Chapter 7
Biofeedback

Objectives

- Define biofeedback and identify its use in the clinical setting
- Discuss the process by which electrical activity generated by a muscle is processed and converted to meaningful information by a biofeedback device
- Outline the equipment set-up and clinical applications for biofeedback

Biofeedback Defined

- Info provided by some measurement instrument about a specific biologic function
- Provides patients with feedback that enables them to make adjustments in movement or function
Clinical Application

- Useful in helping patients regain function of a muscle
  - Muscle re-education
    - overcome VMO inhibition
    - isolate and train scapular stabilizers
  - Muscle relaxation
    - Upper trapezius
    - Muscle guarding secondary to injury

Biofeedback Instrumentation

- Peripheral skin temperature
  - Vasoconstriction & vasodilation
- Finger phototransmission
  - Vasoconstriction & vasodilation
- Skin conductance activity
  - Sweat gland activity
  - Lie detector testing
- Electromyographic (EMG) activity
- Electrical activity within a muscle
- Mirror
  - Visual feedback for movement patterns

Electromyographic (EMG) Feedback

- Measures or monitors the electrical activity associated with muscle contraction
  - surface electrodes
  - indwelling electrodes
- Does NOT measure the force produced by the contraction
Electromyographic (EMG) Feedback

- Processing the signal
  - Raw signal is recorded as an alternating voltage wave

Electromyographic (EMG) Feedback

- Processing the signal
  - Raw signal is then rectified (negative reflections are flipped to positive pole)

Electromyographic (EMG) Feedback

- Rectified signal is then smoothed by eliminating all of the peaks and valleys
- Smoothed signal is then integrated by measuring the area under the curve
Electromyographic (EMG) Feedback

- Records the electrical activity of the muscle and then transforms it into meaningful feedback data

Instrumentation

- Three electrodes placed over the muscle in line with the direction of muscle fibers
  - Two active electrodes
  - One reference or ground electrode (usually placed between the two active electrodes)
  - Electrodes should be placed close together to eliminate "noise"

Set-up

- Clean electrode site with alcohol prep pad
- Apply conductive gel to electrodes
- Place electrodes in belly of muscle in line with the direction of muscle fibers
- Plug the lead wires into the biofeedback unit
- Turn the biofeedback unit ON
**Electromyographic (EMG) Feedback**

**Set-up**
- Set the OUTPUT to the desired mode of feedback
  - Visual
    - strip of colored lights
  - Meter level
  - Auditory
    - beeps
    - clicks
  - Both

**Electromyographic (EMG) Feedback**

**Set-up**
- Set the SENSITIVITY threshold to the desired level of feedback
  - Increased sensitivity requires less work from the patient
  - Decreased sensitivity requires more work from the patient

**Electromyographic (EMG) Feedback**

**Set-up**
- Set the SENSITIVITY threshold (µV) to the desired level of feedback
  - High sensitivity to promote relaxation
  - Low sensitivity to promote reeducation
Electromyographic (EMG) Feedback

Set-up
- Set the SENSITIVITY threshold to the desired level of feedback
  - Scale reading
    - x1 - .05-10µV (highest sensitivity)
    - x10 - 5-100µV
    - x100 - 50-1000µV (lowest sensitivity)

Instruct the patient on what they are supposed to do
- Contract muscle to produce a certain peak level
- Hold for 6-10 seconds
- Relax muscle to eliminate feedback

Treatment time
- 5-10 minutes

Indications
- To facilitate muscle contraction
- To regain neuromuscular control
- To decrease muscle spasm
- To promote systemic relaxation
Electromyographic (EMG) Feedback

- Cautions
  - Do not exceed prescribe ROM
  - Avoid undue muscle tension that may affect grafts or other tissue restrictions

Electromyographic (EMG) Feedback

- Contraindications
  - Conditions in which muscular contractions would insult the healing tissues

Biofeedback with Mirror
What questions do you have?