

# The Effect of Displacement of Infratectal T-Type Acetabular Fracture on Contact Pressures of The Acetabulum: A Biomechanical Analysis

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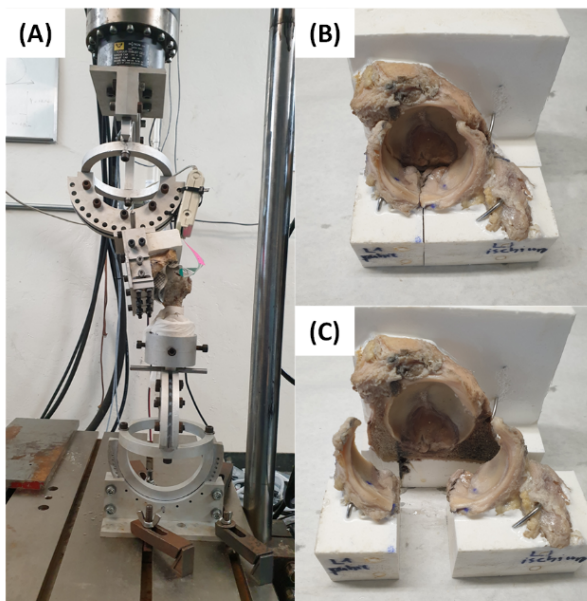
**Introduction:** Acetabulum T-type fractures result in significant loss of motion and function, often requiring surgical intervention. This study was aimed to evaluate the impact of displacement of infratectal T-type acetabular fractures (62B2.1) on contact pressure and stability of the hip joint, and to determine if there is a threshold of displacement that would affect contact pressures to a point at which improvement of reduction may have a benefit compared to allowing the fracture to heal in the malreduced position.

**Methods:** Three fresh-frozen left human hemi-pelves were used to analyze contact force and contact pressure placed upon piezoresistive sensors resting within the acetabulum. A 700N load was exerted to replicate three-fourths of the average human body weight. The specimens were tested in 5 different positions representing: standing (0° adduction 0° flexion); hip range of motion (ROM) during normal walking gait (0° adduction 10° extension and 0° adduction 30° flexion); hip ROM during stair ascending gait (5° abduction 0° flexion and 10° adduction 60° flexion). Widening gaps of 0-mm, 1-mm, 2-mm, and 5-mm for both 0-mm and 2-mm step-offs were compared.

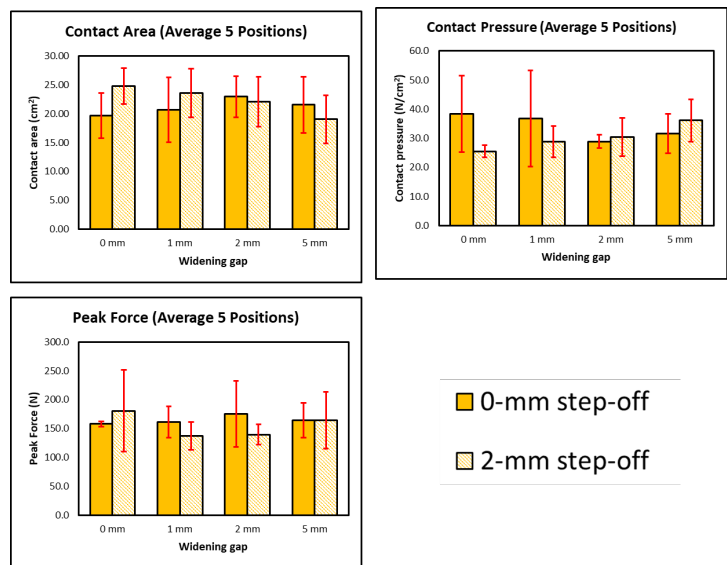
**Results:** Acetabulum with induced T-type fracture without step-off and widening has average contact area of  $19.2 \pm 1.7 \text{ cm}^2$ , average contact pressure of  $38.5 \pm 6.6 \text{ N/cm}^2$  when evaluating at 0° adduction and 0° flexion. In all five testing positions, significant decrease in contact area and significant increase in contact pressure ( $p < 0.05$ ) were consistently observed at 2-mm step off with 5-mm widening gap. When averaging measurement outcomes from all five testing positions, at 2-mm step-off and 5-mm widening gap, contact area significantly decreases compared to 2-mm step-off with 0-mm widening ( $p = 0.048$ ), 1-mm widening ( $p = 0.022$ ), 2-mm widening ( $p = 0.026$ ) while contact pressure significantly increased compared to 2-mm step-off with 1-mm widening ( $p = 0.024$ ), and 2-mm widening ( $p = 0.032$ ). No significant difference was observed when comparing different widening gaps when step-off is 0 mm and when comparing 0 and 2-mm step-off of the same widening gap. No significant difference was observed for peak force.

**Discussion:** No prior studies have investigated the effect of fracture gap and step-off in infratectal fractures. Significant differences observed at 2-mm step-off and 5-mm widening gap suggest that fracture widening has less effect on acetabular contact area and contact pressure when step-off is kept at 0 mm and that one the step-off is at 2 mm, fracture widening should be minimized below 5 mm.

**Significance/Clinical Relevance:** Investing the relationship between fracture gap and step-off in T-type acetabular fracture and joint contact area and contact pressure can impact the decision making for fracture reduction.



**Fig. 1.** (A) Mechanical test setup, (B), (C) Acetabulum with induced T-type fracture.



**Fig. 2.** Average contact area, average contact pressure, and average peak force across all 5 testing position