TRAINING EFFECT OF RUNNING OVER FLAT MARKERS TO INCREASE STRIDE LENGTH - A CASE STUDY -

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The purpose of this study was to verify the effect of running over flat markers (FMR) using longer than usual stride length intervals. One male collegiate sprinter participated in this study as the subject. The subject initially ran 100m normally, and we calculated the stride length during this run. He was FMR training for 4 weeks with a mark interval set up at 105% of usual stride length. The sprint motion of the three runs were compared by two-dimensional motion analysis. The result of the present study showed FMR changed leg motion just before the contact phase. The subject, whose leg motion showed hip angular velocity increased just before the contact phase. The result of the present study show FMR may be a good tool for sprinting improvement to change leg motion.

KEY WORDS: sprint, FMR, sprint motion

INTRODUCTION: In sprinting, maximum running velocity is a key determinant of race time (Matsuo et al.,2008). Maximum running velocity is determined by stride frequency and stride length. In order to increase the running velocity, it is necessary to improve both stride frequency and stride length or improve either one and maintain the other. There is a trade-off between stride frequency and stride length (Hunter et al 2004), whereby the combination of the stride frequency and stride length for obtaining the running velocity is not uniform and the optimum combination differs depending on the sprinter (Kunz and Kaufman, 1981; Schiffer, 2009). A 100m sprinter can be divided into a stride frequency type and a stride length type with the characteristics of each (Ae et al, 1994). Such a superiority of stride frequency and stride length has been reported as a result of examining a 100m race in the individual (Salo et al, 2011), and due to that difference, the training is considered to be different. To improve the stride frequency and stride length, using a stick or mark to regulate the stride length is thought to be a good method (Korchemny, 1994). Saito and Takahashi (2014) reported the effect of running over flat markers (FMR) with mark intervals shorter than stride length. As a result, there were immediate effects of the FMR that increase stride frequency and the running velocity. In addition, there was an improvement of leg motion such as extensional angular velocity of hip and knee joint just before contact. From these points, it is considered that FMR is effective for improving running velocity and lower limb movement. However, the effect of FMR for longer than usual stride length has not been verified. Also, considering the optimum stride frequency and stride length might be different for each individual, there is a need to examine the effect of FMR with longer than usual stride length. The purpose of this study was to clarify the effect of FMR training with longer than usual stride length for one month, and to obtain useful knowledge for sprint coaching.

METHODS: One collegiate sprinter (Height:1.65m, body mass:55.7kg, 100m time PB: 11.65 sec) participated as the subject. The subject ran a 100m dash three times. At first, he ran normally (pre) and the stride length was calculated from the recording, and used to determine the mark interval. Training was set up with ten markers along the runway, and the subject was instructed to engage maximum acceleration from the first mark at

30m. Figure1 shows the setup of the runway for FMR. Markers were set from 30m to 50m. The interval of the marker was 5% longer than usual (105% compared with usual). The training period was one month, five days a week, five times for one practice session. Over a period of two weeks (middle) and the following two weeks (post), the 100m time was measured and running motion was recorded again. A highspeed camera (EXILIM EX-F1, CASIO, JAPAN) was used to record the running motion at 300Hz. This camera was located 30m from the right side of the runway and panned to record the running. Frame Dias4 (DKH, JAPAN) was used to digitize twenty-three body segment points and four reference marks, and to reconstruct two-dimensional coordinates (from right foot contact to the next right foot contact). Running motion was divided into five event phases: ①Right foot on (R-on, 0%) – ②Right foot off (R-off, 50%) – ③Left foot on (L-on, 100%) – ④Left foot off (L-off, 150%) – ⑤Right foot on (L-on, 200%). Data was calculated for: 100m running time, running velocity during the 40-50m section, stride frequency, stride length, hip, knee and ankle angle and angular velocity. The data of the subject was normalized by the time of each phase and averaged.

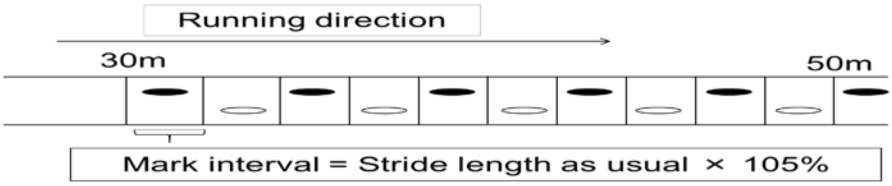

Fig.1 Set up of the runway for running over flat markers

RESULT: Fig.2 shows the 100m time. Fig.3-5 represents data from the 40-50m section for running velocity, stride frequency and stride length. In the middle, stride length increased from 2.02m to 2.07m. However, in the post, stride length decreased 2.07m to 2.05m.

Fig.6 hip angle and angular velocity and Fig.7 shows hip angular velocity, joint torque and joint torque power during one cycle. The hip joint angular velocity and joint torque increased just before ground contact, and joint torque power also had large concentric muscle activity generated by the hip extensor muscle group.

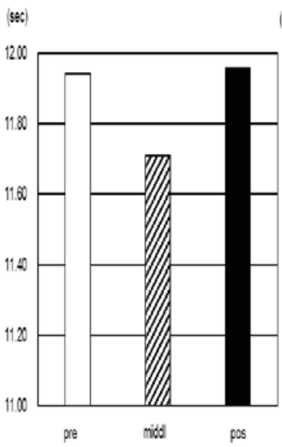

Fig.2 Result of 100m

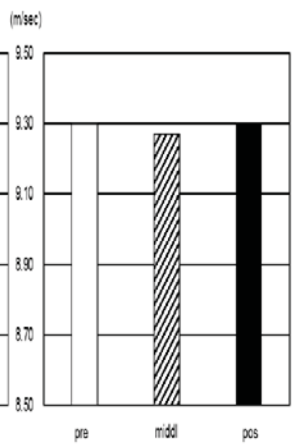

Fig.3 Running velocity (40-50m)

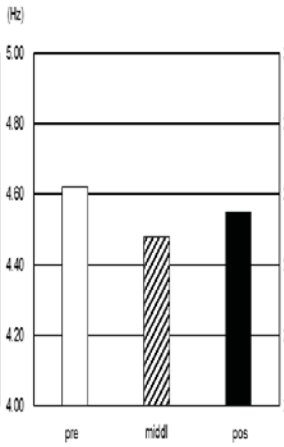

Fig.4 Stride frequency (40-50m)

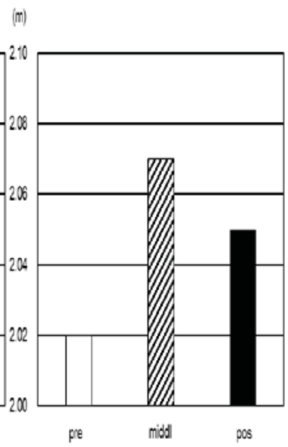

Fig.5 Stride length (40-50m)

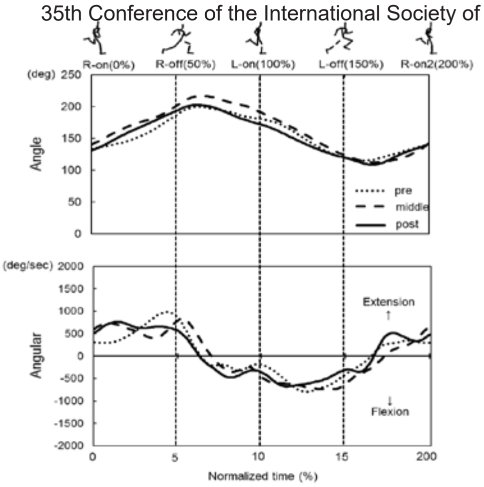

Fig.6 Hip joint angle and angular velocity of each sprint

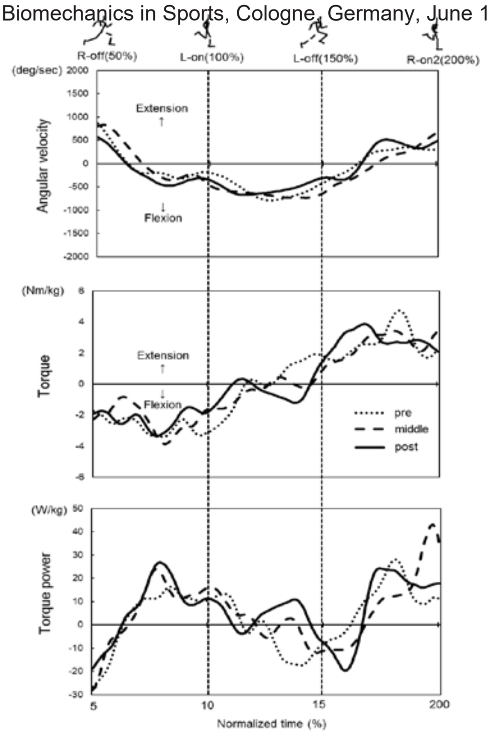

Fig.7 Hip joint angular velocity, joint torque and joint torque power of each sprint

Discussion: The purpose of this study was to examine the effect of one collegiate sprinter’s training using FMR, set up with longer than usual stride length. Although running velocity can be expressed by the product of stride frequency and stride length, there is a trade-off between stride frequency and stride length (Hunter et al 2004). As a result of this study, stride length increased, but stride frequency decreased. Therefore, running velocity decreased. Also, stride length of the post result decreased from the middle and the stride frequency increase is considered to be caused by not changing the mark interval during the training period. From this basis, when performing the same training, it was suggested that it is necessary to change the mark interval set-up length as training progresses.

In leg motion, hip extension angular velocity increased just before the contact phase. In addition, hip joint torque increased in the same phase. Ito et al (1998) reported that hip extension motion just before the contact phase is important for leg motion. Saito and Takahashi (2014) reported the effect of FMR with mark intervals shorter than the usual stride length. This study indicated similar results to the present study. From the above FMR, the mark interval showed no relation, which indicated an increased hip extension angular velocity.

Further studies are needed to increase the number of subjects, in order to clarify results statistically. Also, mark intervals with shorter than usual stride length will be an aim to verify training effects. By clarifying them, it is considered that feedback would be useful information for sprint training.

CONCULUSION: The purpose of this study was to clarify the effect of FMR training with longer than usual stride length. From this study, FMR did not increase the stride length. However, FMR changed leg motion just before the contact phase. FMR did not have an immediate effect on stride length, but it has the possibility of improving leg motion. FMR may be a good tool for sprinting improvement to change leg motion.

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