Tremor is described by Stein and Lee as an "involuntary movement characterized by a rhythmic oscillation about a fixed point or trajectory during activities controlled by the central nervous system." Among such oscillations are those demonstrated by healthy individuals and referred to as physiological tremors. These tremors are associated with posture or voluntary movement and are enhanced during tonic activation of the muscle, with fatigue and anxiety, and under conditions of increased metabolism. The frequency of physiological tremors (8–12 Hz) is greater than the frequencies of resting tremors (4–7 Hz) and of clonus (5–8 Hz), which are associated with abnormal neurologic states.

Although the Cybex® II dynamometer* has been used to document conditions such as paresis,2,3 reciprocal delays,3 and spasticity,4 the therapists at this facility do not believe it has been used to document the presence of tremor in patients who have had central nervous system lesions. Because tremors are important in the "diagnosis and localization of disease of the nervous system,"5 their documentation often is included in the physical therapy assessment of patients with central nervous system lesions.6 The purpose of this clinical report is to describe the tremors we have observed using the Cybex® II dynamometer during routine velocity spectrum testing of brain injured patients.

Our dynamometer testing has revealed rhythmic oscillations in both the elbow flexion and knee extension torque curves of brain injured patients (eg, those with closed head injuries, cerebral palsy, or cerebrovascular accidents). The oscillations have been observed rarely in the range of motion (electrogoniometer) curves obtained during such testing. During testing, we have noted most measurable tremors on the 30 ft-lb† torque scale using the 25 mm/sec paper speed and the damping recommended by the manufacturer for the joint being tested. The more sensitive 30 ft-lb scale allows the oscillations to be detected and measured. The 25 mm/sec paper speed spreads out the oscillations so they are more apparent and so their frequency can be measured by counting the number of cycles a second (by millimeter of paper length). The relative insensitivity of the range of motion scale in comparison with the torque scale (3.0°/division vs 1.0 ft-lb/division) may underlie the appearance of oscillations in the torque curve rather than in the range curve.

The oscillations we have observed are usually about 10 Hz (physiological tremors), although we also have observed oscillations of 3 to 7 Hz (clonus). The frequency of the oscillations is consistent across multiple contractions during the same test session. We have never observed the peak-to-valley amplitude of the oscillations to exceed 6 ft-lb. Although we have usually observed the oscillations during testing at 30°/sec, they may also be observed at higher velocities (Figure).

Stein and Lee have proposed that physiological tremors are at least partly the result of "instability of the servomechanism associated with the stretch reflex."1 Like other factors (eg, fatigue, anxiety, and alcohol intake), central nervous system lesions may destabilize further the servomechanism and, thereby, enhance the physiological tremor. Such an enhancement would explain why we often observe 10 Hz oscillations in neurologically involved patients but seldom in orthopedically involved patients. We have observed that the amplitude and incidence of both physiological and clonic tremors decreases in many of our more acutely involved patients as they demonstrate during isokinetic testing other signs of recovery from their lesions (eg, increased torque production or decreased reciprocal delays).

The clinical value and reliability of the Cybex® II dynamometer as an instrument for documenting tremor cannot be established in a report such as this. The potential of the instrumentation, however, is established. Because of the importance of tremor in neurologic assessment and our prelim-
inary experience and observations, we believe the dynamometer’s use in documenting tremor merits further trial and validation.

REFERENCES