Conclusion - The key gait kinematic data for 196 people with early stage knee OA from the APPROACH cohort have been presented: knee and hip range and stance flexion. The results show that the average values for all parameters are statistically significantly lower than for the 198 healthy control group. The maximum values for the minimum side are however well within the normal limits, which suggests that the gait parameters are not affected for all patients.

Introduction

Disease modifying therapy of osteoarthritis (OA) represents an unmet clinical need, and appropriate outcome measures are required that can robustly identify patients with different OA phenotypes who may benefit from specific therapies. APPROACH is an exploratory, European, 5-centre, 2-year prospective follow-up cohort study. It entails extensive clinical, imaging, biomechanical and biochemical parameters, in a cohort recruited using machine learning models based on retrospective patient data to display a high likelihood of radiographic joint space width loss and/or knee pain over the course of the study. The aim of this study was to ascertain gait kinematic data from up to 300 patients with different phenotypes of OA. Each patient will be measured at inclusion, M6 and M24. This paper presents baseline data for the first 196 patients who have been tested at 4 hospitals in 3 countries; Spain, Holland and Norway.

Methods

The APPROACH cohort is a new longitudinal cohort focused on fast knee OA progressors. Patients were recruited from 5 existing European OA cohorts using machine learning models trained to estimate progression probability. Each country obtained its own ethical approval, using the same GaitSmart protocol. The operators at each hospital were trained by ETBH personnel (European Technology for Business Holdings LTD). An appointment time of 20 minutes was allocated per patient to undergo the complete measurement. Patients were asked to wear flat or low heeled shoes with proper support and use the same footwear at inclusion and M6 and M24 if possible.

The healthy cohort were consenting volunteers from across Europe. The inclusion criteria was no lower limb joint replacement, no diagnosis of hip or knee OA and no neurological condition that would affect their cognitive ability or mobility. The test was performed with flat or low heeled shoes with back support.

GaitSmart comprises six sensor modules with accompanying Velcro straps. The sensors are inertial measurement units and contain three orthogonal gyroscopes and three orthogonal accelerometers. The six sensors are first synchronized using the dedicated software and then disconnected from the computer. Each sensor is switched on and then mounted in to the appropriate pocket within Velcro straps. The Velcro straps are applied on the lateral sides of the hip, just above the iliac crest, the thigh, just below the greater trochanter and the belly of the gastrocnemius muscle of the calf (see figure 1).

Measurement protocol

• Patients stand still for ten seconds to calibrate the sensors.
• Then each patient walks up and down a 20m corridor at their self-selected speed.
• Once the evaluation is completed the sensors are removed from the straps, switched off and attached back to the laptop via the USB connectors.

Poseidon software is used to analyse the data. The observer must choose a minimum of 5 strides where the stride duration was continuous to within 5% of the mean and from this the most representative stride of the gait pattern will be calculated automatically, i.e. the stride with the lowest error compared to the other strides. The parameters are provided for this stride and shown graphically and in tabular form in the patient report. Gait parameters included pelvis, hip, thigh, knee and calf range of motion in the sagittal plane; thigh and calf medial-lateral movement; knee stance flexion; joint and segment symmetry and stride duration. For the overall project database, the main predictors of the severity of knee OA: Knee ROM in swing and stance and hip ROM are stored for both sides.

Results

The side on which the patient has the lowest stance flexion has been defined as Side 1 for both the APPROACH and healthy cohorts. In Table 1 the knee, hip and stance for sides 1 and 2 are quoted for both cohorts. Figure 2 shows the interquartile values and the range for each of the parameters in early OA patients.