



Anatomical fit of a precontoured suprapectineal plate in Japanese patients with acetabular fractures: A three-dimensional morphometric study

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ABSTRACT

Background: Anatomically precontoured suprapectineal plates have been developed to reduce intraoperative contouring and facilitate anatomical fixation of acetabular fractures. However, their fit to the pelvic morphology of Japanese patients remains inadequately investigated. We aimed to evaluate the anatomical fit of a commercially available precontoured suprapectineal plate using mirrored three-dimensional (3D) pelvic models reconstructed from computed tomography (CT) images.

Methods: This retrospective morphometric study included 12 consecutive Japanese patients with acetabular fractures (nine men and three women; mean age, 73.5 years). Thin-slice CT images (1–2 mm) were reconstructed into patient-specific 3D pelvic models using ZedView software. The intact contralateral hemipelvis was mirrored to create an anatomical model. The mirrored models were exported as stereolithography (STL) files, processed using Z-SUITE software, and fabricated at full scale (1:1) using a Zortrax® fused deposition modeling 3D printer with acrylonitrile butadiene styrene (ABS) filament. A commercially available precontoured suprapectineal anatomical plate was placed on each mirrored pelvic model without additional contouring. Plate fit, iliopectineal line length, and pelvic curvature were evaluated. Poor fit was defined as a gap > 5 mm between the plate and bone surface. Plate fit and morphometric measurements were performed by a single orthopedic surgeon according to predefined criteria. Correlations between anthropometric parameters and pelvic morphology were analyzed using Pearson's correlation coefficient. Statistical significance was set at $p < 0.05$.

Results: Poor plate fit was identified in eight of 12 patients (66.7%). In four patients (33.3%), the anterior portion of the plate overhung the pubic symphysis despite appropriate positioning along the pelvic brim. Iliopectineal line length was positively correlated with body height ($r = 0.628$, $p = 0.029$) and body weight ($r = 0.610$, $p = 0.035$), but not pelvic curvature ($r = 0.385$, $p = 0.216$).

Conclusions: The precontoured suprapectineal anatomical plate frequently showed inadequate anterior conformity in Japanese patients with acetabular fractures. Preoperative patient-specific evaluation using mirrored 3D pelvic models may facilitate implant selection and surgical planning while providing valuable information for future anatomical plate design.

Introduction

Acetabular fractures are among the most challenging injuries in orthopedic trauma surgery because anatomical reduction and rigid internal fixation are essential to restore hip joint congruity and achieve favorable long-term functional outcomes. In recent decades, the

incidence of acetabular fractures has increased, particularly among older adults, owing to population aging and the rising prevalence of fragility fractures [1]. Consequently, surgical treatment of acetabular fractures has become more common, increasing the demand for implants that facilitate accurate fracture reduction while minimizing operative time [2].

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