

Journal of Science and Cycling

Breakthroughs in Cycling and Triathlon Sciences



Special number: World Congress of Cycling Science 2015, 1/2 July 2015, Utrecht

Editors: Mikel Zabala (PhD)
Greg Atkinson (PhD)



Science & Cycling
1 & 2 July 2015, Utrecht



OPEN ACCESS

www.jsc-journal.com

Evaluating the central pressure point to determine the optimal saddle setback

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Abstract

Background: Over half of all cyclists describe discomfort at the saddle as limiting condition. (Detori & Norvell, 2006) The saddle setback is an important parameter to consider when aiming to improve the comfort for sportive road bike riders in a professional analysis of the position on the bike. Traditional method Knee Over Pedal Spindle (KOPS) determines the saddle setback using the distance that the patella come over the centre of the pedal spindle This method, however, lacks empirical background and following expert advices gives a range of 80 mm for optimal setback position. (Burke and Pruit, 2003; Gressmann 2006). This paper empirically analyses the effect a change of the saddle position in the sagittal plane (setback) by ± 10 mm has on the position of the knee joint as well as the pressure parameters central pressure point (COP), maximal pressure and loaded surface on the saddle.

Methods: In a lab-setting 18 sportive male cyclists were tested using a standardized watt-based protocol (7 minutes warm-up/ 100W, 5 * 4 minutes measurement/ 200W). The sitting position was standardized knee angle (mean 139.3°), hip angle at 78°-85° (mean 82°), shoulder angle at 90° (mean 90°) on a stationary fit bike (Size Cycle, USA). KOPS was measured with a high speed camera (60 HZ sampling rate) and the 2d motion analysis software GP BikeView (GebioM). Saddle pressure was measured with the saddle pressure system GB Bike (GebioM), which measures the saddle pressure with 64 sensors at a sampling rate of 200 HZ. Besides actual pressure, the additional GB Bike software also provide information centre of pressure, maximal pressure and the loaded surface The basis setup of the saddle in the sagittal plane was performed dynamically using the KOPS- method. The measurement sequence of setback +10 +5 -5 -10 was randomized, while sitting height and length remained constant.

Results: Regarding saddle setback and KOPS it appeared that 12 of the subjects (67%) react to changes in setback by adjusting their position on the saddle, i.e., these riders sit different on their saddle, resulting in the same knee over pedal spindle. The other subjects (33%) did not change their position on the saddle, consequently a change in KOPS was measured by these riders. Setback positions +10mm and -10mm results in a highly significant change in the position of the riders' COP on the saddle ($p=0.01$). Setback positions +5mm and -5mm results in a significant change of position ($p = 0.04$). There is a moderate relation between adjusting the COP towards the back of the saddle and reducing the maximal pressure in the pubic area as well as increasing the loaded area under the ischial tuberositis ($r^2 = 0.6/0.78$).

Conclusion: According to the currently available evidence, the KOPS-method provides for a position of the knee joint above the pedal spindle a range of approximately 80mm when following the different expert advices. Including the analysis and interpretation of the COP's position during a dynamic saddle pressure measurement adds valuable information to finely adjust the saddle position in the sagittal plane within this range. Furthermore, analysing the position of the COP provides a means to quantify the comfort in the sitting area.

Funding: GeBioM



Figure 1. KOPS "Expert range"

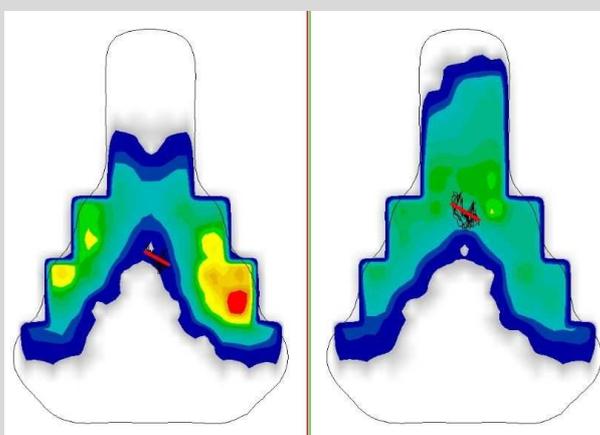


Figure 2. COP of one subject with setback -10mm and +10mm

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