

# A Biomechanical Study of 4-hole Pubic Symphyseal Plating: Locked versus Unlocked versus Hybrid Plating

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## Background

There are no published studies examining the use of locking plates on injuries of the anterior pelvic ring.

## Purpose

We performed this investigation to determine if locked plates provide enhanced stability in the treatment of pubic symphyseal disruptions.

In addition, we examined hybrid fixation with emphasis on purchase of the medial two screws into the most inferior aspect of the body of the pubis.



Figure 1 – AP view of the pelvis with the MTS applying a vertical load through linear bearings to assure the load follows the movements of the pelvis as it rotates on the femur in simulated single leg stance loading. The femur is adducted to 8 degrees with the abductor force simulated through the turnbuckles. The LED brackets measure the 6 DOF motions of each bony part.

## Methods

Tile C pelvic injuries were simulated in pelvic Sawbones.<sup>®</sup>

Three different fixation constructs were used for anterior fixation (four-hole 3.5 mm pubic symphysis plate with all locked, all unlocked, or hybrid screws with distal purchase).

Adjunctive sacroiliac screw fixation with a single 7.3 mm screw placed into S1 was used in all specimens.

Specimens were analyzed for motion at both the symphysis pubis (PS) and sacroiliac joints (SI) using a Material Testing System.

Each specimen was subject to compressive loading in single-limb stance. Axial rotation and side loading were examined as well.

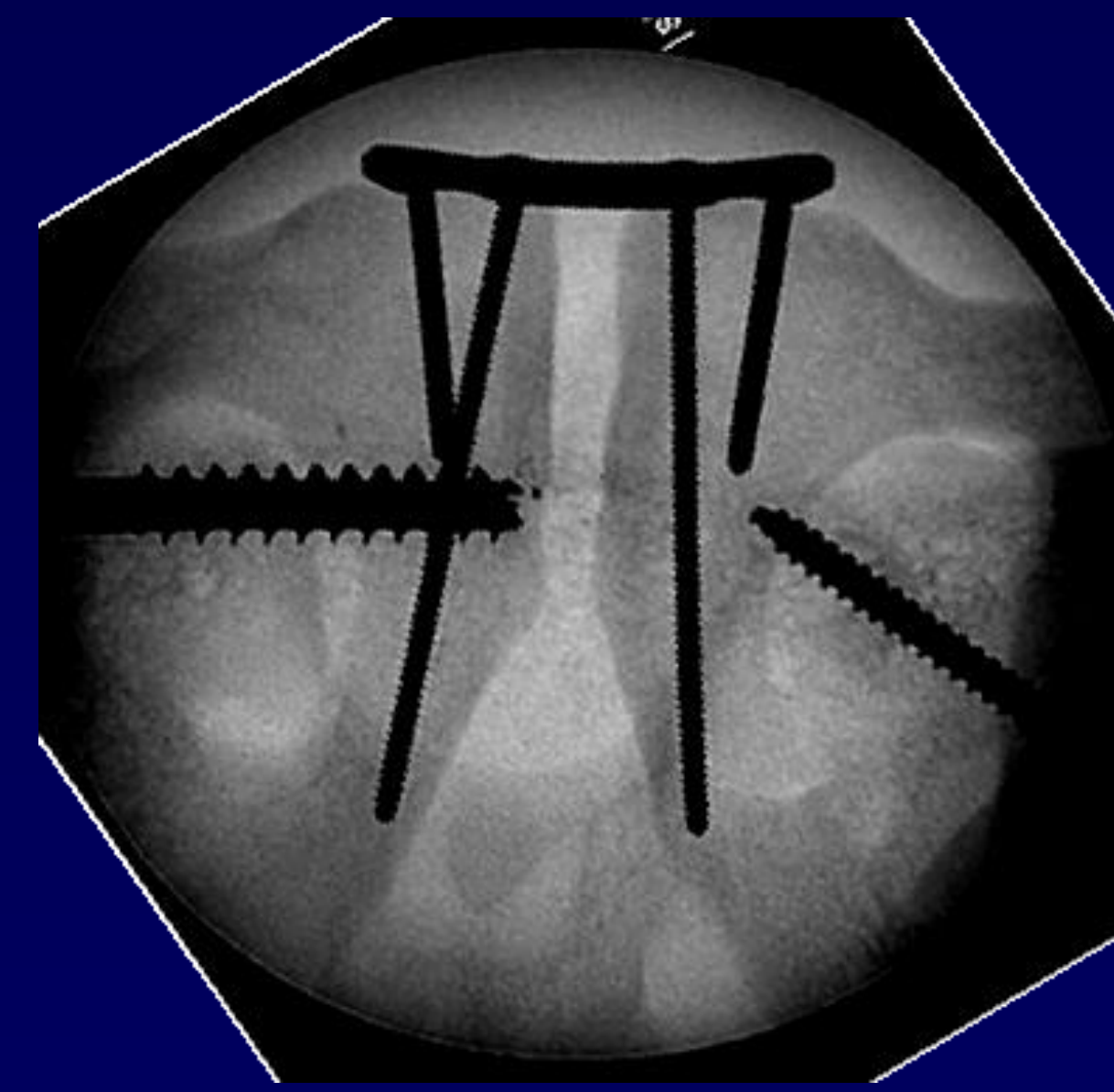


Figure 2 - Hybrid fixation

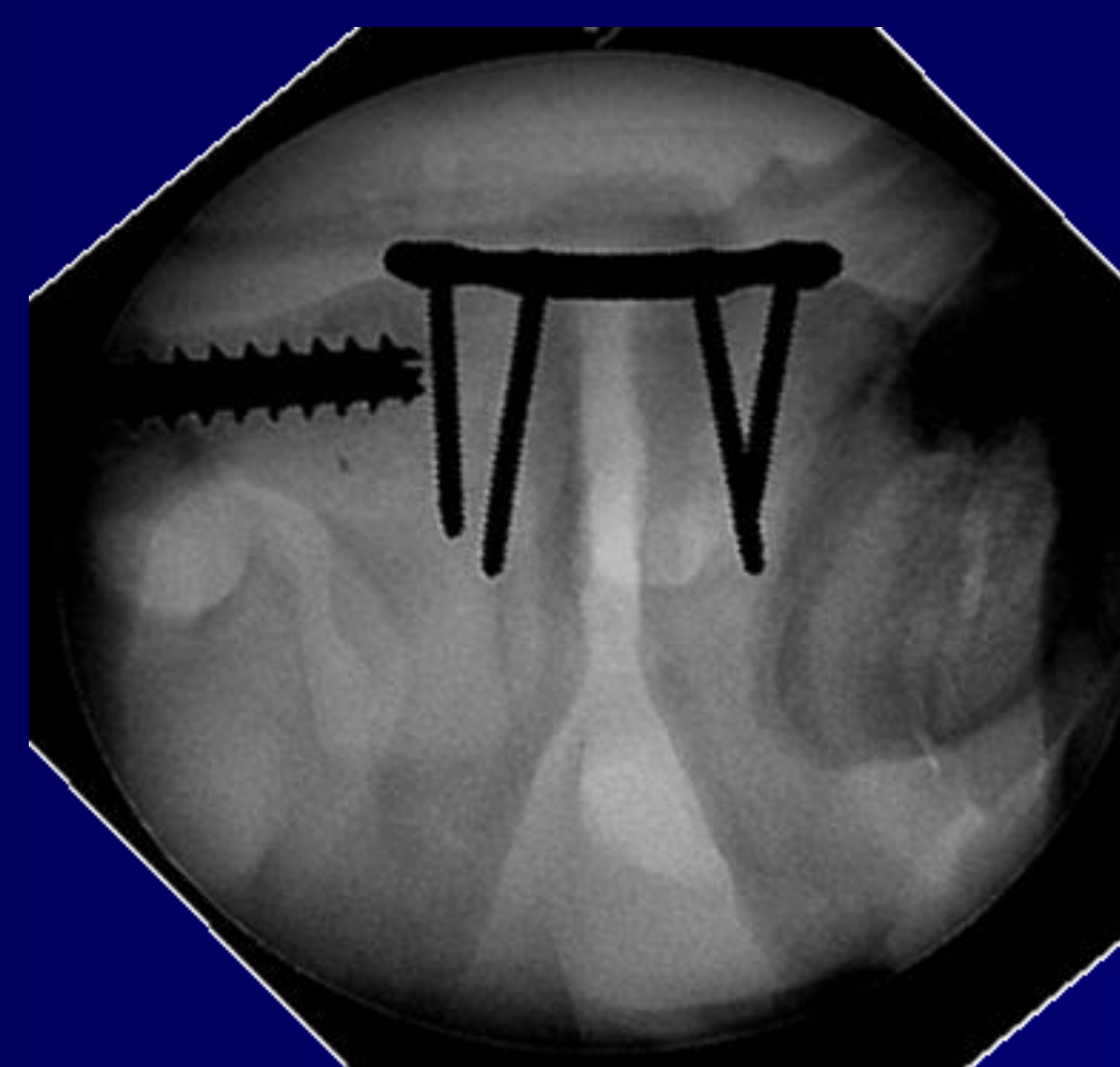


Figure 3 - Unlocked

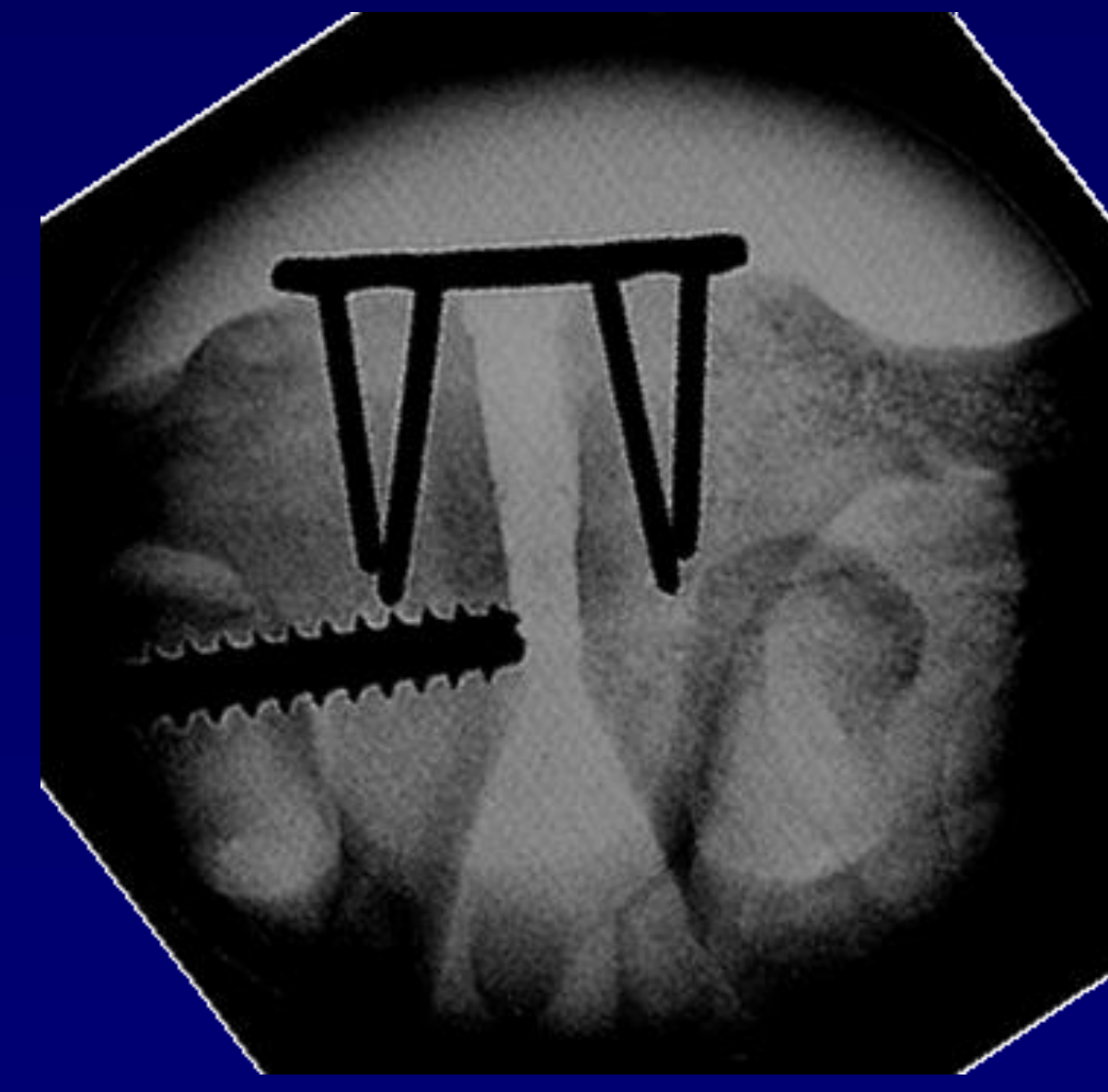


Figure 4 - Locked

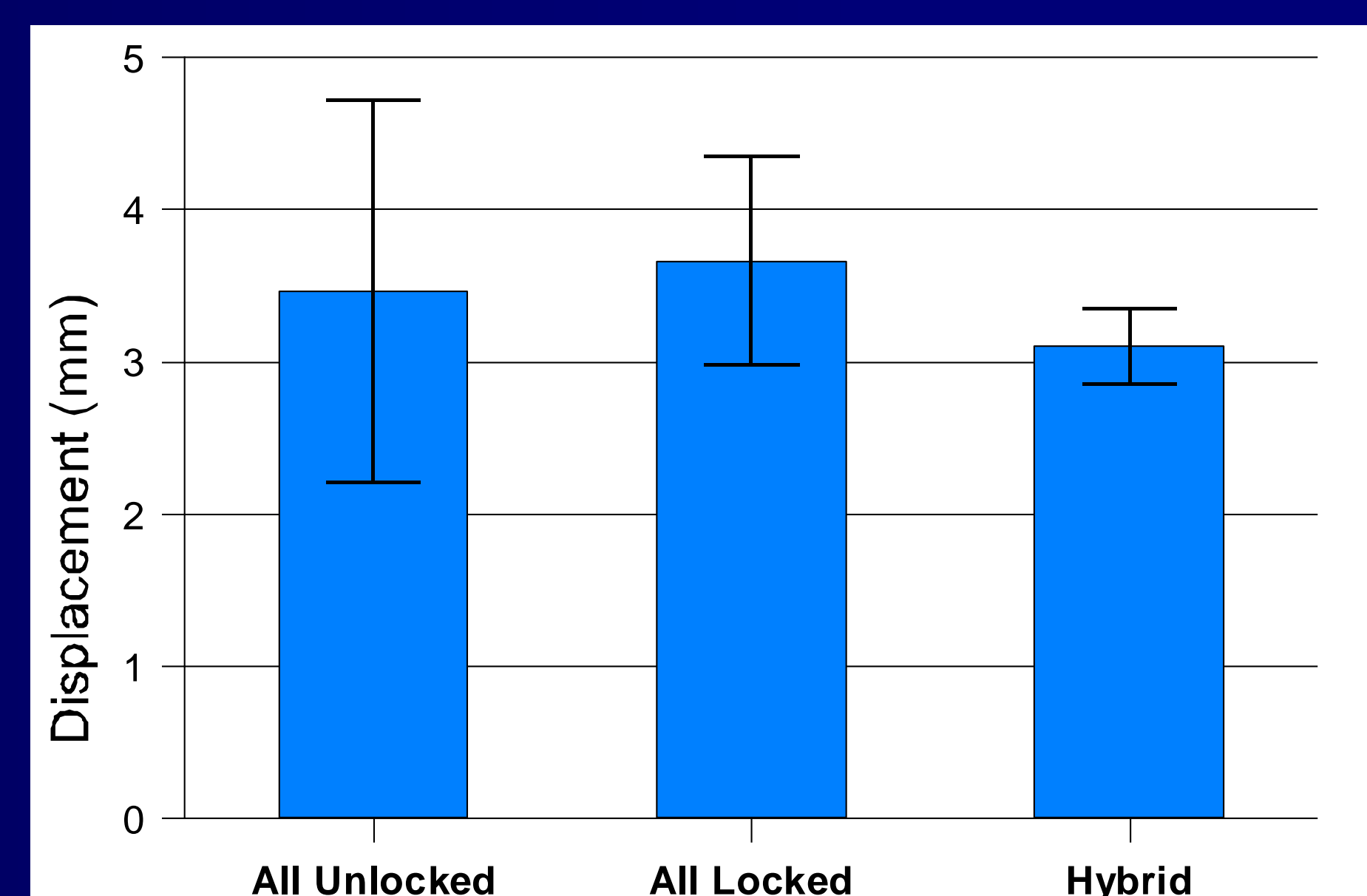


Figure 4 – Vertical movement at the symphysis

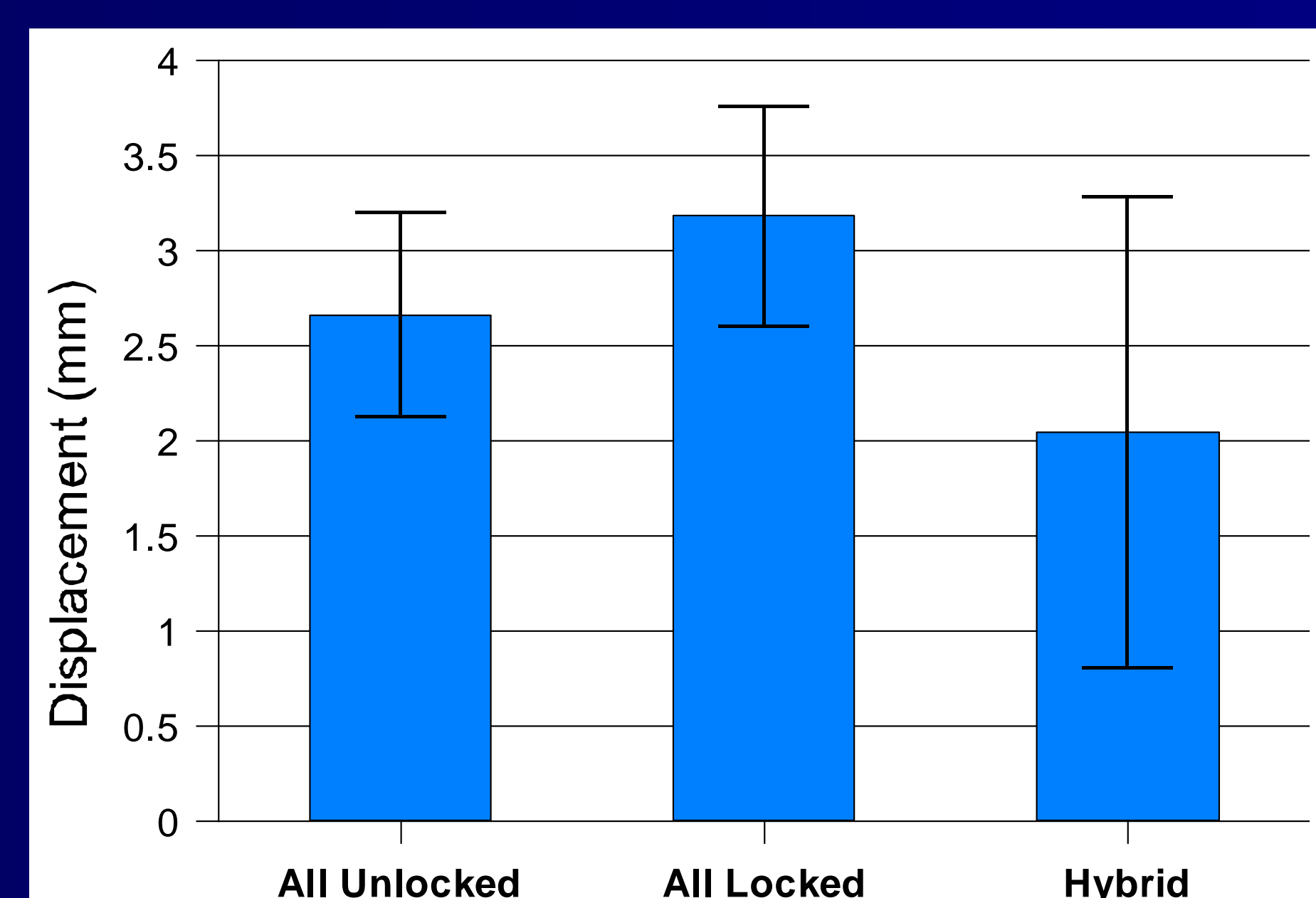


Figure 5 – Vertical movement at the SI joint

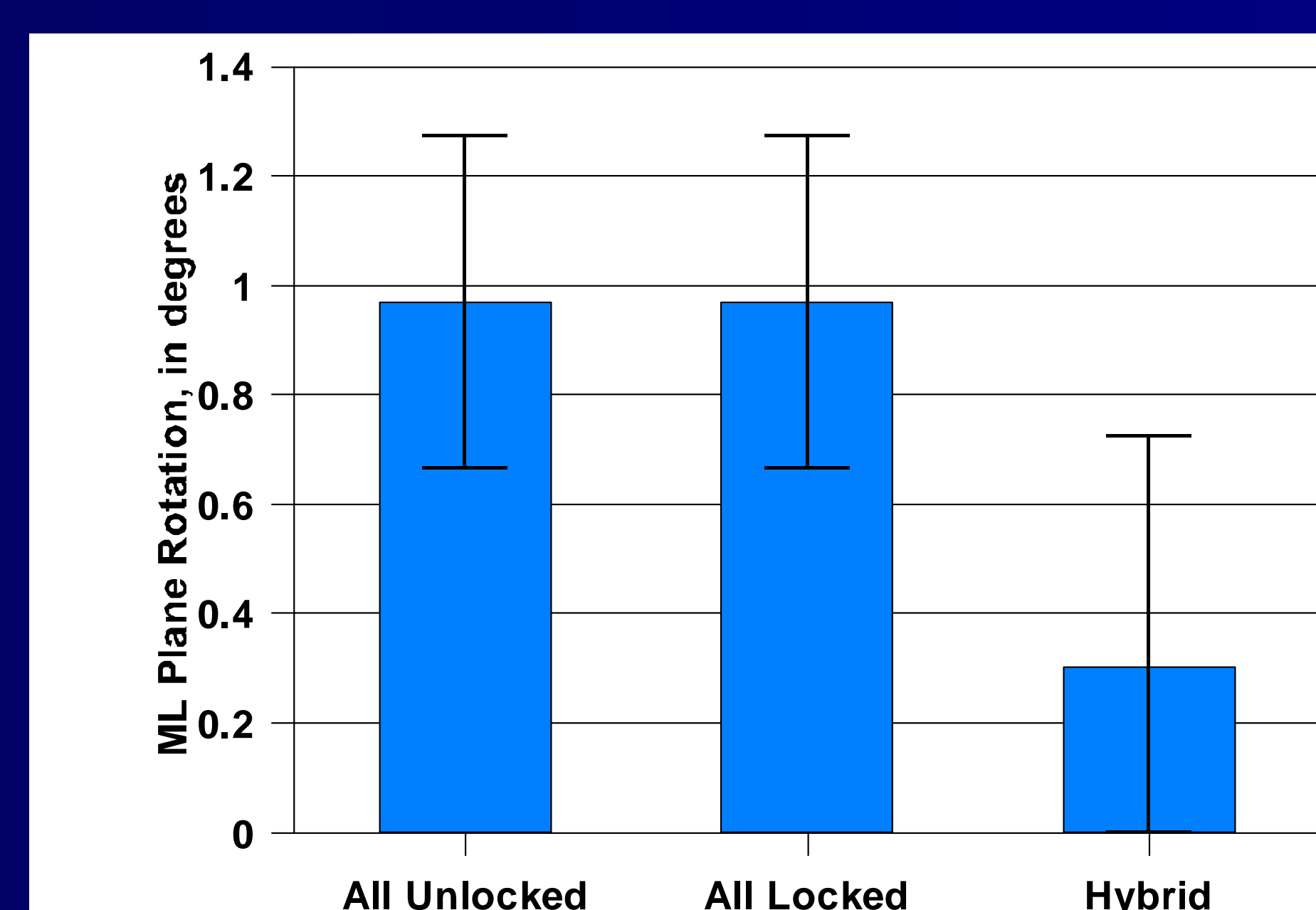


Figure 6 – ML plane rotation at the SI joint

## Results

There was no significant difference in overall construct stiffness between the 3 methods of SP fixation

The hybrid average stiffness was slightly better than all locked or unlocked screws.

The motions at the SP joint only slightly different between groups and none were statistically significant, Figure 4.

The same was true for the SI joint vertical translations, but there was a significant improvement with the Hybrid fixation in ML plane rotations, Figure 5, ( $P < 0.02$ )

The closing of the SP joint with lateral load was significantly improved with the hybrid fixation, Figure 6, ( $P < 0.05$ ).

## Conclusions

We were unable to show any improvement in construct stability by using locked versus unlocked screws for fixation of pubic symphysis dislocations.

By utilizing hybrid fixation with longer medial screws placed into the most inferior aspect of the body of the pubis there was significant improvement in ML plane rotations at the SI joint, as well as resistance to lateral loading at the SP joint.

The hybrid construct tested may represent the most stable fixation for pubic symphyseal plating in unstable pelvic ring injuries.

## ACKNOWLEDGEMENTS

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