Open lower limb fractures; Objective recovery assessed by balance and agility.

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Background

Open lower limb injuries, exemplified by those of the ankle and tibia can be life changing, resulting in a wide range of outcomes and a significant increase in health service utilisation. Changes in clinical management have been recommended in 2009 with published standards of care jointly from British Orthopaedic Association (BOA) and British Association for Plastic, Reconstructive and Aesthetic Surgery (BAPRAS), and more recently by NICE in 2016.

The aim of this research was to determine whether Force Sensing Array (FSA) Pressure Mapping System assessment of balance is likely to be reliable objective tool in measuring and monitoring recovery.

The results obtained from Objective Functional Outcomes Measures (OFOM) and patient reported outcome scales such as WaLLTR scale and Global Perceived Score were then compared with the results obtained form the balance measurement proposed here.

Methods

The Classic FSA Pressure Mapping System" was used to measure the balance. The data derived from the balance study was collected and collated in Excel and analysed in SPSS. Data processing, to evaluate the metrics was done using custom written code in R. Only non-parametric tests were used. For paired comparisons Mann-Whitney was used and for correlations Spearman correlation was used.

The control group consisted of twenty-two participants and the total number of limbs tested was forty. The patient group consisted of twenty-five individuals, some of whom took part in multiple sessions at different follow up points. In total there were forty-nine limbs recorded.

Additionally in order to enable a comparison between the balance test results and the existing recovery measurement tools, namely Objective Functional Outcome Measures and WaLLTR scale, the data collected as a part of OPRC measurements was analysed further.

Results

Analysis of the extent of movement: Centre of Mass (COM) - Global Centre of Mass GCOM) shown highly significant differences between the injured legs and the control group ($p<0.001$ in all cases) as well as between injured and uninjured leg for the patients. High Frequency Movement (COM-MA COM) shown highly significant ($p<0.001$ in all cases) difference between the bad leg and control. Comparison between good leg and control also confirms that there is a difference in extent of movement which suggests that the control group have better balance than the patients, even where their uninjured leg is tested. Additionally, the metrics used to measure balance shown a strong correlation in the time since injury. Consequently it can be concluded that the recovery process appears to be continuing at a noticeable rate up to around two years.

Discussion

This study has demonstrated that it is possible to successfully differentiate between the control and the patients' group based on the balance measurement generated using FSA mapping system. The researchers also noted a statistically significant difference between the injured and uninjured leg in the patients' cohort. Moreover, once compared with the results of the Objective Functional Outcome Measures, which are currently used in clinical practise, it became apparent that proposed here method is superior to all Range of Movement (ROM) tests as well as Single Leg Stand in showing patients' improvement with the passage of time. At the same time, the results of other OFOM tests such as Edgren Side Step Test, Comfortable Gait Speed and Fast Gait Speed were shown to correspond with the findings in this study. Finally, the results were compared with the WaLLTR scale scores as well as the Global Perceived Scores and there appears to be a correlation with the recovery progress between those. The information gained through this research has a capacity to add valuable information in the existing quest to improve existing quality of care metrics as well as create a foundation for further research.