

Biomechanical Analysis in Lateral Malleolus Danis-Weber Type A1 Fracture Fixations: A Cadaveric Study

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INTRODUCTION:

Ankle fracture is a common fracture type encountered by Orthopaedics doctors with lateral malleolus fracture making up most cases. A minimally invasive technique is proposed in this study using intramedullary screw fixation. This study is done to assess the biomechanics properties of the proposed fixation technique.

METHODS:

Eight distal fibula bones procured from cadaveric specimens were used to demonstrate the two different types of fixations, four in each construct. Axial loading force loaded until constructs yield and fail are. Further testing was done using finite element analysis.

RESULTS:

Intramedullary screw construct shows superiority in withstanding the axial loading force though insignificant ($p=.851$). Finite element analysis also supports the supremacy of the intramedullary screw group, which shows minimal displacement compared to another group with p value of .009.

Table 1 showing the result of the experiment and finite element analysis.

Biomechanical analysis		
	Force-to implant failure (N)(mean)	Force-to yield (N)(mean)
Plate-fixation	241.775	134.825
Screw-fixation	243.2	133.8
p-value	.898	.851
Finite element analysis		
	Construct-displacement (mm)	Maximum-compressive stress (MPa)

Plate-fixation	13.06	361.15
Screw-fixation	0.98	220.7
p-value	.009	.124

DISCUSSIONS:

Though the Weber A1 may be able to be treated non-operatively, surgical intervention is one of treatment. Simply available implants were chosen due to economic, availability and technical demand factors. Intramedullary screw offers less risk of wound complication, removal of implant, nonunion and malunion. Discrepancies in amount of force and displacement in finite element analysis can be explained as the bones used in the actual experiment may have different biological and density than the one used in FEA.

CONCLUSION:

In conclusion, intramedullary screw fixation is superior to the plate fixation group and thus should serve as the fixation of choice in treating Weber A1 lateral malleolus fracture.

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