Abstract 2019

Effect of different seat position on lower limb kinematics, kinetic and electromyography during cycling.

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Background: An accurate riding position can not only attenuate injuries, but also enhance performance. However, which adjustment could provide better performance improvement is still arguable. The main factor that leads to poor position can be attributed to inaccurate saddle position. Unquestioningly, saddle position is the crucial adjustment. Generally, seat tubes on road bike are tilted-design, that is, when the saddle being adjusted, the saddle height and forward-backward position will differ simultaneously.

Purpose: The purpose of this study was to investigate different saddle position to kinematic, kinetic and muscle activation during cycling.

Methods: This study recruited 15 experienced cyclists (average stature: 176.5±5.5 cm, average weight: 75.4±8.4 kg, average age: 25.6±3.8 years old). All participants have at least 1~3 years of cycling experience. No musculoskeletal and neuromuscular injuries happened in the past 6 months with every participant living under normal condition. The three-dimensioned motion capture system (Vicon) was utilized to calculate angle as sampling frequency set up as 200Hz. An ergometer (Bioforcen) was implemented to record the power output under 1000Hz sampling frequency. The center saddle position was defined at 30-degree knee flexion on bottom dead point. In all, 9 combination made up the saddle position variables that altered up to 5% of the length from trochanters to the floor. A two-way analysis of variance (ANOVA) with repeated measures was used to analyze all the data to determine the differences between different seat position (3 saddle height and 3forward-backward position).

Results: When the saddle be adjusted to an upward position, the results have shown a lower hip, knee, ankle angle as well as lower power output and higher biceps femoris muscle activation. On the other hand, as the saddle be adjusted forward, smaller hip angle and lower anterior tibialis, gastrocnemius muscle activation, larger knee, ankle angle and higher power output were observed.

Discussions: The main factor amongst all poor riding postures is the adjustment of seat position. The adjustment of the seat position will change the distance from paddle to saddle, handlebar to saddle and trunk angle because the seat tube design are usually incline backward. There are still a lack of scientific evidences to explain how the bike adjusting methods can enhance the performance. In our study, the upward and downward saddle adjustment can influence the thigh muscle activation; on the other hand, the forward and backward saddle adjustment can impact the calf muscle. As the saddle be moved forward will get the result reflects an increased knee angle, ankle angle, declined muscle activation and higher pedaling force, to which it might further increase the pedaling efficiency.

Conclusions: The saddle forward-backward position could affect kinematics, kinetic and muscle activation during cycling. The optimized saddle position setting, should not only consider saddle height but the forward-backward saddle position should also be focused during cycling.

Key word: bike fitting, saddle height, forward-backward position

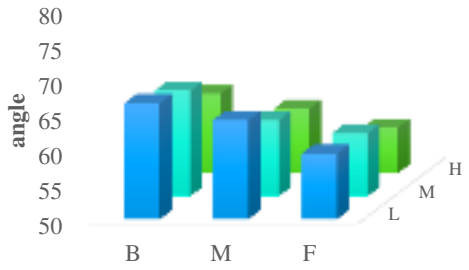

Figure 1. Mean Hip angle during pdaling

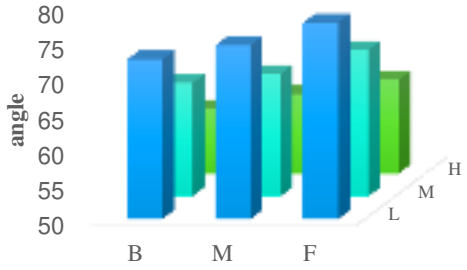

Figure 2. Mean Knee angle during pedaling

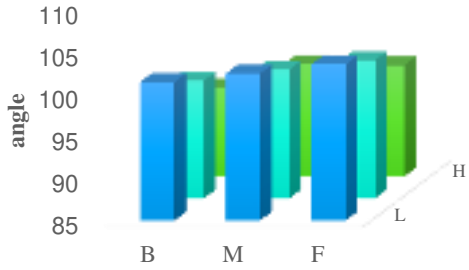

Figure 3. Mean Ankle angle during pedaling

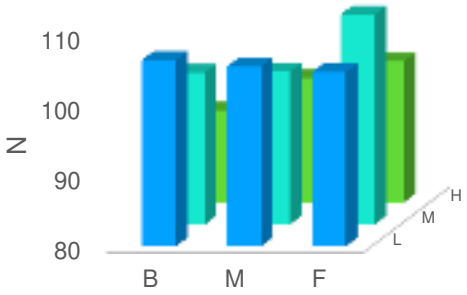

Figure 4. Mean result force during pedaling

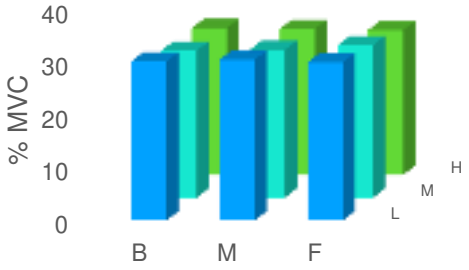

Figure 5. RF activation during pedaling

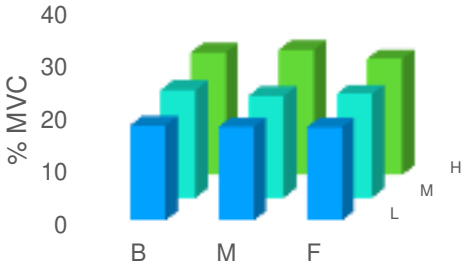

Figure 6. BF activation during pedaling

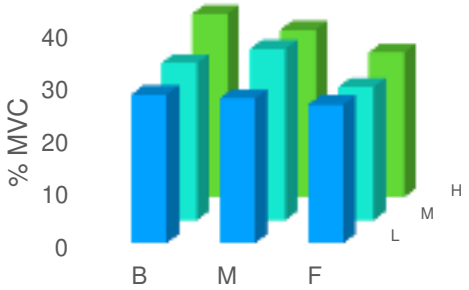

Figure 7. TA activation during pedaling

Figure 8. GAS activation during pedaling

B represents the backward saddle position, M represents the center saddle position, F represents the forward saddle position, H represents the upward saddle position, L represents the downward saddle position. RF= Rectus femoris, BF= Bicep femoris, TA= Tibialis anterior, GAS= Gastrocnemius.