SKR
Société de Kinésithérapie de Réanimation

STIMULATION ELECTRIQUE NEUROMUSCULAIRE

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Plyneuromyopathie

Dysfonction musculaire

- Prolonge la durée de la VM
- Aggrave la maladie primaire
- Prolonge la durée du séjour

↘ **PRONOSTIC VITAL…!**

Dejonghe Bet coll. JAMA 2001
Sergers J et coll. JCC 2014

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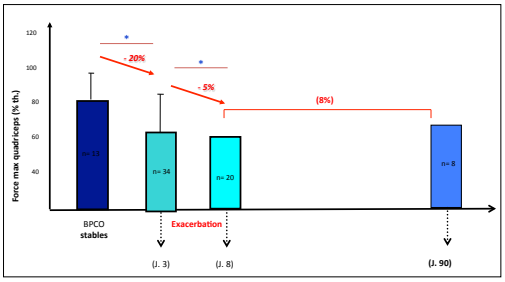
POST USI: FONCTION MUSCULAIRE !



Pitta et al, *Chest*, 2006
Spruit, *Thorax*, 2003

RECUPERATION = QUASI NULLE

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PLAN:

1. Principe de base SENM
2. Application clinique
3. Limites & intérêts
4. En pratique!

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STIMULATION ELECTRIQUE NEUROMUSCULAIRE

Définition et principes …

Definition of NMES

Neuromuscular electrical stimulation (NMES) involves the application of a series of intermittent stimuli to superficial skeletal muscles, with the main objective to trigger visible muscle contractions due to the activation of the intramuscular nerve branches (Hultman et al. 1983). Electrical stimuli are generally delivered using one or more active electrodes positioned in proximity to the muscle motor points (Fig. 1), and pre-programmed stimulation units. An intact motor nerve is a prerequisite for eliciting muscle contractions with NMES.

Maffiuletti et coll. 2010

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STIMULATION ELECTRIQUE NEUROMUSCULAIRE

Définition et principes …

- Sans sollicitation cardio-respiratoire (sans dyspnée)
- Méthode non invasive /simple
- Avérée scientifiquement efficace

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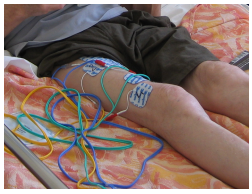
STIMULATION ELECTRIQUE NEUROMUSCULAIRE

Renforcement Musculaire

Contraction musculaire **volontaire** au cours d'un exercice avec charge ou résistance

ElectroMyoStimulation



Contraction musculaire **induite** par une stimulation électrique neuromusculaire

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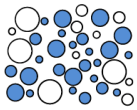
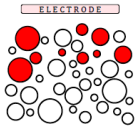
STIMULATION ELECTRIQUE NEUROMUSCULAIRE

Principes

Renforcement Musculaire	ElectroMyoStimulation
Recrutement temporel	
• Asynchrone	• Synchrone
Recrutement spatial	
• Dispersé (quasi complet)	• Fixe et superficiel (incomplet)





Maffiuletti N Eur JAP 2010

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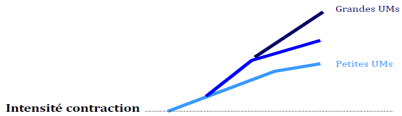
STIMULATION ELECTRIQUE NEUROMUSCULAIRE

Principes

Renforcement Musculaire	ElectroMyoStimulation
Recrutement temporel	
• Asynchrone	• Synchrone
Recrutement spatial	
• Dispersé (quasi complet)	• Fixe et superficiel (incomplet)
Ordre de recrutement	
• Ordonné sélectif	• Désordonné non sélectif



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STIMULATION ELECTRIQUE NEUROMUSCULAIRE

Renforcement Musculaire	ElectroMyoStimulation
Recrutement temporel	
• Asynchrone	• Synchrone
Recrutement spatial	
• Dispersé (quasi complet)	• Fixe et superficiel (incomplet)
Ordre de recrutement	
• Ordonné sélectif	• Désordonné non sélectif
Conséquence	
• Fatigue partielle	• Fatigue extrême

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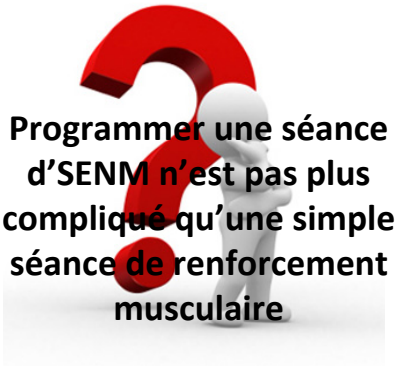

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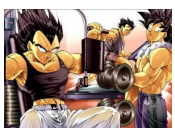
Stimulation Electrique NeuroMusculaire

COMMENT PROGRAMMER ?

- Type d'entraînement
- Temps de contraction/ temps de repos
- Charge de travail
- Disposition des poids
- Courant (pente) et Fréquence de stimulation
- Train d' impulsion (on/ off)
- Intensité de stimulation
- Electrodes



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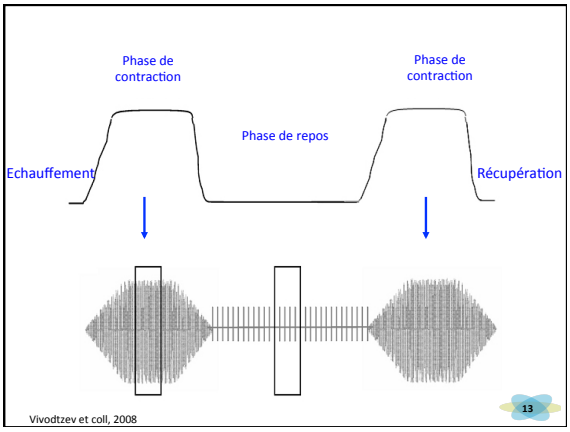

Vivodtzev et coll, 2008

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Stimulation Electrique NeuroMusculaire

COMMENT PROGRAMMER ?

- Courant (type, forme et pente)
- Train d'impulsion (on/off)
- Fréquence de stimulation
- Intensité de stimulation
- Largeur d'impulsion
- Electrodes

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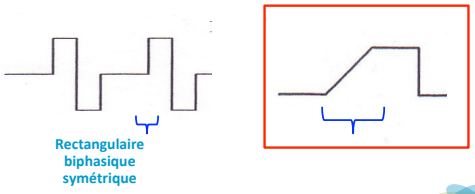
1. Courant

Pente d'établissement du courant

✓ Applications cliniques (ex: spasticité, sensibilité à la stimulation)



Rectangulaire biphasique symétrique

Bracciano AG 2008

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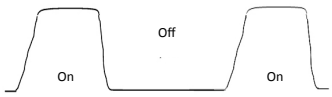
2. Train d'impulsion

Cycle de travail

Le rapport du temps de stimulation sur le temps total (temps de stimulation + temps de récupération)

- Duty cycle: on/off
- 10-50% ou 1:2 (10sec ON et 20sec Off)
- Contrôle la **fatigue musculaire**



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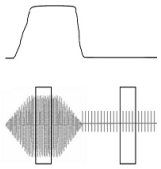
3. Fréquence de stimulation

Fréquence du courant

Le nombre de chocs générés par seconde (Hz)



Vivodtzev et coll 2008

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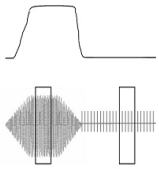
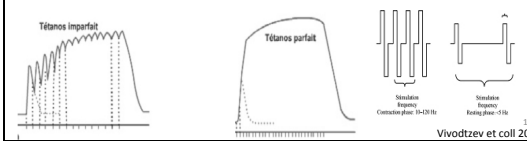
3. Fréquence de stimulation

Fréquence du courant

Le nombre de chocs générés par seconde (Hz)

- Haute et basse fréquence
  - Tétanos parfait ou imparfait





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Vivodtzev et coll 2008

4. Intensité du courant

Amplitude du courant

L'amplitude de l'onde du courant (mA)

- Recrutement des unités motrices
- Relation linéaire entre intensité/production de force
- Maximum tolérable pour les patients

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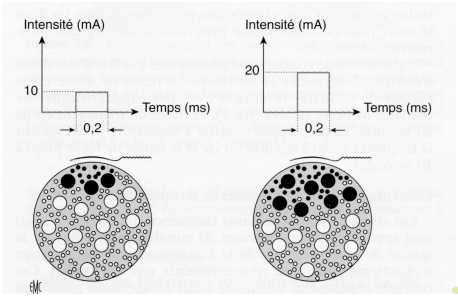
4. Intensité du courant

Amplitude du courant

L'amplitude de l'onde du courant (mA)



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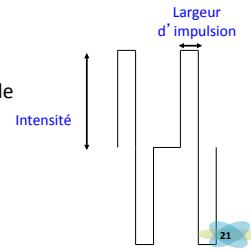
5. Largeur d'impulsion

Largeur d'impulsion

La durée minimale de passage du courant au-dessous de laquelle aucune réponse n'apparaît

- Dépend de la taille du muscle (0.2 et 0.4 ms)



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6.Electrodes

Electrodes

Le choix des électrodes se fait en fonction du programme et du patient

- Localisation Points moteurs +++++

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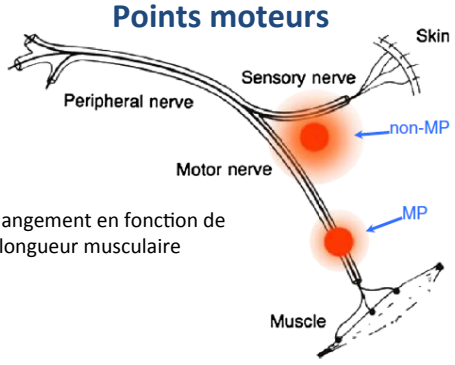
Points moteurs



Changement en fonction de la longueur musculaire

Gobbo et coll 2014

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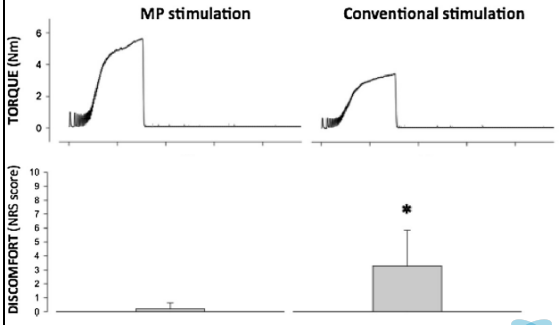
Points moteurs



Gobbo et coll 2011

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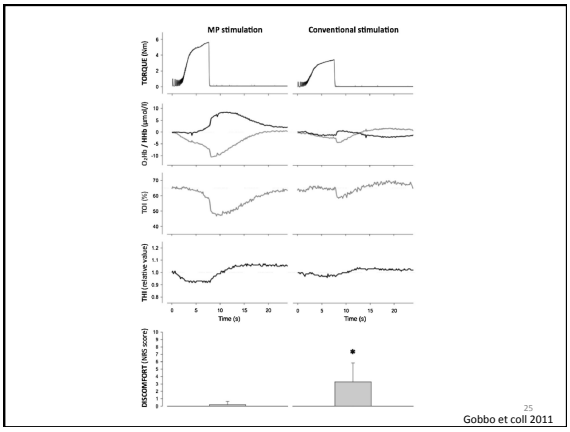
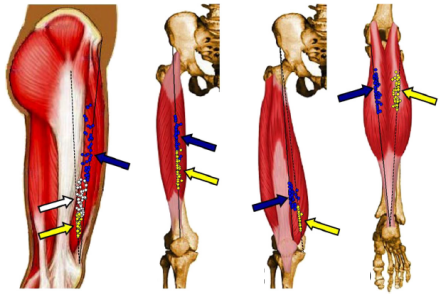


Gobbo et coll 2011

Points moteurs



✓ Chez 53 sujets sains

6.Electrodes

Electrodes

Le choix des électrodes se fait en fonction du programme et du patient

- Localisation Points moteurs +++++
- Distance inter-électrodes
- Taille

PLAN:

1. Principe de base SENM
2. Application clinique
3. Limites & intérêts
4. En pratique!

Stimulation Electrique NeuroMusculaire

APPLICATIONS CLINIQUES

- Sportif
- Sarcopénie de la PA
- Maladies chroniques
- Unité de Soins Intensifs
- Pédiatrie
- …

Stimulation Electrique NeuroMusculaire

DE NOMBREUSES ÉTUDES …

- Autonomie
- Masse musculaire
- Force musculaire
- Tolérance à l'effort

Study	Interventions by group/side		NMES parameters	Outcomes[a] (tools)	Main results
	C	N			
Abdellaoui et al. [42]	ALM + sham NMES to quadriceps and hamstrings	ALM + NMES to quadriceps and hamstrings (BL): 60 min/day × 5 days/week × 6 weeks	Frequency: 35 Hz Pulse duration: 400 μs Intensity: 15–32 mA for quadriceps, 22–47 mA for hamstrings (start–end)	Muscle strength (dynamometry)	Quadriceps strength increased more for N than C ($p < 0.01$)
Gerovasili et al. [25]	Usual care	Usual care + NMES to quadriceps and peroneus longus (BL): 55 min/day × 8 days	Frequency: 45 Hz Pulse duration: 400 μs On-off ratio: 1:2-6 s Intensity: 37–38 mA (mean)	Muscle thickness (US)	Rectus femoris and vastus intermedius (right side) thickness decreased less for N than C ($p < 0.005$; $d = 0.11$–0.39 (small-moderate))
Gruther et al. [43]	Sham NMES	NMES to quadriceps (BL): 30-60 min/day × 5 days/week × 4 weeks	Frequency: 50 Hz Pulse duration: 350 μs On-off ratio: 8–24 s Intensity: tolerance	Muscle thickness (US)	Quadriceps thickness increased only for N (long-term patients) ($p < 0.13$; $d = 0.36$ (moderate))
Karatzanos et al. [34]	Usual care	Usual care + NMES to quadriceps and peroneus longus (BL): 55 min/day × 7 days/week until ICU discharge	Frequency: 45 Hz Pulse duration: 400 μs On-off ratio: 1:2-6 s Intensity: motor threshold	Muscle strength (MRC)	MRC scores for wrist flexion, hip flexion, ankle dorsiflexion ($p < 0.05$) and knee extension ($p < 0.01$) were greater for N than C
Poulsen et al. [44]	Contralateral side acted as control	NMES to quadriceps (UL): 60 min/day × 7 days	Frequency: 35 Hz Pulse duration: 300 μs On-off ratio: 4-6 s Intensity: motor threshold +20% (adjusted daily)	Muscle volume (CT)	Quadriceps volume decreased for both C and N, with no difference between sides ($p = 0.1$)
Rodriguez et al. [45]	Contralateral side acted as control	NMES to biceps brachii and quadriceps (UL): 2 × 30 min/day × 13 days	Frequency: 100 Hz Pulse duration: 300 μs On-off ratio: 2-4 s Voltage: 20–200 V	Muscle strength (MRC) Muscle thickness (US)	MRC scores for elbow flexion ($p = 0.005$) and knee extension ($p = 0.034$) were greater for N than C. Biceps thickness was unchanged
Routsi et al. [33]	Usual care	Usual care + NMES to quadriceps and peroneus longus (BL): 55 min/day × 7 days/week until ICU discharge	Frequency: 45 Hz Pulse duration: 400 μs On-off ratio: 1:2-6 s Intensity: motor threshold	Muscle strength (MRC)	Global MRC score was greater for N than C ($p = 0.04$)
Zanotti et al. [46]	ALM: 5 days/week × 4 weeks	ALM + NMES to quadriceps and glutei (BL): 25–30 min/day × 5 days/week × 4 weeks	Frequency: 8-35 Hz Pulse duration: 250-350 μs Intensity: motor threshold	Muscle strength (MRC)	MRC score increased more for N than C ($p < 0.02$; $d = 1.44$ (large))

Maffiuliti et coll. 2013

Research

Open Access

Electrical muscle stimulation preserves the muscle mass of critically ill patients: a randomized study

Vasiliki Gerovasili[1], Konstantinos Stefanidis[1], Konstantinos Vitzilaios[1], Eleftherios Karatzanos[1], Panagiotis Politis[1], Apostolos Koroneos[1], Aikaterini Chatzimichail[2], Christina Routsi[1], Charis Roussos[1] and Serafim Nanas[1]

- Patients admis en ICU sans maladie neuromusculaire préexistante
- 55min par MI (45 Hz)
- Tous les jours pendant 7 à 8jours
- Quadriceps et long fibulaire

Gerovasili et coll. 2009

Baseline characteristics of critically ill patients randomly assigned to the EMS group or the control group (mean ± SD)

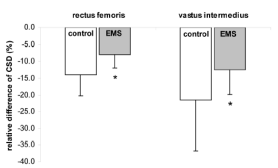
	EMS group	Control group	P
Age (years)	59 ± 23	56 ± 19	NS
Gender (male/female)	6/7	8/5	
APACHE II admission	19 ± 3	18 ± 6	NS
SOFA admission	10 ± 3	8 ± 3	NS
SAPS 3 admission	66 ± 9	61 ± 14	NS
Mechanical ventilation (days, n)	9 ± 2 (4-10), 13	9 ± 3 (6-10), 12	
Reasons of ICU admission (n)			
Sepsis	5	5	
Trauma	4	3	
Neurologic (including cerebrovascular)	2	4	
Other	2	1	
Sedation (days, n)	5 ± 4, 9	6 ± 4, 11	
Vasopressors (days, n)	5 ± 4, 10	5 ± 4, 10	
Hyperglycemia (days, n)	4 ± 3, 11	4 ± 3,10	
Glucocorticoids (n)	4	4	
Neuromuscular blockers (n)	2	2	
Aminoglycosides (n)	6	7	
Sepsis developed (n)	9	10	

Hyperglycemia was defined as blood glucose level >140 mg/dl

- **Evaluer l'effet EMS sur la masse musculaire**
  - → *Cross Sectional Diameter (US)*

Réduction de CSA est de 13,9% (1semaine) dans le groupe contrôle

Réduction de CSA moins importante chez les EMS



Moindre altération de la masse musculaire

Préservation de la masse musculaire

Routsi *et al. Critical Care* 2010, **14**:R74
http://ccforum.com/content/14/2/R74

CRITICAL CARE

RESEARCH

Open Access

Electrical muscle stimulation prevents critical illness polyneuromyopathy: a randomized parallel intervention trial

Christina Routsi, Vasiliki Gerovasili, Ioannis Vasileiadis, Eleftherios Karatzanos, Theodore Pitsolis, Elli Tripodaki, Vasiliki Markaki, Dimitrios Zervakis and Serafim Nanas*

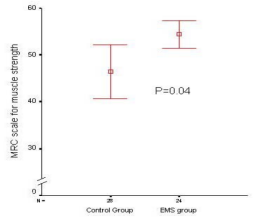
- Patients admis en ICU
- 24 patients dans le groupe EMS et 28 contrôles
- 55 min par MI (45 Hz)
- Tous les jours
- Quadriceps et long fibulaire

Routsi et coll. 2010

	EMS group (n = 68)	Control group (n = 72)
Age, years	61 ± 19	58 ± 18
Gender M/F	46/22	49/23
Severity of illness at ICU admission		
APACHE II score	18 ± 4	18 ± 5
SOFA score	9 ± 3	9 ± 3
SAPS III score	61 ± 13	60 ± 14
Diagnostic category at admission		
Sepsis/septic shock, n(%)	11 (16.2)	14 (19.4)
Trauma, n(%)	12 (17.6)	14 (19.4)
Post-surgical, n(%)	13 (19.1)	12 (16.7)
Brain injury, n(%)	24 (25.3)	23 (31.9)
Respiratory failure, n(%)	2 (2.9)	4 (5.6)
Other, n(%)	6 (8.8)	5 (6.9)
Duration of sedation, days	12 ± 10	12 ± 11
Sepsis/septic shock, n(%)	54 (77)	58 (80)
Aminoglycoside use, days	5 ± 8	8 ± 11
Corticosteroids use, days	6 ± 9	5 ± 8
Neuromuscular blocking agents use, days	1 ± 2	3 ± 5

- **Evaluer l'efficacité EMS sur la fonction musculaire**

Force (MRC) NEMS> contrôle



Réduction de l'incidence de la polyneuromyopathie dans groupe NEMS

	EMS group (n) (%)	Control group (n)(%)
CIPNM	3 (12.5)	11 (39.3)
No CIPNM	21 (87.5)	17 (60.7)

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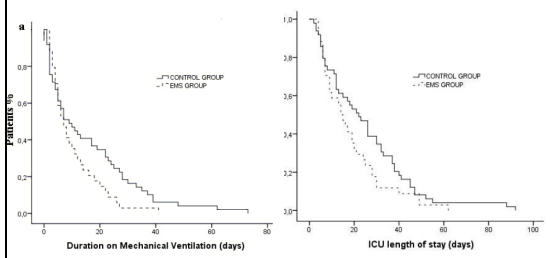

Durée de VM NEMS< contrôle

Durée du séjour en ICU NEMS< contrôle

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Journal of Critical Care (2012) 27, 319.e1–319.e8
Journal of Critical Care

Muscle weakness in septic patients requiring mechanical ventilation: Protective effect of transcutaneous neuromuscular electrical stimulation☆

Pablo O. Rodriguez MD[a,b,c,*], Mariano Setten PT[a,d], Luis P. Maskin MD[a], Ignacio Bonelli MD[a,b], Silvana Romero Vidomlansky MD[e], Shiry Attie MD[a], Silvana L. Frosiani PT[d], Shigeru Kozima MD[e], Ricardo Valentini MD[a,b]

- Patients en unité de soins intensifs (Choc septique et VM)
- 30 min par cuisse (100 Hz)
- Muscles quadriceps (vaste int) et biceps
- 5 fois / sem. pendant 7-30jours

Rodriguez et coll., 2011

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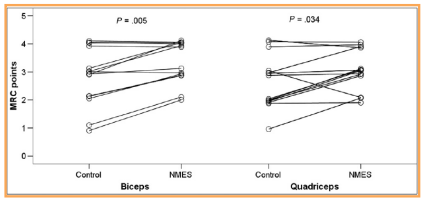
- **Evaluer l'efficacité EMS sur la force musculaire**
  - → *Medical Research concil score*



Augmentation de la force des muscles stimulées

Amélioration de la fonction musculaire

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Clinical Investigations

Effect of transcutaneous electrical muscle stimulation on muscle volume in patients with septic shock*

Jesper B. Poulsen, MD; Kirsten Møller, MD, PhD; Claus V. Jensen, MD; Sigge Weisdorf, MD; Henrik Kehlet, MD, PhD; Anders Perner, MD, PhD

- 8 Patients en unité de soins intensifs (Choc septique et VM)
- 60 min par cuisse (35 Hz)
- Random/Muscles quadriceps
- 5 fois / sem. pendant 7jours

Poulsen et al., 2011

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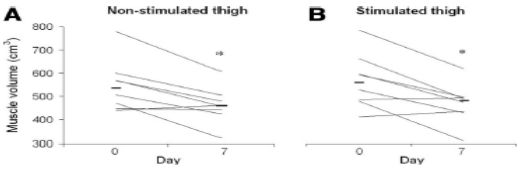
- **Explorer les effets d'un programme EMS sur la masse musculaire**
  - → *Scans*



Réduction du volume musculaire de 16% (7jours) dans le groupe contrôle

Réduction du volume musculaire de 20% dans le groupe EMS

Aucun effet sur la masse musculaire

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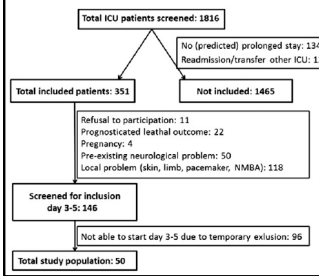
Journal of Critical Care
Journal of Critical Care 29 (2014) 1082–1088

Feasibility of neuromuscular electrical stimulation in critically ill patients☆,☆☆,★

Johan Segers, PT, MSc [a], Greet Hermans, MD, PhD [b], Frans Bruyninckx, MD, PhD [c], Geert Meyfroidt, MD, PhD [d], Daniel Langer, PT, PhD [a], Rik Gosselink, PT, PhD [a,*]



- 50% seulement de patients répondeurs À SENM!

Main diagnosis	Responders (n = 25)	Nonresponders (n = 25)	P
Sex, male, n (%)	15 (30)	11 (22)	.258
Age, y (mean ± SD)	58 ± 13	62 ± 10	.166
Height, meter (mean ± SD)	1.70 ± 0.09	1.69 ± 0.11	.711
Weight, kg (mean ± SD)	73 ± 16	74 ± 16	.899
BMI, kg/m² (mean ± SD)	25.1 ± 4.3	25.9 ± 5.5	.584
Admission category:			.093
– Abdominal/pelvic surgery (n)	4 (16%)	3 (12%)	
– Cardiac surgery (n)	2 (8%)	4 (16%)	
Sepsis, yes, n (%)	4 (8)	19 (38)	<.001
Barthel index (/20)	18 ± 3	18 ± 2	.944
APACHE II score (0-70)	25 ± 8	27 ± 6	.578
GCS (0-15)	7 ± 3	9 ± 3	.216
SSQ (0-5)	2 ± 1	3 ± 2	.162
SAS (1-7)	2 ± 1	3 ± 1	.266
Intensity, mA	65 ± 8	69 ± 13	.236
No. of sessions/patient	5 ± 4	8 ± 7	.152
Medical ICU, n (%)	6 (12)	13 (26)	.041
Edema, yes, n (%)	10 (20)	23 (46)	<.001
Corticosteroids, yes, n (%)	12 (24)	18 (36)	.114
Vasopressors, yes, n (%)	16 (32)	24 (48)	.011
Inotropes, yes, n (%)	6 (12)	8 (16)	.588
Aminoglycosides, yes, n (%)	9 (18)	6 (12)	.355
NMBA, yes, n (%)	11 (22)	12 (24)	.879

L'état pro-inflammatoire de la septicémie
→Catabolisme ++
→Activation du protéasome (contenu musculaire)
→Dysfonction mitochondriale (énergie musculaire)
→Augmentation des cytokines (excitabilité musculaire)

Main diagnosis	Responders (n = 25)	Nonresponders (n = 25)	P
Sex, male, n (%)	15 (30)	11 (22)	.258
Age, y (mean ± SD)	58 ± 13	62 ± 10	.166
Height, meter (mean ± SD)	1.70 ± 0.09	1.69 ± 0.11	.711
Weight, kg (mean ± SD)	73 ± 16	74 ± 16	.899
BMI, kg/m² (mean ± SD)	25.1 ± 4.3	25.9 ± 5.5	.584
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NMBA, yes, n (%)	11 (22)	12 (24)	.879

L'œdème :
→Augmentation de la distance entre l'électrode/muscle ++

Maffiuletti et al. BMC Medicine 2013, 11:137
http://www.biomedcentral.com/1741-7015/11/137

BMC Medicine

RESEARCH ARTICLE Open Access

Neuromuscular electrical stimulation for preventing skeletal-muscle weakness and wasting in critically ill patients: a systematic review

Nicola A Maffiuletti[1*], Marc Roig[2,3], Eleftherios Karatzanos[4] and Serafim Nanas[4]

PHYSIOTHERAPY THEORY and PRACTICE
http://informahealthcare.com/ptp
ISSN: 0959-3985 (print), 1532-5040 (electronic)
Physiother Theory Pract, 2014; 30(1): 6–11
© 2014 Informa Healthcare USA, Inc. DOI: 10.3109/09593985.2013.811567
informa healthcare

SYSTEMATIC REVIEW

A review of the efficacy of neuromuscular electrical stimulation in critically ill patients

Nicola Williams, MCSP, BSc (Hons)[1] and Maria Flynn, RGN, BSc (Hons), PGCE, MSc, PhD[2]

PLAN:

1. Principe de base SENM
2. Application clinique
3. Limites & intérêts
4. En pratique!

LIMITES & INTÉRÊTS

POINTS NÉGATIFS ☹

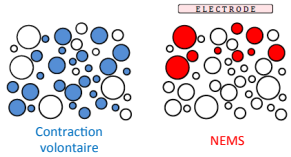
Inconfort cutané

- ✓ Taille des électrodes
- ✓ Paramètre du courant
- ✓ …

LIMITES & INTÉRÊTS

POINTS NÉGATIFS ☹

Recrutement spatial très incomplet



Adams et coll 1993

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LIMITES & INTÉRÊTS

POINTS NÉGATIFS ☹

Fatigabilité ++++

- ✓ Modification de longueur musculaire
- ✓ Déplacement des électrodes
- ✓ …

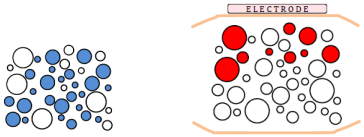
Gobbo et coll 2014

50

LIMITES & INTÉRÊTS

POINTS POSITIFS ☺

Recrutement d'unités rapides à des bas niveaux de force



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LIMITES & INTÉRÊTS

POINTS POSITIFS ☺

Plus efficace que l'exercice volontaire
quand celui-ci est difficilement réalisable

La fonction neuromusculaire

Maffiuletti N 2011

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PLAN:

1. Principe de base SENM
2. Application clinique
3. Limites & intérêts
4. En pratique!

53

Pratique !!

Besoin d'une cuisse ?!

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CONTRE-INDICATIONS RELATIVES

- Pacemakers (+/-)
- Les femmes enceintes
- Thrombose veineuse ou obstruction artérielle sévère
- Les plaies sur la peau

55

POURQUOI UTILISÉ SENM?

- **L'atrophie touche les fibres musculaires de type II +++ (recrutement ++)**

- Ne nécessite pas la coopération du patient
- Empêche le développement de DM
- Augmente la force musculaire et Préserve la masse musculaire
- Réduit la durée de VM
- Permet une reconquête plus rapide de l'autonomie

EMS → Outil de prévention et de rééducation

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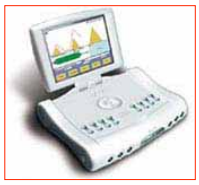
QUELS APPAREILS CHOISIR ?



Feil et coll, 2011

57

The effect of electrical stimulation on dysphagia following treatment for head et neck cancer
JU SEOK RYUE & al.
Oral Oncology, 2009, Volume 45, 665-668.

- Etude randomisée, en double aveugle
- 26 patients avec des troubles de la déglutition (post traitement chirurgical ou radiothérapie pour un cancer de la tête ou du cou)
- Groupe 1: 30min SENM + 30min rééducation traditionnelle de la déglutition, 5jours/semaine pendant 2semaines
- Groupe 2: 30min stimulation placebo + 30min rééducation traditionnelle de la déglutition, 5jours/semaine pendant 2semaines
- Mesures : clinical dysphagia scale et functional dysphagia scale

	Experimental group		Control group		*p*-value
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	
FDS	33.9 ± 13.2	22.4 ± 13.4	38.6 ± 15.9	35.3 ± 17.7	0.04*
CDS	46.1 ± 21.0	44.8 ± 19.6	42.8 ± 16.5	44.3 ± 17.7	0.07

FDS: Functional dysphagia scale.
CDS: Clinical dysphagia scale.

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Peripheral Muscle Strength Training in Bed-Bound Patients With COPD Receiving Mechanical Ventilation*

Effect of Electrical Stimulation

Ercole Zanotti, MD; Guido Felicetti, MD; Maurizio Maini, MD; and Claudio Fracchia, MD

- ✓ BPCO sous ventilation (trachéo.)
- ✓ Alités+++ perte d'autonomie fonctionnelle
- ✓ 30 min par cuisse (35 Hz)
- ✓ 5 fois / sem. pendant 4 semaines

Temps transfert lit-chaise : - 4 jours

60

Zanotti et coll, 2003

J Rehabil Med 2010; 42: 593–597

ORIGINAL REPORT

EFFECTS OF NEUROMUSCULAR ELECTRICAL STIMULATION ON MUSCLE LAYER THICKNESS OF KNEE EXTENSOR MUSCLES IN INTENSIVE CARE UNIT PATIENTS: A PILOT STUDY

Wolfgang Gruther, MSc, MD[1], Franz Kainberger, MD, PhD[3], Veronika Fialka-Moser, MD, PhD[1], Tatjana Paternostro-Sluga, MD, PhD[1], Michael Quittan, MD, PhD[4], Christian Spiss, MD, PhD[2] and Richard Crevenna, MD, PhD[1]

- Patients en unité de soins intensifs
- 30-60 min par cuisse (50 Hz)
- Muscles quadriceps
- 5 fois / sem. pendant 4 semaines

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Gruther et coll., 2010

	Acute patient group		Long-term patient group	
	SG	CG	SG	CG
Sex male/female, *n*	7/1	8/1	7/1	4/4
Age, years, mean (SD)	52 (10)	48 (12)	61 (10)	64 (8)
Height, m, mean (SD)	1.77 (0.08)	1.8 (0.06)	1.78 (0.08)	1.67 (0.1)
Weight, kg, mean (SD)	80 (15)	88 (19)	91 (17)	79 (19)
Body surface, m², mean (SD)	2 (0.2)	2.1 (0.3)	2.2 (0.3)	1.9 (0.3)
Days before stimulation, mean (SD)	3 (2)	4 (2)	33 (15)	27 (15)
MLT at baseline, mean (SD) [range]	28.9 (6.6) [20.6]	32.9 (9.7) [23.1]	18.4 (4.2) [13.6]	18.6 (5.9) [15.7]
MLT after 4 weeks, mean (SD) [range]	18.3* (3.2) [9.7]	20.1† (5.4) [16.4]	19.3‡ § (3.8) [12.4]	18 (5.8) [16.1]
Individual differences (baseline – after 4 weeks), mean	−10.6	−12.8	0.09	−0.04
% changes from baseline	−36.7	−38.9	4.9	−3.2
Main diagnosis, *n*				
Polytrauma	3	4	2	1
Cardiovascular disease	2	2	1	1
Transplantation	2	1	2	2
Pneumonia	0	1	1	2
Cancer	1	1	2	2

- **Evaluer l'effet EMS sur la masse musculaire**
  - → *Epaisseur de la couche musculaire (US)*

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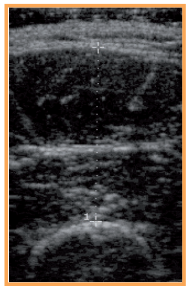

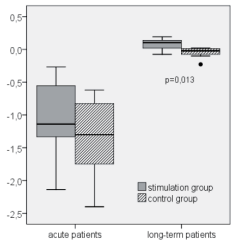

Augmentation de l'épaisseur de la couche musculaire dans 2ème groupe

Augmentation (préservation) de la masse musculaire

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Neuromuscular Electrical Stimulation As a Possible Means to Prevent Muscle Tissue Wasting in Artificially Ventilated and Sedated Patients in the Intensive Care Unit: A Pilot Study

Raf L.J. Meesen, PhD*†‡, Paul Dendale, MD§, Koen Cuypers, MSc*‡, Jan Berger, BSc§, Ann Hermans, MSc§, Herbert Thijs, PhD¶, Oron Levin, PhD†

- Patients en unité de soins intensifs
- 30 min par cuisse (60-100 Hz)
- Muscles quadriceps (vaste int et droit fémoral)
- 5 fois / semaine (aussi longtemps qu'ils ont été Intubé et sédaté)

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Meesen et coll., 2010

Table 1. Patients Characteristics.

	Intervention (ES) group (*N* = 7)	Control group (*N* = 12)
Age (Years)	65.3 ± 16.5	67.2 ± 13.2
Gender	Male (*N* = 3)	Male (*N* = 9)
	Female (*N* = 4)	Female (*N* = 3)
Diagnosis	CABG (*N* = 3)	CABG (*N* = 3)
	COPD (*N* = 2)	COPD (*N* = 2)
	Pneumonia (*N* = 2)	Pneumonia (*N* = 3)
		*CVA (*N* = 4)

*Measurements of circumference in these patients were taken from the unaffected side.
CABG = coronary artery bypass graft; COPD = chronic obstructive pulmonary disease; CVA = cerebro vascular accident.

- **Explorer les effets d'un programme EMS sur l'atrophy musculaire**
  - → *Circonférence de la cuisse*

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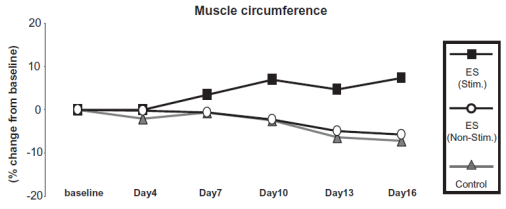

Augmentation de la circonférence de la cuisse stimulée

Augmentation de la masse musculaire

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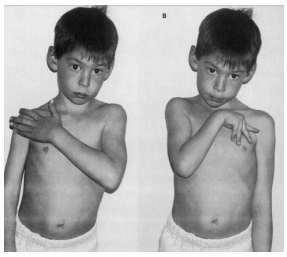
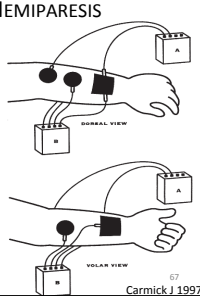
ELECTROMYOSTIMULATION

En Pédiatrie

USE OF NEUROMUSCULAR ELECTRICAL STIMULATION AND A DORSAL WRIST SPLINT TO IMPROVE THE HAND FUNCTION OF A CHILD WITH SPASTIC HEMIPARESIS



7ans



Carmick J 1997

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USE OF NEUROMUSCULAR ELECTRICAL STIMULATION AND A DORSAL WRIST SPLINT TO IMPROVE THE HAND FUNCTION OF A CHILD WITH SPASTIC HEMIPARESIS

Muscles were often stimulated for a maximum of 15 minutes, then different muscles were stimulated, depending on need. If the child was manipulating a toy and needed help maintaining wrist extension, the remote switch was pressed for as long as 15 seconds. As many as four muscle groups were stimulated at appropriate times during the activity. At those times, one of the parents would assist with one remote switch. During reach and release, finger and wrist extension was facilitated. During grasp, finger flexion with wrist extension was facilitated.

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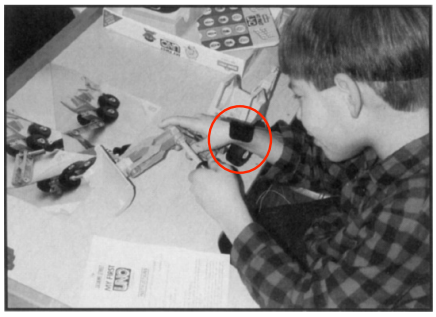

La stimulation est appliquée aux muscles extenseurs des doigts et du poignet

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USE OF NEUROMUSCULAR ELECTRICAL STIMULATION AND A DORSAL WRIST SPLINT TO IMPROVE THE HAND FUNCTION OF A CHILD WITH SPASTIC HEMIPARESIS

The amplitude was always set to his tolerance, as it has been found that increased function can occur with low amplitudes, with the maximal amount determined by the child's tolerance.

- Courant asymétrique (pt muscles stimulés)
- Pente à 0.5s et Largeur d'impulsion 300msec
- On/Off 15sec (1:1)
- Fréquence 35Hz
- 7Hz & une intensité élevée pour détecter les muscles

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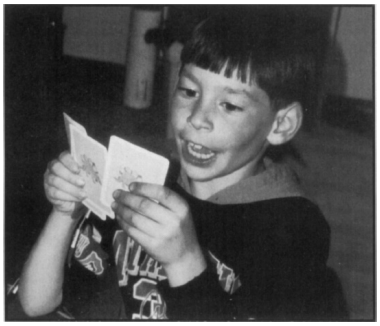
Résultats :



Opposition des doigts

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Résultats :

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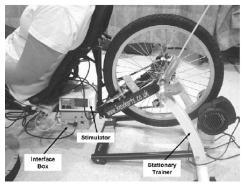
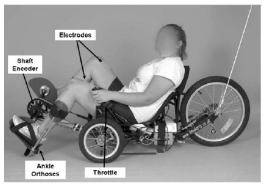
ELECTROMYOSTIMULATION

En Pédiatrie

Cycling for children with neuromuscular impairments using electrical stimulation—Development of tricycle-based systems

C.G.A. McRae[a,*], T.E. Johnston[a,b], R.T. Lauer[a,c], A.M. Tokay[d], S.C.K. Lee[a,e], K.J. Hunt[f,g]





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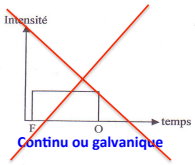
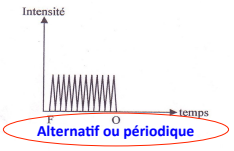
McRae et coll, 2009

1. Courant

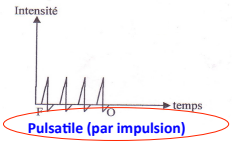
Type de courant



Continu ou galvanique



Alternatif ou périodique



Pulsatile (par impulsion)

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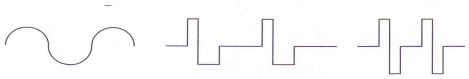
1. Courant

Forme du courant

Impulsion monophasique

Impulsion biphasique:
Symétrique ou asymétrique



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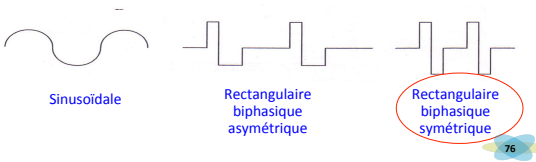
1. Courant

Pente d'établissement du courant

Rectangulaire

Rectangulaire à pente progressive

Triangulaire



Sinusoïdale

Rectangulaire biphasique asymétrique

Rectangulaire biphasique symétrique

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