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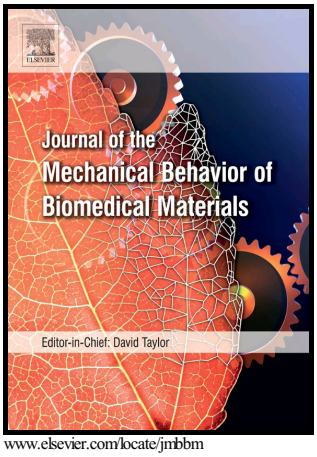

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Bridget Volinski, Anil Kalra, King Yang

Author Affiliations: Bioengineering Center, Wayne State University, 818 W. Hancock, Detroit, MI USA 48201

Corresponding author: Bridget Volinski bridgetv100@gmail.com

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Highlights

- Quantifies, through stress analysis, the affect on the bone due to muscle position and hip angle changes of the various gait phases.
- Hip obliquity is a contributor to the change in pelvic stresses
- Resulting pubic symphysis displacement was shown to be within the expected range.
- The different loading phases of walking cause significant changes to the bone stresses.

Abstract

Trauma to the pelvis is debilitating and often needs fixation intervention. In 58% of patients with this trauma, the injuries can lead to permanent disability, preventing the return to jobs. Of all unsuccessful fixation procedures, 42% are caused by failures of the method, sometimes due to mobilization during healing. Patients would benefit by having fixation hardware in place that enabled ambulation. During walking the bilateral hip joint plus leg and trunk muscle forces, including those from hip motion, can induce torsion into the pelvic ring and across the joint cartilages, and affect the internal stresses of the pelvis. For an accurate understanding, fixation that bridges the bilateral innominate bones needs to be evaluated considering all of these factors, and the affect on the stresses throughout the pelvic ring. Yet there is no bilateral, comprehensive method to do so in the literature. In this study a method was developed that incorporates all of the necessary factors in four bilateral, static, finite element models representing eight gait phases. The resulting stress migration through the full pelvic ring and pubic symphysis displacements were demonstrated under these conditions. In subsequent work, fixation improvements can be applied to these models to evaluate the change in internal stresses, joint displacements and deformations of the hardware, leading to a better quality of design and permitting ambulation during healing for the patient.

Graphical Abstract