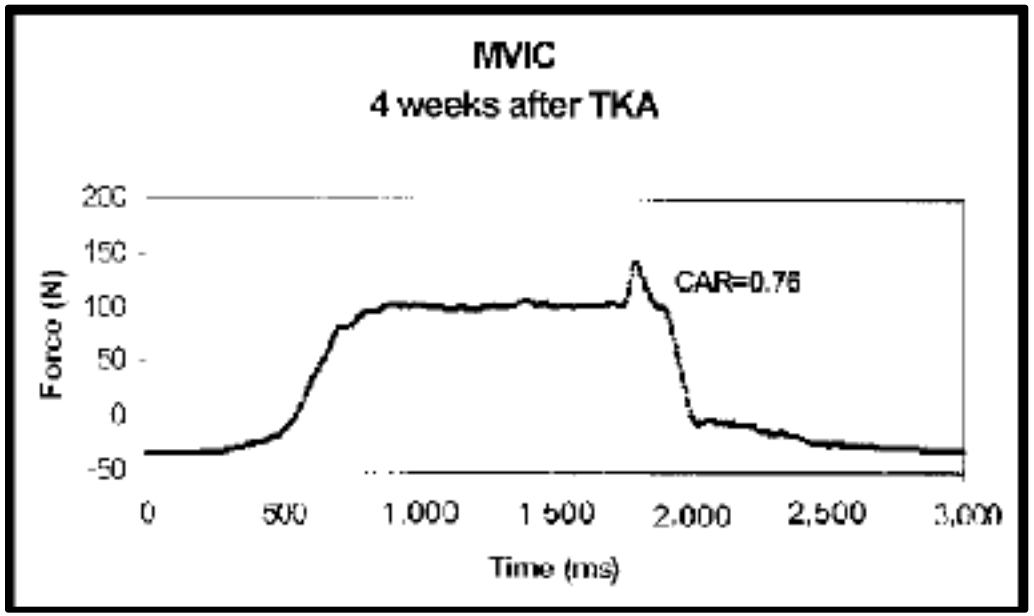
Estimulação Elétrica Neuromuscular (EENM)

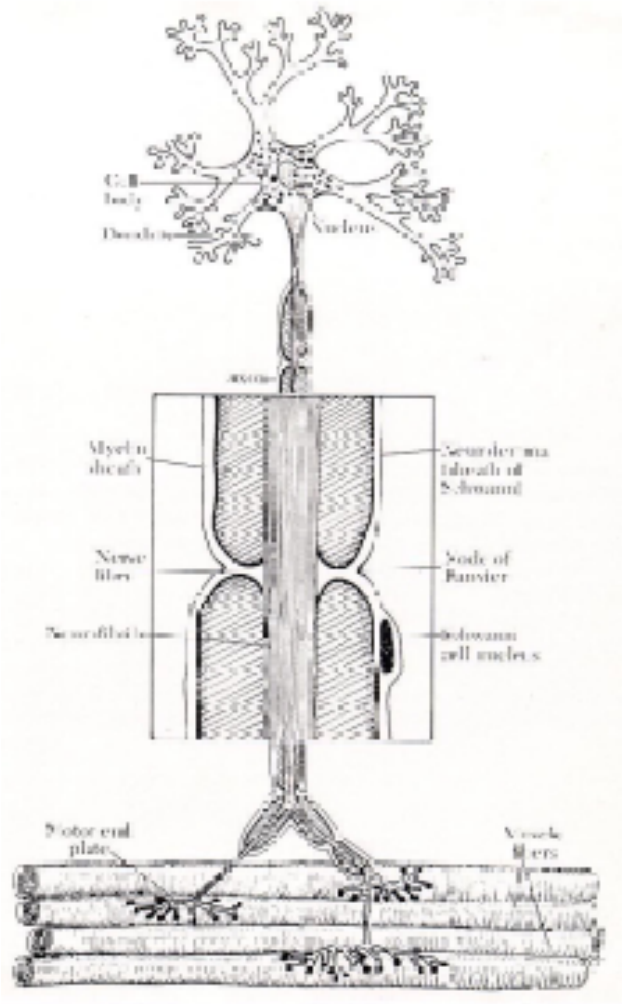
FES / Russa / Aussie

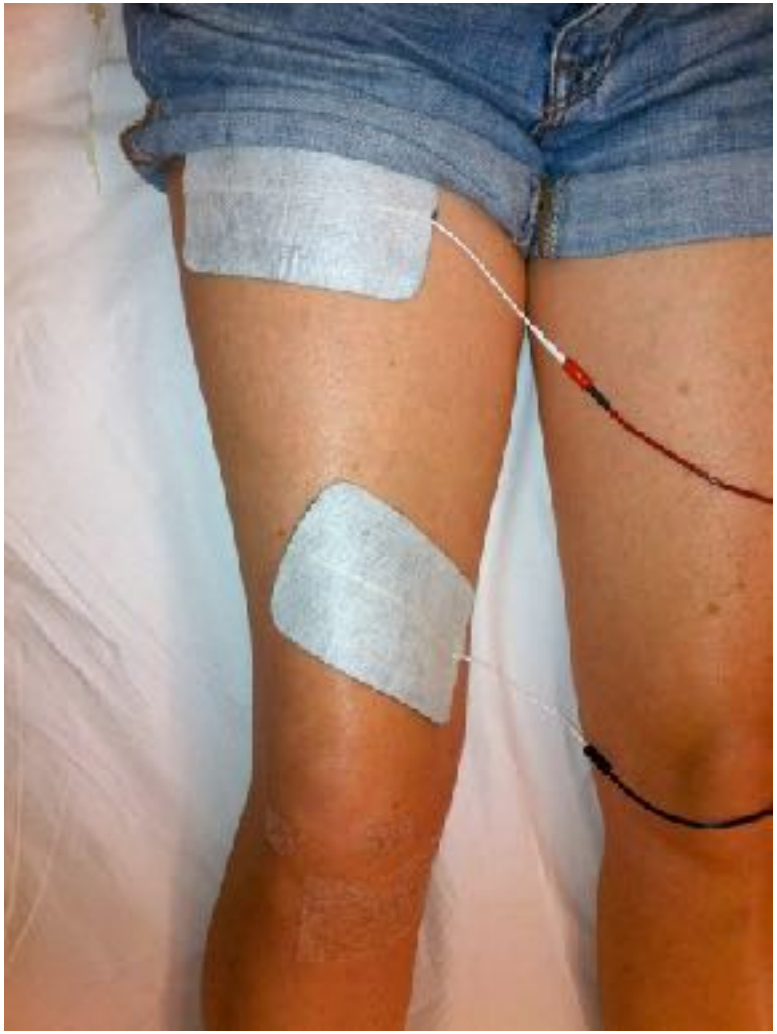
Prof. Dr. Thiago Y. Fukuda



Snyder-Mackler et al. JBJS. 1995; Mizner, Snyder. Physical Therapy, 2003

ELETROESTIMULAÇÃO NEUROMUSCULAR





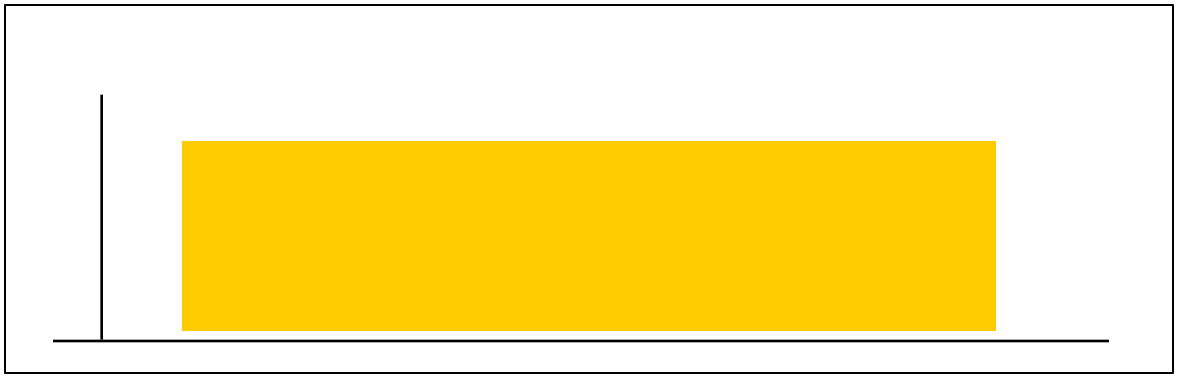
Ward e Shkuratova, Physical Therapy, 2002

FRAQUEZA OU INIBIÇÃO?

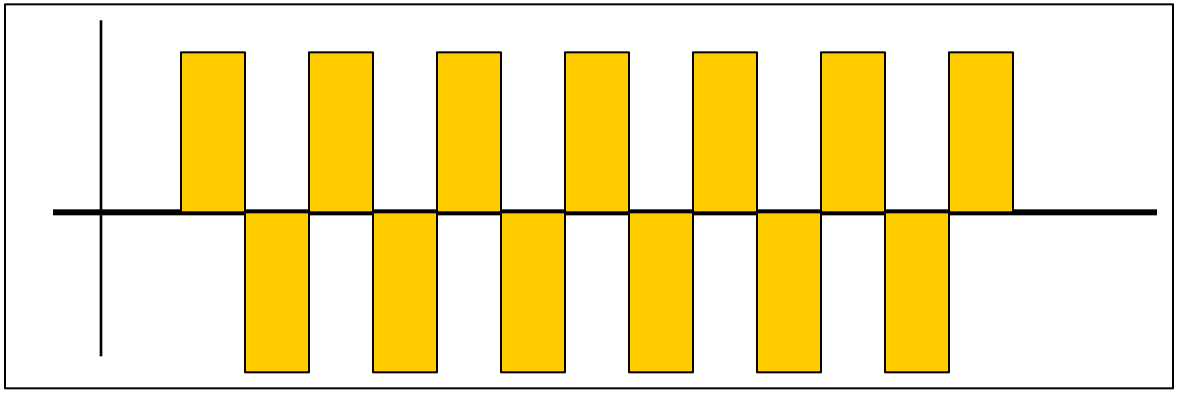
Keays et al., J Orthop Res. 2003
Ericsson et al., Arthritis Rheum. 2006

Formas de correntes eletroterapêuticas

Corrente contínua



Corrente alternada

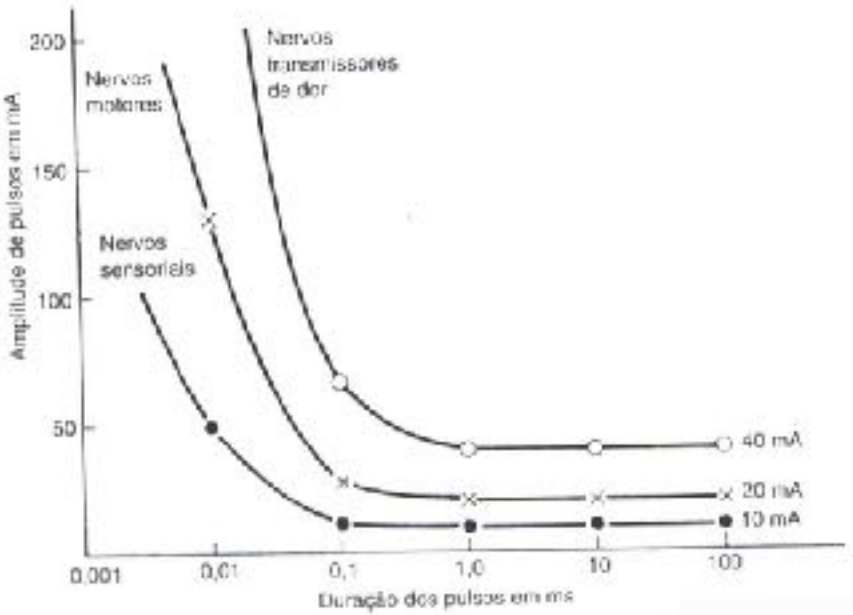


Corrente Pulsada

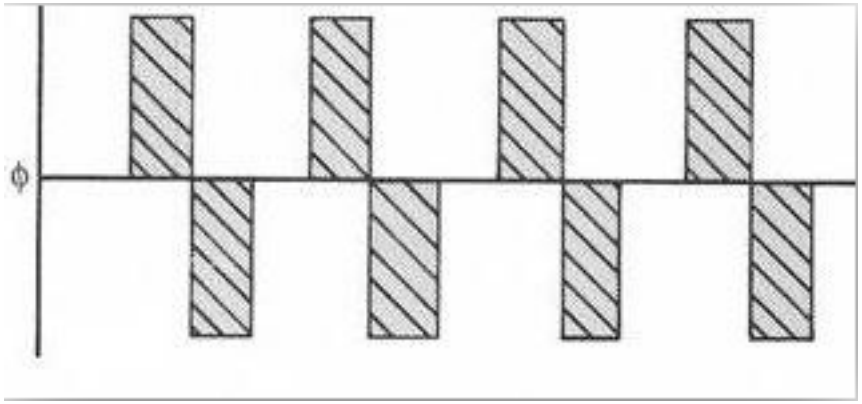

2005 3 21

FREQUÊNCIA

BAIXA F	MÉDIA F
> Resistência capacitiva	< Resistência capacitiva
< Intensidade	> Intensidade
< Penetração	> Penetração
Recruta poucas fibras	Pode ativar 30-40% a mais de U.M. em relação a ex. resistido



BAIXA FREQUÊNCIA – FES



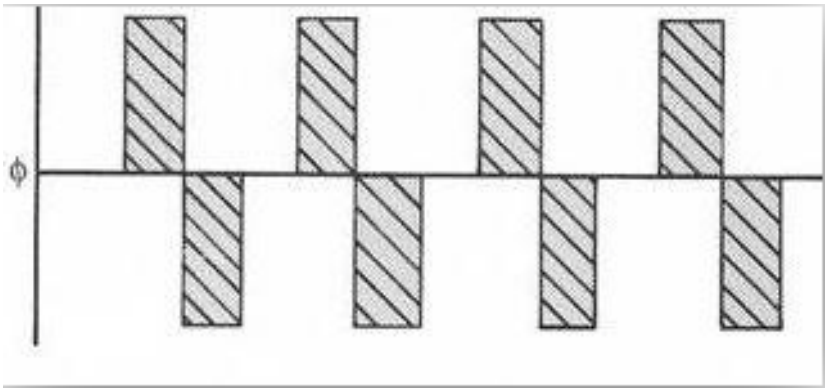
Alternada (bifásica), pulsada, simétrica, pulsos retangulares, baixa frequência

1. DURAÇÃO DO PULSO

EENM

50 a 1.000 µs (até 400 µs)

FRACOS (200 A 300 µs) / NORMAIS (300 A 400 µs)

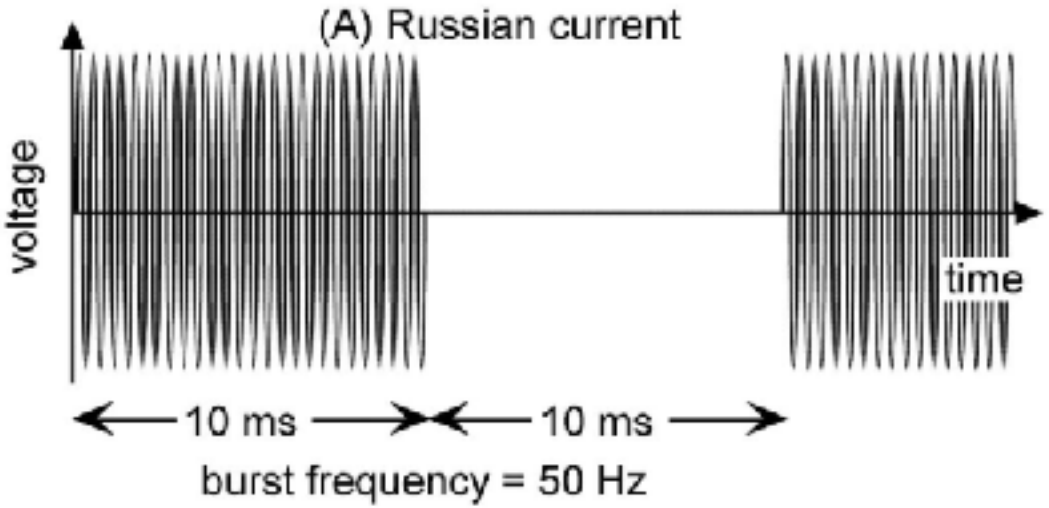


2. FREQUÊNCIA

1 a 100 Hz

- **30 a 50 Hz fibras vermelhas**
- **50 a 80 Hz fibras brancas**

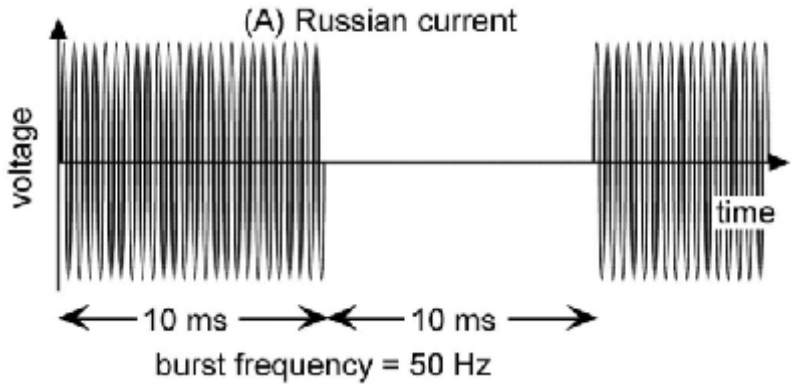
MÉDIA FREQUÊNCIA – RUSSA



Alternada (bifásica), simétrica, pulsos sinusoidais, média frequência modulada em baixa

1. FREQUÊNCIA PORTADORA

2500 Hz



2. FREQUÊNCIA DE MODULAÇÃO

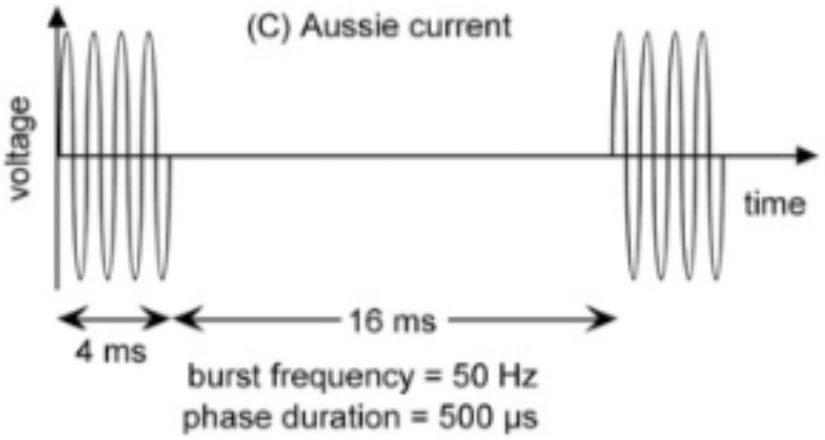
1 a 100 Hz

- **30 a 50 Hz fibras vermelhas**
- **50 a 80 Hz fibras brancas**

3. CICLO DE TRABALHO

FRACOS (10-30%) / NORMAIS (30-50%)

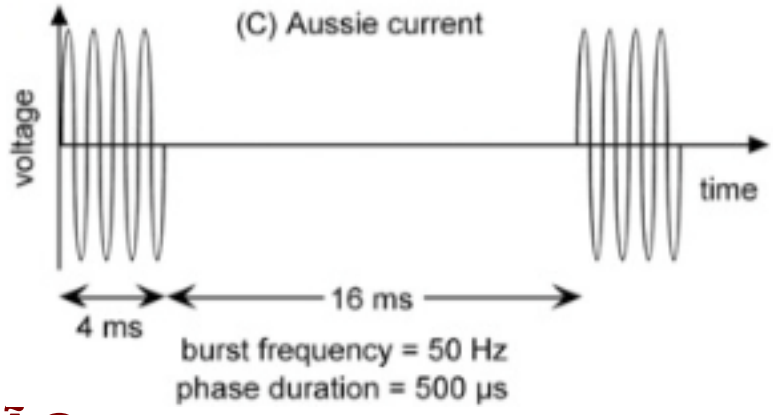
MÉDIA FREQUÊNCIA – AUSSIE



Alternada (bifásica), simétrica, pulsos sinusoidais, média frequência modulada em baixa

1. FREQUÊNCIA PORTADORA

1000 Hz



2. FREQUÊNCIA DE MODULAÇÃO

1 a 100 Hz

- **30 a 50 Hz fibras vermelhas**
- **50 a 80 Hz fibras brancas**

3. DURAÇÃO DE BURST

2 ou 4 ms

Ward, 2008

TEMPO DE CONTRAÇÃO

1:1

INTENSIDADE (A)

Ganho de força muscular

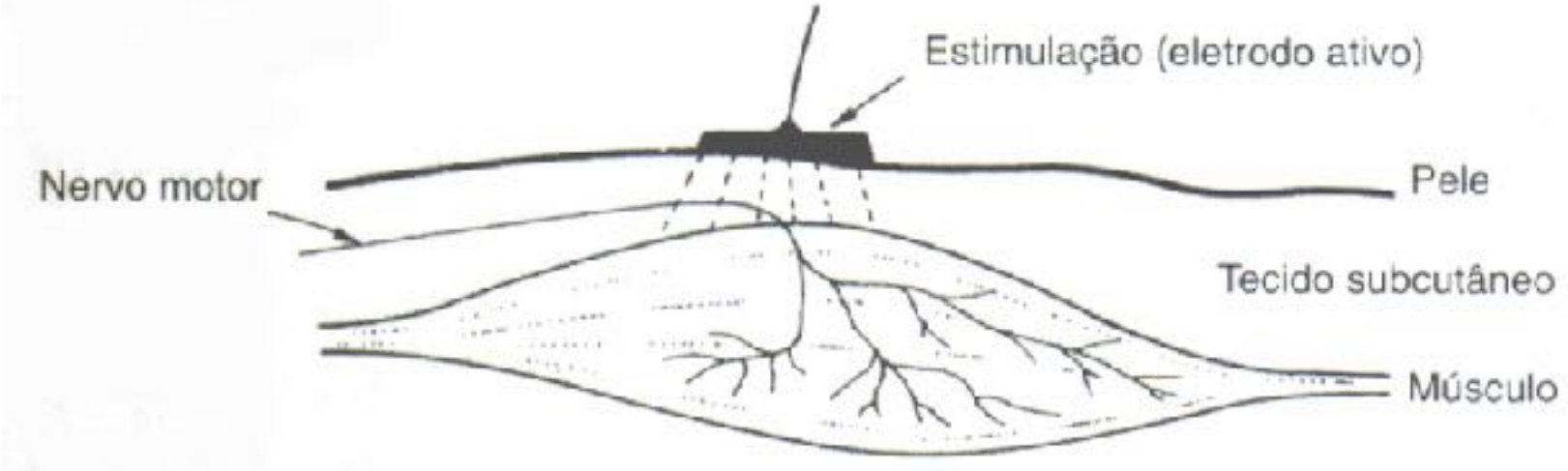
Linearmente relacionado com nível de força muscular

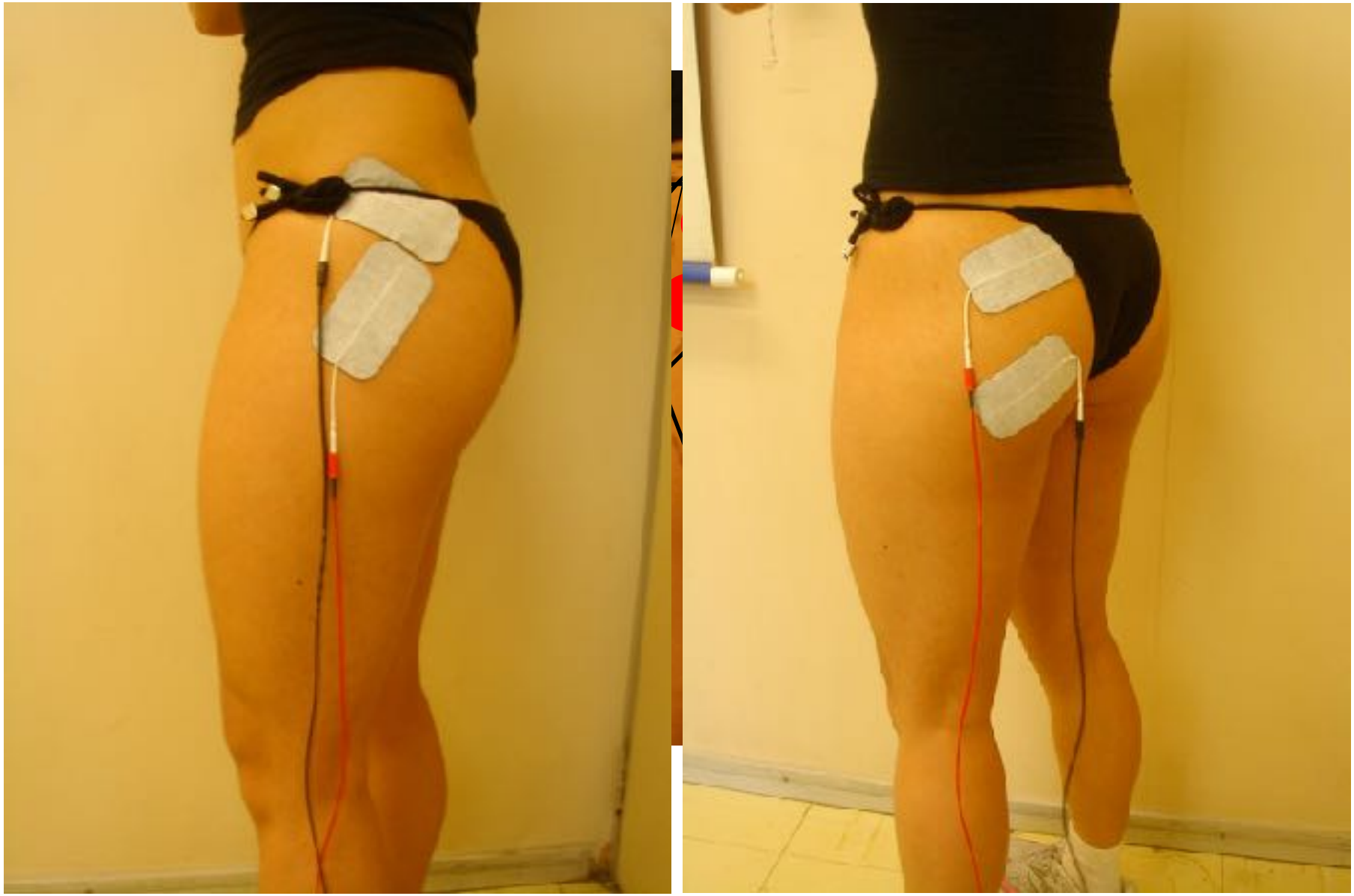
Linearmente relacionado à Intensidade da EENM e resultados finais da força muscular

TÉCNICAS DE APLICAÇÃO

MIOENERGÉTICA

PONTO MOTOR





KYUNG-MIN KIM, MS, ATC[1] • TED CROY, PT, DCS[2] • JAY HERTEL, PhD, ATC[3] • SUSAN SALIBA, PT, PhD, ATC[3]

Effects of Neuromuscular Electrical Stimulation After Anterior Cruciate Ligament Reconstruction on Quadriceps Strength, Function, and Patient-Oriented Outcomes: A Systematic Review

• STUDY DESIGN: Systematic literature review

• OBJECTIVE: To perform a systematic review of randomized controlled trials assessing the effects of neuromuscular electrical stimulation (NMES) on quadriceps strength, functional performance, and self-reported function after anterior cruciate ligament reconstruction.

• BACKGROUND: Conflicting evidence exists regarding the effectiveness of NMES following anterior cruciate ligament reconstruction.

• METHODS: Searches were performed for randomized c… databases fr… Methodologic… Physiotherapy… group effect s… (CIs) were cal…

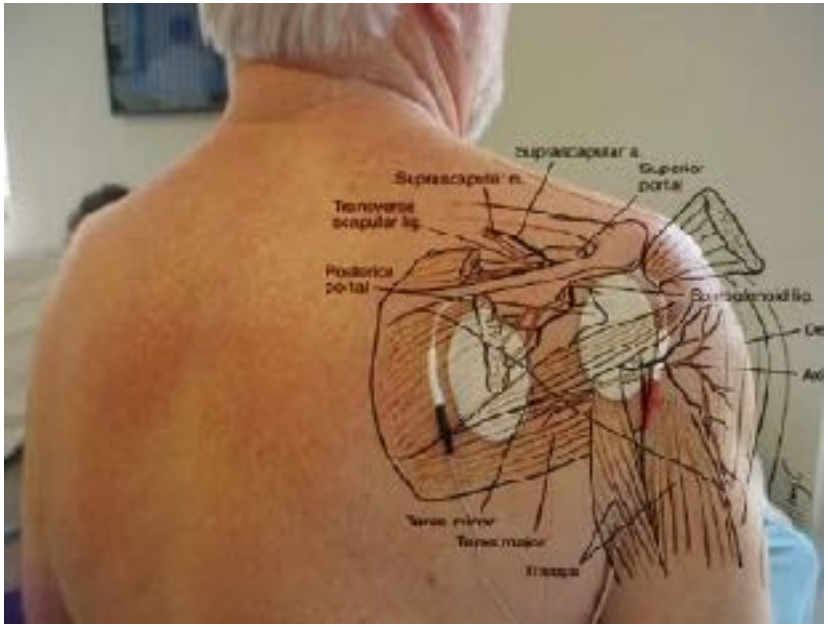
• RESULTS: … were included… Database Sca… mum 10. The … measures (fr… studies range… 6 weeks postoperatively; 6 of 11 comparisons were statistically significant, with strength benefits favoring NMES treatment. The effect sizes for functional performance measures from 1 study ranged from 0.07 to 0.64 at 6 weeks postoperatively; none of 3 comparisons were statistically significant, and the effect sizes for self-reported function measures from 1 study were 0.66 and 0.72 at 12 to 16 weeks postoperatively; both comparisons were statistically significant, with benefits favoring NMES treatment.

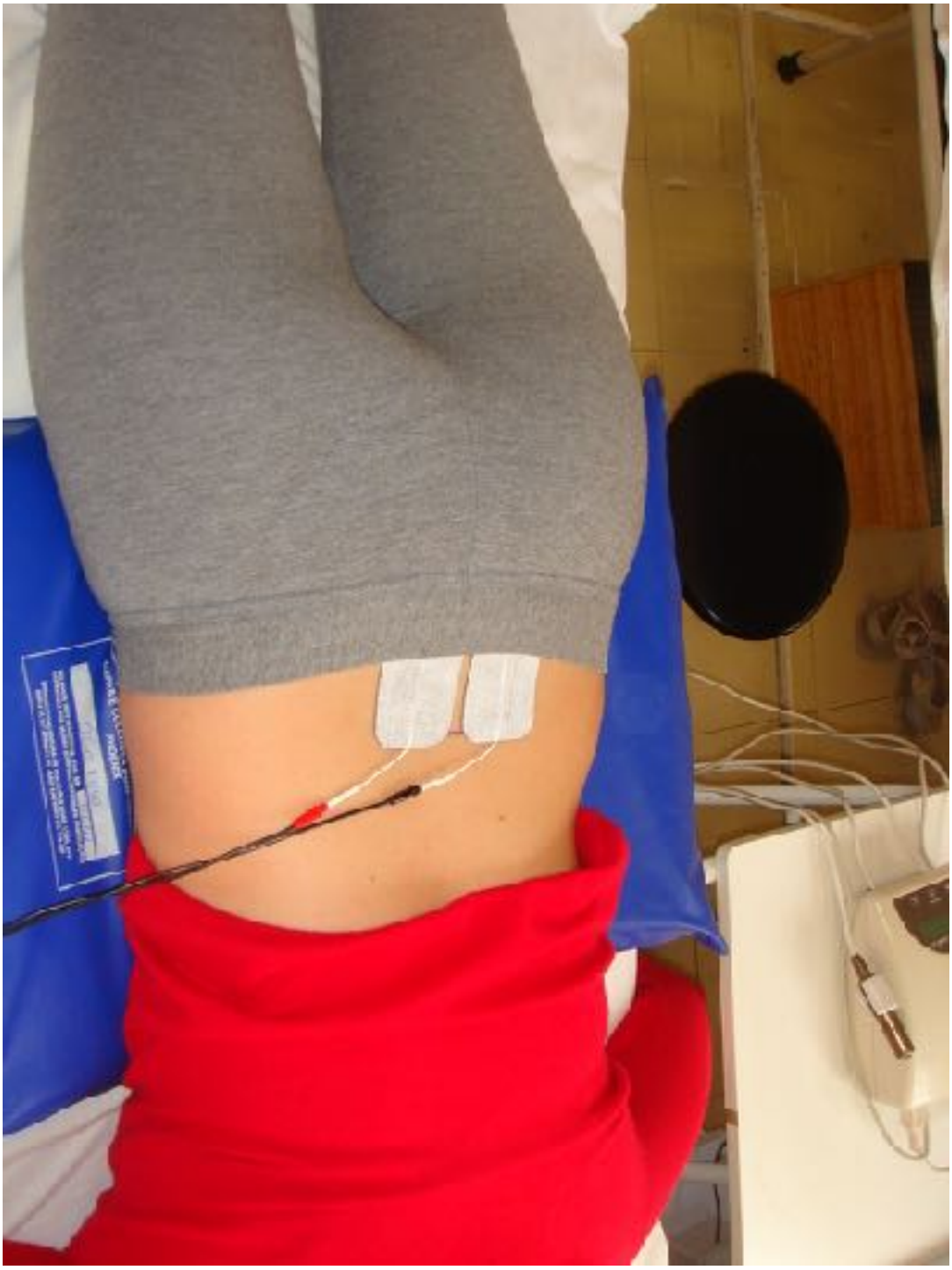
• CONCLUSION: NMES combined with exercise may be more effective in improving quadriceps strength than exercise alone, whereas its effect on functional performance and patient-oriented outcomes is inconclusive. Inconsistencies were noted in the NMES parameters and application of NMES.

The Effect of Neuromuscular Electrical Stimulation of the Infraspinatus on Shoulder External Rotation Force Production After Rotator Cuff Repair Surgery

Michael M. Reinold,*†‡ PT, DPT, ATC, CSCS, Leonard C. Macrina,§ MSPT, CSCS, Kevin E. Wilk,§‖ PT, DPT, Jeffrey R. Dugas,‖** MD, E. Lyle Cain,‖** MD, and James R. Andrews,‖** MD

30 pacientes (10° PO reconstrução MR)
EENM (infra-espinal) - Aumento torque em 22%





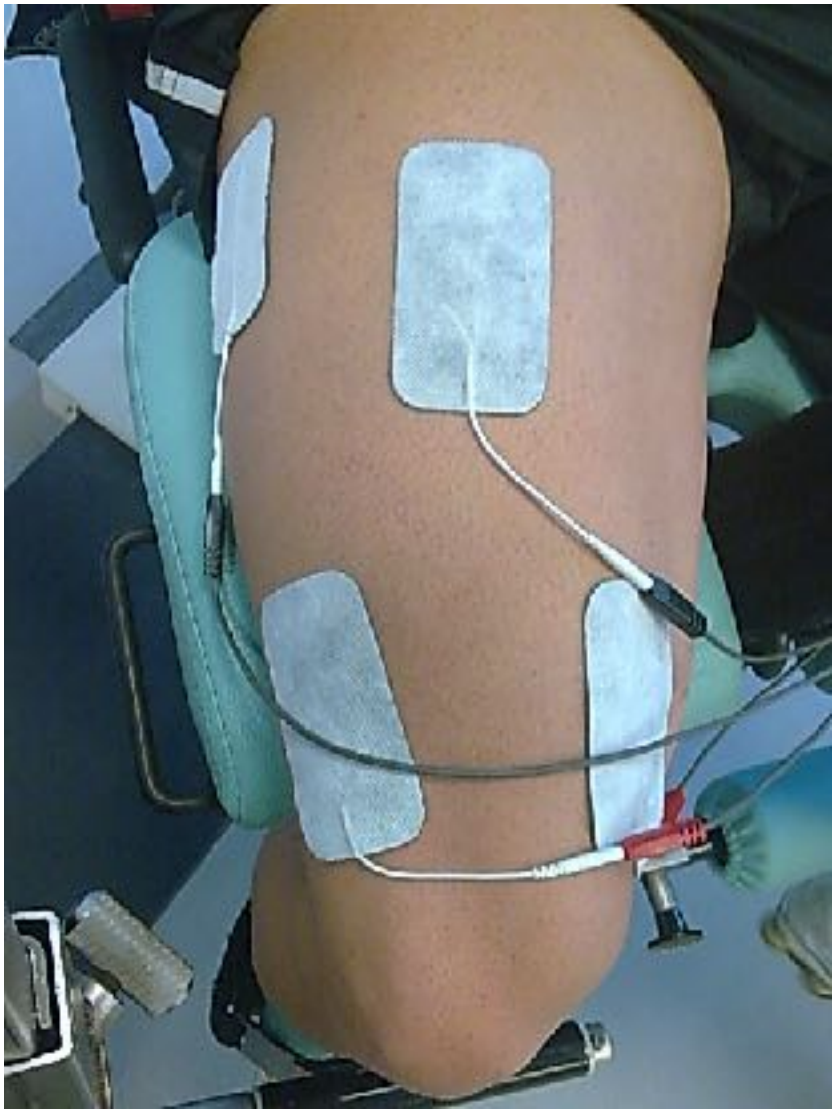
Comparison of peak torque, intensity and discomfort generated by neuromuscular electrical stimulation of low and medium frequency

Thiago Yukio Fukuda[a,b,*], Freddy Beretta Marcondes[c], Nayra dos Anjos Rabelo[d], Rodrigo Antunes de Vasconcelos[c] and Claudio Cazarini Junior[e]

- **30 indivíduos**
- **Saudáveis**
- **Masculino**
- **Aleatório**

TORQUE MÁXIMO VOLUTÁRIO ISOMÉTRICO (60°)

Isokinetics and Exercise Science, 2013



	% TMV
RUSSA	45,6%†*
FES	55,8%*ǂ
VMS	57,4%†ǂ

† p < 0,05 – diferença significante
* P < 0,05 – diferença significante
ǂ p > 0,05 – sem diferença significante

	EVA
RUSSA	6,8 ± 1,6
FES	8,3 ± 1,5
VMS	8,4 ± 1,0

CONTRA-INDICAÇÕES

Lesões mms, tendinites e tenossinovites

Afecções mms. agudas, distrofias, miosites

Marcapasso cardíaco / Deficit sensibilidade

Rupturas musculares ou tendíneas

BOM SENSO

Você conhece o conceito exclusivo para tratamento de joelho e quadril, criado pelo Prof. Dr. Thiago Fukuda?

www.thiagofukuda.com

PRÁTICA

Quadriceps (CCA - sinal de LAG)
Quadriceps (CCF – agachamento, afundo)
Discinese escapular
Intrinsecos do pé (fasceíte plantar)
Gluteo médio e máximo (valgo dinamico)