Biomechanical Comparison of Refracture Rates Following Removal of Either 2.7-mm or 3.5-mm Constructs in Sawbones Models of the Forearm

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Purpose: Forearm fractures are common orthopaedic injuries treated with open reduction and internal fixation with a plate-screw construct. Removal of the construct following healing increases the incidence of refracture from 2.1% to 6.3%. We hypothesized that the bone's biomechanical strength is decreased more when 3.5-mm constructs are removed, compared to the removal of 2.7-mm constructs.

Methods: 36 cylindrical Sawbones samples were used. 2 samples were used for preliminary testing, 17 were used for the 2.7-mm construct group, and 17 were used for the 3.7-mm construct group. 3.5-mm or 2.7-mm holes were drilled in accordance with commonly used forearm plates. 3-point bend and axial compression testing was performed with an Instron 3-point bending and compression loading machine. Maximum failure load was collected.

Results: There was no difference in the 3-point bend test failure loads between 3.5-mm and 2.7-mm construct removal (2145.6 ± 141.0 N vs 2228.6 ± 175.1 N; P = 0.28). There was no difference in the axial compression test failure loads between 3.5-mm and 2.7-mm construct removal (14097.7 ± 686.9 N vs 14782.3 ± 841.9 N; P = 0.17).

Conclusion: There was no difference in failure load during 3-point bend or compression testing between 3.5-mm or 2.7-mm construct removal. Clinically, the decision between 3.5-mm and 2.7-mm constructs should not be influenced by the biomechanical strength of a healed bone after construct removal.