

Klinik und Poliklinik für Urologie der Universität zu Köln

Privatdozent Dr. Frank Sommer

“Type of Saddle and Sitting Position Influence Penile Oxygen Pressure while Cycling”

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Introduction

Apart from the considerable health benefits to be gained from exercise, the overzealous pursuit of fitness can also result in a number of health hazards, sometimes calling for the attention of a physician. Cycling is no exception here (Baeyens et al. 2002, Frauscher et al. 2000, Mellion 1991, Vuong et al. 1988).

There have been several case reports of genital numbness after cycling (Desai et al. 1989, McDonald 1987). Even cases of impotence have been reported (Desai et al. 1989, Sommer et al. 2001). Perineal compression during bicycling appears to be responsible for some of the cases described (Sommer et al. 2001).

Some authors suggest that the pudendal nerve might be pinched against the pubic arc because of the forward tilting of the body on the bicycle seat (Ricchiuti 1999). Another explanation could be that the seat of the bicycle compresses the blood supply to the penis (Sommer et al. 2001). Penile blood pressure and blood flow can be measured via spectroscopy, Doppler ultrasound, penile transcutaneous partial oxygen pressure (tcpO₂) using a modified Clark oxygen electrode (Sommer et al. 2001) or pulse volume recording. Arteriography reveals the blood supply to the pudendal artery and its branches. The corpus cavernosum trabecular structure of the penis is dependent on a critical balance of smooth muscle to connective tissue for successful erection (Moreland et al. 1998). There has been considerable discussion regarding the role of oxygen tension in the modulation of male erectile function at the level of smooth muscle tone and connective tissue metabolism. Hypoxemia of the penis is associated with penile fibrosis (Moreland et al. 1998). Thus, reduced oxygen tension leads to trabecular connective tissue synthesis, which works counterproductively to the achievement of an erection. Increased oxygen tension leads to reduced connective tissue synthesis and collagen degradation – an important structural change required for obtaining an erection (Nehra et al. 1996).

Therefore a good oxygen supply to the penis is fundamental to preserve the structures of the penile tissues (Sommer et al. 2002). A frequent reduction of the oxygen supply for a long period of time, as can happen for cyclists riding over 400 km/week, can lead to risks of impotence, as it has also been pointed out by a study which has been done by our working-group at the University of Cologne with the German University of Sports Science in 1999 (Sommer et al. 2001). In earlier studies, we had addressed the question if different saddle designs of bicycle seats or different body-position during cycling (bent

forward on a normal bike versus reclined position on a recumbent bicycle) have any influence on penile perfusion. We were able to demonstrate that a very important factor in safeguarding penile perfusion is the width of the saddle on a normal bicycle (Sommer et al. 2002). Additionally we could show that cycling in a reclined position on a recumbent bicycle caused hardly any alteration in penile blood flow during cycling (Sommer et al. 2001).

Aims of the study

In previous studies we have shown that penile transcutaneous partial oxygen pressure – and therefore the blood supply to the penis - is decreased during cycling. Now we addressed the questions of

- what kind of cycling position on a normal bicycle (60 vs. 90 degrees) (Picture 1),
- what kind of saddle material / padding (GEL vs. Foam) (Picture 2),
- what kind of size of saddle (Sport vs Travel) (Picture 3), and
- what kind of geometry of saddle (Uniform Flat Surface or Surface with Central Hole)

best safeguards blood supply to the penis during cycling, helping to avoid any genital health hazards, such as erectile dysfunction.

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Picture 1: Test done in the 2 cycling positions: 60° (bent forward) and 90° (upright)

Picture 2: One saddle with GEL (Travel Gel) compared with the same saddle with Foam (Travel Foam)

Picture 3: A narrow saddle (Sport GEL) compared with a wider saddle (Travel GEL) in the 60° position.

Picture 4: One saddle with uniform flat surface was compared with the same saddle with a surface with central hole
(uniform flat surface) (surface with central hole) (central hole from above)

Cyclists and Methods

Male cyclists with a mean age of 28.6 (range 20 – 37) years took part in this study. These cyclists have typically been cycling between 3,500 to 5,000 kilometers / year, for several years (range 4 – 12). All men had experienced an erection and ejaculation in the 10 days prior to the study. None of the men were diabetic or had any other endocrinological disorders. The mean height of the men was 178 cm (range 174 – 181) and their mean weight was 72 kg (range 67 – 82).

Transcutaneous penile oxygen pressure was obtained using a device consisting of a modified Clark pO₂ electrode (TCM3, TCC3, Radiometer, Copenhagen Denmark, see Picture 5), attached to the glans of the penis (Picture 6). The electrode uses a thermistor-controlled heating element to keep the skin temperature at 44° C in order to improve oxygen diffusion across the electrode membrane. The electrode was attached to the glans of the penis by a single-sided adhesive ring, and a droplet of electrolyte solution placed between the membrane and the skin.

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Before measurement, a one-point calibration was made automatically. Pulse and blood pressure were automatically measured (Dinamap, Vital Data Monitor 8100, Criticon) to demonstrate stable hemodynamic circumstances.

All men had their tcpO₂ measured while standing for 15 min. before cycling. Then they sat and pedaled on their own bicycle, which was fixed on a cycling-roll (home trainer, see Picture 7), after 2 min reaching 60-65% of their maximum training heart rate. The aim was to keep the heart rate constantly at this level (+/- 5 bpm). During a period of 30 minutes of cycling in a seated position, the penile tcpO₂ was measured continuously. Transcutaneous penile oxygen pressure was also measured in each man over a period of 15 minutes post-exercise.

Picture 5 Picture 6 Picture 7

Results

Cycling Position (60° vs. 90°)

Looking at both saddles padded with foam and with gel, there was a statistically significant difference between riding in a 60° or 90° position:

- the Foam Saddle showed mean penile transcutaneous partial oxygen pressure moving from 29.8 mmHg in a 60° position to 41.7 mmHg in a 90° position;

- the GEL Saddle showed mean penile transcutaneous partial oxygen pressure moving from 42.0 mmHg in a 60° position to 57.8 mmHg in a 90° position.

Therefore, cycling in a 90° position showed 40% better penile oxygenation than cycling in a 60° position with each saddle type, confirming that the more bent forward the rider is, the more the perineum is compressed (Diagrams 1 and 2).

Gel Saddle vs. Foam Saddle

Looking at both riding positions (60° and 90°) there was a statistically significant difference between saddles padded with Foam and with GEL:

- in the 60° position the mean penile transcutaneous partial oxygen pressure was 29.8 mmHg on the Foam Saddle and 42.0 mmHg on the GEL Saddle;

- in the 90° position the mean penile transcutaneous partial oxygen pressure was 41.7 mmHg on the Foam Saddle and 57.8 mmHg on the GEL Saddle.

Therefore, cycling on a GEL Saddle showed 40% better penile oxygenation than cycling on a Foam saddle, both in a 60° position and on a 90° position, confirming that the GEL padding helps distributing pressure in the perineum and relieving pressure from the delicate blood vessels of this part of the body (Diagrams 3 and 4).

Narrow Saddle vs. Wide Saddle

Considering the 60° riding positions there was a statistically significant difference between a narrow saddle (Sport GEL) and a wider saddle (Travel GEL). The average penile transcutaneous partial oxygen pressure was measured at 27.2 mmHg on the narrow Sport GEL and at 42.0 mmHg on the wider Travel GEL. Considering same sitting position and same padding material, therefore, the geometry of the saddle also influences the oxygen pressure. The wider saddle showed more than 50% better penile oxygenation than the narrow saddle.

Uniform Surface vs. Central Hole

Finally a test was done to compare two saddles of the same shape, one with a uniform flat surface (Aliante CB) and one with a small hole in the central part (Aliante SH). The saddles were with no padding, in order to evaluate just the effect of the geometry of the sitting surface. This test was performed at an extremely bent forward position (less than 60°), as cyclists riding on a road racing or mountain bike sit, when pressure in the perineal area reaches the highest levels. There was no statistically significant difference in the measurements of the transcutaneous partial oxygen pressure using a saddle with a hole or one with no hole in the genital area. Both saddles led to very low values of the oxygen pressure (21,4 and 23,8 mmHg) with a reduction of 65% of the oxygen pressure from the normal levels of 65-70 mmHg, when not cycling. Therefore there is no advantage in cutting a saddle in the middle introducing a hole, because it does not relieve pressure from blood vases of the genitals, as it has also been demonstrated with other testing methods, such as the pressure distribution measurement (Rodano et al 2002).

Conclusions and Recommendations

The results of these tests and previous researches done with this methodology show that oxygenation of the genitals in men while cycling is affected by different variables. Keeping the highest level of oxygenation is important for preserving the structures of the penile tissues in order to avoid health problems in the long run, such as erectile dysfunctions. Using a good saddle as well as changing sitting position while cycling can make the difference. It has been demonstrated that:

- when using the same saddle, shifting from a bent forward position (60°) to an upright position (90°) significantly improves the oxygenation of the genitals;
- when sitting in the same position, using a saddle with GEL padding (compared with Foam) also improves the oxygenation of the genitals;
- finally, with all other variables being constant (sitting position and saddle padding), a wider saddle (compared with a narrow one) improves the oxygenation of the genitals.

All these results point out that an increased total contact surface is important to distribute the weight of the cyclist in a more uniform way. A wider total contact surface -achieved though a more upright sitting position, a padding adapting to the anatomy of the cyclist (ex. GEL) or the geometry of the saddle (ex. wider) -reduces the compression of the blood vases of the perineum and improves oxygenation of the genitals.

Since it is not likely that cyclists change the style of bicycle they use to assume a more upright position, it is very important that cyclist pay attention to the choice of the saddle. From the evidence so far available, a wider saddle is to be preferred to a narrow one and a gel saddle to one with just a foam padding.

Attached Diagrams

Diagram 1

Positions 90° vs 60° on Foam Saddle

Diagram 2

Positions 90° vs 60° on GEL Saddle

Diagram 3

GEL Saddle vs Foam Saddle in 60° Position

Diagram 4

GEL Saddle vs Foam Saddle in 90° Position

Diagram 5

Wide Saddle (Travel Gel) vs Narrow Saddle (Sport Gel) in 60° Position

Diagram 6

Comparing Geometries of Sportive Saddles with No Padding: Uniform Flat Surface vs Surface with Central Hole

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