O17

Abnormal loading of the major joints in knee osteoarthritis and the response to knee replacement

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Introduction: Patients with knee osteoarthritis frequently complain that they walk abnormally and subsequently develop pain in other joints due to 'over-loading'. However, there have been no previous studies examining the effect of knee arthritis on the weight bearing joints of the other leg. The aim of this study was to examine the loading of the hips and contra-lateral knee during gait in a cohort of patients pre- and post knee replacement.
Patients/materials and methods: Twenty patients with single joint, medial compartment knee osteoarthritis were recruited from the knee arthroplasty waiting list of the North Wales NHS Trust. Twenty healthy age-matched volunteers were recruited from the community. Gait analysis during level gait was performed using a 12 camera Vicon Mx motion analysis system with 3 AMTI force plates and processed using Plug in Gait (Vicon, Oxford). EMG electrodes attached to the medial and lateral hamstrings and quadriceps bilaterally were used to record muscle activity and a co-contraction index was calculated. Patients were invited to return 12 months post-operatively and the analysis was repeated. Statistical analysis was performed using *t*-tests with Bonferroni correction and stepwise multiple regression using SPSS v16.0.
Results: The mean age of the patients was 69 (range 53–82) and the controls was 68 (range 60–83). Mid-stance moments and knee adduction moment impulses were elevated at both hips and both knees in patients compared to normal individuals (adduction moment impulses: OA knee = 1.45 N m s; opposite knee = 1.16 N m s; controls = 0.82 N m s; $p < 0.05$ bilaterally) whilst peak moments were not significantly different. Co-contraction was elevated in both knees compared to normal ($p < 0.01$ for both knees). Coronal plane alignment, gait speed and knee extension were all significant factors using multiple regression analysis. Ten patients have so far returned for follow up. Substantial improvements in mid-stance moments were seen at the replaced knee (mean decrease in moment 0.97 N m/Bw Ht) with smaller improvements in the peak moment (mean decrease in moment 0.56 N m/Bw Ht). Changes in loading in the contra-lateral knee were very variable, and did not always normalise. Peak moments at the contra-lateral knee increased in some patients as gait speed increased (mean increase in moment 0.27 N m/Bw Ht) but mid-stance moments and waveform shape varied considerably between patients (mean decrease in mid-stance moment 0.11 N m/Bw Ht). Improvements were seen at mid-stance moments for both hips in the majority of patients. Persisting co-contraction was a common feature post-operatively, particularly in the contra-lateral knee (mean decrease in co-contraction: lateral affected side 0.08; lateral unaffected side 0.04; medial affected side 0.07; medial unaffected side no change in mean).
Discussion and conclusion: Patients with single joint knee osteoarthritis have abnormal loading of both knees and both hips, potentially leading to further disease and disability. The gait pattern appeared to be consistent with the adoption of a stable, safe pattern of gait. Recovery following knee replacement is variable, and abnormal biomechanics often persist, especially in the unaffected knee. Therapies to treat persisting biomechanical abnormalities following knee replacement may be of benefit in preventing future disease in these patients.
Disclosure: No significant relationships.

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Cerebral palsy I, 16:00–17:00

O18

What are the most important clinical measurements affecting gait in patients with cerebral palsy?

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Introduction: Clinical measurements are used to interpret gait analysis in patients with cerebral palsy (CP). Our hypothesis is that some of the clinical parameters, or their combinations, are more important than others in explaining the severity of gait alterations in CP. Identifying these parameters could support the interpretation of gait analysis. Authors have already tested the relationship between clinical measurement and gait analysis and found poor correlations [1,2]. We can speculate that these poor correlations are due to the only use of linear regression. Fuzzy Decision Trees (FDT) is a method that seems particularly appropriate for identifying and explaining gait alterations. This method has been employed in machine learning, but is rarely used in gait analysis [3]. It combines fuzzy logic, which simplifies the knowledge extraction process and increases the interpretability, with the automatic induction of easy, readable rules from a dataset. Consequently, this study aimed to determine which of clinical parameters or their combinations would most influence a gait index for patients with CP.
Patients/materials and methods: A retrospective search, including clinical and gait assessments, was conducted from August 2005 to September 2009. 155 patients with a clinical diagnosis of CP (mean age: 11 ± 5.3 years; range: 3–30 years) were selected. A decision-tree induction, adapted to fuzzy data coding, was employed to predict the Gait Deviation Index (GDI) from a dataset of clinical assessments (i.e., range of motion (ROM), force and spasticity).
Results: Seven rules that could explain a low GDI (<77) were induced. Overall, FDT method was highly accurate (90%) and permitted to predict GDI values with a mean error of 2.35 ± 0.4. The three most important clinical parameters used to predict the severity of gait alterations are the hip extensor strength, tibialis posterior spasticity and tibialis posterior strength.
Discussion and conclusion: The accuracy of the FDT method indicates that the chosen clinical measurements provide a good explanation of the severity of gait alterations in patients with cerebral palsy. Among clinical parameters, hip extensor strength has been already identified to play an important role in CP classification according to the Gross Motor Function Classification System [4]. The spasticity of tibialis posterior lead to equinovarus of the foot [5], moreover, the equilibrium of inversor and eversor muscle strength is primordial for a good foot position. There is an important relationship between clinical parameters and the severity of gait alterations. Forces and spasticity parameters are more involved than ROM to predict gait severity.
Disclosure: No significant relationships.

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O19

Discrimination of the abnormal gait parameters due to increased femoral anteversion from the other cerebral palsy related effects

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Introduction: The affects of increased femoral anteversion (IFA) are complexly involved with the other orthopedic and neurological abnormalities of children with cerebral palsy (CP) which causes misinterpretation, deficient treatment and end up with preoperative gait pattern after the surgery [1–3]. The aim of the study is discrimination of the affects of IFA from the other CP related abnormalities such as motor control problems, abnormal tonus, and sensory motor problems on gait patter.

Patients/materials and methods: 14 neurologically intact children with IFA (mean age: 7.4 ± 1.8) (Group-A), 10 spastic diplegic children with IFA (7.8 ± 1.7) (Group-B), 11 diplegic children with nearly normal femoral anteversion (10.5 ± 4.5) (Group-C), particpated in to this study. Both groups' subjects had similar GMFCS scores (Level 2). The hip internal rotation angles for all the children with IFA groups were $\geq 70^{\circ}$ and external rotations were $\leq 20^{\circ}$ bilaterally. Pelvis, hip, knee and ankle kinematics, kinetics and temporal-spatial parameters were analyzed in gait analysis laboratory. ANOVA and post-hoc tests were performed to analyze parametric data. The significantly different parameters between Groups B and C considered as the femoral anteversion (FA) affects and differences between Groups A and B were assumed as the other CP affects.

Results: Knee flexion at initial contact, mean and excursion of pelvic tilt, peak hip flexion and in GC and peak ankle plantar flexor moment in 0–30% of gait cycle (GC) and peak knee power absorption in 0–30% GC significantly increased and power generation between 30-60% GC decreased significantly in Group-B relative to Group-A (Figs. 1–3). Mean value of pelvic tilt during entire gait cycle (Fig. 3) and knee valgus value during stance, peak hip flexion in GC and pelvic rotation excursion increased and peak knee extension in stance decreased in Group-B relative to Group-C. Stance-time(%), double-support time (ms), step-width significantly increased and swing-time (%), anterior step length, stride length, velocity significantly decreased in Group-B relative to Group-A. Only increased swing time was found as significant in Group-C relative to Group-B.

Discussion and conclusion: Increased pelvic tilt in GC and augmented knee valgus in stance were the obvious gait parameters directly related with IFA. Increased knee flexion, enlarged peak knee power absorbsion in early stance phase (K1) and decreased ankle power generation in late stance seem to be directly related with disease of cerebral pasly. Derotational femoral ostetotomy procedure may decrease abnormal anterior pelvic tilt and increased knee valgus itself. Orthopedic surgeons should previously focus on correcting lever arm dysfunction on femur for cerebral palsy children with increased femoral anteversion.

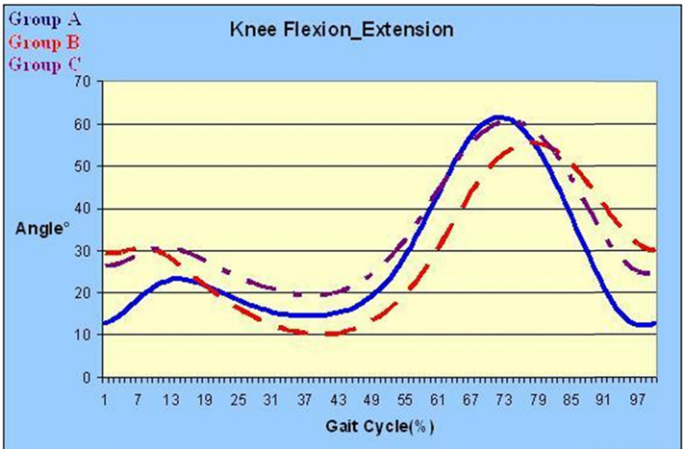

Fig. 1.

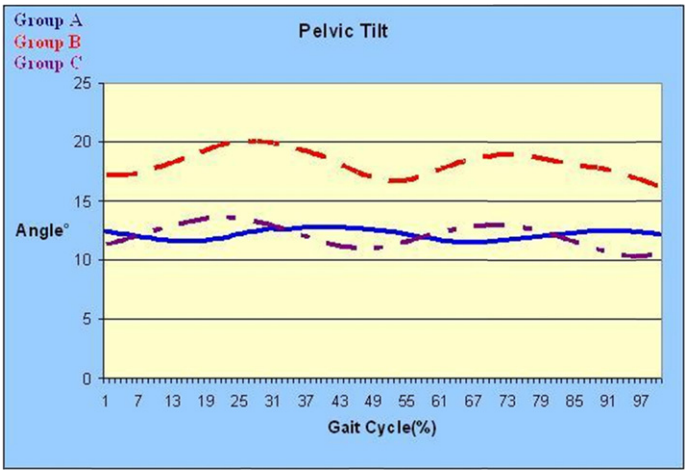

Fig. 2.

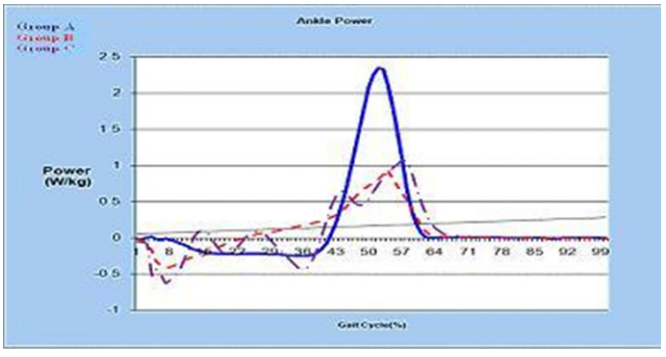

Fig. 3.

Disclosure: No significant relationships.

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