

## **Detection of Concussion Using Cranial Accelerometry.**

Auerbach PS<sup>1</sup>, Baine JG, Schott ML, Greenhaw A, Acharya MG, Smith WS.

### **Author information:**

Division of Emergency Medicine, Department of Surgery, Stanford University School of Medicine, Stanford, California; <sup>†</sup>Department of Orthopedic Surgery, Stanford University School of Medicine, Stanford, California; <sup>‡</sup>Stanford-Kaiser Affiliated Residency in Emergency Medicine, Stanford University School of Medicine, Stanford, California; <sup>§</sup>Los Altos High School, Los Altos, California; and Department of Neurology, School of Medicine, University of California, San Francisco, San Francisco, California.

### **Abstract**

#### **OBJECTIVE:**

To determine whether skull motion produced by pulsatile cerebral blood flow, as measured by cranial accelerometry, is altered during concussion.

#### **DESIGN:**

In phase 1, to identify a specific pattern indicative of concussion, cranial accelerometry of subjects who sustained a concussion underwent analysis of waveforms, which was compared with accelerometry from subjects without a concussion (baseline). In phase 2, this concussion pattern was tested against prospectively acquired, blinded data.

#### **SETTING:**

High school tackle football practice and game play.

#### **PARTICIPANTS:**

Eighty-four football players.

#### **INTERVENTIONS:**

Subjects had accelerometry measurements and concurrent 2-lead electrocardiograms. In players with a concussion, multiple sequential measurements were obtained. Sport Concussion Assessment Tool 2 was used to assist clinical determination of concussion.

#### **MAIN OUTCOME MEASURES:**

Whether a characteristic waveform pattern of cranial accelerometry occurs in subjects with concussion.

#### **RESULTS:**

Phase 1 demonstrated a consistent pattern correlated to concussion. Phase 2 found this pattern in 10 of 13 subjects with concussion (76.9% sensitivity). Seventy-nine of 82 baseline plus nine postseason (total = 91) recordings from nonconcussed subjects did not show the concussion pattern (87% specificity).

#### **CONCLUSIONS:**

In subjects with concussion, we observed a unique pattern determined by cranial accelerometry. This may

**CAUTION:** The Jan Medical BrainPulse system is an FDA cleared device for cranial motion measurement currently under research for a variety of neurological conditions. Limited by federal (US) law to investigational use for diagnostic purposes.

MS-0195 Rev. B, Auerbach, Concussion Journal Abstract, *Detection of Concussion Using Cranial Accelerometry*.



provide a method to noninvasively detect and longitudinally observe concussion.

**CLINICAL RELEVANCE:**

There is no objective, real-time, noninvasive, and easily accessible measure for concussion. If accelerometry is validated, it could provide a critical diagnostic tool for sports medicine physicians.

PMID: 25010149

**CAUTION:** The Jan Medical BrainPulse system is an FDA cleared device for cranial motion measurement currently under research for a variety of neurological conditions. Limited by federal (US) law to investigational use for diagnostic purposes.

MS-0195 Rev. B, Auerbach, Concussion Journal Abstract, *Detection of Concussion Using Cranial Accelerometry*.