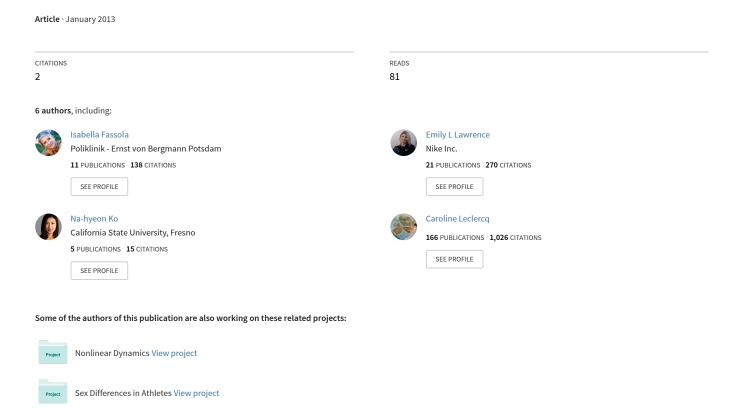
Is osteoarthritis of the thumb strictly a orthopedic condition?



Is osteoarthritis of the thumb a strictly orthopedic condition?

Fassola*1, E. L. Lawrence*2, S. Dayanidhi³, N. Ko³, C. Leclercq¹, F. J. Valero-Cuevas²,³
1) Institut de la Main, Clinique Jouvenet, Paris, France
2) Department of Biomedical Engineering, University of Southern California, Los Angeles, CA, USA
3) Division of Biokinesiology & Physical Therapy, University of Southern California, Los Angeles, CA, USA *denotes equal contribution

INTRODUCTION. Osteoarthritis (OA) of the carpometacarpal (CMC) is an orthopedic condition that can lead to difficulties gripping objects and limited range of motion, both of which affect activities of daily living (ADLs) including writing, feeding, and dressing [1]. Parkinson's disease (PD) is a progressive degenerative neurological disorder, characterized by numerous motor features that also impact ADLs [2]. The purpose of this study was to compare deficits in dynamic dexterous manipulation between these conditions. METHODS. We measured performance in the Strength-Dexterity (SD) test—a validated instrument for quantifying dynamic dexterous manipulation with pinch forces < 300 grams force [3]—in 33 female patients diagnosed with CMC OA (65.81 ± 9.7 yrs., 42 hands) an average of 40 months post-treatment, 14 patients diagnosed with PD (10M, 4F; 67.6 ± 9.6 years, 27 hands), and a non-clinical control group of 29 healthy, age-matched volunteers (10M, 19F; 65.6 ± 9.7 years, 48 hands) with no history of hand injury or disease or neurological disorder. The SD test consists of compressing a slender spring prone to buckling between thumb and index, where the maximal compression (in gmf) is indicative of the maximal manipulation instabilities the subject can sustain. **RESULTS.** We report no significant differences in maximal mean compression force among groups. However, both the CMC OA (p<0.000001) and PD (p=0.019) groups displayed significant differences in the dynamic force variability while maintaining the maximal spring compression (1st and 2nd derivatives of forces and RMSE) compared to the control participants. This indicates significantly reduced stability of manipulation. Furthermore, linear regression shows that individuals with CMC OA (p=0.013) and PD (p=0.026) showed greater rates of decline of maximal spring compression vs. age than control subjects (-1.3 gmf/yr and -1.7 gmf/yr vs. -0.96 gmf/yr, respectively). **DISCUSSION**. Both CMC OA (an orthopedic condition) and PD (a neurological condition) are associated with significantly worse neuromuscular control of dynamic manipulation and accelerated losses with age when compared to non-clinical volunteers. These results challenge the notion that CMC OA is a strictly orthopedic condition given that it seems to also produce sensorimotor deficits. We underscore the need to investigate and understand these little known or studied effects of CMC OA on the neuromuscular control of dynamic manipulation at low force levels—which is so critical to ADLs.

Acknowledgements. We thank Veronique Lothon and Alexander Reyes. Funding: NIDRR grant H133E080024; NSF grant EFRI-COPN 0836042 and NIH grants AR050520 and AR052345 to FVC. FVC holds US Patent No. 6,537,075 on some of the technology used, but has no licensing in place. **References**

- [1] Armstrong, A.L., et al., *The prevalence of degenerative arthritis of the base of the thumb in post-menopausal women.* J Hand Surg Br, 19(3): p. 340-1, 1994.
- [2] Jankovic J. *Parkinson's disease: clinical features and diagnosis.* J Neurol Neurosurg Psychiatry, 79: p. 368-76, 2008.
- [3] Valero-Cuevas, F.J., et al., *The strength-dexterity test as a measure of dynamic pinch performance.* J Biomech, 36(2): p. 265-70, 2003.