Muscle co-contraction during gait following total knee arthroplasty is challenged by higher velocity, not by a cognitive dual task

Booij, M.; Apeldoorn, K.; van Royen, Barend; van den Noort, J.C.; Harlaar, Jaap

DOI
10.1016/j.joca.2018.02.529

Publication date
2019

Document Version
Final published version

Published in
Osteoarthritis and Cartilage

Citation (APA)
Booij, M., Apeldoorn, K., van Royen, B., van den Noort, J. C., & Harlaar, J. (2019). Muscle co-contraction during gait following total knee arthroplasty is challenged by higher velocity, not by a cognitive dual task. *Osteoarthritis and Cartilage*, *26*(Supplement 1), S259-S260. Article 490. https://doi.org/10.1016/j.joca.2018.02.529

489
THE HAND OSTEOARTHRITIS OF NEW YORK UNIVERSITY (HONEY) COHORT: SPECTRUM OF DISEASE IN A RHEUMATOLOGY FACULTY PRACTICE

F. Bomfim, S. Chen, S. Zak, T. Jazrawi, R. Cohen, M. Kundler, A. Chebli, J. Samuels. *NYU Langone Hlth., New York, NY, USA*

Purpose: The diagnosis of hand osteoarthritis (OA), as with other anatomic locations of OA, lacks a proven disease-modifying medication, yet this most common form of hand pathology receives less attention than other types of "inflammatory" arthritis. Most hand OA publications from North American researchers appear as secondary data from knee OA studies (retrospective and prospective) or other investigations. Thus we aim to meet a defined need for dedicated cohorts that are recruited primarily for hand OA deformities and/or pain, with targeted questionnaires to better accumulate the spectrum of clinical patterns and severity – while facilitating the study of etiologies, pathophysiology and potential treatments.
Methods: Patients with clinically diagnosed hand OA were identified through two major mechanisms: referrals from our rheumatology faculty practices (facilitated by an IRB-approved flyer to remind providers), and electronic medical record reviews of ICD-9/10 codes (and subsequent charts) from patients who have been diagnosed with hand OA (1st CMC and/or PIPs and DIPs). Patients were excluded if there was any evidence of inflammatory arthritis or the chart notes did not corroborate the diagnosis of hand OA. Those who agreed to participate answered a number of validated hand OA clinical questionnaires about pain, function and other concurrent or prior sites of painful hand OA. The medical records were also reviewed for comorbidities and demographics. Patients underwent a hand-focused physical examination by a rheumatologist to score involved joints. They provided blood and urine samples for future testing, and hand radiographs if not taken within three years.
Results: Thus far of 193 patients screened, we identified 70 who were both eligible and willing to participate. The average age at enrollment was 65.9 ± 9.5 years (range 43 to 88) with an average BMI of 26.2 ± 5.1 kg/m2 (range 16.41 to 37.92). A majority of our cohort is Caucasian (65 of 70, 92.9%) and female (56 of 70, 20.0%), with most of the females post-menopausal (48 of 56, 85.7%). The current cohort includes 25 with a a history of smoking, with an average of 1.23 ± 1.12 packs per day over 19.6 ± 13.7 years. Of the 70 subjects, one-third had isolated hand OA, while the rest (67.1%) reported having OA in other anatomical regions most commonly being the knee. The patient questionnaires included the QuickDASH disability/symptom score, and we found that patients with isolated hand OA had significantly lower hand scores than those with multifocal OA (20.18 ± 15.2 vs. 34.9 ± 25.1,$P = .005$). There was a trend toward more disability by the QuickDASH scores for patients who had prior hand trauma (39.0 ± 29.9 vs. 26.2 ± 18.2, $P = .112$). Independent samples *t*-test of post-menopausal and pre-menopausal women's QuickDash scores revealed no significant differences in disability between the two groups (33.4 ± 20.8 vs. 32.2 ± 30.1 , $P = 0.928$). The physical hand examinations revealed all participants to have at least one IP joint involved, while 46 of 70 (65.7%) only had involvement of IP joints without 1st CMC disease. None of the patients had only 1st CMC involvement. Radiographs were available for 62 of 70 total patients, with IP joint erosions seen in for 28 of the 62 patients (45.2%).
Conclusions: Painful hand OA is a common presentation in a university rheumatology faculty practice. We have established the only actively enrolling registry and biorepository in North America dedicated primarily to hand OA, and thus far have found a wide variety of clinical presentations and symptoms. With continued diligent collection of clinical, specimen and radiographic data for most of the patients, we expect the HONEY registry will be a useful resource for elucidating etiologies and pathophysiology of hand OA as well as facilitating clinical trials with emerging therapeutic options.

490
MUSCLE CO-CONTRACTION DURING GAIT FOLLOWING TOTAL KNEE ARTHROPLASTY IS CHALLENGED BY HIGHER VELOCITY, NOT BY A COGNITIVE DUAL TASK

M. Booij, Jr. †, K. Apeldoorn, Jr. †, B. Royen †, J. Noort ‡, J. Harlaar †,§. † *VU Med. Center, Amsterdam, Netherlands;* ‡ *AMC, Amsterdam, Netherlands;* § *TU Delft, Delft, Netherlands*

Purpose: Many total knee arthroplasty (TKA) patients report persisting knee complaints after surgery. These patients often show atypical neuromuscular activation patterns during gait compared to the healthy population, which could explain these persisting complaints. However, no consistent findings are available on these neuromuscular deviations, although they do point to higher levels of co-contraction around the knee joint. It is suggested that high-demand motor tasks are more sensitive to detect persisting alterations in muscle activations following TKA. However, research designs often allow patients to walk at their preferred – lower – gait speed in a safe environment in which patients can fully focus on their gait, during which they can compensate for pain, knee complains or altered muscle activation or weakness.
Therefore, the aim of this study was to investigate how peak muscle activation and co-contraction patterns of the main lower limb muscles in TKA patients change during gait in a challenging condition, i.e., with a cognitive dual task (Stroop test) and at higher than comfortable walking speed. This will contribute to the understanding of neuromuscular alterations or weaknesses in the gait pattern of TKA patients.
Methods: Twenty-three TKA patients walked on a treadmill in a virtual reality environment (age 63.3 ± 4.3, BMI 28.2 ± 3.42). Electromyography was recorded of seven leg muscles (gastrocnemius, hamstrings, quadriceps), under four gait conditions: Comfortable speed, Comfortable+Stroop, Fast (130% of comfortable walking speed), Fast+Stroop. Muscle activation was time-normalized to 100% of the stride and averaged for all subjects. The co-contraction (CC) of medial-lateral and extensor-flexor knee muscle combinations were calculated. The peak activation and CC-index were derived from four phases in the gait cycle (loading response, midstance, late stance and swing phase). All conditions were compared to the Comfortable condition using repeated measures ANOVA. Fast+Stroop was compared to the Fast condition.
Results: Adding the Stroop test to the Comfortable condition did not influence the muscle activation patterns (Fig. 1). Increasing the speed during the Fast condition increased both peak muscle activations and CC values during loading response and swing phase. More specifically, peak muscle activations increased significantly between Comfortable and Fast conditions for the lateral and medial gastrocnemius ($P<0.012$), for the medial and lateral vastus ($P<0.025$) and for the lateral hamstrings ($P = 0.006$). Moreover, CC increased from Comfortable to Fast condition for the medial vs. lateral and extension vs. flexion muscles during early stance ($P<0.015$) and medial-lateral during swing ($P = 0.005$) (Fig. 2).
No significant muscle activation or CC changes were found when the Stroop test was added to the Comfortable condition. When the Stroop was added to the Fast condition the peak muscle activation differences to the Comfortable condition remained, though the strength of the difference decreased (*P*-value ranges: 0.010 – 0.044), and moreover, the difference for the CC became non-significant.
Conclusions: When patients were able to adjust their walking speed (Comfortable condition), the cognitive dual task did not lead to significant changes in the level of co-contraction, while a higher imposed gait speed induced higher peak muscle activations and co-contraction. Adding the Stroop test to the high speed decreased co-contraction to Comfortable levels, while peak muscle activations remained significantly higher than during the Comfortable condition. Increased physical demand during gait leads to increased co-contraction, while increased cognitive demand does not, or may even decrease co-contraction. In conclusion, higher mechanical demand should be used to amplify underlying neuromuscular deviations after TKA.

Figure 1

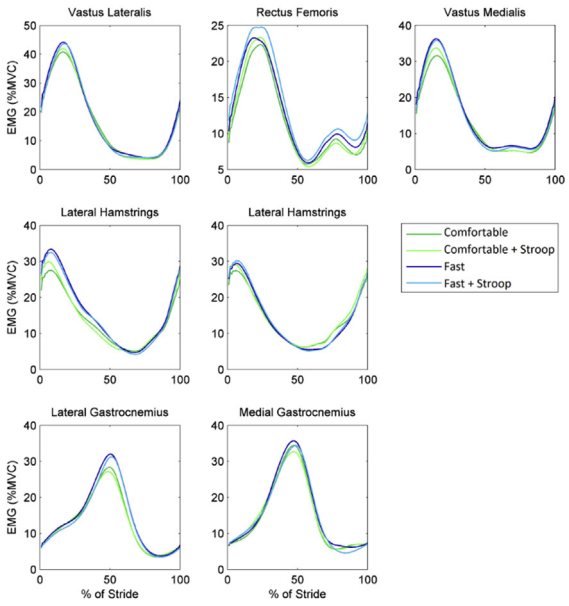
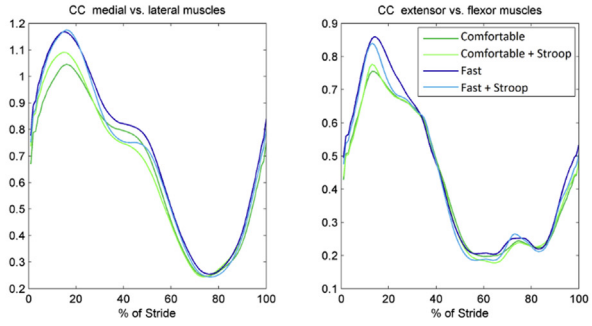


Figure 2



491

DISEASE BURDEN IN RHEUMATOLOGY ROUTINE CARE SETTING IS SIMILAR IN OSTEOARTHRITIS (OA) AND RHEUMATOID ARTHRITIS (RA) AT FIRST VISIT BUT SIGNIFICANTLY GREATER IN OA AT A 6-MONTH FOLLOW-UP VISIT

J.R. Chua, T. Pincus, I. Castrejon. *Rush Univ., Chicago, IL, USA*

Purpose: Osteoarthritis commonly is regarded as less severe and less debilitating than RA. However, limited data are available for direct comparison of OA versus RA, in large part because different measures traditionally have been used to assess patients, primarily a HAQ (Health Assessment Questionnaire) in RA and WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) in OA. RAPID3 (Routine Assessment of Patient Index Data) on an MDHAQ (Multi-Dimensional HAQ) is a composite of 3 patient self-report measures that was developed for RA, but is informative in many other rheumatic diseases, including OA[1]. Recent observations from 4 settings indicate that RAPID3 and other MDHAQ scores were similar or higher in OA versus RA patients[2]. Those findings were from a cross-sectional convenience sample, and likely were affected by treatment in most patients. We analyzed MDHAQ/RAPID3 scores in patients with a primary diagnosis of either OA or RA at their first visit to a rheumatology center and at 6 month follow-up.

Methods: At one academic center, all patients complete an MDHAQ/RAPID3 prior to seeing the rheumatologist. The 2-page MDHAQ/RAPID3 includes scores for physical function (FN) (0-3 converted to 0-10) and 0-10 visual analog scale (VAS) scores for pain (PN) and patient global assessment (PATGL), compiled into a 0-30 composite RAPID3. Patients with physician-diagnosed primary OA or RA were included in the study. Mean FN, PN, PATGL and RAPID3 scores in RA and OA at baseline and 6-month follow-up (range 3-9 months) were compared for differences between first and second visits using t-tests, as well as between OA and RA adjusted using MANOVA.

Results: At first visit, RAPID3 was 15.9 in OA vs 15.3 in RA – no meaningful differences in individual measures or index (Table). At 6-month follow-up, in OA, RAPID3 fell from 15.9 to 14.9 (-1.0, $P = 0.06$) vs 15.3 to 11.1 (-4.2, $P<0.001$) in RA, indicating greater improvement in RA, resulting in significantly higher disease burden in OA vs RA. These differences remained significant after adjusting for age, sex, body mass index, and education level.

Conclusions: Patients with OA or RA have similar disease burdens at first visit, but OA patients have a considerably higher burden 6 months later, reflecting more effective treatments for RA than for OA. Nonetheless, OA is a severe disease at first visit, suggesting a need for further research in OA toward improved treatment and outcomes. MDHAQ/RAPID3 is feasible and useful to assess and monitor clinical status in routine care of patients with different rheumatic diseases.

Mean and standard deviation (SD) at first visit and 6-month follow up visit MDHAQ/RAPID3 of patients with OA and RA seen in routine care

Measures	OA (n=109)	RA (n=102)	OA vs RA p value	OA vs RA p adjusted*
	First visit			
Function (0-10)	3.15 (1.9)	2.89 (2.2)	0.34	0.60
Pain (0-10)	7.01 (2.3)	6.36 (2.9)	0.07	0.49
PATGL (0-10)	5.69 (2.8)	5.85 (3.0)	0.69	0.30
RAPID3 (0-30)	15.9 (5.9)	15.3 (7.0)	0.52	0.47
	Follow-up visit			
Function(0-10)	2.93 (1.9)	2.24 (2.2)	**0.02**	**0.006**
Pain (0-10)	6.36 (2.5)	4.60 (3.0)	**<0.001**	**0.03**
PATGL (0-10)	5.62 (2.7)	4.10 (3.2)	**<0.001**	**0.001**
RAPID3 (0-30)	14.9 (6)	11.1 (7.6)	**<0.001**	**0.001**

*adjusted for age, sex, BMI and education

492

QUANTITATIVE AND TOPOGRAPHIC ASSESSMENT OF HEBERDEN'S NODES FOR PREDICTION OF KNEE OSTEOARTHRITIS: DATA FROM OSTEOARTHRITIS INITIATIVE

N. Kumar †, N. Hafezi-Nejad ‡, A. Guermazi §, A. Haj-Mirzaian †, I. Haugen ||, F. Roemer §, S. Demehri †. † *Johns Hopkins Univ. Sch. of Med., Baltimore, MD, USA;* ‡ *Univ. System of Maryland, Baltimore, MD, USA;* § *Boston Univ. Sch. of Med., Boston, MA, USA;* || *Diakonhjemmet Hosp., Oslo, Norway*

Purpose: To determine whether the presence, number, and topography (digit location and symmetry) of Heberden's nodes (HNs) are predictive of radiographic knee osteoarthritis (OA) incidence and progression.

Methods: 8023 knees from the Osteoarthritis Initiative (OAI) were analyzed (8-years follow-up). Cox regression was performed on HN presence, total number, location, and symmetry (using two symmetry index models) obtained at baseline physical-examination as well as