

cessation. Twenty-one subjects (10 men and 11 women, 18–32 yr) completed 10 wk (3/wk) unilateral concentric or eccentric maximal isokinetic knee extension training through 90 deg at 30 deg/s. Before (0 wk), during (5 wk) and after (10 wk) training, and after 14 wk of detraining, the subjects performed an isometric knee extensor test aiming for a maximal rate of force increase. The maximum RFD, relative RFD (to MVC; rRFD) and the integral of the force-time curve (contractile impulse) were measured in the epochs 30, 50, 100 and 200 ms after the initiation of contraction. The relative RFD was also calculated to the level of 1/6, 1/2 and 2/3 of MVC. Repeated measures MANOVA was used for analysis after log transformation of non-normally distributed data ($\alpha=0.05$). Our results revealed an effect of training mode on only one of the 19 RFD variables (concentric group > eccentric group for RFD to 30 ms: 38% vs 12%); there was no effect of gender or pre-training isometric strength on RFD changes. When all subjects were pooled, there was a significant increase in RFD, rRFD and impulse in the first 30 ms, and an increase in impulse measured to 50 ms at 5 wk. After 10 wk, there were significant increases in MVC, RFD, rRFD and impulse calculated to 30, 50, 100 and 200 ms, as well as a reduced time to reach RFD to the level of 1/6 MVC. These improvements remained unchanged through 14 wk of detraining. Interestingly, subjects with less-than-median rRFD at 0 wk improved in all RFD measures (with most increases occurring by 5 wk; $p<0.01$), while subjects who had greater-than-median rRFD showed decreases in rRFD at 50, 100 and 200 ms and to 1/2 and 2/3 of MVC ($p<0.05$). In conclusion, our data provide further evidence that maximal strength training improves early-phase RFD irrespective of training mode, but also show that improvements occur largely in the first few weeks of training and are maintained through a prolonged (14 wk) period of detraining. A unique finding of the present study was that the increases in RFD were limited to those subjects who had the slowest rRFD prior to training, with those subjects with faster rRFDs showing no change, or a reduction, in RFD. Thus, the use of heavy resistance training to improve RFD might be best limited to individuals who have a slower rRFD.

LOADING CONDITIONS AND NEUROMUSCULAR ACTIVITY DURING "TURN MOVEMENTS" IN ALPINE SKIING AND IN A NEW SKI SIMULATOR

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Introduction In alpine skiing the loading constrains make the legs to resist to high level of peak forces and vibrations. This loading conditions are not easy to be reproduced by means of standard strength exercise used in training protocols. The aim of this study is to verify the affinity of the turn movement carried out in a real giant slalom (GS) and on a new simulator (SS). The simulator used has two breach footboards which can rotate around their longitudinal axis and can vibrate with a frequency between 0 to 50 Hz. The athlete is tied with a waist belt from which two lateral cables and one directed to middle line of the feet are connected to a traction lever which is controlled by an external operator.

Methods Different methods have been used during GS and SS situation. 3D-Kinematics: two videocameras (50 Hz) and dedicated SIMI software. Dynamics: insoles with pressure cell sensors (PEDAR 100 Hz). Muscle activity: EMG by MEGA-electromyographer (1000 Hz) with 8 channels. In GS testing session, vertical and lateral forces acting on the subject's belt were recorded (100Hz) by means of load cells.

Results On the SS the joint variations show the same time phase for both legs, whereas in the GS the curves are time shifted. This is due by the different external constrains affecting the flexion phase. In GS the ski move laterally from each other causing the external leg to be much more extended with respect to the SS situation where the can only rotate in the frontal plane. Maximal knee flexion are consistent in the vibration exercise and reach a mean value of 110 deg and 85 deg for external and internal knee, whereas in GS the value are 96 deg and 60 deg respectively. Internal and external reaction forces show similar curve patterns in both situations GS and SS. Peak forces in GS and during SS, when the lateral traction cables are omitted and under different vibratory condition, were: highest values, 2500 N external and 1300 N internal, occurred during the 30 Hz vibration, while in the GS they reach 1400 N and 500 N respectively. Using traction cable, forces on the feet are 1100 N external and 300 N internal while lateral force acting on the hip is 700 N. So, lateral force constrains allows the typical distribution of the forces between legs. The EMG showed high similarity between the GS and SS conditions. For the BF, VM, and RF there is a linear tendency to increase the RMS values according to the augmented frequency of vibration. Maximum RMS values are observed during GS. Analogous considerations are founded for IEMG parameter.

According to these results new assumption can be made in order to improve the constrains of the simulator and make it more useful in training or in the rehabilitation.

BLOOD LACTATE CONCENTRATION AFTER SLALOM COURSE OF DIFFERENT LENGTH

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In alpine skiing, most of the required energy for slalom skiing comes from an anaerobic glycolytic system (Andersen and Montgomery, 1988; Tesch, 1995). This causes that fatigue appear very soon. Following a race, blood lactate concentration averages 9 to 13 mmol/l (Andersen and Montgomery, 1988) so the fatigue is beyond anaerobic threshold. Fatigue beyond anaerobic threshold disturbs body balance (Nardone et al., 1997) and consequently slow-down learning processes. For technique training, fatigue should be kept at low level. Therefore the aim of this experiment was to find the level of fatigue that appears in slalom skiing after 15, 30 and 45 gates respectively to establish the proper distance for technique training. Eight alpine skiers (age 19 ± 1.3 years; height 182.4 ± 3.6 cm; weight 81.5 ± 4.4 kg) from the Slovenian national team volunteered in the experiment and gave their written consent. After the warm-up, the participants perform three runs on the same course. In random order they performed courses with 15, 30 and 45 slalom gates respectively. The end of the course was always in the same place. The rest between runs was at least 30 minutes. Before each run and three minutes after skiing we took blood samples from the ear lobe for blood lactate concentration analysis. T-test for dependent samples was used for testing differences. Before runs the lactat concentrations were 2.5 ± 0.88 mmol/l for 15 gates, 1.6 ± 0.58 mmol/l for 30 gates and 1.8 mmol/l ± 0.71 for 45 gates. The lactate concentration after skiing on 15 gates course was 2.6 ± 0.57 mmol/l and was significantly lower than after skiing on 30 gates course (4.5 ± 0.52 mmol/l). The highest lactat concentration was after skiing on 45 gates course (6.7 ± 0.99 mmol/l). Only skiing on 15 gates course caused fatigue that is under anaerobic threshold. Such a low level of blood lactate concentration should not significantly interfere neuromuscular function. Since the body balance is very important in learning process we can speculate that skiing on 15 gates course is suitable for learning skiing technique. Skiing on 30 and 45 gates course caused fatigue that is beyond anaerobic threshold and may not provide good physiological basis for learning skiing technique.

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