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### EFFECTIVE CONSERVATIVE CARE TARGETING MECHANICAL MARKERS AS RISK FACTORS FOR KNEE OSTEOARTHRITIS PROGRESSION: A CLUSTER RANDOMIZED CONTROLLED TRIAL

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**Purpose:** Primary care physicians (PCPs) have underscored the lack of adequate assessment tools to guide therapies within current medical management (CMM) of knee osteoarthritis (KOA) patients. It is well recognized that joint mechanics are important risk factors in KOA progression and that kinematics information can be useful to assess causes of symptoms. Dynamic knee KinesioGraphy (KG-Knee) assessment can be performed by a trained therapist (physical therapist, kinesiologist, physical rehabilitation therapist) in a clinical setting to serve as an objective measurement tool to identify and measure evidence-based mechanical markers. The aim of this study was to determine the impact on clinical outcomes of adding a KG-Knee assessment and personalized treatment recommendations to CMM for KOA patients.

**Methods:** This pragmatic, cluster randomized, controlled trial was carried out in primary care clinics (Montreal, Canada). Patients with a clinical diagnosis of KOA as identified by their PCP were selected for participation if 1) KOA was the main cause of their knee pain, 2) they rated their worst pain in the past 7 days  $\geq 4$  on a 0-10 pain intensity scale, 3) they had a Kellgren-Lawrence (KL) grade  $\geq 2$  on radiographs. They were excluded if they 1) were on a waiting list for total knee replacement, 2) suffered from rheumatoid arthritis or active cancer, 3) had met a specialist of KOA in the past or 4) were pregnant. Participants from a same clinic formed a cluster which was randomly assigned to one of 3 groups: 1- a control group with patients receiving CMM (Group 1-CMM), 2- an intervention group receiving CMM plus KG-Knee-based recommendations (Group 2-KG-Knee), and 3- an intervention group receiving CMM, KG-Knee-based recommendations, and a self-management education session plus two follow-up supervised meetings (Group 3-KG-Knee+Education). In the KG-Knee groups, three-dimensional knee kinematics at baseline were captured using the KneeKG™ system (Figure 1) during treadmill walking at a self-determined comfortable speed. Therapists also performed a standardized musculoskeletal assessment and combined their findings on these two assessments to establish KG-Knee-based recommendations. Those consist of treatment recommendations (e.g. orthoses, cardiovascular activities...) and a personalized home exercise program targeting the identified mechanical markers linked to KOA progression. Patients from Group 2 received them directly from their PCP. Patients from Group 3 met with the therapist for a one-hour education session on KOA self-management, received explanations on their exercises and two follow-up sessions to regulate the nature and intensity of their exercises. Primary outcomes were the scores on the Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales and the overall score. Quadriceps strength (with a manual dynamometer) and the 30 seconds Chair Stand test (30sCST) were used as objective tests to assess function at baseline and 6 months after intervention. Patients global impression of change (PGIC) and satisfaction level in regards to their treatment were also collected at 6 months, as well as adherence in the KG-Knee groups (asking patients if they had followed the recommended exercises for at least 3 months). Linear Mixed models adjusting for the cluster design of the study were used. We assessed between-group differences at baseline on sociodemographic and clinical characteristics, and after 6 months adding TIME (baseline/6-month) to the models as a variable. If the time\*group interaction on outcome scores between the three groups was statistically significant, post-hoc analyses were performed on

delta scores. Chi-square tests were used to assess between-group differences on PGIC and satisfaction.

**Results:** 894 patients from 87 clinics were contacted, 515 were randomized, and 449 (87.2%) completed the study. There were 66.4% women and the mean age was 63.6 years (95% confidence interval: 62.8;64.5). There were no differences between groups at baseline (Table 1). At 6-month follow-up, patients in both KG-Knee groups reported statistically significant improvement on the KOOS overall score (Group 2-KG-Knee: +5.5; Group 3-KG-Knee+Education: +5.0) compared to the control group (both  $p=0.02$ ; Tables 2-3). They also reported statistically significant improvement in terms of symptoms, pain, and function during activities of daily living (KOOS: all  $p<0.05$ ), as well as higher treatment satisfaction levels compared to Group 1-CMM (both  $p<0.001$ ). Patients in Group 3-KG-Knee+Education had statistically significant improvement in both objective functional tests and showed a greater global impression of change in pain, function, and quality of life (all  $p<0.05$ ). Adherence to the exercises was significantly higher in Group 3 (87%) than in Group 2 (56%).

**Conclusions:** These results support the clinical added value of a Knee KinesioGraphy assessment to personalize conservative treatment strategies: symptoms and pain can be reduced, function and satisfaction can be improved. A maximum of three sessions including education and follow-up can reinforce adherence to PCPs recommendations and further improve outcomes. This study reinforces that assessing mechanical markers with a dynamic knee functional test can be useful to support treatment management of non-surgical KOA patients.

