Guidelines Document:

Electrical Impedance Myography (EIM)

Device Information:	**More information available here: Electrical Impedance Myography Link**
Classification:	**Exploratory** for Facioscapulohumeral Muscular Dystrophy (FSHD) and Congenital Muscular Dystrophy (CMD)
Short Description of Instrument:	Electrical impedance myography (EIM) is a new non-invasive technique for the evaluation of neuromuscular disease that relies upon the application and measurement of high-frequency, low-intensity electrical current. EIM assesses disease-induced changes to muscle's normal composition and architecture, including myocyte atrophy and loss, edema, reinnervation, and the deposition of endomysial connective tissue and fat. With application of single-frequency electrical current, EIM can be used to help grade the severity of neuromuscular disease. Assessing electrical impedance across a spectrum of applied frequencies and with current flow at multiple orientations relative to the major muscle fiber direction can provide a more complete picture of muscle condition. EIM does not focus on measuring the inherent electrical activity of the tissues. Rather, similar to diagnostic ultrasound, measurements are made over a small area of interest, with energy being applied to the body and the resultant surface patterns analyzed.
Comments / Special Instructions	**Methodology:** EIM measures the impedance of skeletal muscle over a frequency range between 1 kHz and 10 MHz. The impedance is measured at each frequency by applying low-intensity electrical current (<1 mA) via surface electrodes, and measuring the resulting voltage signals using a second set of surface electrodes, converting them into 2 impedance parameters, the resistance (R) and the reactance (X). The resistance and reactance can be used to calculate the phase angle. **Validation in FSHD:** There is a clear path towards validating EIM provided by separate validation studies already performed in multiple other neuromuscular diseases, including ALS, SMA, and DMD.

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References:	**EIM in clinical research (General):** Rutkove, Seward B. Electrical Impedance Myography: Background, Current State, and Future Directions Muscle Nerve. Dec 2009; 40(6): 936–946. **Disease-specific recommendations:** **EIM in SMA:** Rutkove, S. B., J. M. Shefner, et al. (2010). "Characterizing spinal muscular atrophy with electrical impedance myography." Muscle Nerve 42(6): 915-921. Description of Portable EIM system: Ogunnika, O. T., S. B. Rutkove, et al. (2010). "A portable system for the assessment of neuromuscular diseases with electrical impedance myography." J Med Eng Technol 35(7-8): 377-385 **EIM in ALS:** Rutkove, S. B., J. B. Caress, et al. (2014). "Electrical impedance myography correlates with standard measures of ALS severity." Muscle Nerve 49(3): 441-443. Rutkove, S. B., J. B. Caress, et al. (2012). "Electrical impedance myography as a biomarker to assess ALS progression." Amyotroph Lateral Scler 13(5): 439-445. **EIM in Duchenne Muscular Dystrophy:** Schwartz, S., T. R. Geisbush, et al. (2014). "Optimizing electrical impedance myography measurements by using a multifrequency ratio: A study in Duchenne muscular dystrophy." Clin Neurophysiol.