

## MECHANICAL ENGINEERING STUDENT SEMINAR

**Thursday, January 05 2023 at 13:30**, D. Dan and Betty Kahn Building, Auditorium 1.

**Online:** <https://technion.zoom.us/j/95977686932>

### **A comparative biomechanical analysis of gait with several foot-ankle offloading devices**

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Various medical conditions, such as diabetic foot ulcers and ankle fractures, may prevent individuals from loading the ankle and foot (A&F). Crutches are one of the most common assistive devices allowing patients to ambulate with a non-weight bearing (NWB) status of their A&F. Using crutches allows greater mobility and functionality, and has both short and long-term health benefits relative to wheelchairs. However, crutches severely alter the natural walking pattern, overstrain the upper body, and might cause pain and secondary injuries. Recently, alternative devices (e.g., iWALK and ZeroG) have been introduced to the market, which allow NWB status of the A&F, while freeing the upper extremities. The main aim of this study was to compare the biomechanics of walking with these devices. Using a motion capture system and floor-mounted force plates, we examined several spatiotemporal, kinematic, and kinetic parameters of gait at a self-selected speed. Additionally, the participants rated their walking experience using questionnaires. Gait experiments were conducted on 15 healthy participants using the three devices (crutches, iWALK, and ZeroG) and during natural unassisted gait. The gait parameters of the weight-bearing leg were compared between each device and natural gait. The results indicate that all the devices altered the walking pattern with respect to their normal gait. The hip and knee joint angles obtained using the ZeroG were the most similar to normal gait, whereas no significant differences were found for the ankle. The medial-lateral fluctuations of the center of mass were largest for iWALK and smallest for crutches. All the devices significantly altered the ground reaction forces patterns of the weight-bearing leg. The stride length was most significantly shortened using iWALK and the stance phase was most significantly elongated using crutches. All the devices caused a reduction in the cadence and walking speed. The questionnaires revealed that crutches were least preferred by the participants, whereas iWALK and ZeroG were similarly preferred. ZeroG was rated as requiring the least perceived exertion and being the most stable, whereas iWALK was rated as the most comfortable. These findings may be beneficial for informing clinicians' decisions regarding the prescription of these devices for patients with foot-ankle injuries and contribute to the design of improved ambulatory devices.

Note: the seminar will be given in Hebrew