Short and longer term effects of a toe in gait retraining program in people with medial knee osteoarthritis

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DOI
10.1016/j.joca.2018.02.674

Publication date
2019

Document Version
Final published version

Published in
Osteoarthritis and Cartilage

For between group differences at 6-months: MT was significantly better than UC for increasing knee extension ($P < 0.05$), and MT2 was significantly better than MT1 ($P < 0.03$). There were no significant between group differences at 6-months for pain, function or QoL.
Conclusions: The study design was feasible, with high compliance to treatment frequency. This is important, as the main aim of the research is to identify optimal treatment frequency. An 87% retention rate was less than a pre-defined criterion (90%). This will inform sample size calculation for a future RCT, as will data variance. We acknowledge the preliminary nature of clinical outcomes. However, there were encouraging changes in knee extension and patient self-reported measures, suggesting the study question is worth pursuing in a fully powered RCT with similar design. While sample size was adequate for a feasibility study, it may be too small to detect clinically relevant differences. Despite large standard deviations, and wide 95% CI (data not shown), MT2 appeared to show greater improvement in clinical outcomes than other groups. If this trend were repeated in a fully powered study, it would support more frequent treatment sessions. Improvements may reflect benefit of repeated contact with research physiotherapists, and usefulness of the standardised intervention. Both the feasibility and clinical outcomes support conduct of a future RCT, and results will inform sample size calculation and minor changes to study design.

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SHORT AND LONGER TERM EFFECTS OF A TOE IN GAIT RETRAINING PROGRAM IN PEOPLE WITH MEDIAL KNEE OSTEOARTHRITIS

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Purpose: To investigate changes in the first peak knee adduction moment (KAM) (as a proxy of medial knee loading) and changes in patient reported outcome measures, specifically WOMAC pain and functional ability, immediately after and three and six months after a six week toe-in gait retraining program.
Methods: Twenty-one patients with medial knee osteoarthritis (16F, 5M, age 61.3 (5.73), BMI 25.4 (2.6), KL score of the most affected knee I:14, II:2, III: 4, IV:1) were recruited for this study from a previous study investigating gait retraining within our group. Patients attended the Virtual Reality lab for one gait training session per week for six weeks. During the training sessions patients walked at a comfortable, fixed speed on an instrumented treadmill. Gait parameters (including KAM and foot progression angle, FPA) were calculated in real-time using a 10 camera Vicon motion capture system, two ForceLink forceplates and the DFlow Human Body Model. Targets for the FPA were projected onto a large screen in front of the treadmill and the current FPA was displayed alongside the target to allow patients to adjust their foot positioning in real-time. A faded feedback protocol was used to reduce reliance on the feedback, with the feedback time reduced between week four and week six. During the training sessions, we first measured the patient's natural walking. Following this, patients received three training blocks with feedback on the FPA. Finally we re-measured the patient's normal gait (without feedback) to investigate the retention effect. At the follow-up measurements at 3 and 6 months, patients were not provided with feedback on their FPA; instead we measured their normal gait pattern and their gait pattern while they concentrated on walking with toe-in gait. Our primary outcome measure was the changes in first peak KAM between week one and week six and the follow-up measurements. Furthermore we investigated within-session changes in first peak KAM (between normal walking and retention).
Patient reported outcome measures, specifically knee pain and functional ability, were assessed at the start and end of the training program and at the follow-up measurements using the WOMAC questionnaire.
Results: Sixteen of the twenty-one patients (76.2%). starting the gait retraining program completed all training sessions. In week six, first peak KAM was significantly reduced by 7.7% compared to week one ($P = 0.049$), Figure 1a. At the follow-up measurements, first peak KAM was still reduced on average by 6.86% but the changes did not meet statistical significance ($P = 0.101$), Figure 1a. Within-session changes in first peak KAM between the normal walking condition and retention condition were observed (average reduction of 9.9%, $P = 0.003$), Figure 1a. The WOMAC score for functional ability was reduced immediately after the gait retraining program by eight points ($P = 0.04$) indicating a significant improvement, Figure 1b. A significant change was also noted at the six month follow up (9 point reduction, $P = 0.04$). There was also a trend towards reduced pain (WOMAC pain subscale) at the follow-up measurements ($P = 0.06$), Figure 1c.
Conclusions: Gait retraining with real-time biofeedback on the FPA was successful in reducing first peak KAM in the short term in patients with medial knee osteoarthritis (immediately after the training and within-session). However, there was evidence of a wash-out of the effects in some patients at the follow-up measurements. The change in KAM within session and the wash-out of effects at follow-up suggest that to reduce the KAM conscious effort is required in order to maintain the modified gait pattern. Based on this we suggest that home training using wearable technology may be required to encourage a more permanent change in the gait pattern next to training sessions in a hospital environment. This is likely necessary to reduce the KAM in the long-term and hence influence the progression of the KOA.

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DETERMINANTS OF QUALITY-OF-LIFE 12-MONTHS FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN ACTIVE YOUTH AND YOUNG ADULTS

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Purpose: An anterior cruciate ligament (ACL) rupture is a common injury sustained by active youth and young adults. Beyond the short-term, these injuries have long-term consequences including increased risk of physical inactivity, increased adiposity, and early-onset post-traumatic osteoarthritis (PTOA). Further, youth and young adults who suffer an ACL rupture display reduced knee-related (quality-of-life) QOL. Many advances in ACL rehabilitation have focused on return-to-sport (RTS) with minimal consideration for restoring QOL or reducing long-term consequences such as PTOA. There is a paucity of information regarding what modifiable factors impact knee-related QOL following youth sport-related ACL reconstruction (ACLR). Assessing these factors during rehabilitation and determining their association with future QOL outcomes may inform early interventions that may prevent long-term decline in overall well-being and decrease the incidence of future PTOA. The aim of this research is to examine the association of 6-month knee symptoms, kinesiophobia (fear of movement), and daily average moderate-to-vigorous physical activity (MVPA) with 12-month knee-related QOL following sport-related ACLR.
Methods: Participants in this pilot cohort study include 19 youth and young adults with an isolated, first-time, sport-related (Cincinnati Sports Activity Scale Level I or II) ACL tear (arthroscopic confirmation) who elected to undergo ACLR and expressed a desire to RTS. The outcome variable was knee-related QOL at 12 months following ACLR assessed with the Knee Injury and Osteoarthritis Outcome Score QOL subscale ($KOOS_{QOL}$). Exposure variables included: 6-month KOOS symptoms subscale ($KOOS_{sx}$), Tampa Scale of Kinesiophobia (TSK), and daily average MVPA minutes. To inform future research additional covariates were collected. These included: body mass index (BMI; kg/m^2), KOOS function in sport and recreation ($KOOS_{SR}$), pain ($KOOS_{PAIN}$) and, function in daily living ($KOOS_{ADL}$) subscales, ACL-Return to Sport after Injury scale (ACL-RSI), return to main sport (RTS main), return to any sport (other than main sport; RTS any), and subsequent surgery. Data was collected at baseline (pre-surgery), three, six, nine, and 12-months post-operatively. Descriptive statistics [mean (95% CI), median (range), or proportion (exact 95% CI)] were calculated for all outcomes and covariates at each time point. Linear regression was used to evaluate the associations between 12-month $KOOS_{QOL}$ and each of the 6-month exposure variables ($KOOS_{SX}$, TSK, MVPA; $\alpha = 0.05$). All assumptions of linear regression analyses were assessed and met.
Results: Participant characteristics are summarized in Table 1. Mean participant age was 18.1 years (95% CI; 15.1, 20.6) and 68% were female. Descriptive statistics for all outcomes and covariates at each time point are summarized in Table 2. The median (range) $KOOS_{QOL}$ score at 12-months post-ACLR was 50 (6–100). The median (range) 6-months $KOOS_{SX}$, TKS and daily average MVPA were 75 (50–96), 37 (30–46), and 51 (21–135), respectively. There was a significant positive linear association between 6-month $KOOS_{sx}$ and 12-month $KOOS_{QOL}$ ($r^2 = 0.391$, $P = 0.006$), and negative linear association between 6-months TSK and $KOOS_{QOL}$ ($r^2 = 0.290$, $P = 0.021$) scores. Specifically, for every unit