An investigation of bicycle seat pressure and pudendal nerve entrapment mechanism during recumbant stationary cycling

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Introduction
A 40 year-old male with numerous urological problems including bladder dysfunction, erectile dysfunction, and testicular pain was diagnosed with pudendal nerve entrapment. This condition was believed to be secondary to an aggressive exercise program of recumbant stationary cycling. Male pudendal nerve entrapment from extended periods of bicycle riding have been reported in the medical literature (Andersen and Bovim, 1997; Desai and Gingell, 1989; Solomon and Cappa, 1987; Mellion, 1991). However, seat forces and pressures on recumbant seats had not been previously reported. Therefore, an investigation was conducted to measure and compare seat dynamics on a normal bicycle seat ridden upright and a recumbant seat ridden in recumbant posture.

Methods
Three experienced stationary cyclists were tested on three stationary bicycles; an upright model with a normal bicycle seat (Figure 1) and two recumbant models with typical recumbant seats (Figure 2 and 3). Each subject pedaled at three workloads (150, 250, 350 Watts) and at two cadences (70, 80 rpm). A pull condition was also tested to simulate a rider pulling up on the side grips with their hands on a recumbant cylerce as allegedly done by the claimant. A Novel Electronics flexible mat system with a 16x16 sensor matrix was placed between the rider’s buttocks and the seat. Synchronized data were collected and averaged over 5 pedal revolutions. The seat contact area was divided into center, left, and right for regional comparison. Maximum force, normalized to body weight, and peak pressures in each region were compared.

Figure 1. Upright model, normal bicycle seat
Figure 2. Recumbant model and seat
Figure 3. Recumbant model and seat
Results
Exemplar data are reported here. Total contact area for the recumbant seat (508-523 cm²) was 47-55% larger than the upright seat (338-346 cm²) while the maximum area was measured during the recumbant pull condition (608 cm²; 20% additional increase). Maximum forces were comparable and ranged from 59-77%BW on the upright seat and 62-72%BW on the recumbant seat while maximum force decreased with increased workload except during the pull condition, which resulted in 104%BW. Peak pressures were greatest in the center region on the upright seat and increased with decreasing workload (3.5-7.4 N/cm²). Peak pressures on the recumbant seat were always smallest in the center region and increased with workload (1.4-2.1 N/cm²). The center region peak pressures on the recumbant seat were 40-80% less than those measured on the upright seat across similar workload conditions. The pull condition increased the recumbant seat center peak pressure 33% to 2.8 N/cm².

Discussion
Larger total seat contact areas and smaller center peak pressures were measured on the recumbant seat when compared to the normal bicycle seat. Even the pull condition, which could not be maintained for long periods due to arm fatigue, generated substantially lower center peak pressures than the normal seat. It was concluded that recumbant seat dynamics and specifically peak pressures in the anatomically critical center region could not be reasonably associated with causing pudendal nerve entrapment.

References

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