Abstract

Comparison of penile blood flow changes in performance road cyclists obtained during a ride on a customized 3D printed and conventional saddle

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Aim: To update findings on penile blood flow in performance cyclists by measuring transcutaneous partial pressure of O_2 ($tcpO_2$) and CO_2 ($tcpCO_2$) on current style of racing bicycle saddles

Subjects and methods: $tcpO_2$ and $tcpCO_2$ were measured non-invasively on the glans penis in healthy highly trained male cyclists ($n = 30$) with an average annual mileage of 14240 km on three different road cycling saddles - Posedla Joyseat, Specialized Power and Fizik Tundra M5. It has previously been shown that $tcpO_2$ is highly correlated with arterial pO_2. $TcpO_2$ and $tcpCO_2$ were measured continuously in each participant for ten minutes on each saddle with a random order of saddles while riding stationary bike trainer in a race fit position. Simultaneously, various data like saddle surface pressure via Velometrik Smart Cover BT, rider position via Retül Fit, power output, heart rate and cadence via Wahoo KICKR Bike were recorded, and glans penis biothesiometry data were collected with Bio Medical Instruments. Data analysis was done on statistical level of significance $p < 0{,}05$. Statistical methods used to test three hypotheses were two sample paired t-test for means, single factor ANOVA analysis of variance and linear mixed effects model.

Results: There was a significant decrease in $tcpO_2$ and increase in $tcpCO_2$ confirming penile ischemia during cycling. The mean (SD) for initial $tcpO_2$ on all saddles was $55{,}5\ (15{,}7)\ mmHg$, and for final $tcpO_2$ $10{,}5\ (14{,}8)\ mmHg$. The mean for initial $tcpCO_2$ was $56{,}2\ (18{,}1)\ mmHg$, for final $tcpCO_2$ $91{,}6\ (43{,}9)\ mmHg$. Statistically significant difference between saddles Specialized $(12{,}58;\ 15{,}64)$ and Fizik $(7{,}39;\ 12{,}65)$ $t_{pO2\_12s\_end}(29) = 2{,}25; p < 0{,}05$ when averages of the last 12 s were analyzed. No statistically significant difference in final $tcpCO_2$ values was observed. Few statistically significant differences between the pressure distribution on the saddle surface were revealed through analysis of the relative values of the pressure distribution to the anterior and posterior part of the saddle and analysis of the pressure values in the perineal region using linear random

effects model. With parallel lines of dependence pO2_change_point ~ PERI_1 * fsedlo , we find a statistically significant difference only between saddles Joyseat $(256{,}17;\ 57{,}00)$ and Fizik $(304{,}12;\ 18{,}53)$, $p = 0{,}01$. Analysis of pCO2_usek2 ~ PERI_1 * fsedlo between Joyseat $(502{,}32 \times 10^{-2};\ 0{,}33)$ and Specialized $(502{,}37 \times 10^{-2};\ 0{,}35)$ resulting in $p < 0{,}01$. There was a statistically significant difference in anterior-posterior pressure distribution on the saddle surface between all three tested saddles, $p < 0{,}001$. Also statistically significant differences $p < 0{,}001$ in magnitude of pressure in the perineal area were identified. Nevertheless, these differences did not lead to significantly different levels of penile blood flow in performance cyclists riding at moderate load intensity in a position with a trunk flexion angle (42°) on different types of road cycling saddles.

Keywords: bike fit, biothesiometry, cycling, erectile dysfunction, hypesthesia, saddle pressure, transcutaneous carbon dioxide pressure, transcutaneous oxygen pressure