Subchondral rafting wires may prevent tibial plateau fracture subsidence

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Introduction: Tibial plateau fractures often require operative fixation to restore alignment and stability of the joint. Some patients may experience post-operative articular subsidence of the tibial plateau after initial fixation, which may be associated with the development of post-traumatic arthritis and poor functional outcomes. We hypothesized that the use of subchondral rafting wires is associated with a decreased incidence of post-operative articular subsidence.

Methods: Institutional Review Board (IRB) was obtained prior to data collection. Adult patients (18+ years) who underwent open reduction and internal fixation (ORIF) of a tibial plateau fracture at a level 1 trauma center from 2018-2023 were identified. Patients were grouped based on retained subchondral rafting wire use. Potential confounding covariables including demographic, comorbidity, injury characteristic, and treatment data were collected by chart review. Linear and angular post-operative subsidence were measured by comparing differences between immediate post-operative and follow-up tibial plateau radiographs (Figure 1). Welch two sample t-tests were performed for the normalized linear and angular subsidence between the groups with retained or removed rafting wires. Associations between subsidence and patient, injury, and treatment covariables were assessed through multivariable linear regression.

Results: 179 patients with a mean follow-up time of 217 days were identified. Of those, 15 patients retained subchondral rafting wires as definitive implants while 164 patients did not retain subchondral rafting wires as definitive implants. Compared to patients without retained subchondral rafting wires, patients with retained rafting wires experienced less linear subsidence (-0.52 log[mm] vs –1.92 log[mm], 0.30 mm vs 0.012 mm, $p<0.001$) and less angular subsidence (-0.55° vs 0.93°, $p=0.003$) as represented by a positive difference in medial proximal tibial angle (MPTA). Linear regression demonstrated that retained rafting wires, sex, depressed plateau area, and active smoking had significant effects ($p<0.01$) on linear subsidence, while retained rafting wires, osteoporosis, Charleston Comorbidity Index (CCI), AO-OTA classification, and race had significant effects ($p<0.05$) on angular subsidence.

Discussion: The use of retained subchondral rafting wires was significantly associated with less linear and angular subsidence. However, current literature suggests linear articular subsidence greater than 2 mm is associated with worse functional outcomes. Thus, the difference in linear subsidence measured in this study may be clinically insignificant. Known risk factors were confirmed to significantly contribute to the degree of articular subsidence. Further studies may be warranted to determine whether retained subchondral rafting wires improve functional outcomes after tibial plateau fracture as well as the degree of post-operative subsidence associated with complications.

Clinical Significance: The use of retained subchondral rafting wires may reduce articular subsidence after tibial plateau fracture, albeit to a clinically insignificant degree.

Table 1. Multivariable Linear Regression Analysis on Normalized Linear Subsidence and Angular Subsidence (Statistically Significant Covariates)

Log Linear Subsidence			
Variable	Coefficient	T-Value	P-Value (<0.05)
Retained wires	-1.37	-4.67	<0.001
Sex (Male)	0.49	2.63	0.009
Depressed Area	0.001	2.16	0.032
Active Smoker	0.46	2.53	0.012
Angular Subsidence			
Variable	Coefficient	T-Value	P-Value (<0.05)
Retained wires	1.52	2.15	0.033
AO-OTA Classification (41C3.2)	-6.28	-2.09	0.038
AO-OTA Classification (41C3.3)	-5.69	-2.04	0.043
AO-OTA Classification (41B1.3)	-8.02	-2.5	0.015
Race (Multiple)	-2.32	-2.32	0.022
Osteoporosis	13.65	2.51	0.013
CCI Score	-1.23	-2.12	0.036

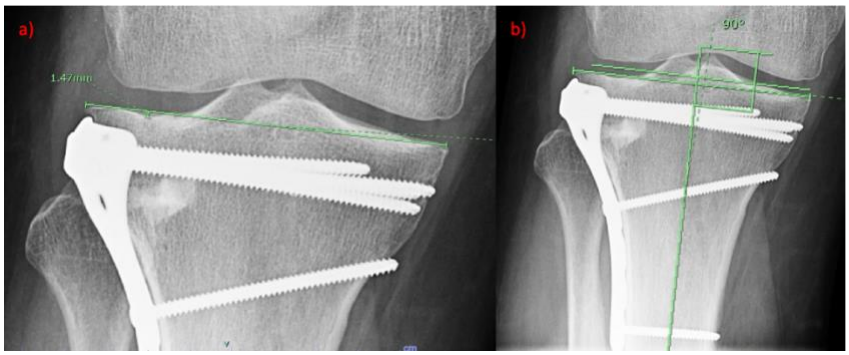

Figure 1a. Linear subsidence measured from the joint line to the most depressed part of the articular surface. Figure 1b. Angular subsidence measured as the medial proximal tibial angle.