The kinematic issue of double poling was dealt with in study of Stöggle, Lindinger a Müller (2007). The aim of their wide research was a multiple analysis of physiological reactions, a recision of relations between kinematical and physiological variables of sprinting performance and verification of hypothesis, whether the maximal speed of double poling and diagonal stride correlates with a sprinting performance. 12 elite ski racers were tested and took a simulated race in classical technique sprint. The results prove that the faster double poling skiers used its sprinting form with the same stroke frequency but with a greater power effect then the slower ones. This indicates the importance of power abilities and also confirms the fact, that technique of upper limbs, torso and downer limbs influences the speed of classical technique sprint.

This fact is also confirmed by another, two years younger, study of Stöggle and Müller (2009). They were dealing with a period of double pole cycle. They observed how the abbreviated time of tension and prolonged time of panache influence double poling maximal speed. Test was participated by 24 Austrian elite ski racers. The results proved that the phase that most influences speed is the first phase of tension (0,30s), when poles are digged into surface with a great impulsion. The followed tapping phase is recovering phase (Stöggl & Müller, 2009). This is also affirmed by Nilsson, Tveit and Eikrehagen (2004) research. They found out that the period of double pole cycle is practically the same, but by more impulsive tapping skier accelerate the whole motion (Nilsson, Tveit, & Eikrehagen, 2004).

The abbreviation of tension is confirmed also by last published research of Austrian-Swedish research team (Lindiger, Holmberg, Müller, & Rapp, 2012). This research tested 13 elite skiers neuromuscular activation of major muscles involved in double poling by EMG. During the test of double poling on treadmill, executed on roller-skies, they aimed at involvement of selected muscles in different phases. The research affirmed the

abbreviation of tension time in the first third of tapping phase of the fastest runners, especially for triceps brachial (m.triceps brancii), and also high dependence on maximal performance and maximal strenght.

XC technique perspectives and use of particular styles of classic technique

According to researches (Lindiger, Holmberg, Müller, & Rapp, 2012; Smith, & Holmberg, 2010; Stöggl, Lindinger, & Müller, 2007; Stöggl, & Müller, 2009) it is evident, that double poling technique is very important speed factor. Researches show, that major significance of this sprinting technique is in sprinting disciplines. The key to success of the fastest skiers who use double poling is acceleration in first third of tension and abbreviation of the last phase. When look on sprint races of world cup, you do not see any competitor who does not use this technique. It is also sure, that it has significance even in other ski-running disciplines. During the last years also standard distance competitors of world cup use this technique more often. It is more and more common that competitors deal with collective start and according to very equal efficiency also collective finish. With the increasing speed and high fitness of the “sprinting” double poling technique is more or less settled in a ski platoon and most of top skiers use it. The proof is finishing of Peter Northug and other, especially Norwegian and Swedish, competitors.

It can be assumed, that significance of double poling will be increasing in the future even as a share of this XC technique and using other XC techniques, like kick double poling and diagonal stride, in overall track distance. Here we can see also possibilities for further research, because by this time there is no published issue about share of particular XC-techniques of particular competitors in different parts of a race track. However, we expect that in the World Cup races on standard tracks with a wavy profile the significance of double poling will be increasing even in the future but

diagonal stride won't disappear and it will be a faster way to get through steep uphill and simultaneously the kick double poling will be more effective on a flat parts of race track.

It can be assumed, that in Worldloppet long distance races will be double poling still major cross-country technique and its application within the whole track will increase even in races with relatively wavy profile. Competitors will still apply glider on their skies and they will use grip wax only in races with high uphill share like Norwegian Birkebeinerrenet.

It should also be noted that double poling technique is closely related to power endurance capabilities of competitors and their high fitnessThis is why it is performed mostly by male competitors. Women use double poling technique less but, as well as for men, it can be assumed that there will be an increasing progression of this technique in women races.

Perspectives of double poling in training practice

The importance of power endurance capabilities and double poling technique was mentioned more than 10 years ago in many publications and studies (Hoff, Gran & Helgerud, 2002; Kulhánek, 1989; Mahood, Kenefick, Kertzer & Quinn, 2001; Saltin, 1997). In 70s of the 20th century the importance of power capabilities was realized by competitors and coaches of, that time, Soviet Union. They called it "Soviet power-frequency school". It was typical by its usefulness, increased frequency of motion and especially by its power concept of movement, which brought higher application of double poling, its modifications and also increased share of strenght training of competitors (Gnad, 2006). As it was mentioned above, another break in the conception of this technique and the related changes in strength training was brought by the invention and introduction of skating sprint races. The research of Holmberg, Lindinger, Stöggl, Eitzlmair and Müller (2005) shows that muscles are involved in double poling with sequential effect. First is m.

rectus abdominis, m. obliquus externus and internus abdomini and trun flexor like m. quadriceps femoris. Furthermore, the effect is made by muscles of cingulum, like m. latissimus dorsi, m. teres major and m. pectoralis major. In the last phase then muscles of arm and forearm are involved – m.triceps brachii and m. flexor carpi. Also muscles of lower limbs are involved in sprinting form of double poling (m. quadriceps femoris, m. gluteus maximus, m. biceps femoris, m. triceps surae and also m. tibialis anterior). This clearly show, that strength training of race skiers must be comprehensive with special training equipment such as double poling on roller skies and cross-country skies. Various types of simulators, which imitate work of muscles that are involved in double poling, should definitely be a part of cross-country skiers training, which is also proved by study (Wisloff & Helgerud, 1998). The proportion of strenght training of adult racers should be more than 30% in one year training cycle.

Conclusion

In the introduction of this article we asked ourselves two questions. What will be the development of two basic styles of classical technique and will ski racers use diagonal stride also after year 2020? We suppose, that the significance of double poling will be still increasing in future and with the development of training and run speed will also grow its utilization on race tracks. However, in World Cup races the double poling wont replace diagonal stride completely and it will be used also after year 2020. Other situation will be in long distance Worldloppet races, where this cross-country technique already completely replaced diagonal stride.

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