



EFFECTS OF A NOVEL BICYCLE SADDLE ON SYMPTOMS AND COMFORT IN CYCLISTS

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Background. While the bicycle frame and other parts of the bicycle have undergone many improvements, the bicycle saddle has remained relatively unchanged since it was first designed more than 100 years ago. Given the number and range of cycling injuries believed to result from the saddle, this is surprising. This study investigated the effects of a novel bicycle saddle on saddle-related comfort and symptoms during cycling.

Method. Eleven competitive or recreational cyclists, 6 females and 5 males, performed three 2-hour stationary cycle rides in the laboratory, using their personal bicycles. Ride 1 was performed using the standard bicycle saddle and rides 2 and 3 using the novel bicycle saddle. Subjects reported saddle comfort rating scores (SC) while using the different saddles. Subjects also completed a questionnaire evaluating saddle symptoms (SS) when using either the conventional or the novel bicycle saddle during daily cycling.

Results. The most common saddle-related medical complaint with chronic use of the conventional saddle was painful pubic bones, with or without chafing. Others were severe chafing, saddle sores, chafing and back pain, and painful pubic bones associated with a loss of feeling in the pelvic area. The mean SS rating score during the 2-hour laboratory ride was significantly less for the novel saddle (11.6 ± 1.2 versus 19.1 ± 3.2 arbitrary units, $P < 0.01$). Similarly the mean SC score was significantly lower for the novel saddle (36.2 ± 10.5 v. 54.7 ± 11.2 arbitrary units). Values for both SC scores were similar for rides 2 and 3. On completion of the trial all subjects indicated that they would continue to use the novel saddle in preference to the conventional saddle. Three months later 9 subjects (82%) reported continued use of this saddle in preference to the conventional saddle.

Conclusion. These results show conclusively that this novel bicycle saddle: (i) significantly reduced reported symptoms

during daily cycling compared with the conventionally designed cycling saddle; (ii) significantly improved saddle comfort during 2-hour cycles in the laboratory, such that (iii) when given the option the majority (82%) of the subjects chose to use this saddle 3 months later. Furthermore, the beneficial effects of the novel saddle were apparent during its first use, suggesting that the novel saddle is effective because the design is anatomically correct.

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While the bicycle frame, first designed in 1885, has undergone substantial modification especially in the past two decades, the bicycle saddle has remained relatively unchanged for more than a century.¹ This is surprising given the range of perineal problems caused by saddle pressure in cyclists.²⁻⁵

Commonly reported perineal problems in cyclists include chafing, folliculitis and ulceration of the skin.²⁻⁵ More serious complaints include the development of furuncles and nodular indurations,⁶ pudendal neuropathy leading to impotence in males, traumatic urethritis and priapism, and vulval trauma in females.⁷⁻¹³ To the best of our knowledge there are no reported clinical trials of techniques that either prevent or cure these conditions.

Recently a South African cyclist developed a novel bicycle saddle (Fig. 1) to cure his own medical complaint, priapism. When using this saddle, the weight of the body is supported only on the ischial tuberosities without pressure being exerted on the delicate perineal structures (Figs 2 and 3). Here we report on the first controlled trial comparing the symptoms experienced and reported comfort felt by experienced cyclists when using this and the conventional saddle.

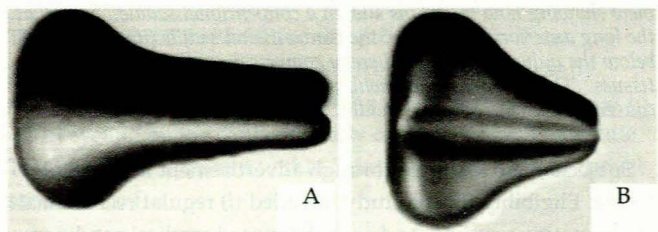


Fig. 1. Comparison of the novel bicycle saddle, the 'Murray Orthopedic bicycle saddle' (B) and the conventional saddle (A), both viewed from above. Note that the novel saddle is broad posteriorly and is guttered in the area where the conventional saddle provides its greatest support.

METHODS

Experimental design

The study was approved by the Research and Ethics Committee of the Faculty of Medicine, University of Cape Town.

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Fig. 2. Lateral view of pelvis (supported anteriorly) showing that the ischial tuberosities are supported by the broad area of the novel saddle (see also Fig. 3A).

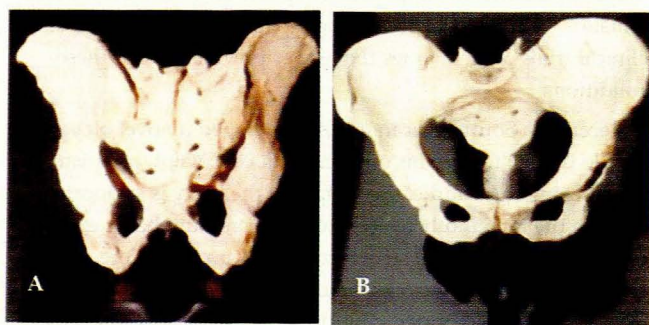


Fig. 3. A: Posterior-anterior view of Fig. 2 showing that the novel saddle supports only the ischial tuberosities. B: the posterior-anterior view showing how the pelvis sits on a conventional saddle. Note that the long anterior extension of the conventional saddle fits neatly below the pubic symphysis, thereby compressing all the perineal tissues. This picture depicts why pudendal neuropathy is likely caused by the conventional saddle.⁷⁻¹³

Subjects were recruited through advertisement in the local media. Eligibility for the study included (i) regular recreational or competitive cycling; and (ii) a diagnosed medical condition caused by the use of a conventional cycling saddle.

Protocol

Before commencement of the trial subjects completed a questionnaire designed for the trial, in which they rated the severity of the saddle symptoms (SS) they experienced when cycling on their conventional saddles. The questionnaire included 10 questions for males and 12 for females. Questions were answered in either the positive or negative. If the answer was positive, the extent to which that specific symptom was experienced was rated. This questionnaire was repeated on

completion of the trial, at which time subjects also rated the SS score after they had cycled for one week on the novel saddle. The answers to the questionnaire were summed to produce SS scores for the standard and novel bicycle saddles.

Following a full training history and assessment of the subject's saddle-related medical diagnosis, body fat content was measured as the sum of seven skinfolds (biceps, triceps, subscapular, supra-iliac, anterior thigh, abdominal and medial calf)¹⁴ and also expressed as a percentage of body weight.¹⁵

Subjects then completed three supervised rides (ride one — R1, ride two — R2 and ride three — R3) each of 2 hours' duration, in the laboratory, using their own bicycles, mounted on a King Cycle ergometry system (Kingcycle Ltd, High Wycombe, UK). This system allows the cyclist to place his or her bicycle on a bracket and supporting pillar, following the removal of the front wheel. The bracket and supporting pillar are used to position the rear wheel correctly on an air-braked flywheel. R1 and R2 were completed within 7 days. Thereafter the subject cycled for a minimum of 7 days using the novel bicycle saddle. The final R3 trial was then performed. Subjects used their standard bicycle saddle for R1 and the gender-appropriate, anatomically correct, novel bicycle saddle for R2 and R3.

During the 2-hour trial laboratory rides subjects rated their perceived saddle comfort (SC) every 15 minutes using a specifically designed questionnaire scale. The scale rated feelings of comfort on a scale of 1 - 10, in which 1 was 'extremely comfortable' and 10 was 'unbearable discomfort'. These scores, at the end of each 15 minutes, were added together to obtain a single SC score for each of the three laboratory cycle trials.

For obvious reasons neither the subjects nor the investigator were 'blind' to the nature of the intervention, or to the purpose of the trial. However, data from all of the trials were stored immediately on completion of the trial and were analysed only on completion of the trial. This ensured that neither the investigator nor the subjects were aware of the scores for any previous test.

On completion of the trial the subjects each received a novel saddle as reward for participating in the study. They were invited to use the saddle in preference to their conventional saddles should they so wish. Three months later subjects were contacted to determine: (i) whether they were still using the novel saddle; and (ii) whether the original symptoms they experienced with chronic use of the conventional saddle had altered as a result of using the novel saddle.

Statistics

Results are expressed as means \pm standard deviations (SD). Non-parametric analysis of the data was performed using the Wilcoxon matched pairs test and the Spearman's rank order correlation test to determine significant difference between the



subjects with regard to the first ride (R1), second ride (R2) and third ride (R3). Statistical significance was accepted when $P < 0.05$.

RESULTS

Subject characteristics and saddle-related symptoms

Eleven subjects, 6 females and 5 males, participated in the trial. The average age of the females was 31 ± 8 years (range 24 - 46 years) and of the males 41 ± 9 years (range 24 - 59 years).

The average weekly cycling distance of the group in summer was 105 ± 57 km/week (range 20 - 200 km/week).

The average body mass for the females was 65.8 ± 7.2 kg (range 57.0 - 78.0 kg) and for the males 81.5 ± 8.6 kg (range 69.0 - 92.0 kg). The average body fat percentage in the females was $24.6 \pm 6.1\%$ (range 18.0 - 37.0%) and for the males $18.8 \pm 4.3\%$ (range 13.0 to 23.1%). The average body mass index (BMI) for the females was 22.3 ± 3.5 (range 18.8 - 29.0) and for the males 25.4 ± 3.4 (range 21.3 - 31.5).

The most common saddle-related medical complaints were painful pubic bones and chafing (4 of 11 subjects). Three other subjects complained of painful pubic bones without chafing. The remaining 4 subjects complained of severe chafing only; saddle sores; chafing and back pain; and painful pubic bones associated with a loss of feeling in the pelvic area.

Saddle symptom (SS) and saddle comfort (SC) scores

Fig. 4 compares SS scores when training on the standard and novel bicycle saddles. The mean SS score for the standard saddle was 19.1 ± 3.2 (range 14 - 25) and for the novel saddle 11.6 ± 1.2 (range 10 - 14). The difference was statistically significant ($P < 0.001$). Of the 11 subjects only 1 (subject 8, Fig. 4) reported a marginal worsening of symptoms when using the novel saddle.

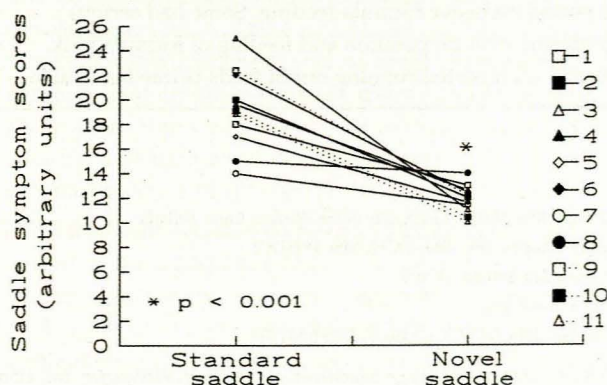


Fig. 4. Ratings of saddle symptom scores when training on the standard or novel saddles. (Note that the saddle symptom scores were significantly lower when using the novel saddle.)

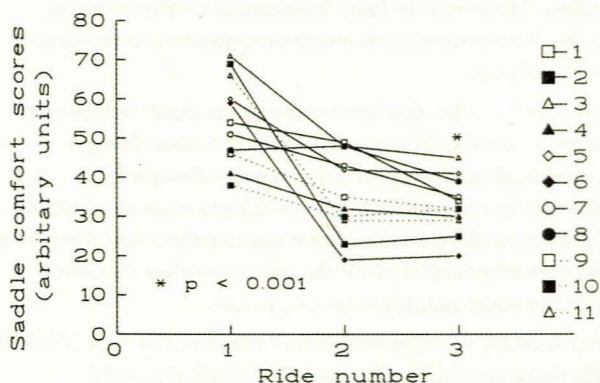


Fig. 5. Total saddle comfort scores during 2 hours' cycling on the standard (ride 1) and novel (rides 2 and 3) saddle. (Note that saddle comfort scores were significantly lower on rides 2 and 3 when the novel saddle was tested.)

Fig. 5 compares the SC scores for the three 2-hour laboratory cycle rides. The mean SC score for R1 was 54.7 ± 11.2 (range 38 - 71), for R2, 36.2 ± 10.5 (range 19 - 49) and for R3, 32.9 ± 7.1 (range 20 - 45). Differences between R1 and R2 and between R1 and R3 were significant ($P < 0.001$). Values for R2 and R3 were not different.

At the end of the trial subjects were asked to indicate whether they would continue to use the novel saddle. All 11 indicated that they would use the novel saddle in the future. When contacted 3 months after the completion of the trial, 9 of the 11 subjects (82%) reported that they were still using the novel saddle in preference to the conventional saddle. All 9 subjects reported a decrease in the saddle-related symptoms they had experienced when starting the trial.

DISCUSSION

There were three important findings of this study. First, subjects reported that use of the novel saddle significantly reduced the severity of the symptoms they were accustomed to when cycling on the conventionally designed bicycling saddle. This effect was apparent within 7 days of training on the novel saddle (Fig. 4).

Second, the subjects reported that during a 2-hour laboratory ride the novel saddle was significantly more comfortable than the conventional saddle. Furthermore, this effect was achieved immediately on first exposure to the novel saddle (R2, Fig. 5), without any further improvement after a further week's exposure to the novel saddle (R3, Fig. 5). This would be expected if the saddle is anatomically correct and does not require a period of adaptation, as is normally required with use of the conventional saddle.

Third, after 1 week's use of the saddle all 11 subjects chose to continue using the saddle in preference to their conventional

saddles. Three months later, 9 continued to use the novel saddle. Furthermore, saddle-related symptoms were reduced in all 9 subjects.

We conclude that this initial evaluation shows that cyclists who experience saddle-related symptoms when using a conventional saddle report that a novelly designed, anatomically correct saddle is significantly more comfortable than their standard saddle, that it reduces their symptoms and, most importantly, that given the choice the clear majority prefer the novel saddle for long-term use.

Accordingly we suggest that this anatomically correct saddle offers significant advantages over the standard saddle. Furthermore, physicians treating cyclists with saddle-related medical disorders or who complain of substantial discomfort when cycling should consider that these conditions may be caused by the use of an anatomically incorrect bicycle saddle. The prescription of a more anatomically correct bicycle saddle would seem a logical therapeutic option.

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