EFFECTS OF VISUAL FEEDBACK IN ORTHOPAEDIC REHABILITATION

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INTRODUCTION

Currently, functional outcome following total knee arthroplasty (TKA) is not fully restored, with the majority of TKA patients exhibiting lower functional outcome scores than their healthy counterparts [1]. A contributing factor to limited functional outcome may be the nature of the rehabilitation provided as there is still some controversy regarding the most appropriate methods for rehabilitation delivery [2]. Providing patients with visual feedback during rehabilitation has had a positive effect in other patient populations such as stroke survivors [3] and therefore may also improve the efficacy of orthopaedic rehabilitation. The aim of this study was to develop a visual feedback tool based on real time data from 3D motion capture for routine clinical use. Further aims included determining if provision of augmented feedback was acceptable to patients and whether it had a positive effect on functional outcome.

METHODS

A bespoke, cluster based motion analysis protocol which has been previously validated for calculation of lower limb kinematics [4] was used to develop an avatar of lower limb movement and measure real-time kinematics. Three bespoke feedback scenarios were developed for “step-up”, “sit to stand” and “weight transfer” exercises which displayed the patients’ movement and a limited amount of useful biomechanical information to help patients complete exercises correctly. Fifteen patients were sequentially recruited into a control group and 15 into an intervention group. All patients completed a baseline gait assessment. Control patients completed rehabilitation exercises as normal and intervention patients completed three of nine exercises with visual feedback. After six weekly rehabilitation sessions, all patients completed an outcome gait assessment. Further, intervention patients completed a questionnaire regarding their experience using the feedback tool. Peak knee extension velocity in swing (PEVS), peak knee flexion in swing (PFS) and total knee flexion excursion (TFE) were compared between groups using an independent t-test ($\alpha = 0.05$).

RESULTS AND DISCUSSION

The majority of patients found use of the tool highly acceptable, were motivated by it and found it an enjoyable addition to their routine care. One aspect which was slightly less favourable was the biomechanical information which was displayed. This issue could be combatted by use of a ‘virtual teacher’, which has shown a positive effect in previous visual feedback studies [5] and would negate the need for biomechanical information to be displayed while still ensuring exercises were being completed correctly. Table 1 details the results for each group at outcome and the change in each outcome measure between baseline and outcome. There was a positive change in all outcome measures for both groups, with controls achieving similar values to patient data from the literature and interventions achieving similar values to healthy controls from the literature [1]. When examining the change between baseline and outcome, there were no significant differences between groups. However the intervention group showed larger improvements in PFS and TFE in comparison to controls. Subsequent sample size calculations revealed that a group size of 22 would have resulted in a significant difference for TFE and therefore it is likely that the study was underpowered. These results suggest that provision of visual feedback may have a positive effect on knee range of motion in the sagittal plane.

CONCLUSIONS

Visual feedback using motion analysis was successfully delivered in a routine clinical environment and was widely acceptable to patients. Further, provision of visual feedback appeared to lead to improved knee range of motion in the sagittal plane in comparison to control patients. However, larger scale studies are required to confirm these positive effects.

REFERENCES

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Table 1. Mean ± SD at outcome and the mean change between baseline and outcome for each group and each outcome measure ($\alpha = 0.05$)

	Outcome		**Change**		
Outcome Measure	**Controls**	**Interventions**	**Controls**	**Interventions**	***P* Value**
PEVS (°/s)	388.7 ± 63.7	459.6 ± 74.6	217.7 ± 52.1	208.3 ± 82.8	0.86
PFS (°)	53.1 ± 1.7	63.0 ± 2.1	9.8 ± 2.1	12.9 ± 3.7	0.41
FE (°)	47.5 ± 11.1	55.7 ± 9.4	12.6 ± 10.6	16.7 ± 10.4	0.07