# Comparison of Intramedullary Screw Fixation of Length Stable Versus Length Unstable Metacarpal Shaft Fractures

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INTRODUCTION: Intramedullary screw (IMS) fixation is a minimally invasive technique for metacarpal shaft fractures that provides stability while minimizing soft tissue stripping. Outcomes of IMS fixation for various fracture patterns are unclear. This study's aim was to determine radiographic and clinical outcomes of intramedullary fixation for metacarpal shaft fractures in skeletally mature individuals. The null hypothesis is that there is no difference in postoperative displacement and complications between length-unstable (LU) and length-stable (LS) metacarpal shaft fractures treated with IMS fixation.

METHODS: This is a retrospective cohort study of patients treated between November 2022 and November 2024. Fractures were classified as LU if the fracture was comminuted, long oblique or spiral oblique in morphology, whereas transverse and short-oblique fractures were classified as LS fractures. The primary outcome was postoperative interval displacement (i.e. loss of reduction). Secondary outcomes were reoperations, complications, and Visual Analog Scale (VAS) pain scores. Statistical analyses involved independent t-tests for continuous variables and chi-square tests for categorical variables, with significance set at $p \leq 0.05$.

RESULTS: A total of 144 metacarpal fractures were included among 131 patients, with 74 (51.4%) classified as LS and 70 (48.6%) as LU fractures. The primary outcome, postoperative interval displacement, occurred in 4 patients (5.4%) in the LS group and 1 patient with nonunion (1.4%) in the LU group, with no statistically significant difference observed ($p = 0.14$). Regarding secondary outcomes, no reoperations were reported. Complication rates were comparable between LS (6.8%) and LU (4.3%) groups. There were four complications in the LS group due to repeat striking with the injured hand causing bending the IMS with a fifth complication due to nonunion of the small finger metacarpal shaft in a patient with multiple metacarpal fractures. In the LU group, there was one nonunion, a case of IMS protrusion into the metacarpophalangeal (MCP) joint, and failure to capture the proximal segment during IMS fixation. In total, 118 fractures were reduced adequately and another 26 inadequately reduced. Overall, there was a 99% (142/144) radiographic union rate. Mean postoperative VAS pain scores were low in both groups (LS: 0.38 ± 0.90 vs. LU: 0.22 ± 0.91), with no significant difference ($p = 0.73$).

DISCUSSION AND CONCLUSION: IMS fixation offers relative stability for both LS and LU metacarpal shaft fractures with low rates of displacement, reoperation, and complications, though loss of reduction can still occur irrespective of fracture morphology. Although, percutaneous treatment of LU fractures may lead to inadequate reduction, the difference in adequacy of reduction with percutaneous IMS fixation between LS and LU fracture patterns remained statistically insignificant.

**Figure 1** (a-d) 28 year, male patient w/ Rt.5 hand. Intermediate, oblique proximal metaphyseal fracture of the ring metacarpal. Length stable and adequately reduced. Healing at 6 weeks and 3 months. Note the persistent presence of the IM screw and healing of the ring and little finger metacarpal fractures