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Ankle fractures: When can I drive doctor? A simulation study

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ABSTRACT

Traumatic ankle fractures are common injuries. Following injury, patients ask their doctor 'when can I drive doctor?' The ability to safely drive depends on several variables including reaction time, force, range of movement and pain. Return of the braking force is essential for return to driving and to our knowledge has not been addressed previously in the literature. The aim of this study is to pilot a sample of patients with ankle fractures for the return of their normal power and visual reaction time following injury using a simulator (DTS: Drive Test Station). Normal parameters were defined by the patient's contra-lateral non-injured limb. After confirming fracture union, 12 drivers with an isolated right ankle fracture were recruited 7.8 days after coming out of plaster (0–21 days). DTS was used to examine patients' ability to apply a braking force of 35 kg, representing the amount of force required to do an emergency stop at 70 mph. Visual reaction time was tested to assess patients' cognitive function. Results showed the average maximum brake pedal force to be 34.4 kg (range: 32–35 kg). Paired sample *t*-test for the total visual reaction time and visual pathway reaction time showed the *p*-value > 0.05 indicating no statistical difference between the injured limb and non-injured control side at the time of the examination. In conclusion, the DTS can be used to simulate an emergency stop to assess the motor power and cognitive function (visual reaction time) in case of right ankle fractures as this can give the patient an idea regarding their ability to apply brake force and the return of their visual reaction time. It is a practical assessment tool that could be used in fracture clinic setting. We still reserve our ability to advise patients to return to driving as this could bear significant medicolegal responsibility.

Introduction

Traumatic ankle fractures are common injuries. Following this injury, patients can ask their doctor "when can I drive doctor?".

Driving is a complex task that requires motor and cognitive skills. Following a lower limb injury motor ability may be directly affected because of pain, joint stiffness and muscle weakness.

A recent literature review shows that most studies attempting to answer our research question assess patient's ability to go back to diving, by testing the brake response time [3]. Very few studies in the literature assess patients' ability to apply a brake force, a function that is essential for safe driving. These studies however do not assess trauma patients [8,9].

The Driver and Vehicle Licensing Agency (DVLA) have no guidelines as to when a patient should return to driving. According to the DVLA 'Drivers do not need to notify the DVLA unless the medical conditions likely to affect safe driving persist for longer than 3 months and licence holders wishing to drive after surgery should establish with their own doctors when it is safe to do so' [4].

Return of lower limb power is an essential requirement for going back to driving. Our study is a pilot study aiming to assess patients' ability to go back to driving by assessing the return of their power and their response reaction time.

Methodology

Patients were approached following assessment by an independent surgeon in the fracture clinic. Recruitment into the study was considered, if patients' ankle fracture has clinically and radiologically united and were allowed to start fully weight bearing.

For recruitment, the patient had to have an isolated ankle injury with no medical history of any musculoskeletal pathology, which could compromise patients' function, and had to be a driver. Both surgically and conservatively treated ankle fractures were included.

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Data collection included patients' demographics, date of injury, diagnosis, type of treatment, past medical history, number of driving years, average annual mileage and any problems with driving prior to the injury.

We have taken the patients' ability to perform an emergency stop as a benchmark for safe vehicle control and testing motor ability. Visual reaction time was used to test return of cognitive function. The 'Drive Test Station' (DTS) was used for assessment [5].

Ethical approval was obtained prior to starting the study and all patients consented to participating in the study. SPSS version 19, was used for data analysis.

Drive Test Station

The Drive Test Station (DTS) is a simulator used at several mobility centres in the UK for assessment of disabled patients fitness to drive [5].

The DTS is connected to a computer screen where all the assessments are run through special provided software (Fig. 1).

The DTS has a seat, which can be adjusted to simulate the ergonomics of a car's seat, a steering wheel together with brake and accelerator pedals, as shown in Fig. 2.

The brake and accelerator pedal are connected through sensors to relay the tested force and reaction times. Force was measured in kilograms and reaction times in seconds.

The software used measured the total visual reaction time (time from application of a visual stimulus to the time required to complete a task). The latter was further analysed by the provided software to give the reaction time or the visual pathway reaction time.

Planned tests

(1) Brake power test.
(2) Visual reaction time.

The following protocol was used:

- Quite room for conducting the examination.
- Patients adjusted the seat position (forwards, backwards and the back rest angle) until the position simulated their real position in a car.
- Each test was conducted three times.
- The non-injured limb was examined first.
- A minute of rest was taken in between each of the planned test.
- Patients were asked to perform the task as long as they were comfortable to do so.
- A visual analogue scale (VAS) was used to assess patients' comfort while conducting the examination (non-graded scale of 10 units measurement, ranging from no pain at to very painful).

Fig. 1. Drive Test Station.

Fig. 2. Brake pedal and accelerator pedal.

Brake pedal force test

In this test the patient was asked to press the brake pedal building up from 0 to 35 kg, in 5 kg increments and maintaining each increment for 5 s. A force of 35 kg represents the amount of force required to do an emergency stop for a car travelling at 70 mph. The incremental rise was used to test patients' ability to 'control' the brake pedal; by applying an increasing static force for 5 s.

Visual reaction time

This was tested using a braking power of 35 kg (amount of force to stop a car travelling at 70 mph). Visual reaction time was analysed by the software into total visual reaction time and the visual pathway reaction times.

The software tested the visual reaction time using the 'traffic light system' where the patient was asked to push the accelerator pedal between 3 and 3.5 kg that changed the traffic light colour to yellow on the screen. The patient was asked to pull their foot off the accelerator pedal and push the brake pedal as quick as possible to 35 kg, as indicated on the screen, once the yellow colour changed to red. The timer stops when the patient achieved a force of 35 kg.

Total visual reaction time was defined as the time from the application of a visual stimulus to the time that the patient has completed the task, pushing the brake pedal to a force of 35 kg simulating an emergency stop. The software analysed this time into visual pathway reaction time, throttle movement time, shifting between throttle and brake pedal time and the brake travel times.

Examining the reaction time for the left ankle

On examination of the left ankle an adapter was fit which created a left accelerator pedal, as shown in Fig. 3.

Examining the left ankle for the above-proposed test is not a normal manoeuvre as the left ankle is not used to doing an emergency stop. All the patients were given two or three trials first before being tested to orient themselves moving the ankle between the two pedals. If in any of the attempts it was obvious to the examiner that the patient failed to perform the test because of mechanical failure, i.e. misplacing his foot on the brake pedal, the test was repeated.

Study control

We hypothesised that we can use the contralateral normal limb as a control for the injured limb. To test our hypothesis, we

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