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Do foot & ankle assessments assist the explanation of 1 year knee arthroplasty outcomes?

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SUMMARY

Objective: Whilst a number of risk factors for poor patient reported outcome measures (PROMs) following knee arthroplasty (KA) have been identified, unexplained variability still remains. The role of pre-operative foot and ankle status on such outcomes has not been investigated. The aim of this study was therefore to determine the association of clinical foot and ankle assessments with patient reported outcomes 1 year following KA.

Design: One hundred and fifteen participants from the Clinical Outcomes in Arthroplasty Study (COASt), underwent detailed foot and ankle assessments at baseline, prior to KA (2012–2014) and were followed up for self-reported outcomes 1 year after surgery.

Results: Thirty nine percent of subjects reported foot pain at baseline. Mean pre-operative Oxford Knee Score (OKS; 0 [worst] to 48 [best outcome]) was 21 and post-operative OKS score was 38. In fully adjusted analysis pre-operative foot pain was significantly associated with 1 year outcome (risk ratio [RR] 0.78 95% confidence interval [95% CI] 0.62, 0.98). No significant association was observed between ankle dorsiflexion or foot posture and outcome.

Conclusions: Patients with pre-operative foot pain are more likely to have poorer clinically important outcomes 1 year following KA than patients without foot pain. Static ankle dorsiflexion and foot posture do not further explain post-operative KA outcomes. Consideration should also be given to address pre-operative foot pain when attempting to achieve a good clinical outcome for KA.

Introduction

Knee Arthroplasty (KA) is considered to be a successful and cost-effective intervention for individuals with severe end stage Osteoarthritis (OA)[1]. Growing emphasis is therefore now placed upon Patient Reported Outcome Measures (PROMs) to measure the success of KA[2] and it has become apparent that not all patients are satisfied with their surgery, with dissatisfaction rates ranging from 7% to 32%[3–7].

A number of factors for poor patient reported outcomes following KA have been identified. These include body mass index (BMI)[8,9], anxiety, depression and social deprivation[10], rheumatoid arthritis (RA)[10,11], age[10,12] and musculoskeletal comorbidities[13]. Whilst these studies have provided good insight into the explanation of KA outcome, less than 20% of the variability in PROMs of KA has so far been explained[10], suggesting there are other factors still to be identified to improve our ability to recognise patients at risk of poor KA outcomes.

Patients undergoing KA often have other troublesome hips and knees[13]. It is acknowledged by clinicians and researchers that there is a relationship between foot, ankle, knee and hip kinematics. Clinical foot and ankle assessments is based on the theory to which, the degree of movement at the foot, subtalar and ankle joint affect the lower limb alignment as movement is transferred proximally. An excess of subtalar joint inversion/eversion is hypothesised to increase external/internal rotation about the tibia, which in turn is said to disrupt the normal mechanics of the tibiofemoral joint[14]. These axial links between the subtalar and tibiofemoral joint indicate that foot and ankle kinematics may play an influential role on the both the transverse rotational and frontal measures about the knee. Such theories remain limited in their evidence base, likely

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due to the difficulty in assessing dynamic anatomical forces and motion within the intricate articulations around the foot and ankle joints. Despite the growing body of evidence which has observed the effect of altering biomechanical factors, via the use of foot interventions, on knee OA related kinematics[15–19], there is little known about the role of the foot and ankle on clinical knee outcomes such as pain and function, in particular following KA.

A study of KA patients found worse post-surgical pain and function in individuals who reported arthritis related symptoms in the ankles/feet/toes[13], these associations were however mediated through depression. Recent findings from a large prospective cohort, enhanced with patients with or at risk of knee OA, show that foot pain adversely affects knee OA related pain and symptom severity as measured by WOMAC and objective measures of physical function (20-m walk test pace and repeated chair stand pace)[20]. Due to the cross-sectional nature of the study no inference could be made as to whether foot pain preceded knee OA or developed subsequent to it.

The aim of this study was therefore to determine if clinical foot and ankle assessments, including pain are associated with patient reported outcomes 1 year following KA.

Methods

Study population

A subset of participants ($n = 115$) from a prospective cohort of patients listed for KA, known as the Clinical Outcomes in Arthroplasty Study (COASt), underwent detailed foot and ankle assessments. This subset is known as COASt-Foot. COASt is a prospective, dual-centre longitudinal cohort study of patients who were listed for hip and knee arthroplasties across two hospitals; Southampton University Hospital NHS Foundation Trust (UHS) and Nuffield Orthopaedic Centre (NOC), part of the Oxford University Hospital NHS Trust (OUH). 1760 patients recruited for COASt for KA underwent baseline data collection. 1441 at UHS and 319 at the NOC. Full ethical approval was gained (Oxford REC A ref: 10/H0604/91). All participants provided written informed consent. One hundred and fifteen patients underwent detailed foot and ankle assessments pre-operatively and were prospectively followed up 1-year post-operative to allow comparison of pre and 1 year post-operative knee outcomes.

Baseline data collection for COASt-Foot ran from 2012 to 2014 at both sites. All patient characteristics and clinical measures including foot and ankle measures were made during the COASt pre-operative visit, alongside all other measures taken with COASt at baseline. Follow up patient reported outcomes were collected 1 year post-operatively. All patients listed for KA at both sites were approached to take part in COASt. Participants were included if above the age of 18, with no upper age limit. The broad inclusion criteria of COASt provided a high level of generalizability. COASt-Foot is a sample of COASt KA participants, randomly selected over a short period for a doctoral study. Participants with Charcot's arthropathy or other severe neurological disease, previous knee or ankle arthroplasty or fusion were excluded from COASt-Foot.

Covariates

Demographic and clinical data, including age (years) and gender, was collected when enrolling on the COASt study. BMI (kg/m^2) was measured at baseline pre-operative assessment by the COASt researcher, along with depression (Hospital Anxiety and Depression Score)[21], which was assessed via patient completed questionnaire.

Pre-operative Oxford Knee Score (OKS)[22] was also collected at baseline visit. OKS is a validated patient-administered questionnaire which consists of 12 questions relating to knee pain and physical function limitations during the past 4 weeks. Each question is answered on a five-point Likert scale, and an overall score is calculated by summarising the responses to each of the 12 questions. This sum score ranges from 0 to 48, where 0 indicates the most severe symptoms and 48 the least severe symptoms.

Main exposures

Disabling foot pain, foot posture and passive ankle dorsiflexion were examined. Objective assessments were chosen based on the findings of an international consensus study[23] and extensive literature review[24]. Prior to this the absence of agreement for which assessment measures should be used to assess the foot and ankle in clinical practice was a dilemma for researchers and clinicians and whilst foot and ankle assessment measures were routinely used, the evidence to support their use was weak. Many historically used measures are limited in that associations to clinical outcomes such as foot pain or function have yet to be reported and as such the clinical relevance and minimally important clinical change values have not been established.

The consensus study informed the choice of ankle dorsiflexion range of motion and Foot Posture Index (FPI), which unlike most, have undergone previous investigations for both reliability and clinical validity[25–29] and were selected as two of the most highly recommended measures among a battery of others[23]. An additional measure of foot pain was introduced to COASt-Foot due to the importance of pain within disease. A measurement of foot pain that has often been used in epidemiology is the Manchester Foot Pain and Disability Index (MFPDI). The MFPDI can be used for foot pain in different populations, with or without the presence of musculoskeletal disease. It has been validated in both the rheumatology and general population[30,31].

One clinical examiner at each site (research physiotherapist and clinical research nurse) conducted the ankle dorsiflexion measures, after receiving training from an experienced Podiatrist (LG) and all FPI measures at both sites were conducted by LG.

Disabling foot pain was established for either foot using the MFPDI[30] at baseline pre-operative assessment. A practical definition of disabling foot pain (at least one of the 10 FPDI function items experienced on most/every day(s)) has been proposed and shown to be sensitive to age and gender differences within the older population[31,32].

Passive ankle dorsiflexion of the affected limb was also assessed at the pre-operative assessment visit, using a goniometer placed on lateral aspect of calcaneus, one arm bisecting the midpoint of lateral lower leg and other arm orientated at 90°, whilst the participant lay supine with knee extended. The examiner applied pressure to passively dorsiflex the ankle, whilst measuring the movement.

The FPI provides a composite measure of overall foot posture[25]. It consists of six criteria: talar head palpation, curves above and below the malleoli, inversion/eversion of the calcaneus, bulge at the region of the talonavicular joint, congruence of the medial longitudinal arch and abduction/adduction of the forefoot on rearfoot. Total FPI score is the sum of six ordinal items with individual scores of −2 to +2. High intra-rater reliability has previously been reported for both of these measures[26–28].

The FPI has undergone testing against the Rasch model to determine its internal construct validity. Ordinal data that fits the Rasch model can be transformed to an interval measurement level using logits as the units of measurement, these logit values has been previously established[33] and prior to analysis the total FPI