

1984, Dubrovnik

The Biomechanics of External Fixation of Fractures

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The external fixation of the lower leg with an external fixator is indicated in 2nd and 3rd degree compound fractures, soft tissue lesions and contusions as well as in vascular damage. It is also preferably used in chronic cases as instability associated with arterial and venous insufficiency, skin disease and osseous infections.

As in many cases a sufficient stability was not attained experimental studies and theoretical reflections were performed to reveal the causes.

The stability of external fixation of fractures is influenced by the material properties, the anchorage of the implants in bone, the type of fracture and the arrangement of the external fixator.

Whereas the fracture type and often the material of the external fixator are fixed, the arrangement of the fixator can be changed by the surgeon.

In biomechanical tests short oblique fractures of the tibia were stabilized with two and three dimensional and various V-shaped external fixators, applied at the ventral-medial side. The stability of all different types of fracture fixations was tested with and without an additional lag screw. Under torsional load the stability of the fracture was measured. The three dimensional and the V-shaped external fixator yielded the best results. An additional lag screw increased the stability significantly. Further improvement can be achieved by enlarging the diameter of the Schanz- and Steinmann screws as well as by shortening its free length. These results caused us to develop an unilateral external fixator which will be demonstrated.