Background: Osteoarthritis (OA) is a degenerative disease with complex underlying mechanisms. The interactions among several factors make the study of the disease very complex and often lead to different treatment, i.e. surgical or conservative, decisions for subjects clinically and radiographically similar. Recent explorations performed at the body level pointed out that macro-factors, like overweight or age, can influence the development of the disease. The number of related factors is high, and they are very likely to interact with each other. However, the literature lacks randomized and balanced studies to verify such effects of multiple factors.

Objectives: The aim of this work is to develop a multifactorial analysis to explore whether and how gait functionality and dynamics can be related to treatment decision.

Methods: A multifactorial analysis of gait dynamics in OA subjects was developed. 81 OA subjects, graded 2-3 in KL, were selected based on 4 clinical factors: Gender (male – female), Age (60-67 – 68-75), BMI (25-29.9 – 30+) and Treatment (total knee replacement (TKR) – conservative treatment). Gait analysis was performed using 8 cameras BTS Smart-DX 700, 1.5 Mpixels 250 fps and 2 force plates BTS P-6000 500 Hz sampling (BTS S.p.A., Milan, Italy). Each volunteer was asked to perform a minimum of 5 valid gait sequences. Functionality and dynamics parameters were measured.

Functionality: Velocity of gait and the time needed to perform a gait cycle were computed.

Dynamics: The reaction forces and torques at the ankles, knees and hips were computed through inverse dynamic analyses.

Analysis of variance was performed for the four factors described among the functionality and dynamics parameters.

Results: The multifactorial analysis showed that functionality values are more subjective to the studied factors than the dynamics ones. Functionality seems to be directly related to the clinical treatment. Patients who selected TKR needed more time to make a step, spent more time in double stance position and walked slower (p<0.007). Age was also significant as was the interaction between age and BMI (both p<0.007).

Conclusion: Reduced functionality seems to be related to the selection of therapy. In contrast to current paradigm, forces at the joints may have no role in the definition of the best therapy for OA subjects. Subjects requiring TKR do not present higher loads at the joints. However, torques seems to be related to the therapy selected. Instead of forces, kinematics and posture assessments might support rational definitions of the therapy and future multifactorial analysis should take them into consideration.

References:

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Figure 1 Interaction between Clinical treatment and age.