

**Δ Collagen X Longitudinal Fracture Biomarker Suggests Staged Fixation in Tibial Plateau Fractures Delays Rate of Endochondral Repair**

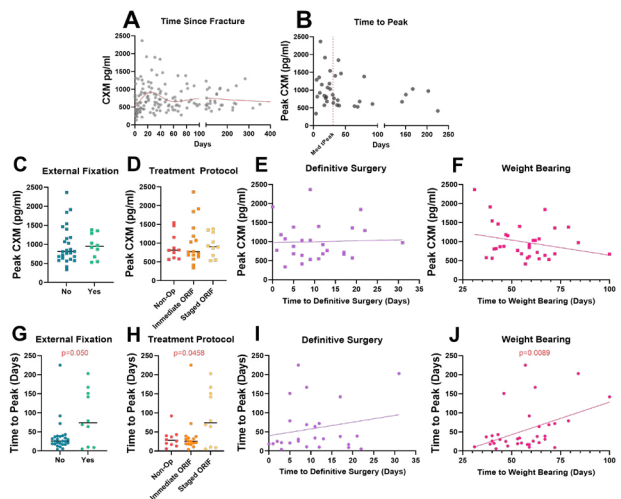
*Zachary Mark Working, MD, FAAOS; Danielle Peterson, MD; Michelle Lawson, MD; Kelsey O'Hara, BS; Ryan Coghlan, MS; Matthew T. Provencher, MD, MBA; Darin M. Friess, MD, FAAOS; Brian Johnstone, PhD; Theodore Miclau, MD, FAAOS; Chelsea S. Bahnney, PhD*  
 OHSU, SPRI, UCSF, Portland (also San Francisco & Vail), Oregon, UNITED STATES

**Purpose:** No validated method to quantify biologic fracture healing exists. Many fractures heal via callus and cartilage intermediate with expression of collagen X (ColX), providing a diagnostic opportunity. A published preclinical murine fracture-model (novel validated sandwich enzyme-linked immunosorbent assay [ELISA]: CXM) demonstrates early gene expression (day 7) after fracture, delayed serum CXM peak (day 14), and supportive immunohistochemistry staining (ColX). Here we present observational CXM data from adults sustaining tibial plateau fractures, exploring the effect of treatment protocol on CXM expression.

**Methods:** Patients presenting within 14 days (isolated plateau fractures, IRB approval) were approached. Dried blood spots (DBS) were collected (lancet/fingerprick; protein cards; injury/2/6/12 weeks, all other visits; ≥3 samples for analysis). DBS sampling included 3.1-mm punch in duplicate, +250 mL of sample diluent, and overnight extraction (4°C) before assay.

**Results:** 22 males and 14 females (average age: 46.3 years; range 22.6-73.4, standard deviation [SD] 13.3) enrolled (16 unicondylar/20 bicondylar). 25 patients (72.2%) were treated operatively, including 12 (33.3%) provisionally or definitively treated via external fixation. There was no difference between sexes/age in peak CXM values. Patients demonstrated peak expression near 1000 pg/mL (average: males, 986.5 pg/mL, SD 369; females, 953.2 pg/mL, SD 576). There was no difference in peak CXM by treatment protocol, external fixator use, or fracture severity. Patients treated with external fixation (P = 0.05) or staged open reduction and internal fixation (P = 0.046) critically demonstrated delayed peaks (Fig. 1).

**Conclusion:** Pilot analysis demonstrates a strong CXM peak after fractures, matching prior research, delayed with staged fixation. This may represent the consequence of delayed construct loading. ColX may provide an opportunity to support prospective interventional studies testing novel orthobiologics or fixation techniques.



Δ OTA Grant

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device they wish to use in clinical practice.