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When Is It Safe for Patients to Drive after Right Total Hip Arthroplasty?

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ABSTRACT

Old studies recommend 6 weeks post-operative before patients can return to driving safely. This is a prospective study assessing brake reaction time (BRT) after THA. 38 patients underwent a pre-operative, 2, 4 and 6 weeks post-operative BRT test. General linear repeated measurement was used. The mean pre-operative reaction time was 0.635 ± 0.160 seconds SD and 2-week was 0.576 ± 0.137 seconds SD ($P = 0.029$); 33 patients (87%) were able to reach their baseline time by 2 weeks. The remaining five patients (13%) reached their baseline at the 4-week post-operative. No differences were found with respect to age, gender, and the use of assistive devices. With new techniques in THA, most of patients return to normal times within the 2-week.

Total hip arthroplasty (THA) is a common procedure. Over 300,000 are performed in the United States yearly, with expectations that the frequency will increase dramatically in coming years [1]. Return to normal activity and lifestyle is common and expected. Advances in surgical technique and pain management have decreased patient length of stay in the hospital after surgery as well as accelerated recovery. Modern patient expectations have also changed. A common question from THA patients involves how soon they are able to return to driving. This is an important question because it implies recovery and mobility, and has significant social and economic impact for patients and society.

Most surgeons give recommendations for returning to driving after THA based on two studies [2,3] published over a decade ago. In both of these studies, the brake reaction time (BRT) returned to baseline between the 4th and the 8th week after THA. However, in the past 10 years, major advances in THA have resulted in improved outcomes for THA patients in the immediate post-operative period. These advances, including muscle sparing surgical approaches, better pain management and rapid recovery protocols, may have a profound effect on return of BRT baseline.

The ability to drive is based on the patients' sensory, motor, and cognitive ability. This implies the ability to keep both hands on the steering wheel while applying adequate grip, and adequate strength to activate the brake pedal with an optimal reaction time [4]. The brake reaction time (BRT) is measured based on the total time that a person takes to apply the brake of the vehicle after receiving a stimulus to stop the vehicle. This can be measured precisely, objectively and reproducibly in an experimental setting.

The purpose of this study was to prospectively evaluate driving safety after THA through the measurement of BRT. Our hypothesis is that patient who undergoes THA with contemporary techniques will return to their baseline before the 4th postoperative week and, thus, return to safe driving much sooner than previously thought possible.

Methods and Material

After IRB approval, 38 patients who were scheduled for, and underwent, right THA were prospectively evaluated between October 2013 and June 2014 at our institution. Driving performance was evaluated using the BRT that measured brake time after a stimulus. BRT is the sum of the reaction time that it takes the driver to perceive the sensory stimulus, move the right foot from accelerator pedal to the brake pedal, and the time that it takes to apply sufficient pressure to brake (initiate a stop of the vehicle). Every patient in our study underwent right THA. All patients underwent a preoperative assessment to establish a baseline of their BRT. Then, all patients underwent a THA using a muscle sparing approach with a modern press-fit acetabular and femoral component. All patients were treated with the same postoperative pain and rehabilitation protocols and received identical follow-up. Everybody underwent preoperative medical evaluation to diminish the risks of postoperative delirium, urinary retention, and pulmonary and cardiac complications. All patients were managed with spinal anesthesia, a program of multimodal pain management (including minimal use of narcotics) and a rapid mobilization physical therapy protocol. Aspirin was used for DVT prophylaxis and early discharge was utilized whenever possible.

The inclusion and exclusion criteria are described in Table 1. Patient demographics were recorded including: age, BMI, co-morbid conditions

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Table 1
Inclusion and Exclusion Criteria.

Inclusion	Exclusion
Diagnosis of end-stage right hip degenerative joint disease	A diagnosis of posttraumatic arthritis
Avascular necrosis of the right hip	Left THA or left advance degenerative joint disease of the hip
Elective primary THA	Revision or conversion surgery
A valid driver's license	Continued use of narcotics at the time of testing
A vehicle with an automatic transmission	

and gender. A brief history was obtained to rule out the use of pre-operative and post-operative narcotics at the time of testing. Patients were then re-tested at 2, 4, 6 and 8 weeks post-operatively, or until their brake reaction time was equal to or less than their pre-operative score. Furthermore, all patients received a questionnaire at each follow-up visit with the following statement, "Based on my reaction time, I think I am ready to drive", from this statement patients can chose from the following answers: (1) Strongly disagree, (2) Disagree, (3) Neither, (4) Agree and (5) Strongly agree.

Patients were allowed to drive when the post-operative reaction time was equal to or less than their pre-operative brake reaction time baseline.

Model/testing Equipment

The RT-2S brake reaction timer (Advanced Therapy Products, Inc. Richmond, VA) was used for our study (Fig. 1). The RT-2S is a lightweight and portable brake reaction time simulator that assists driving evaluators in assessing driving safety. Parnell et al have previously validated the RT-2S. They found that the RT-2S simple reaction time tester is an appropriate replacement instrument for the AAA brake reaction timer. In fact, it is believed that the RT-2S more accurately reflects simple reaction times than the AAA brake reaction timer, which is no longer being manufactured [10]. The BRT is measured as the time from stimulus to the time an individual fully depresses the brake pedal. The tester randomly controls the illumination of the red and green lamps simulating stop and go traffic or signal lights. The same tester performed all testing in this study to insure consistency and to prevent inter-tester variability.

All patients followed a standardized procedure that consisted of sitting in a chair (adjusted individually for each patient) at a desk with the foot pedal on the ground in front of his/her right foot, and the light box in front of the patients within a viewing distance on the desk.

Patients were instructed to place their right foot on the accelerator pedal and keep it depressed to maintain the illumination of the green lamp. The patients were then instructed to move their right foot from the accelerator pedal to the brake pedal and depress the brake pedal as rapidly as possible when the red lamp on the test light box illuminated. We randomly controlled timing between the illumination of the red and green lamps for two, three, or four seconds. During testing, each subject was given one practice test and three trial times that were collected for data analysis.

Statistical Analysis

The SPSS 21 (IBM; Armonk, NY) was used to analyze the data. General linear repeated measurement was used for analysis. A difference of $P < 0.05$ was considered significant.

Power Analysis

A power analysis was performed to calculate the number of individuals needed. The nationally recommended safe brake time standard is 1.25 seconds which is based upon several scientific studies looking at BRT in all types of patients, surgical and non-surgical alike [7,4]. The normal brake time was estimated to be 1 second. A Bonferroni correction (i.e., alpha = 0.05) was used for the power analysis. In order to detect a 20% increase in braking time (1200 seconds), with a standard deviation of 0.250 seconds thirty five patients were needed to obtain a power of 0.8.

Results

Study patients had a mean age of 62 years ± 10.5 SD. The mean pre-operative reaction time was 0.635 ± 0.160 seconds SD (range: 0.402 to 1.1 seconds). The mean 2-week reaction time was 0.576 seconds ± 0.137 seconds SD (range: 0.394 to 1.03 seconds) ($P = 0.029$). Of the 38 study patients, 33 (87%) were able to reach their baseline time (or better) by 2 weeks (pre-operative 0.645 seconds ± SD 0.166) to 2 weeks 0.558 seconds ± SD 0.199 ($P = 0.001$). The remaining five patients (13%) reached their baseline at the 4-week post-operative test (pre-operative 0.572 seconds ± SD 0.094) to 2 weeks 0.692 seconds ± SD 0.203, to 4 weeks 0.501 second ± SD 0.596 ($P = 0.05$). Evaluation of confounding variables revealed no differences with respect to age, gender, and the use of assistive devices in the group. Age distribution can be observed in Fig. 2.

Fig. 1. The RT-2S brake reaction timer (Advanced Therapy Products, Inc. Richmond, VA) was used for our study.