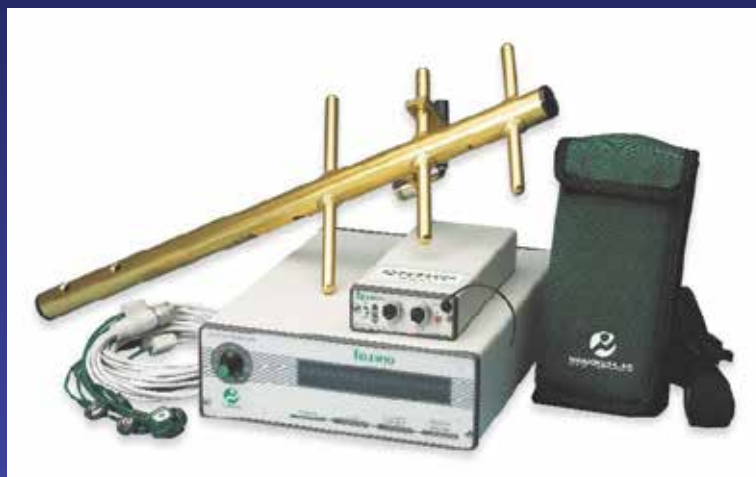


Eletromiografia



**Ricardo Martins de Souza
2013**

Eletromiografia

'Electro' – electric

'Myo' – muscle

'Graphy' – to graph

Técnica experimental que tem por objetivo gravar e analisar os sinais eletromiográficos .

(ABC of EMG)

Eletromiografia

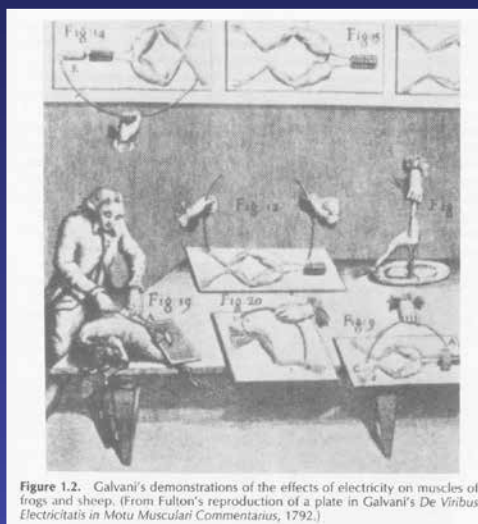
É um conjunto de técnicas utilizadas no estudo da atividade elétrica muscular. Inclui: captação, amplificação, filtragem, aquisição por computador, quantificação, análise e interpretação da atividade elétrica do músculo.

(Kohn e Mezzarane, 2005)

História da Eletromiografia

Luigi Galvani – 1791

Observou a relação entre músculo e eletricidade despolarizando pernas de sapos com hastes de metais.



História da Eletromiografia

Carlo Matteucci - 1838

Provou que correntes elétricas eram formadas nos músculos.

Du Boys-Reymond - 1849

Desenhou um galvanômetro para medir correntes elétricas e reduziu a impedância da pele.

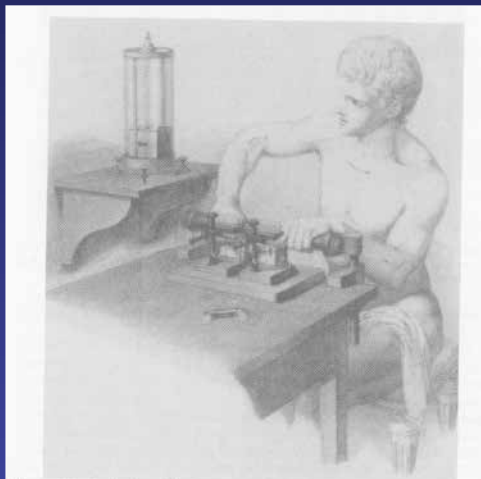
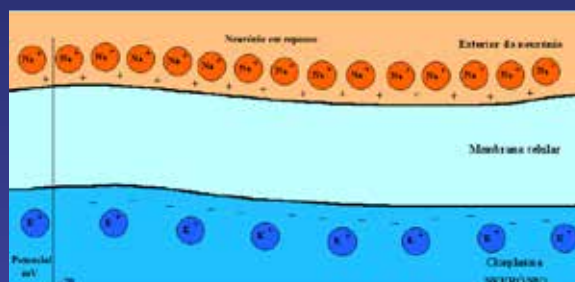
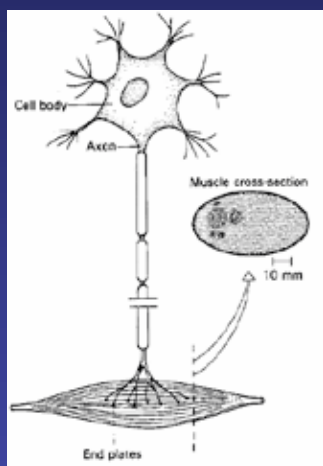
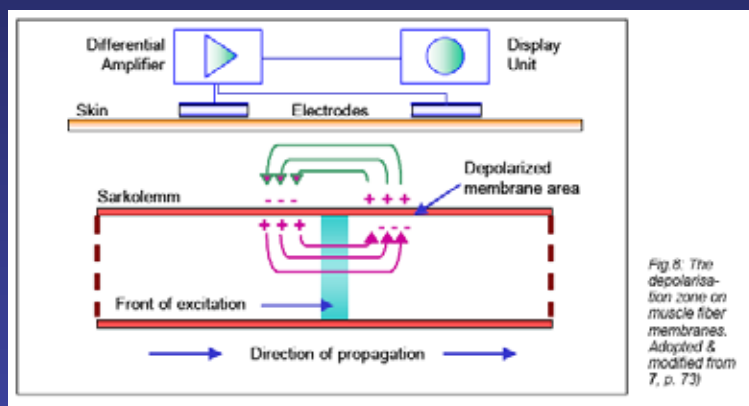


Figure 1.3. Depiction of the first recorded detection of the EMG signal from human muscles during voluntary contraction. (From Figure 147 of the book "Über Thierische Elektrizität" by Du Bois-Reymond published in 1849.)

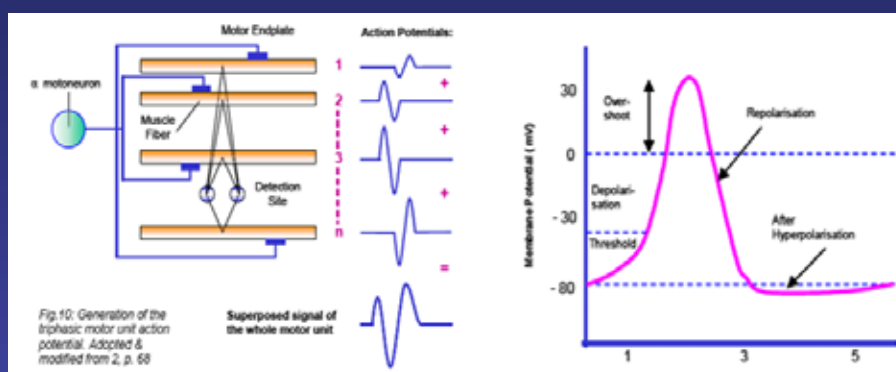
Conceitos Fundamentais da Eletromiografia



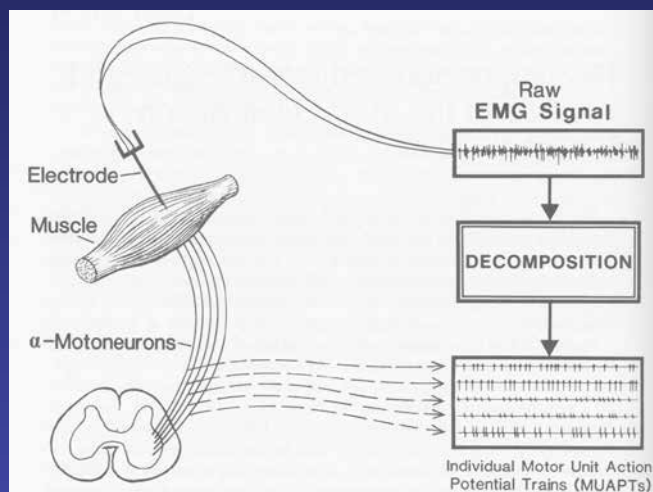
Medição do Potencial de Ação



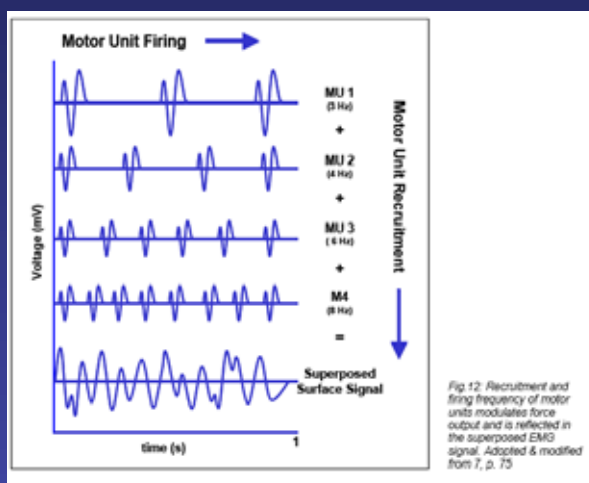
Medição do Potencial de Ação



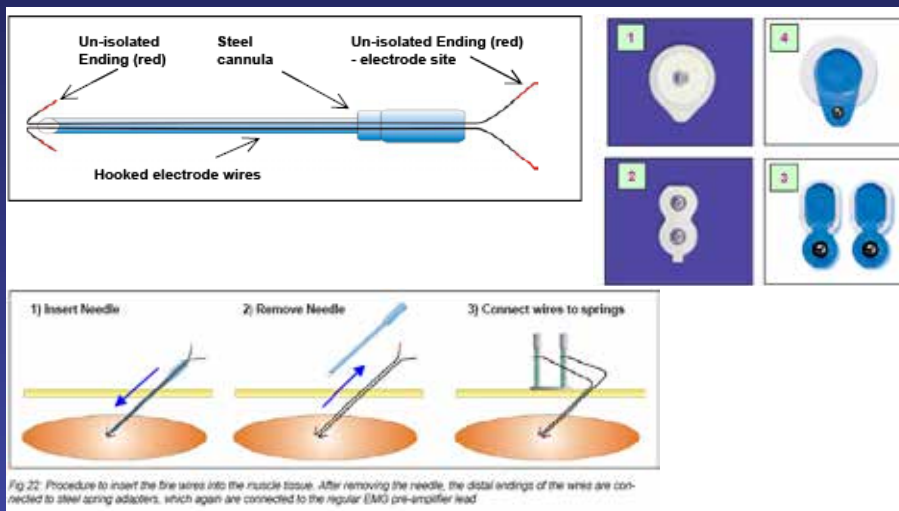
Decomposição do Sinal EMG



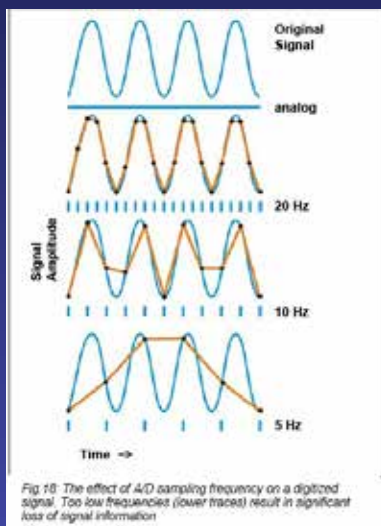
Decomposição do Sinal EMG



Tipos de EMG



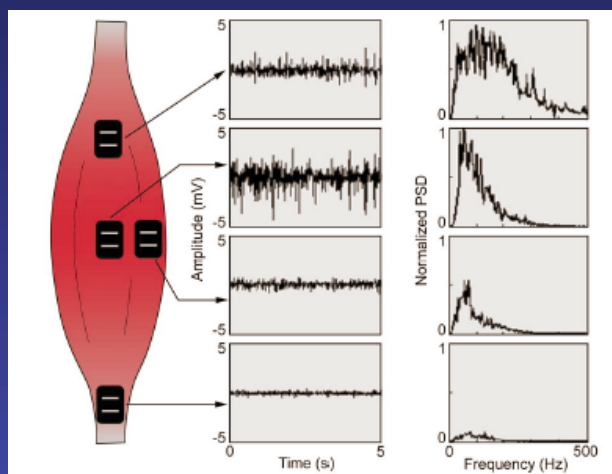
Teorema de Nyquist



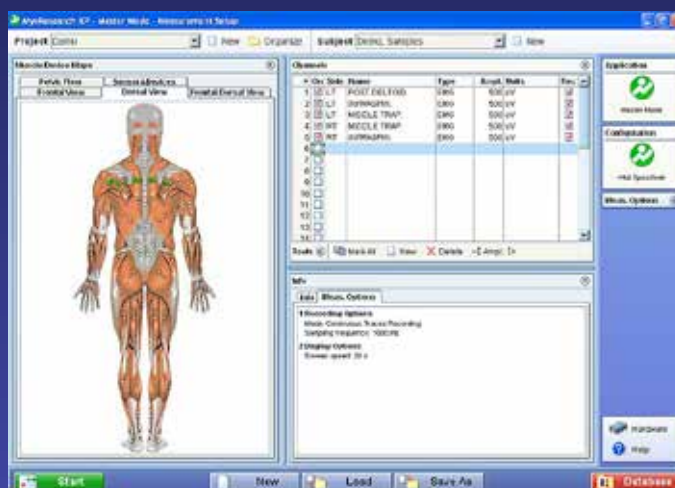
Preparação da pele para a aquisição da EMG

1. Raspagem dos pêlos existentes no local (tricotomia);
2. Limpeza do local de fixação dos eletrodos;
3. Esfoliação para a retirada de células superficiais.

Posicionamento dos eletrodos



Posicionamento dos eletrodos



O que analisar do sinal?

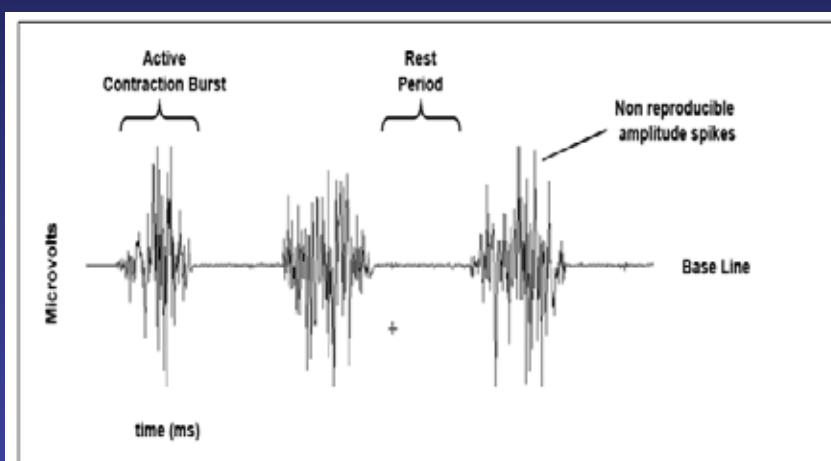
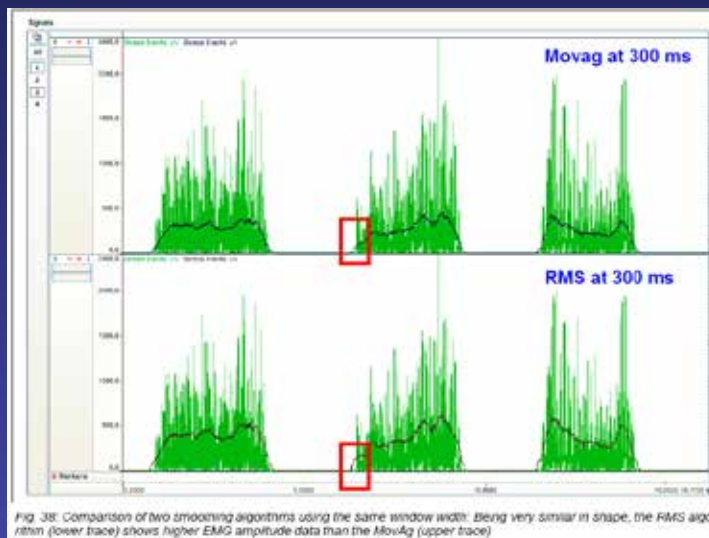
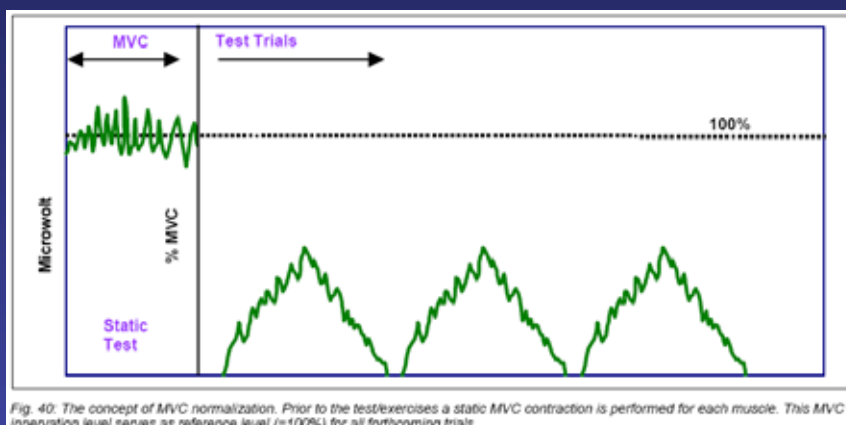


Fig.13: The raw EMG recording of 3 contractions bursts of the M. biceps br.

RMS



Normalização pela MIVC



Normalização pela Média ou Pico do Sinal

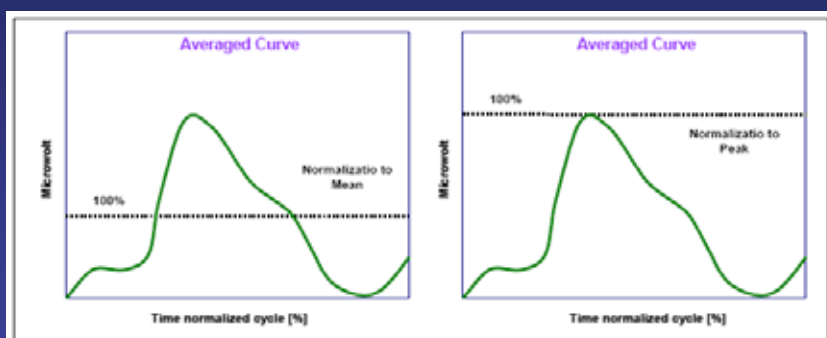


Fig. 44: Amplitude normalization to the test- internal mean (left) or peak value (right) of the averaged curve.

Análise da frequência do sinal de EMG

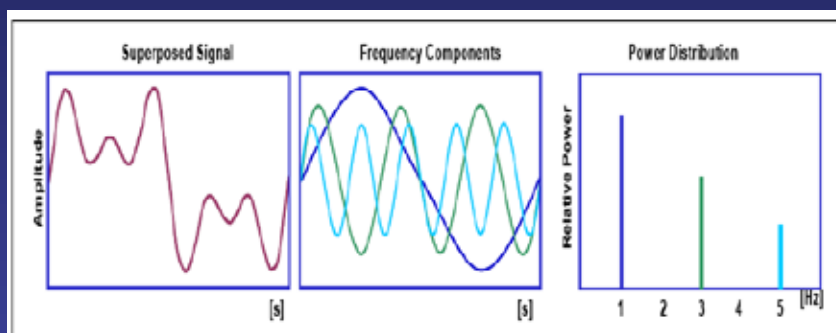


Fig. 56: Model of frequency related signal decomposition based on FFT. The signal on left side contains 3 underlying waves (middle): a sinus wave at 1 Hz, another at 3 Hz and finally one wave at 5 Hz. The power distribution (right) indicates Power of different magnitude at this frequencies. Adopted & redrawn from 3, p. 24

Análise de outros parâmetros do sinal EMG

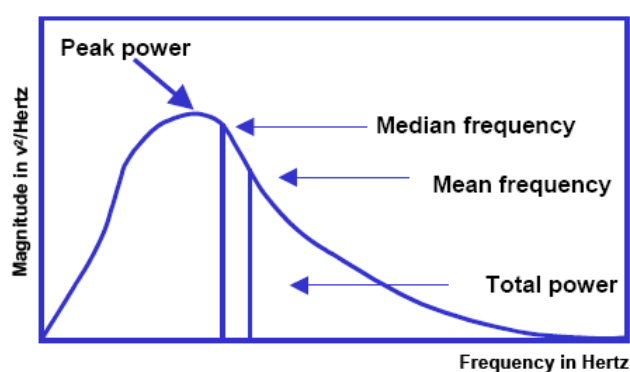


Fig. 57: EMG standard frequency parameters based on FFT calculations

Análise EMG: Ativo vs. Inativo



Fig. 66: EMG on/off analysis of a regular upright standing / posture task. The multifidus (ch. 1) and internal obliques (ch. 4) show significant EMG activity (on), whereas the gluteus maximus (ch. 3) and rectus abdominis (ch. 4) are "off". The same finding is found on instable ground or one leg standing – indicating which muscles really contribute to postural stability

Análise EMG: Maior Ativ. vs. Menor Ativ.

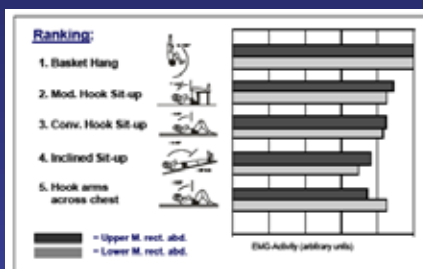


Fig. 69: EMG analysis of 5 abdominal exercises, ranked by the highest EMG found (basket hang) and scaled in arbitrary units

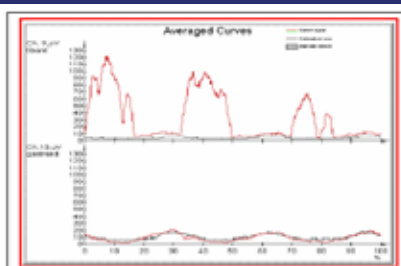


Fig. 70: Qualitative EMG analysis of the tibialis anterior (upper trace) and gastrocnemius medialis (lower trace) in left/right comparison of a spastic patient performing 3 squats. The more/less analysis focuses on side comparison and constancy between repetitions.

Análise EMG: Organização Temporal da Ativação

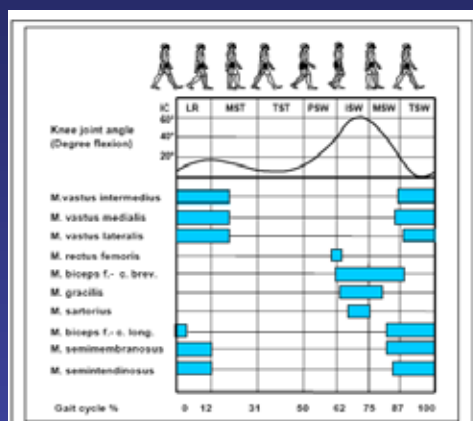
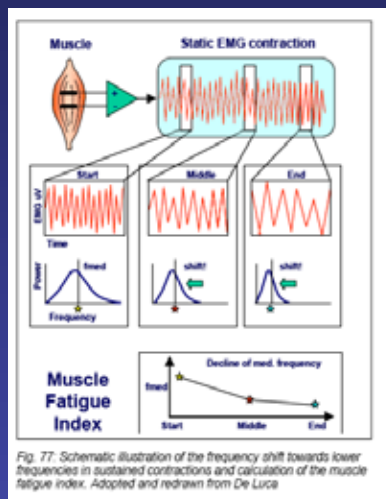
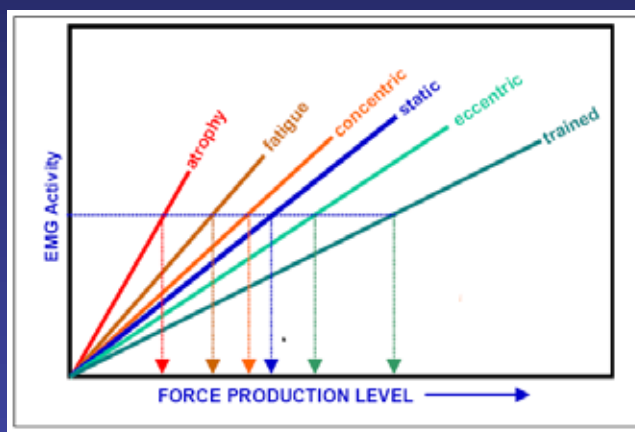


Fig. 71: On/Off timing pattern of ten lower leg muscles within a gait cycle. Blue bars indicate when the muscle is active. Adopted and modified from 8

Análise EMG: Fadiga Muscular



Análise EMG: Força vs. Ativação



Análise EMG: Coordenação Motora

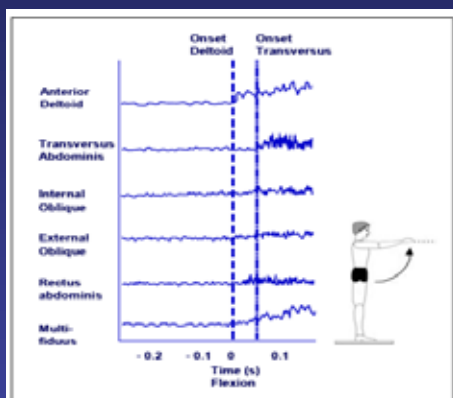


Fig. 73: Delayed innervation (narrow dash line) of lumbar segmental stabilizers (Transversus abdominis, Multifidus) in ratio to the onset of the deltoid muscle (wide dash line) in rapid shoulder flexion done by a low back pain patient. Adapted & redrawn from 9, p. 62

Análise EMG: Análise por comparação

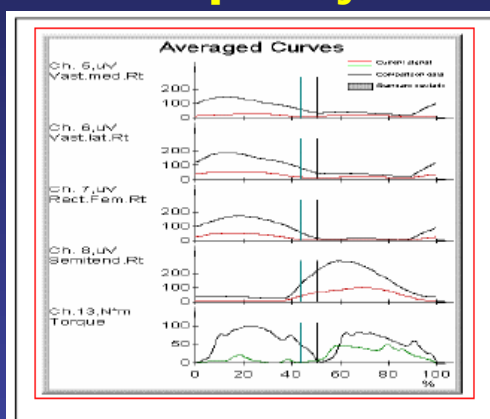


Fig. 89: Side comparison within isokinetic testing, based on averaged curves, with healthy and injured (red) side