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EFFECT OF LOCAL VIBRATION ON ROAD CYCLISTS

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Abstract. *In sprint distance probably the most important factor for a good result is the athletes achievements in power of cycling, because the athletes, who ride with a very high frequency, but cannot put in a cycle solid force in competitions. Consequently is need for new resources or means to increase the strength expressions, to be able to compete successfully with high-level athletes. One of such is the local vibration. In our study we use the local vibration in development of cyclists strength expressions and power the aim of study is to determine influence of local vibration on cyclists peak anaerobic power. The subject of study is 15years old 2 cyclists. To carry out experiment, we arranged both cyclists, was made an anaerobic power test, when the athletes were given an unlimited time to warm up and achieve the highest possible power. Maximum power test results before the local vibration showed that the average power of the test group was 906 W, after application of local vibration peak power was 975W. A study has confirmed our allegation that application of local vibration can significantly improve the results of sprint cycling. Local vibration as an innovative training mean has proved its reliability in training process, as the random-level athletes improve their anaerobic power.*
Keywords: *anaerobic power, local vibration, cyclers.*

Introduction

Many scientists like been interested in the possibilities of increasing cyclists' movement speed. Most of researches are based on oxygen maximal consumption and other physiological characteristics during load. Cadence frequency in different tracks having various terrain is stated (Nilsson, 1977). It is proved in many researches that movement speed depends on cadence frequency and the chosen gear at the definite stage of the track. Cyclists show the most speed in individual races where movement speed is determined by the body core, as well as the leg muscle strength. Therefore, the back, abdomen and leg muscle strength

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plays especially great role in cycling. Taking J. Nilsson's and other research as the basis, it can be concluded that according to different biomechanical structural changes in cyclists' technique exactly cadence frequency is one of the determining factors to increase movement speed. It is considered that having different asphalt surface, air temperature, air humidity and the peculiarities of tire rubber composition speed can be different. Local vibration is used in the world as one of the parts of innovative training means, it helps athletes renew and prepare for a new training faster. The aim of the pilot study is to find out the acute impact of local vibration on cyclists' improvement of strength and cadence frequency.

Literature review

In sport mechanical vibrations are applied as a means of massage, and as a type of training as well. For many years vibration trainings are used as a training means, and earlier vibration had two objectives: vibration stimulation were applied to increase strength, and separate bio-motor ability using all body vibration platforms was increased quite successfully. If vibration as a kind of massage and rehabilitation means has been already known for many thousand years, then vibration as a training means is a quite new thing. Researchers have stated that vibration in sports has two forms of impact: the first is linked with acute or immediate effect, but the second with long term or chronic effect variant, which today is called as vibration trainings, carried out with the same conditions like all other means realized in sports (Siegmund, Barklty, Knapp, & Peer, 2014). The attempts to combine vibration loads with traditional strength trainings with the purpose to achieve greater increase of the work capacity of the neuro-muscular system than only using classical strength trainings have already been carried out comparatively long ago (Souron, Besson, Lapole, & Millet, 2018).

Recent research gives notion about the fact that vibration trainings both in acute or chronic form have explicitly positive effect on strength and power expressions in athlete whole preparation process. If it is considered that vibration is a constant component of a training means, then vibration effectiveness in strength and power expressions, and not only, depends on vibration load characteristics, and they are as follows: a kind of vibration realisation or application, the frequency of oscillation waves and amplitude. The classical load formation regularities – a kind of training, intensity and amount have an essential role, too. Vibration frequency and amplitude are load effect values with what vibration affects the neuro-muscular system with the purpose to improve an athlete's body ability to increase the total work capacity. It is already proved in many scientific conclusions that as a result of the vibration training not only strength and power expressions increase, but also flexibility or movement amplitude, movement coordination, balance successfully improve, movement and

moving speed increases, athletes' ability to focus attention on training loads and competition activity increases.

However, at the present stage of the research process scientists have made the main conclusion that for the present the vibration trainings give the best effect in the field of strength and power expressions. It is pointed out in the scientific publications that the vibration frequencies of 30-50 Hz range have the greatest effectiveness on the neuro-muscular system (to optimise strength and power expressions). Only vibration platforms, where only the whole body vibration which is considered as the vibration of indirect effect is provided, can give the frequencies of such a range. It has smaller effectiveness than the direct or local vibration, where vibration is applied to definite muscle or its tendon, and it has essentially bigger effectiveness (Curt, 2015). In the case of the direct or local vibration the vibration frequency is significantly bigger (>100 Hz), but the amplitude is smaller (1-4 mm).

So, each of these various vibration forms affect muscles in different way, and wherewith vibration has different effect on training effectiveness (Souron, Besson, Millet, & Lapole, 2017). To get greater effect in strength and power development, it is not enough to increase the intensity and amount of vibration loads used in trainings or to increase vibration frequency and amplitude (Krauksts & Ņemčenko 2011). Firstly, excellent general and special physical condition should be provided then in the training process vibration should be included as a means of training. To state every athlete's individual methodology of vibration trainings during the application of vibration it is necessary to observe the athlete and communicate with him/her. Although the methodology of vibration trainings is worked out the same for all athletes, the strength of vibration application is different.

Methodology

Two Riga cyclist school (RCS) trainees' anaerobic power were stated experimentally applying test exercises on the cycling-ergometer Watt Bike. Test exercises were filmed in movement laterally using the digital camera GoPro 7 (200Hz). The obtained video material was processed using video analysis program Swing It. Then followed mathematical procession and analytical analysis of the obtained data. Local vibration trainings were carried out applying Vibromassager WM-1, S/N09/01 (see Figure 1), with frequency 100 Hz, amplitude 2 mm and variative pressure on the muscles *m. Erector spinae, m. Quadriceps femoris, m. Biceps femoris, m. Semitendonosus, m. Semimebranosus, m. Triceps surae.* The time of local vibration was 10 min followed by 30 min long passive rest. The experiment was held on December 2, 2019 and December 6, 2019 in Latvian Academy of Sport Education (LASE) laboratory. The air

temperature was 17 C, the air humidity 62%. The test exercises were performed on the cycling-ergometer Watt Bike and pushing from lying position with feet in the training machine.

Figure 1 ***Local vibration device Vibromassager WM-1, S/N09/01***

Research results

Athletes' speed and movement frequency – pace – is limited by their technical proficiency. High quality technical condition is characterized by the body lever, condition easiness and economy, a good neuro-muscular coordination, what impacts effective energy realization and a bigger movement speed. Speed is determined not only by mobility and well-synchronized neuro-muscular possibilities, but also movement frequency– pace, realized by precise nerve impulses and strong contractions. Therefore, fast and explosive movements should be guaranteed by high level power expressions. Strong concentration is a very important factor to achieve big speed.

Cyclists' cadence frequency average per 1 minute is from 120 - 180 rotations. For both of RCS trainees after local vibration application to muscles result increase was observed. In anaerobic power test where muscle power when riding the cycle ergometer Watt Bike was stated, both participant result before local vibration was determined. The first participant's result was 834 W, but the second one's was 978 W. After the application of local vibration, the first participant's result was 881 W and the second one's was1069 W. So, the result increase of both was significant: for the first participant it was 47 W, and for the second 91 W. But in 10 second test cadence frequency increased a little. The first participant's result before local vibration was 35 rotations, but after local vibration 37 rotations. But the second participant's result was 33 rotations, and after local vibration 34 rotations. So, the result differences are small: for the first participant 2 rotations and for the second participant 1 rotation. When stating result differences in pushing with feet from the lying position the results of the first and

second participant before local vibration were 190 kg and 260 kg, but after local vibration they increased for the first participant 220 kg, and 300 kg for the second participant. For both participants the result increase was correspondingly 30 kg and 40 kg. When stating the result increase percentage, we can conclude that in the anaerobic power test the results of the participant is 9.3%, but of the second it is 5.6%. In 10 second cadence test the result of the first participant was 3%, and for the second 5.7%. But in pushing from the lying position the first participant's result was 15.4% and the second participant's result was 15.8%.

Discussion

Scientists when researching the role of the local vibration (LV), total body and regional vibration on athletes work anaerobic power have obtained different results which reveal both the increase and also decrease of athlete work power. Analysing the research literature about the effect of the local vibration on athletes' work anaerobic power similar research was not observed, however, the total body vibration and how it affects cyclists' work anaerobic power has been researched. Scientists in their research have developed different methodologies of vibration trainings including vibration characterizing parameters: frequency, amplitude and the vibration application time in the training (Rhim, 2005; Luo, 2005; Kurt, 2015). Researching the trainees of RCS: 100 Hz frequency, 2 mm aplitude and 10 minutes training was applied what is accepted as optimal for LV trainings (Bongiovanni, 1990; Rittweger, 2000), and the most optimal amplitude is 4-6 mm (Abercromby, 2007; Cardinale, 2003; Fontana, 2005), but the vibration application time varies from 5 s to 30 min (Jackson &Turner, 2003), as well as the applied vibration pressure which is still not described, so it cannot be used for precise analysis of this value. Analysing different researches the methodology has been stated which was approximate, but researching RCS cyclers, a precise and thorough information about the applied methodology. The obtained research results confirm the improvement of LV effect in the anaerobic power test have significantly improved after the LV trainings. It has a positive effect on the strength expressions of well-trained athletes (Issurin, 1994; Issurin & Tenenbaum, 1999). After the local vibration sessions for both cyclists, the anaerobic test results and cadence test results prove considerable increase on the stationary Watt Bike ergometer.

Conclusions

The obtained data for both RCS trainees show that after the application of local vibration cadence frequency and anaerobic power have improved. The result increase of both was significant: for the first participant it was 47 W, and for the

second 91 W. 10 second test cadence frequency increased a little. The results testify an essential improvement of anaerobic power results, which is confirmed by the difference of the mean results.

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