ESTIMULAÇÃO ELÉTRICA TRANSCUTÂNEA – APLICADA À TERAPIA DA FALA - DISFAGIA

Terapeuta da fala - Sandra Martins - ABRIL 2024

Estimulação Elétrica Transcutânea

Da teoria à prática…...

"….recurso somente será eficiente se o profissional souber ajustar os parâmetros de acordo com os objetivos de cada tratamento, sempre raciocinando na patologia e
anatomofisiologia dos músculos que serão estimulados." (Carvalho et all, 2017)

REVISÃO: EET

Cuidados a ter quando utilizamos EET

- CONHECIMENTO ADEQUADO DA ALTERAÇÃO A TRATAR COM EE – ETIOLOGIA, CARACTERISTICAS NEUROMUSCULARES, CONTRAINDICAÇÕES, RISCOS,....
- BOA AVALIAÇÃO ANTES DE COLOCAR EE:
  - seleção do aspecto fisiológico alvo
  - definir objetivo terapêutico
  - definir a indicação para a EE
  - Avaliação objetiva + Avaliação clínica?
- BOA AVALIAÇAO DURANTE A COLOCAÇAO DE EE
- Pele (estado, limpeza, ...)
- Monitorização FC e TA antes durante e depois da estimulação
- Na face e na laringe não utilizar altas intensidades
- RESPEITAR LIMITES INDIVIDUAIS DE CADA Indivíduo

Especial atenção:

http://www.tecsetra.com.br/images/cursonr10.JPG

- Pessoas idosas - sarcopenia
- Pessoas com disfagias severas
- Pessoas desnutridas e/ou desidratadas
- Pessoas sem resposta sensitiva nem cognitiva
- Pessoas pouco colaborantes
- Pessoas com mais de 7 dias de inatividade motora
- Crianças com menos de 6 anos
- Pele (excesso de creme, muito seca, com lesões,....)

- Frequência (Hz)
- Pulso (µs)
- Intensidade (mA)

Tempo total de estimulação (min)

Aparelhos – conhecer o seu!

http://www.fisiomarket.com/658

http://www.ibramed.com.br/site/en/produto_des.asp?id=42

http://www.cefarcompex.com/es_ES/index.html

http://www.vitalstim.co.uk

Resposta do músculo a EE:

A contração voluntaria é de baixa intensidade – as fibras de tipo I são recrutadas primeiro

Quando a contração é mais intensa – fibras tipo IIa e logo depois das fibras IIb são recrutadas

Em situação de EE, as fibras tipo II contraem antes de as de tipo I

A **contração provocada é intensa** – fibras **tipo II** produzem **mais força.**

(Agne, 2009)

Resposta do músculo à EE:

Frequências entre 2-20 Hz promovem uma vibração muscular, ativam a circulação

Correntes entre 20Hz - 40Hz ativam fibras do tipo I

Correntes de 60hz – 150 Hz ativam fibras do tipo II

Correntes de 41 – 59 Hz ativam fibras mixtas

(Agne, 2009; Resende e Grenne, 2008; Serena et al, 2008; Squecco, 2008; Bisschop, E.; Bisschop, G.; Commanoré, F, 2001)

FIBRAS MUSCULARES E TIPO DE EXERCICIO.....

- FIBRAS I – RESISTÊNCIA – ISOMETRIA, ISOCINESIA

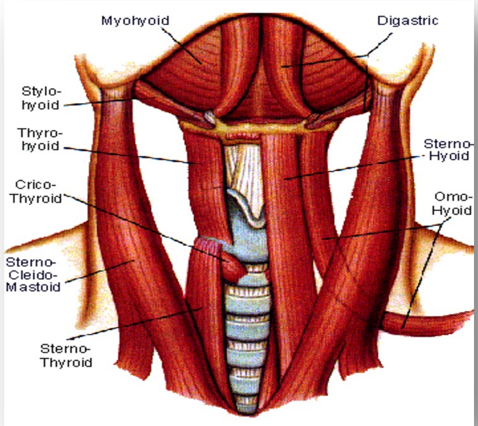
- FIBRAS IIA – FORÇA E MOBILIDADE – ISOMETRIA ISOTONIA

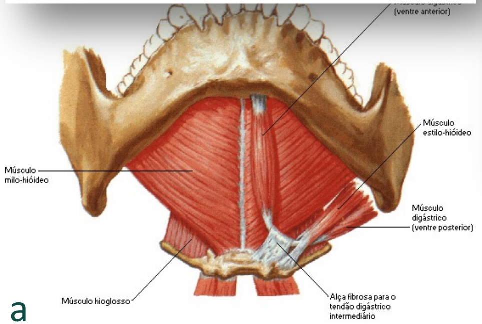
- FIBRAS IIB – FORÇA E POTÊNCIA - ISOTONIA

Músculos - pescoço

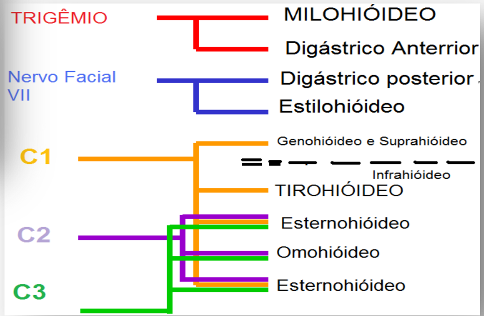
- **Supra hioideos**
  - Estilohioideo
  - Digástrico (ant – F.II)
  - Milohioideo (FII)
  - Geniohioideo
- Funções: elevação da laringe; estabilidade. Relações com a lingua.
- **Infra hioideos**
  - Tirohoideo
  - esternohioideo
  - Esternotirhoideo
  - Omohioideo
- Função: depressão da laringe; estabilidade. Fibras tipo IIb são a maioría (Peter et al, 2014)

MÚSCULOS EXTRÍNSECOS





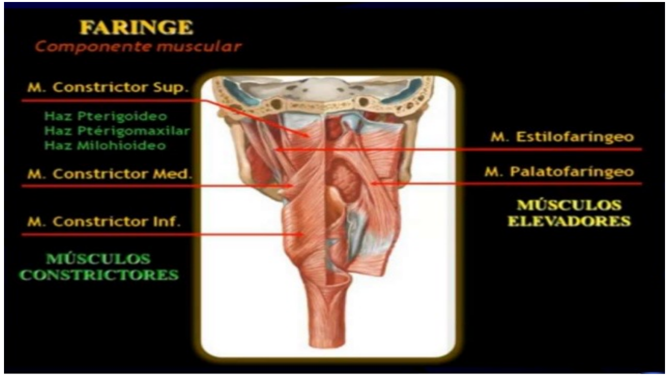
- **Pescoço/Costas-músculos posturais – F . Tipo I**
- **Porção anterior/lateral do pescoço, flexão, balanceio da cabeça – F. Tipo II**



Músculos

- Faringe

- **Cricofaríngeo – F. Tipo I**
- **Constritores superiores da faringe – F. Tipo II**



https://www.slideshare.net/polifemo30/faringe-71307842

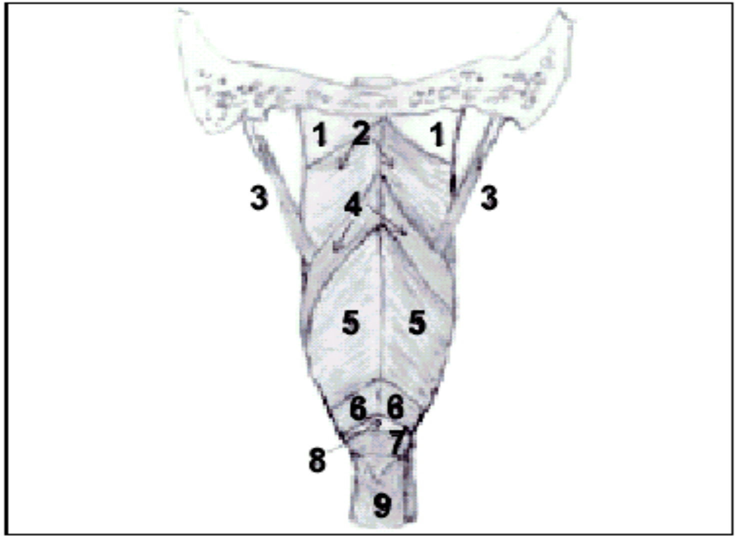
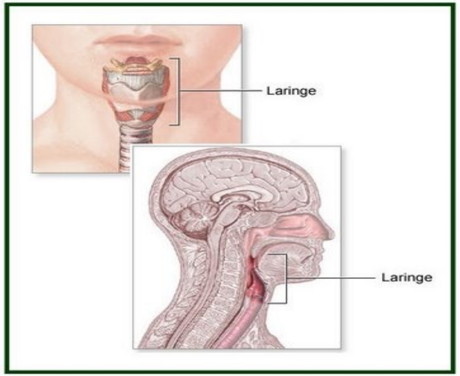


FIGURA 5 – Figura esquemática com vista posterior da faringe onde em: 1. fascia faringobasilar; 2. músculo constritor superior da faringe; 3. músculo estilofaríngeo; 4. músculo constritor médio da faringe; 5, 6 e 7 músculo constritor inferior da faringe, onde 5. músculo tireofaríngeo; 6. fascículo oblíquo do músculo cricofaríngeo; 7. fascículo transverso, impar, do músculo cricofaríngeo; 8. área de rarefação muscular entre os fascículos oblíquo e transverso do músculo cricofaríngeo (Killian); 9. esôfago.

http://www.scielo.br/scielo.php?script=sci_arttext&p S0004-28032003000200002

Músculos - LARINGE

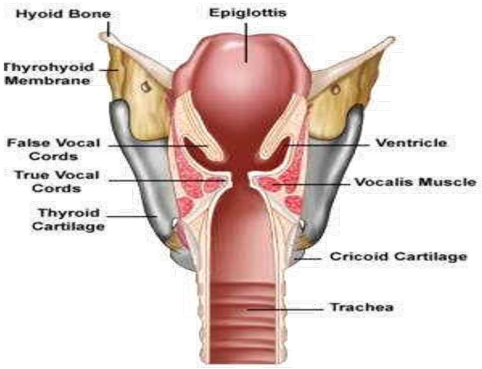
Rodeño et al (1993) identificam que 66,15% das fibras musculares do cricoaritenoideo posterior são do tipo I, enquanto 55,84% das fibras do tiroaritenoideo são do tipo II.



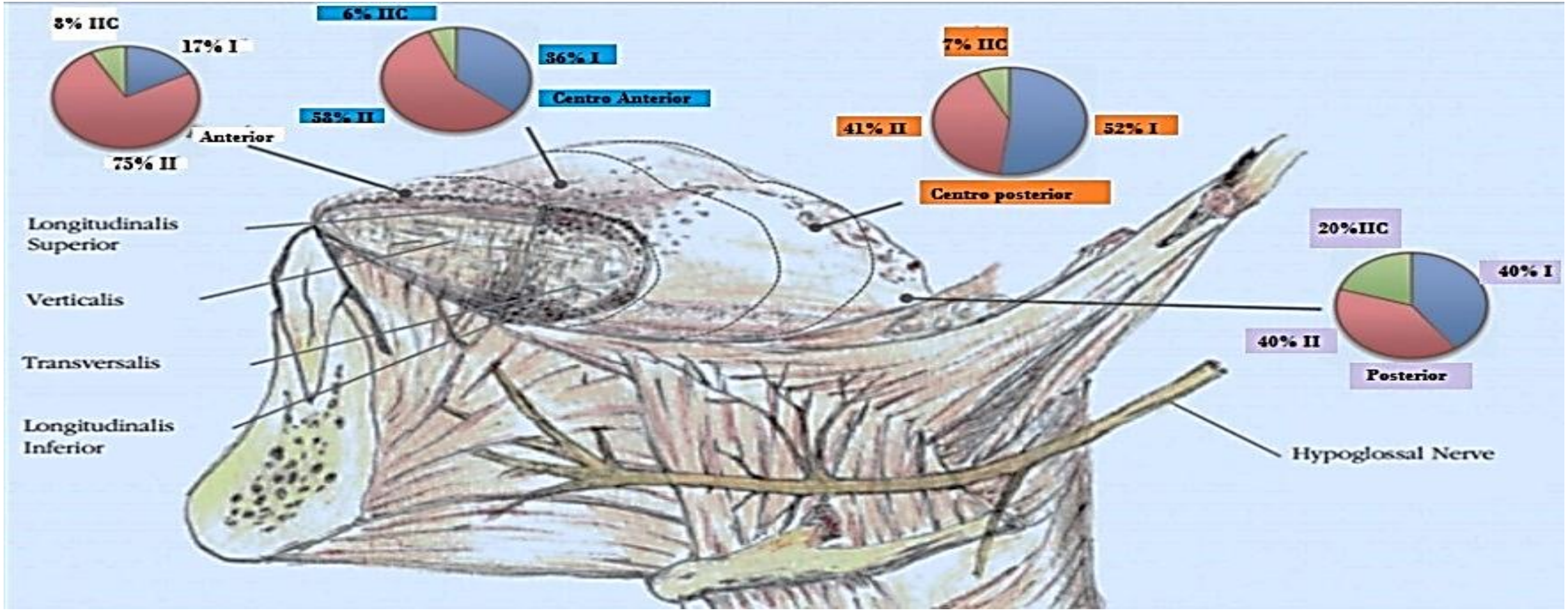
(Rodeño et al, 1993; Peter et al, 2014)

Músculos - LARINGE

O músculo vocal apresenta uma distribução em mosaico, sendo que 40,5% das fibras são do tipo I, 54,75% do tipo IIa e 4,75% IIb.

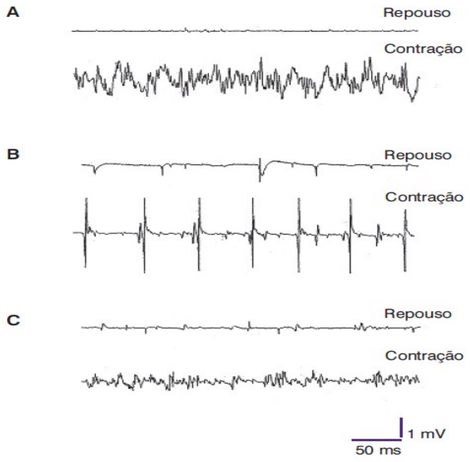


Músculos da lingua



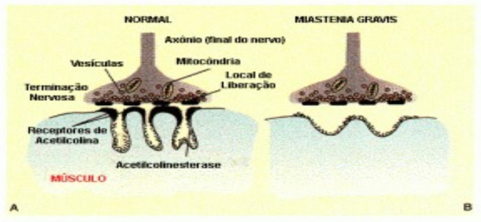
MÚSCULOS:

- **Fasciculação muscular**
  - Quando um impulso anormal atinge uma fibra nervosa motora causando uma forte contração que pode ser observado como uma ligeira ondulação na pele sobre o músculo atingido
  - Ocorre especialmente em casos onde há destruição dos neurónios motores anteriores



http://www.medicinanet.com.br/m/conteudos/revisoes/5936/eletroneuromiografia.htm

- **Fibrilação muscular:**
  - Ocorre após a desenervação e degeneração de todas as fibras nervosas de um músculo
  - Impulsos espontâneos nas fibras musculares após 3/5 dias
  - Atrofia importante impede impulsos fibrilatórios



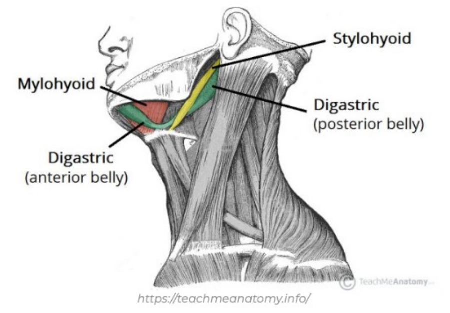
(Guimarães 2013)

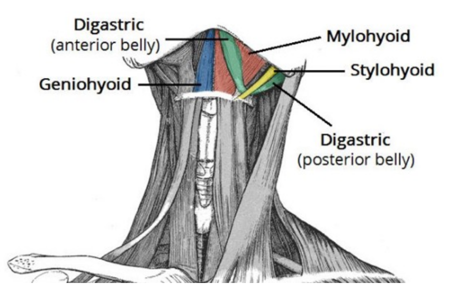
*** Fadiga**

*** Músculo agonista vs antagonista**

*** Músculos sinergistas**

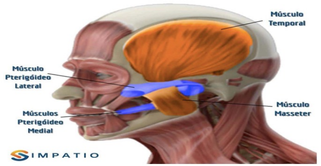
***Relação longitude-tensão**





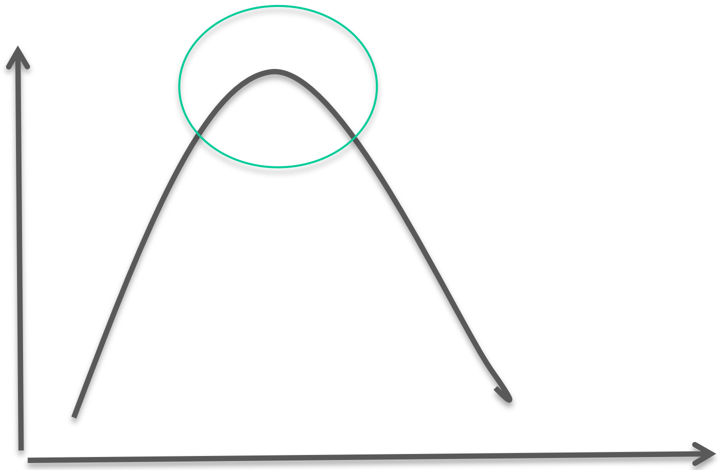
https://anatomia-papel-e-caneta.com/musculos-supra-hioideos/

*** Relação de largura** do **músculo (secção transversal)** e a **sua capacidade de produzir força**



https://simpatio.com.br/musculos-mastigacao/

Desempenho vs Estimulo – fadiga vs re habilitação



MÚSCULOS - MOBILIDADE FARINGEA

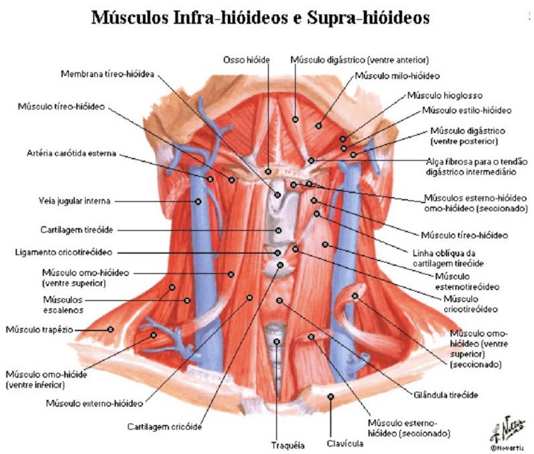
HIOIDE PARA A FRENTE: DIGASTRICO (VENTRE ANTERIOR), MILOHIOIDEO E GENIHIOIDEO

HIOIDE PARA ACIMA E ATRÁS: ESTILOHIODEO E PARTE POSTERIOR DO DIGASTRICO

LARINGE E HIODE JUNTOS: TIROHIODEO

COMPLEXO HIOLARINGEO PARA BAIXO: ESTERNOHIOIDEO, ESTERNOTIROIDEO E OMOHIODEO

ENCURTAMENTO DA FARINGE; ESTILOFARINGEO, PALATOFARINGEO E SALPINGOFARINGEO

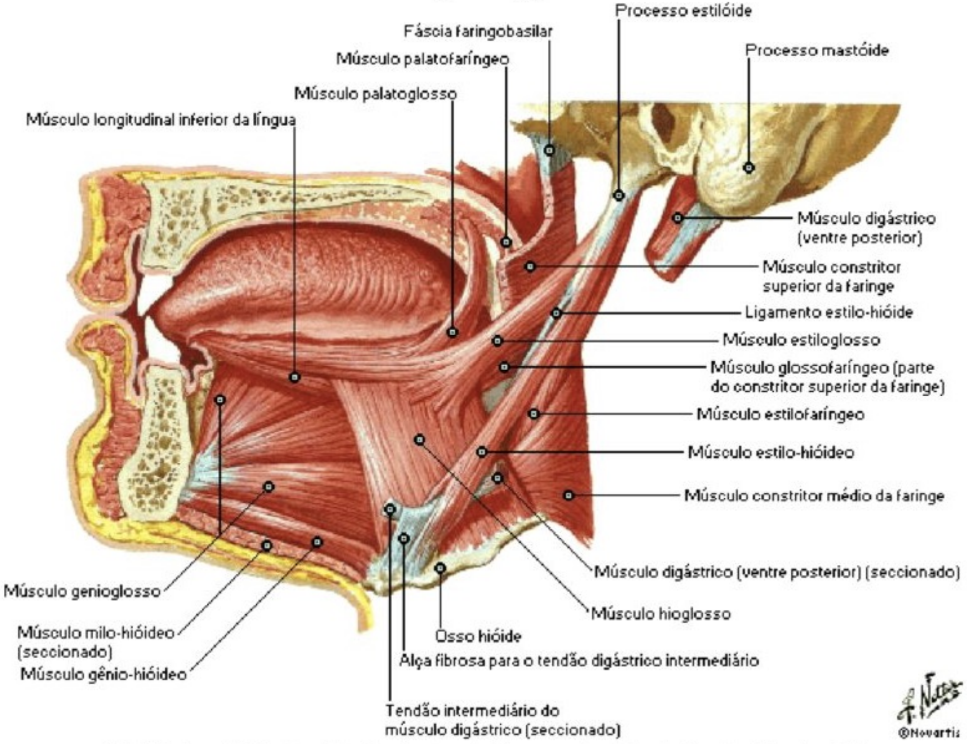


NETTER: Frank H. Netter Atlas De Anatomia Humana. 5 ed. Rio de Janeiro, Elsevier, 2011.

https://anatomia-papel-e-caneta.com/musculos-supra-hioideos/

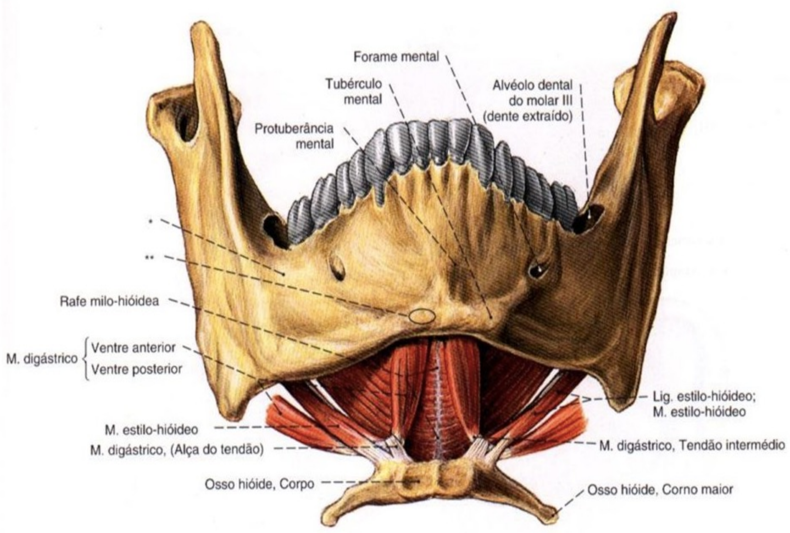
Músculos da Língua

Secção Sagital



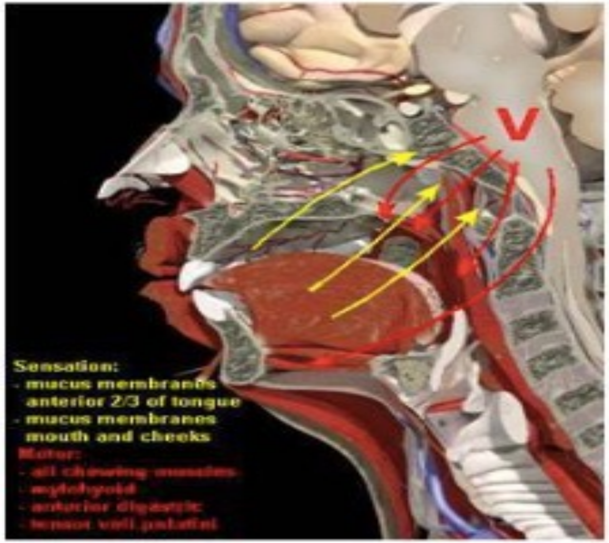
NETTER: Frank H. Netter Atlas De Anatomia Humana. 5 ed. Rio de Janeiro, Elsevier, 2011.

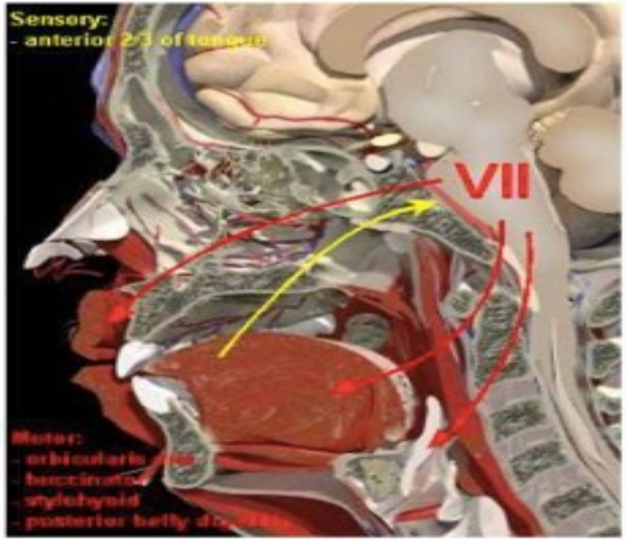
Vista ântero-inferior

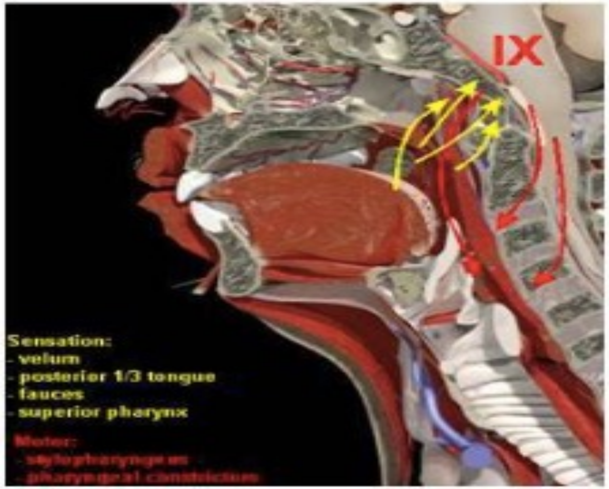


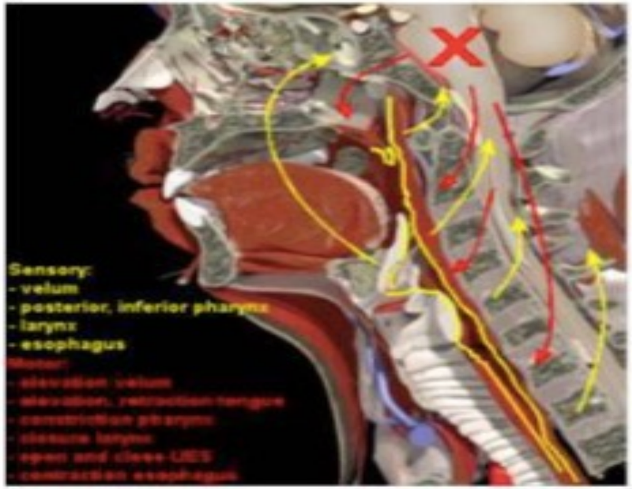
SOBOTTA: Sobotta J. Atlas de Anatomia Humana. 21 ed. Rio de Janeiro: Guanabara Koogan, 2000.

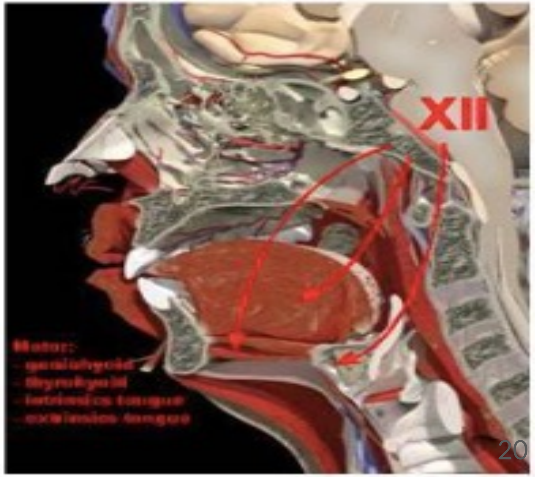
Nervos e suas relações com a EE

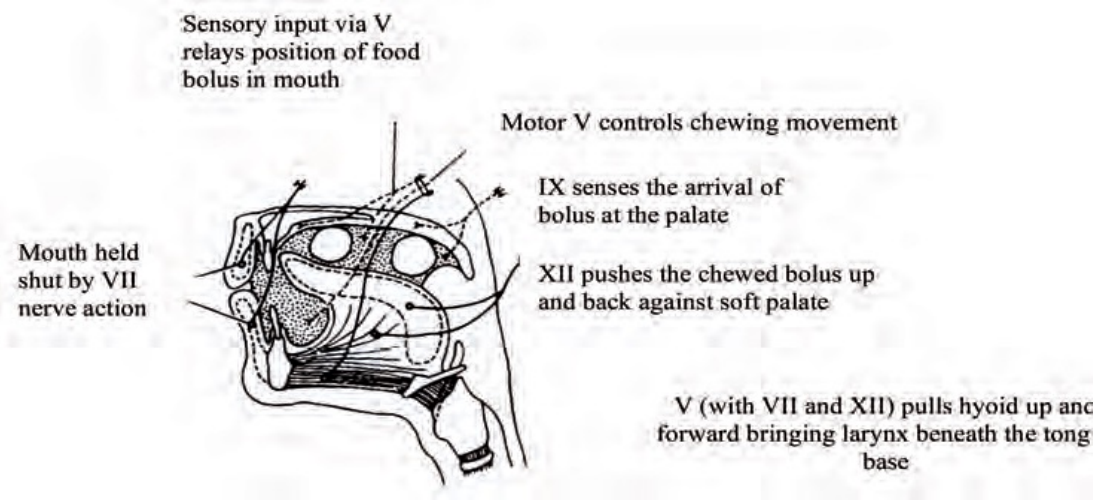


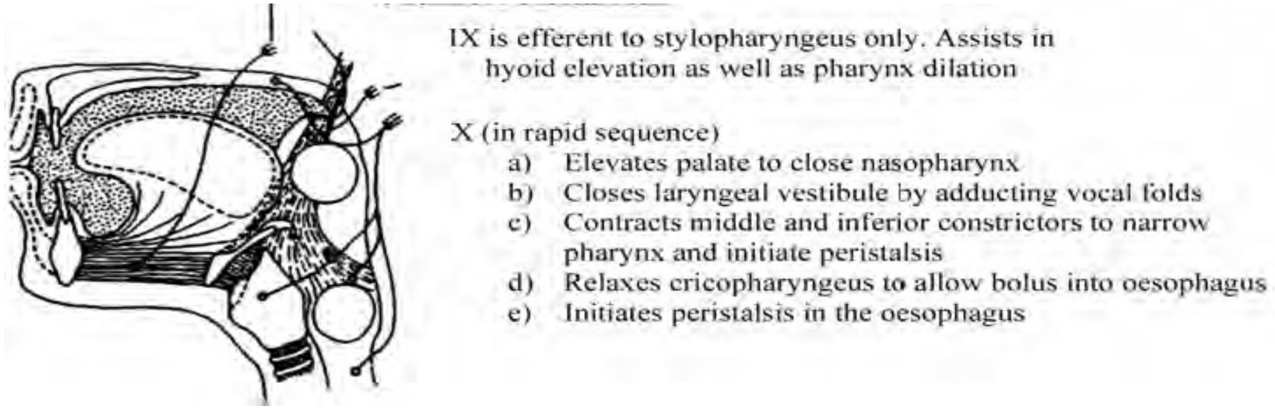









Sensory input via V relays position of food bolus in mouth
Motor V controls chewing movement
IX senses the arrival of bolus at the palate
Mouth held shut by VII nerve action
XII pushes the chewed bolus up and back against soft palate
V (with VII and XII) pulls hyoid up anc forward bringing larynx beneath the tong base


IX is efferent to stylopharyngeus only. Assists in hyoid elevation as well as pharynx dilation
X (in rapid sequence)
a) Elevates palate to close nasopharynx
b) Closes laryngeal vestibule by adducting vocal folds
c) Contracts middle and inferior constrictors to narrow pharynx and initiate peristalsis
d) Relaxes cricopharyngeus to allow bolus into oesophagus
e) Initiates peristalsis in the oesophagus

NMES/FES

- Aumento efetivo na força muscular, no tratamento das limitações da amplitude do movimento das articulações devido a restrições nos tecidos moles ou devido a debilidade.

- Potencia a função muscular durante o ato de deglutir

- Os efeitos imediatos são: inibição recíproca, relaxação dos músculos espásticos e estimulação sensorial das vias aferentes.

- Os efeitos tardios atuam: na neuroplasticidade e na probabilidade que modifiquem as propriedades viscoelásticas musculares e promovam a ação e o desenvolvimento das unidades motoras de contração rápida.

A especificidade desta corrente permite a contração funcional.

(Cacho, Melo, Oliveira, 2004; Lianza 2002; Robbins, 2006, Drummond, Calixto & Carvalho, 2008)

NMS

PARÂMETROS A CONSIDERAR

Duração do pulso	Duração de pulso
Frequência (Hz)	Frequência
Intensidade	Intensidade
TON/TOFF	TON/TOFF
SYNC/ALT	SYNC/ALT
RAMPA	Rampa

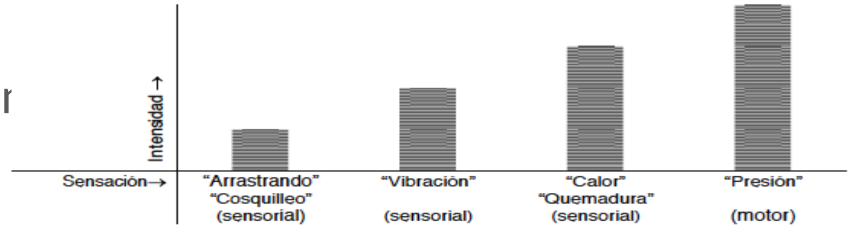
PROGRAMAS FES/NMES/EENM....

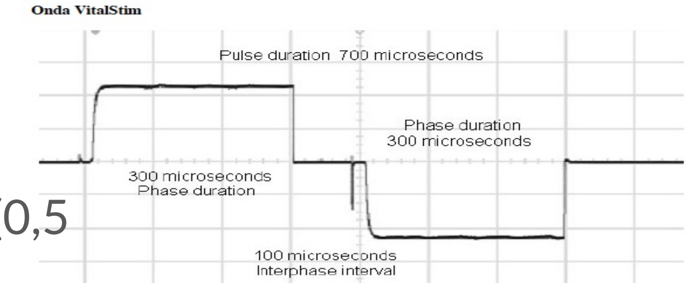
1) Protocolo baseado em Conceição, Cardoso e Beresford, 2009; Guimarães, 2013:

- **FES/EENM/NMES**
  - Pele barbeada
  - Pele limpa com álcool
  - Colocação dependendo da zona a estimular
  - 2 canais (bipolares)
  - Eléctrodos para adultos com 2.1 cm de diâmetro
  - Ligaduras/Bandas para melhorar o contacto dos eléctrodos com a pele
  - Frequência: 60-80 Hz
  - Intensidade: 0 - 25 mA para cada canal
  - Tempo de pulso: 200-300 µs
  - Rampa de Subida e de Descida: 1-2 seg.
  - On: 8-12 seg
  - OFF: sempre superior a On
  - Tempo de estimulação: entre 15-60 minutos

2) Protocolo Vital Stim:

- Pele barbeada
- Pele limpa com álcool
- Colocação dependendo da zona a estir
- 2 canais (bipolares)
- 2 canais (bipolares)
- Eléctrodos para adulto com 2,1 cm de diâmetro
- Ligaduras/bandas para melhorar o contacto dos eléctrodos com a pele
- Frequência: 80 Hz
- Intensidade: 0 - 25 mA para cada canal
- Tempo de pulso: 300/700 µs
- Rampa de subida y de Descida: predefinida (0,5 mA)
- On e Off predefinido (59 segundos ON y 1 segundo OFF)
- Tempo de estimulação:60 min ou 30 min





(Baijens, Speyer, Passos, Pilz, Roodenburg & Clavé, 2012)

3) FES Terapia Disfagia (Bruno Guimarães, 2009)

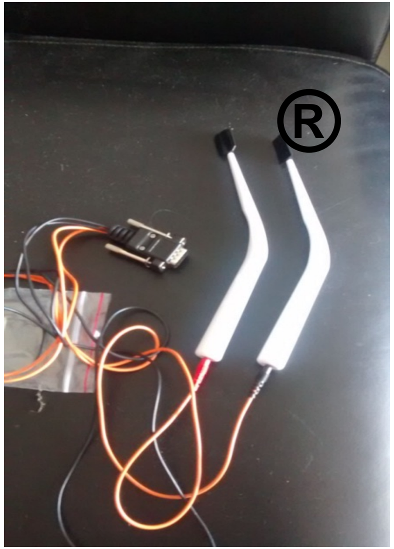
Objetivos	Resultados Esperados	Correntes Empregadas
Objetivo 1 Aquecimento	Resultado 1 oxigenação	TENS ou FES até 10 Hz - 3 minutos Larg pulso 200us
Objetivo 2 Mobilização Sensório motora	Resultado 2 ativação	Fes entre 11 e 19 Hz – 5 minutos / entre 10 e 20 estimulações, TON de até 6 seg Larg pulso 250us
Objetivo 3 Fibras Tipo I	Resultado 3 ativação	FES – 20 a 30 Hz entre 5 e 20 contrações, TON de 5 seg/TOFF no mínimo 10 segs, Larg pulso 300us
Objetivo 4 Fibras Tipo II	Resultado 4 ativação	FES – 60 - 80 Hz entre 5 e 20 contraçoes, TON de 5 segs/TOFF no mínimo 10 segs Larg pulso 300us
Objetivo 5 Tonificação	Resultado 5 mobilização	FES – 50 Hz entre 5 e 20 contrações, TON 5 a 10mA / TOFF mínimo de 10segs sempre com séries de exercícios Larg pulso 300us a 500us
Objetivo 6 Desaquecimento	Resultado 6 oxigenação	TENS 20 Hz, 5 minutos

Arq. Bruno Guimarães 2016

4. Protocolo para EE Sensório e motora da Cavidade Oral- BRUNO GUIMARAES

- **Objetivos:**
  - Estimulação sensorial e motora da língua, velo e faringe
  - Estimulação sensorial e motora de todas as paredes internas da cavidade oral
  - Estimulação sensorial e dos pontos motores da face

- **Cuidados:**
  - Não estimular a ponta da língua
  - Não realizar muitas contrações em qualquer das partes acima citadas
  - Não usar altas intensidades nas regiões acima citadas
  - Muito cuidado ao estimular velo e faringe para não ocasionar reflexo vago vagal



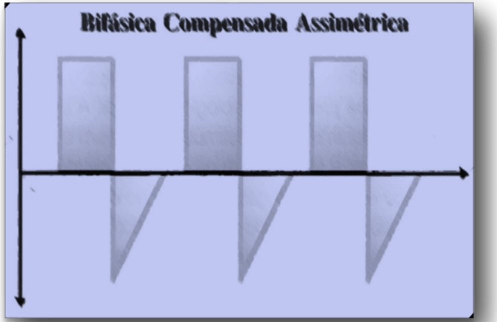
Protocolo de propriedade de BG & MJ®

Fase 1	Fase 2	Fase 3	Fase 4
Corrente FES R = 5 Hz LP = 200μs Int = 10 mA	**Corrente FES** R = 10 a 15 Hz LP = 250μs Int = acima de 10 mA	**Corrente FES** R = 30 Hz LP = 250μs Int = acima de 10 mA	**Corrente FES** R = 50 Hz LP = 300 a 400μs Int = acima de 10 mA

TENS

- **Liberta sustâncias analgésicas do própio corpo: endomorfinas** (libertadas na médula espinhal com frequência de 100 a 1000 Hz), **endorfinas e encefalinas.** (as 2 libertadas no SNC com frequências de 5 -10 Hz)

- **Há dois tipos de TENS:**
  - Baixa frequência - ≤10 HZ
  - Alta frequência - ≥50



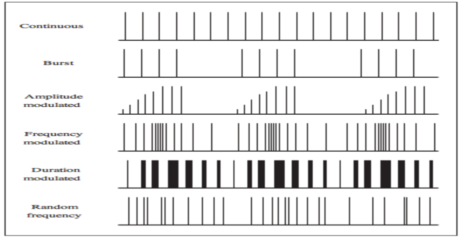


Figure 17.7 Novel pulse patterns available on TENS devices. Modulated patterns fluctuate between upper and lower limits over a fixed period of time and this is usually preset in the design of the TENS device.

(Agne, 2009; Guimarães,, 2012)

TENS: Porque relaxa os músculos?

Eble et al. (2000) realizaram estudos eletromiográficos em sujeitos com distúrbios funcionais de músculos mastigatórios, a fim de analisar os efeitos terapêuticos da TENS nos músculos masseter e temporal, constataram uma diminuição da atividade muscular. Ao final do estudo propõe-se que a TENS pode ter agido com um bloqueio da propriocepção de retorno sobre o estado de fadiga, impedindo que esta informação chegue ao sistema nervoso central. Como segunda hipótese, é que ao aplicar a TENS a contração muscular provocada por este, interfere sobre a interpretação do sistema nervoso central no que se refere ao estado muscular normal, resultando em uma redução da atividade muscular e promoção de relaxamento. A terceira proposta descreve uma atuação direta sobre o músculo, com um aumento da eliminação de metabólitos, assim o centro motor interpreta como um restabelecimento da condição muscular, levando a um relaxamento.

TENS

PARÂMETROS A CONSIDERAR

Duração do pulso
- Duração de pulso

Frequência (Hz)
- Frequência

Intensidade
- Intensidade

PROGRAMAS TENS

1) Protocolo baseado em Conceição, Cardoso e Beresford, 2009; Guimarães, 2013

- Pele Barbeada
- Pele limpa com álcool
- Colocação dependendo da zona a estimular
- 2 canais (bipolares)
- Eléctrodos para adulto com 2,1 cm de diâmetro
- Ligaduras/bandas para melhorar o contacto dos eléctrodos com a pele
- Frequência: 10 - 30 Hz
- Tempo de pulso: 200-300 µs
- Intensidade: 0 - 11 mA para cada canal

PROGRAMAS TENS – Bruno Guimarães

2) Disfonias hipercinéticas, com tensão e dor

- TENS Convencional
  - Frequência = 150Hz
  - Pulso = 100µs
  - Tempo = 30 - 40 minutos

- TENS Acupuntura
  - Frequência = 10 - 20 Hz
  - Pulso = 250 – 500! µs
  - Tempo = 20 - 40 minutos

3) Disfonias por Paralisia da corda vocal

– TENS Burst + FES (Baixa modulação de frequência:
F = 50Hz, Pulso= 300us, tempo ON= 5s, Tempo Off = 10 s.

Associado aos exercícios requeridos para cada tipo de patologia laríngea.

(Guimarães, 2013)

3.

Protocolo para Paralisia Facial – BRUNO GUIMARAES

Trabalhar com mobilização por níveis:
Nível Sensorial - TENS Convencional:
Frequência = 100Hz
Largura de Pulso = 50us
Tempo de estimulação = no máximo 5 minutos

Nível Motor - TENS Acupuntura:
Frequência = 10Hz
Largura de Pulso = entre 250 a 300us
Tempo de Aplicação = no máximo 5 minutos

Estimulação Sensório motora:
TENS VIF
Configuração do equipamento
Tempo de aplicação = no máximo 10 minutos

Fases de Contrações - FES
Frequência = 50Hz
Largura de Pulso = 300us
Rampa subida = 2seg
TON = 3seg
Rampa Descida = 1seg
TOFF = 9seg
Realizar poucas contrações (EE) na fase inicial e associar exercícios

4.

Dores Facias - ATM – Bruxismo – BRUNO GUIMARAES

Dores agudas forma mono ou bipolar – se monopolar, menor eletrodo sobre a área principal da dor.
TENS Convencional (modulação alta frequência)
Frequencia = 100Hz
Largura de pulso = 50 a 75us
Tempo = mínimo de 20 minutos
Associar exercícios suaves próprios para a patologia relativa

Dores Crônicas forma mono ou bipolar
TENS Acupuntura (modulação de baixa frequência)
Frequencia = 5 a 20Hz
Largura de Pulso entre 250 a 500us
Tempo mínimo = 20 minutos
Associar exercícios suaves próprios para a patologia relativa.

Dores agudas ou crônicas mono ou bipolar
TENS Breve-Intenso (modulação alta frequencia)
Frequência = 150Hz
Largura de Pulso = 250 a 500us
Tempo máximo = 15 a 20 minutos

Tipo de TENS	Tempo de Aplicação	Efeito	Indicação
TENS Convencional (Teoria das Comportas)	20 a 60 minutos, com intervalos de 30 min.	Estimulação seletiva de fibra (A beta), gerando confortável parestesia (efeito curto) ou pontadas, sem dor ou contração muscular.	Dor aguda (superficial) ou crônica.
TENS Acupuntura (Teoria Farmacológica)	20 a 30 minutos, preconizada 1 vez ao dia.	Estimulação das fibras nociceptivas (A delta e C) e pequenas fibras motoras, gerando parestesia e contração visível (efeito longo), levando também à liberação de opiáceos endógenos	Dor Crônica.
TENS breve intenso (Teoria Farmacológica)	± 15 minutos.	Ativação de fibra (A delta e C), levando à diminuição dos espasmos contraturas (efeito temporário)	Dor Aguda Junta efeitos da TENS convencional e acupuntura, levando ao efeito analgésico longo (beta endorfina + inibição pré-sináptica)
TENS Burst (Teoria Farmacológica e das Comportas)	Mínimo de 30 min.	Junta efeitos do TENS convencional e acupuntura, levando ao efeito analgésico longo (beta endorfinas +_ inibição pré-sináptica)	Mobilização articular, estiramento mantido ou massagem transversa (condições dolorosas locais)

Fonte: Pena; Barbosa, Ishikawa, 2008

COMO ESCOLHER?

PARAMETROS	MODO
TENS OU NMES	QUAL O NÚMERO DE CANAIS DE TRATAMENTO?
TEMPO ON Y OFF	TEMPO DE ESTIMULO E INTENSIDADE
FREQUÊNCIA	POSICIONAMENTO E TIPO DE ELÉCTRODOS
DURAÇAO DE PULSO	QUAIS E QUANTOS MÚSCULOS ESTIMULAM?

- Quais sao os exercicios possiveis para a terapia?
- Que ocorre com as regiões estimuladas?
- Em que paciente se puede utilizar?

O QUE TRATAMOS COM EET?

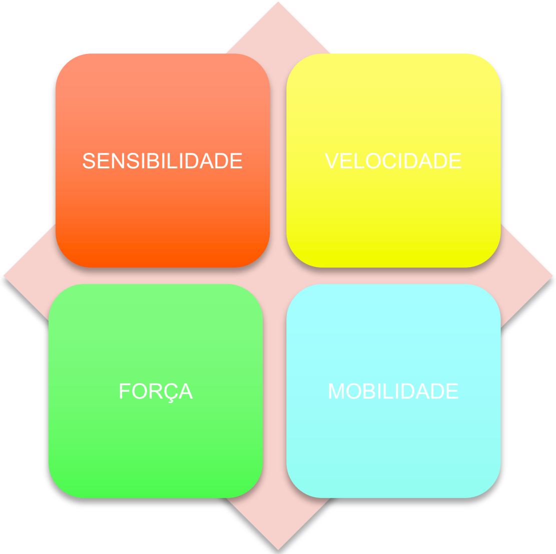
- PATOLOGIA?
  - QUAL É A PATOLOGIA?
  - QUAL É O DIAGNÓSTICO?
- SÍNTOMAS?
  - O QUE NOS COMENTA O NOSSO PACIENTE E/OU CUIDADOR
- SINAIS?
  - QUE OBSERVAMOS NÓS TERAPEUTAS DA FALA?
- DISFUNÇÕES?
  - QUAL É A FUNÇÃO BÁSICA OU ATIVIDADE QUE ESTÁ LIMITADA?
- PERTURBAÇÃO?
  - QUAL É O SISTEMA OU ALTERAÇÃO ANATÓMICA RESPONSÁVEL?

- E.....

QUAL É O OBJETIVO!!?

QUAL É A FISIOPATOLOGIA

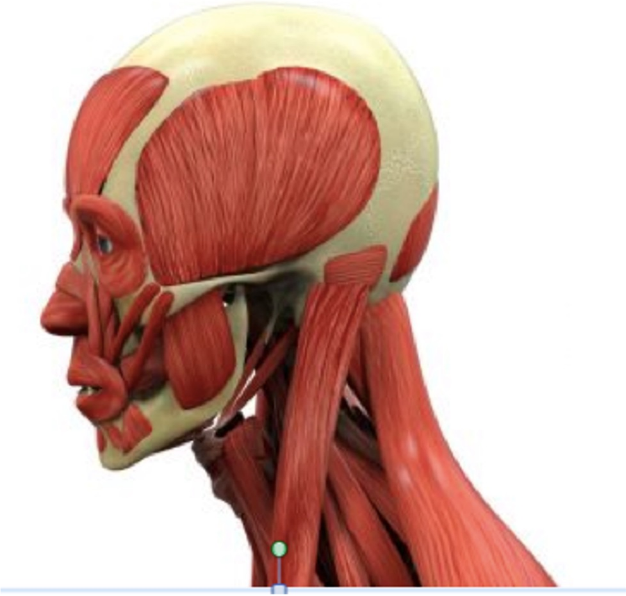
CAPACIDADE E NECESIDADE DO TREINO MUSCULAR

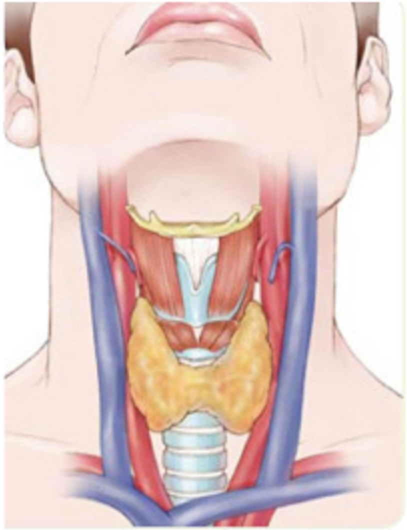


A meta e o objetivo do tratamento é o que determina a aplicação da estimulação eléctrica.

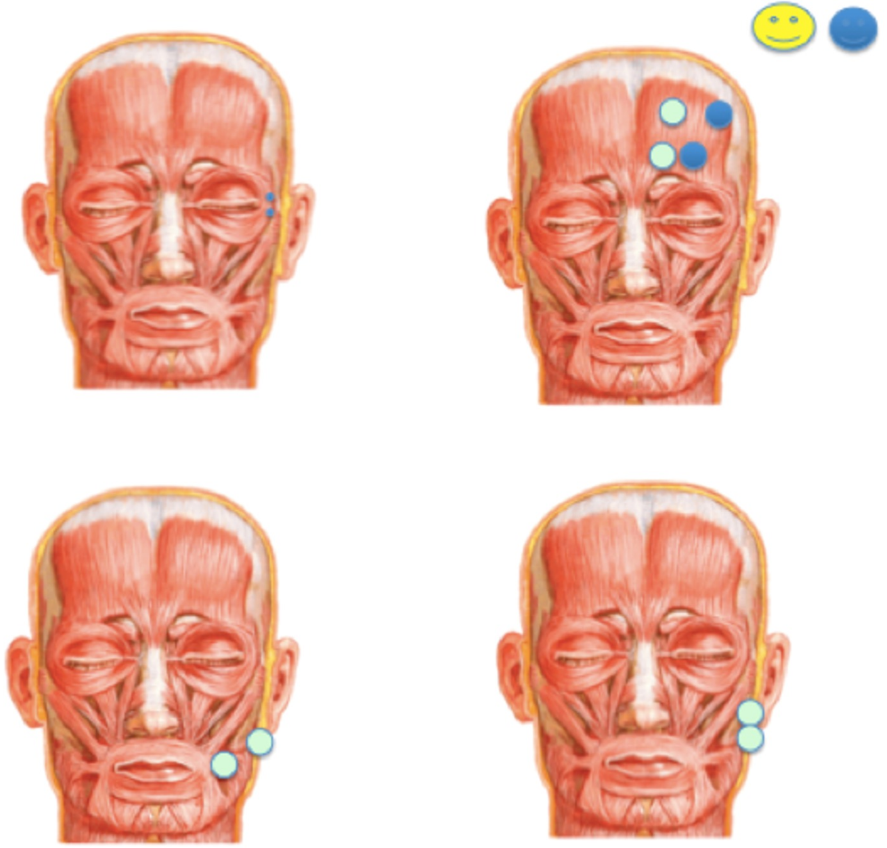
Depois de definir o objetivo e a corrente/programa de EET definir

Elétrodos - material, tamanho, onde e porquê?





Imagens retiradas de:http://musculos.pt/wp-content/uploads/2017/02/musculos-da-cabeca-humana.jpg; http://www.thetrumpetblog.com/wp-content/uploads/2016/06/1.png; http://prozvi.ru/wp-content/uploads/2017/09/SHHitovidnaya-zheleza1-220x300.jpg



- Utilização con TENS
- Utilização con NMES

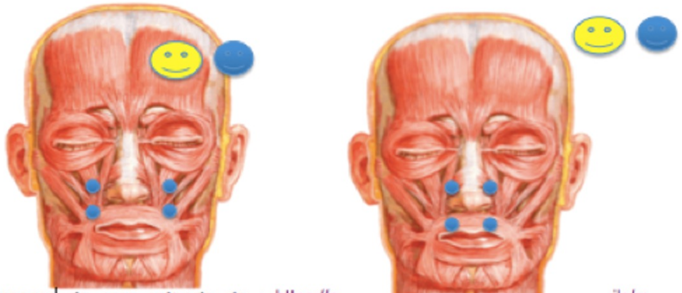
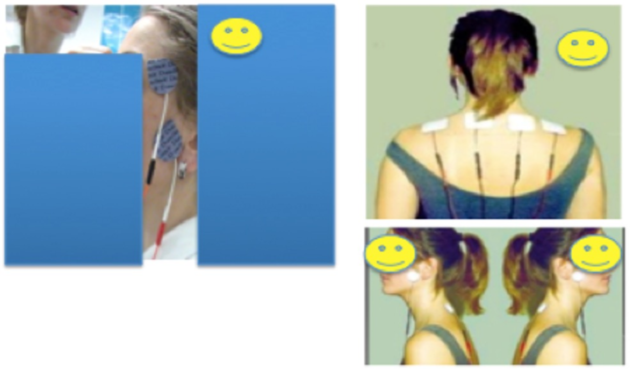
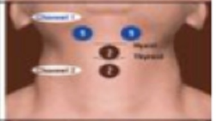
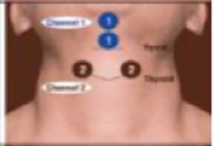
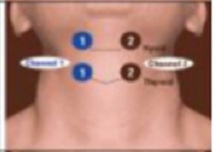
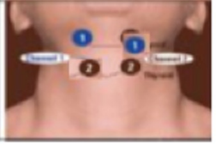


Imagem da cara retirada de : https://c _ ils/m-expresionfacial-masticatorioscavidadoral-lengua-nariz-130326145303-phpapp01-thumbnail-4.jpg?cb=1364309633



http://www.slideshare.net/lariduran1/protocolos-para-analgesia-en-tens

- Utilização con TENS
- Utilização con NMES

Placement Name	Targeted Purpose	Placement of Electrodes	Design
Placement 1	Increase laryngeal elevation; Increase laryngeal sensation; facilitation of midline supra- and infra hyoids	All electrodes aligned vertically; Start at cricoid and work upwards	
Placement 2a	Increase laryngeal elevation; Increase pharyngeal constriction; facilitation of supra hyoids and lingual retraction	Channel 1: horizontally at or above hyoid Channel 2: vertically; top at thyroid Tongue at horizontal by Cranial Nerve (CN) XII	
Placement 2b	Increase laryngeal elevation; Increase tongue base retraction (CN XII); Increase airway protection; Decrease Anterior-Posterior (A-P) transit, premature spillage, pooling/residuals, penetration/aspiration	Channel 1: aligned midline; bottom at hyoid Channel 2: either side of thyroid notch	
Placement 3a	Increase tongue base retraction (CN XII); Increase pharyngeal constriction (CN X); Increase laryngeal elevation; Increase UES opening	Channels on vertical side of midline; Channel 1: Right Channel 2: Left Top electrodes: above hyoid bone Bottom electrodes: level of thyroid notch	
Placement 3b	Increase tongue base retraction (CN XII); Increase Upper Esophageal Sphincter (UES) opening; Increase pharyngeal constriction (CN X); Increase laryngeal elevation	Channels aligned horizontally Channel 1: up Channel 2: down Top electrodes: above hyoid bone Bottom electrodes: at level of thyroid notch	

http://neurorehai.blogspot.com.es/2013/03/vitalstim.html

- Utilização com TENS
- Utilização com NMES

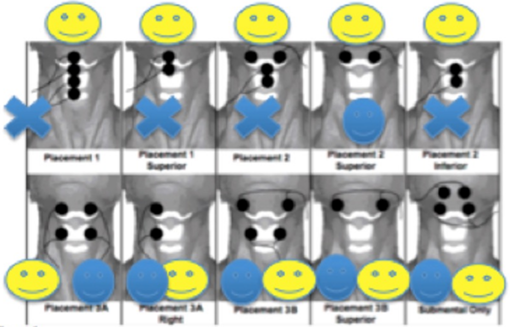
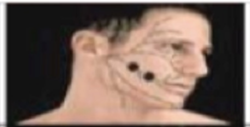
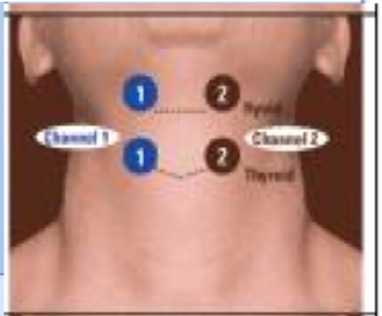


Figure 1.
The electrode positions relative to the hyoid bone, thyroid cartilage, and cricoid cartilage. The bipolar electrode pairs for each placement are connected by lead wires (solid lines) with current flowing between the two electrodes of each pair. Placement 1, 2, 3A, and 3B have electrodes in both the submental and laryngeal regions. Placements 1 superior, 2 superior, 2 inferior, 3A right, and 3B superior are individual electrode pairs. The submental-only placement has two electrode pairs above the hyoid bone in the submental region.

(Humbert, Poletto, Saxon, Kearney, Ludlow, 2008)

Placement 4a	Oropharyngeal "sling" Lip closure Chewing Pocketing Jaw stabilization Facial tone/sensation	Maximum facilitation of synergists when electrodes applied bilaterally	
Placement 4b	Oropharyngeal "sling" Lip closure Chewing Pocketing Jaw stabilization Facial tone/sensation	Maximum facilitation of synergists when electrodes applied bilaterally	

http://neurorehai.blogspot.com.es/2013/03/vitalstim.html

Nome da colocação	Objetivo	Colocação	
3a	Aumenta a retração da base da lingua (NC XII); Aumenta a constrição faríngea (NC X); Aumenta a elevação laringea; Aumenta a abertura do EES	Canais na vertical: Canal 1: direito Canal 2: esquerda *electrodos de baixo ao nível do “nó da tiroide” junto ao musculo cricotiroideo	
3b	Aumenta a retração da base da lingua (NC XII); Aumenta a abertura do EES; Aumenta a constrição faríngea; Aumenta a elevação laringea.	Canais alinhados na horizontal. Canal 1: sup Canal 2: inf. *electrodos de baixo ao nível do “nó da tiroide” junto ao musculo cricotiroideo.	
4a	Encerramento labial Mastigação Limpeza dos vestíbulos Estabilização mandibular Tónus facial/sensibilidade	Ao nível do bucinador Maximizar a facilitação dos sinergistas quando colocação bilateral	

http://neurorehai.blogspot.com.es/2013/03/vitalstim.html

Placement 4a	Oropharyngeal "sling" Lip closure Chewing Pocketing Jaw stabilization Facial tone/sensation	Maximum facilitation of synergists when electrodes applied bilaterally	
Placement 4b	Oropharyngeal "sling" Lip closure Chewing Pocketing Jaw stabilization Facial tone/sensation	Maximum facilitation of synergists when electrodes applied bilaterally	

http://neurorehai.blogspot.com.es/2013/03/vitalstim.html

Exercícios Associados: SIM ou NÃO?

- DURANTE O ESTIMULO VS INTERVALO DO ESTIMULO
- CONTROLAR A FADIGA
- OBSERVAÇÃO DA CONDIÇÃO SENSORIAL E MUSCULAR
- CAPACIDADE DE RESPOSTA VOLUNTÁRIA
- OBJETIVO DA TERAPIA:
  - MANUTENÇÃO DO TROFISMO
  - SENSIBILIDADE
  - TREINO MUSCULAR
  - TREINO FUNCIONAL

Movimento e Reorganização cortical – A TER EM CONTA!

–**Repetições**– o exercício repetido muitas vezes tem melhores efeitos terapêuticos que o exercício de menor intensidade.

–**Estimulação sensorial –** a estimulação sensorial no mesmo dermatoma e miotoma facilita a resposta motora.

–**Retroalimentação específica do movimento** – a retroalimentação sensorial, visual e proprioceptiva quanto à quantidade efetividade do movimento em questão, facilita o retorno motor.

–**Êxito da resposta do movimento** –quando um paciente tem êxito no movimento, uma poderosa retroalimentação positiva intervém e o movimento funcional é facilitado estimula a um maior esforço depois do tratamento.

ELECTROESTIMULAÇÃO TERAPÊUTICA

Evidências científicas de utilização

- Possibilidades de aplicação específicas em terapia da fala: PRÁTICA BASEADA EM EVIDÊNCIA CIENTÍFICA

Disfagia?	DTM?
Presbifagia?	Disfonía?
Xerostomia?	Presbisfonía?
Parálisia Facial?	Disartria?
Alterções Miofuncionais da deglutição, mastigação,...?	Respiradores Orais?

OUTROS?

Effects of Submental Surface Electrical Stimulation on Swallowing Kinematics in Healthy Adults: An Error-Based Learning Paradigm

Selen Serel Arslan , Alba Azola , Kirstyn Sunday , Alicia Vose , Emily Plowman , Lauren Tabor , Michele Singer , Raele Robison and Janessa A. Humbert

https://doi.org/10.1044/2018_AJSLP-17-0224

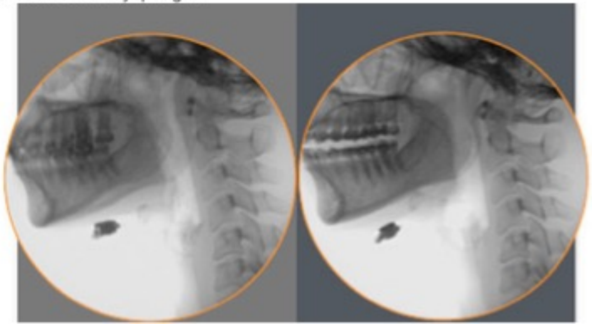
ABSTRACT

Purpose Hyoid bone and laryngeal approximation aid airway protection (laryngeal vestibule closure) while moving toward their peak superior and anterior positions during swallowing. Submental surface electrical stimulation (SES) is a therapeutic technique that targets the muscles that move the hyoid bone during swallowing. It is unknown whether submental SES only increases peak hyoid bone swallowing positions but not peak laryngeal swallowing positions, which could require faster or greater laryngeal movement to achieve adequate laryngeal vestibule closure.

Method We examined the effects of submental SES on hyo-laryngeal kinematics in 30 healthy adults who swallowed 50 times using an error-based learning paradigm.

Results Submental SES did not alter any hyo-laryngeal swallowing kinematic. However, submental SES significantly changed the starting position of the hyoid bone just prior to the swallow onset (more anterior; p = .003). On average, submental SES immediately prior to swallow onset can position the hyoid approximately 20% closer to its peak swallowing point.

Conclusions These findings indicate that electrical stimulation of the agonists for hyoid movement might not alter swallowing outcomes tested in this study. However, submental SES could have clinical utility by minimizing swallowing impairments related to reduced hyoid swallowing range of motion in individuals with dysphagia.



Resultados: A estimulação submentoniana (ES) não alterou nenhum mecanismo na deglutição hio-laríngea. No entanto, a ES alterou significativamente a posição inicial do osso hióide imediatamente antes do início da deglutição (mais anterior; p = 0,003). Em média, a ES imediatamente antes do início da deglutição pode posicionar o hióide aproximadamente 20% mais próximo de seu ponto de pico de deglutição.

Conclusões: Esses achados indicam que a estimulação elétrica dos agonistas para o movimento do hioide pode não alterar os resultados da deglutição testados neste estudo. No entanto, a ES pode ter utilidade clínica, minimizando as alterações da deglutição relacionados à redução da amplitude de movimento do hioide na deglutição, em indivíduos com disfagia.

(Serel el al: Effects of Submental Surface Electrical Stimulation on Swallowing Kinematics in Healthy Adults: An Error-Based Learning Paradigm, American Journal of Speech-Language PathologyResearch Article21, Nov 2018)

> Dysphagia. 2010 Dec;25(4):291-7. doi: 10.1007/s00455-009-9259-3. Epub 2009 Oct 24.

Sensory transcutaneous electrical stimulation improves post-stroke dysphagic patients

Syrine Gallas [1], Jean Paul Marie, Anne Marie Leroi, Eric Verin

Affiliations + expand

PMID: 19856025 DOI: 10.1007/s00455-009-9259-3

Abstract

Oropharyngeal dysphagia is frequent in stroke patients and increases mortality, mainly because of pulmonary complications. We hypothesized that sensitive transcutaneous electrical stimulation applied submentally during swallowing could help rehabilitate post-stroke oropharyngeal dysphagia by improving cortical sensory motor circuits. Eleven patients were recruited for the study (5 females, 68 ± 11 years). They all suffered from recent oropharyngeal dysphagia (>eight weeks) induced by a hemispheric (n = 7) or brainstem (n = 4) stroke, with pharyngeal residue and/or laryngeal aspiration diagnosed by videofluoroscopy. Submental electrical stimulations were performed for 1 h every day for 5 days (electrical trains: 5 s every minute, 80 Hz, under motor threshold). During the electrical stimulations, the patients were asked to swallow one teaspoon of paste or liquid. Swallowing was evaluated before and after the week of stimulations using a dysphagia handicap index questionnaire, videofluoroscopy, and cortical mapping of pharyngeal muscles. The results of the questionnaire showed that oropharyngeal dysphagia symptoms had improved ($p < 0.05$), while the videofluoroscopy measurements showed that laryngeal aspiration ($p < 0.05$) and pharyngeal residue ($p < 0.05$) had decreased and that swallowing reaction time ($p < 0.05$) had improved. In addition, oropharyngeal transit time, pharyngeal transit time, laryngeal closure duration, and cortical pharyngeal muscle mapping after the task had not changed. These results indicated that sensitive submental electrical stimulations during swallowing tasks could help to rehabilitate post-stroke swallowing dysphagia by improving swallowing coordination. Plasticity of the sensory swallowing cortex is suspected.

Os resultados do questionário mostraram que os sintomas de disfagia orofaríngea melhoraram ($p < 0,05$), enquanto as medidas de videofluoroscopia mostraram que a aspiração laríngea ($p < 0,05$) e resíduos faríngeos ($p < 0,05$) diminuíram e que o tempo de reação de deglutição ($p < 0,05$)) melhorou. Além disso, o tempo de trânsito orofaríngeo, tempo de trânsito faríngeo, duração do encerramento laríngeo e mapeamento cortical da musculatura faríngea após a tarefa não mudou. Esses resultados indicaram que estímulos elétricos sensoriais submentais durante as tarefas de deglutição podem ajudar a reabilitar a disfagia pós-AVC, melhorando a coordenação da deglutição. Suspeita-se de plasticidade sensorial da deglutição no córtex.

Health Technol Assess Rep. 1990;(8):1-7.

Patient selection criteria for electrostimulation of salivary production in the treatment of xerostomia secondary to Sjogren's syndrome.

Erlichman M.

Abstract

Electrostimulation has been introduced as a technique for increasing salivary output in the treatment of patients with xerostomia (dry mouth) secondary to Sjogren's syndrome. The procedure uses an electrostimulation device (salivation electrostimulator) to increase salivary production from existing glandular tissue. The device delivers a low-voltage electrical stimulus to the mouth via a probe. Patients with residual salivary tissue in the oral and pharyngeal regions who demonstrate a decrease in the flow rate of saliva are potential candidates for this procedure. It is estimated that more than one million people in the United States, predominantly middle-aged and elderly women, suffer from Sjogren's syndrome. Patients with chronic xerostomia complain of a continual feeling of oral dryness and have difficulty eating dry foods. These patients are susceptible to increased caries, oral pain, infection, and have difficulty speaking, chewing, and swallowing. The approach to the treatment of xerostomia in Sjogren's patients is usually determined by the level of severity of the symptoms. Appropriate management of patients with xerostomia requires that those patients whose salivary flow can be increased by means of sialagogues be distinguished from those patients whose salivary flow is either unaffected or insufficiently stimulated. To alleviate some of the complications due to salivary dysfunction in those patients who respond to stimuli, pharmacologic sialagogues as well as sialagogues that include sugarless gums, mints and candies are prescribed in order to increase salivary flow. Recently, electrostimulation via a hand-held stimulus probe has been introduced as a method of treatment in xerostomia secondary to Sjogren's syndrome.

Neurorehabil Neural Repair. 2010 Jul-Aug;24(6):519-27. doi: 10.1177/1545968309360417. Epub 2010 Mar 12.

Differential effects of neuromuscular electrical stimulation parameters on submental motor-evoked potentials.

Doeltgen SH[1], Dalrymple-Alford J, Ridding MC, Huckabee ML.
Author information

Abstract

BACKGROUND:

Neuromuscular electrical stimulation (NMES) of the muscles underlying the pharynx and faucial pillars affects the excitability of corticobulbar projections in a frequency- and duration-specific manner. The anterior hyomandibular (submental) muscles are primary targets for the clinical application of NMES to improve disordered swallowing, but the optimal NMES parameters for this application are unknown.

OBJECTIVE:

To determine the influence of NMES parameters on the excitability of corticobulbar projections to the submental musculature.

METHODS:

Transcranial magnetic stimulation (TMS) was used in event-related protocols, triggered by either volitional contraction of the submental muscles or pharyngeal swallowing, to assess corticobulbar excitability prior to, immediately following, and 30, 60, and 90 minutes post-NMES in 25 healthy volunteers. In the first 2 experiments, 4 stimulus frequencies (5, 20, 40, and 80 Hz) and 3 NMES dosages, manipulated through stimulus train durations or number of repetitions, were evaluated. The optimal excitatory NMES triggered by volitional swallowing (event-related NMES) was then replicated in a new sample and contrasted with non-event-related NMES (either discrete events or continuously for 1 hour).

RESULTS:

It was found that 80Hz NMES increased motor-evoked potential (MEP) amplitude at 30 minutes and 60 minutes poststimulation only after 60 repetitions of 4-s event-related NMES trains. Non-event-related and continuous NMES did not affect MEP amplitudes. No changes in MEP onset latencies were observed.

CONCLUSIONS:

Changes in corticobulbar excitability induced by NMES of the submental muscle group are frequency and dose dependent and only occur after NMES triggered by volitional swallowing. Underlying neural mechanisms are discussed.

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EUR J PHYS REHABIL MED 2015;51:71-8

The value of adding transcutaneous neuromuscular electrical stimulation (VitalStim®) to traditional therapy for post-stroke dysphagia: a randomized controlled trial

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St. Joseph's Hospital and Medical Center
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Lianyungang, China

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Background. **Dysphagia is not uncommon after stroke. Dysphagia may delay the functional recovery and substantially affects the quality of life after stroke, mainly if lest untreated. To detect and treat dysphagia as early as possible is critical for patients' recovery after stroke. Electrical stimulation has been reported as a treatment for pharyngeal dysphagia in recent studies, but the therapeutic effects of neuromuscular electrical stimulation (VitalStim®) therapy lacks convincing supporting evidence, needs further clinical investigation.**
Aim. **To investigate the effects of neuromuscular electrical stimulation (VitalStim®) and traditional swallowing therapy on recovery of swallowing difficulties after stroke.**
Design. **Randomized controlled trial.**
Setting. **University hospital.**
Population. **135 stroke patients who had a diagnosis of dysphagia at the age between 50-80.**
Methods. **135 subjects were randomly divided into three groups: traditional swallowing therapy (N.=45), VitalStim® therapy (N.=45), and VitalStim® therapy plus traditional swallowing therapy (N.=45). The traditional swallowing therapy included basic training and direct food intake training. Electrical stimulation was applied by an occupational therapist, using a modified hand-held battery-powered electrical stimulator (VitalStim® Dual Channel Unit and electrodes, Chattanooga Group, Hixson, TN, USA). Surface electromyography (sEMG), the Standardized Swallowing Assessment (SSA), Videofluoroscopic Swallowing Study (VFSS) and visual analog scale (VAS) were used to assess swallowing function before and 4 weeks after the treatment.**
Results. **The study included 118 subjects with dysphagia, 40 in the traditional swallowing therapy group and VitalStim® therapy group, 38 in the VitalStim and traditional swallowing therapy group. There were significant differences in sEMG value, SSA and VFSS scores in each group after the treatment ($P<0.001$). After 4-week treatment, sEMG value (917.1±91.2), SSA value (21.8±3.5), oral transit time (0.4±0.1) and pharyngeal transit time (0.8±0.1) were significantly improved in the VitalStim® and traditional swallowing therapy group than the other two groups ($P<0.001$).**
Conclusion. **Data suggest that VitalStim® therapy coupled with taditional swallowing therapy may be beneficial for post-stroke dysphagia.**
Clinical Rehabilitation Impact. **VitalStim® therapy coupled with taditional swallowing therapy can improve functional recovery for post-stroke dysphagia.**

KEY WORDS: Deglutition disorders - Electric stimulation - Deglutition - Stroke.

Corresponding author: L. Li, MD, PhD, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center 350W, Thomas Road, 85013 Phoenix, AZ, USA. E-mail: lilejjun999@hotmail.com

Dysphagia occurs in 45–65% of patients after acute stroke,[1, 2] it is the most significant risk factor for the development of pneumonia. Pneumonia accounts for approximately 34% of all stroke-related deaths and is the third-highest cause of death during the first month after stroke, although not all these pneumonias are caused by aspiration of food fol-

J Oral Rehabil. 2013 Jun;40(6):472-80. doi: 10.1111/joor.12057. Epub 2013 Apr 23.

Transcutaneous neuromuscular electrical stimulation can improve swallowing function in patients with dysphagia caused by non-stroke diseases: a meta-analysis.

Tan C[1], Liu Y, Li W, Liu J, Chen L.
Author information

Abstract

There is still debate over whether the effect of transcutaneous neuromuscular electrical stimulation (NMES) in dysphagia rehabilitation is superior to traditional therapy (TT). The purpose of this meta-analysis was to assess the overall efficacy by comparing the two treatment protocols. Published medical studies in the English language were obtained by comprehensive searches of the Medline, Cochrane and EMBASE databases from January 1966 to December 2011. Studies that compared the efficacy of treatment and clinical outcomes of NMES versus TT in dysphagia rehabilitation were assessed. Two reviewers independently performed data extraction. Data assessing swallowing function improvement were extracted as scores on the Swallowing Function Scale as the change from baseline (change scores). Seven studies were eligible for inclusion, including 291 patients, 175 of whom received NMES and 116 of whom received TT. Of the seven studies, there were two randomised controlled trials, one multicentre randomised controlled trial and four clinical controlled trials. The change scores on the Swallowing Function Scale of patients with dysphagia treated with NMES were significantly higher compared with patients treated with TT [standardised mean difference (SMD) = 0·77, 95% confidence interval (CI): 0·13 to 1·41, P = 0·02]. However, subgroup analysis according to aetiology showed that there were no differences between NMES and TT in dysphagia post-stroke (SMD = 0·78, 95% CI: -0·22 to 1·78, P = 0·13, 4 studies, 175 patients). No studies reported complications of NMES. NMES is more effective for treatment of adult dysphagia patients of variable aetiologies than TT. However, in patients with dysphagia post-stroke, the effectiveness was comparable.

Aplicação e efeitos da eletroestimulação neuromuscular na reabilitação da disfagia orofaríngea: revisão de literatura

Application and effects of neuromuscular electrical stimulation in the rehabilitation of oropharyngeal dysphagia: a literature review

Thalyta Georgia Vieira Borges[1], Graziela Muzzo de Oliveira[1], Fernanda Cristina de Oliveira Rocha[1], Carla Rocha Muniz[1], Mariana Pinheiro Brendim[2], Yonatta Salarini Vieira Carvalho[2], Charles Henrique Dias Marques[2]

RESUMO

Objetivo: Analisar os diferentes métodos de Eletroestimulação Neuromuscular (EENM) na intervenção das disfagias orofaríngeas. **Metódos:** Revisão através dos descritores: "transtornos de deglutição" e "estimulação elétrica" nas bases PubMed, BVS, SciELO e MedLine, de 1997 a 2015. Classificados segundo Sistema Integrado CAPES (SiCAPES), Escala PEDro e Jadad. **Resultados:** 165 artigos encontrados. 25 selecionados de acordo com o tema proposto. Entre 2009-2012 (60%, n = 15) ocorreu maior número de publicações. Caso Controle foi o tipo de estudo mais relatado (28%, n = 7). A maioria investigou indivíduos pós acidente vascular cerebral (44%, n = 11). O tipo de terapia mais recorrente considera EENM em repouso e terapia tradicional (TT) (28%, n = 8), EENM durante a deglutição e TT (28%, n = 7) e EENM em repouso (24%, n = 3). Vital Stim® foi o aparelho de eletroestimulação mais citado (32%, n = 8). A eletroestimulação transcutânea foi a mais relatada (76%, n = 19). Quanto à localização, destacam-se eletrodos fixados na região do pescoço (48%, n = 12) e submentual (44%, n =11). Correntes mais utilizadas: FES (40%, n = 10) e TENS (24%, n = 6). Videofluoroscopia é o método de avaliação predominante (52%, n = 13). Pela distribuição SiCAPES o maior número de materiais classificam-se em B2 (36%, n = 9) e A1 (16%, n=4). Na Escala PEDro os trabalhos pontuaram, principalmente, em 11 (24%, n = 6) e 10 (16%, n = 4). Considerando a Escala Jadad, (24%, n = 6) estudos obtiveram 3 pontos. **Conclusão:** Observou-se maior prevalência de efeito terapêutico na elevação do complexo hiolaríngeo, importante mecanismo de defesa das vias respiratórias durante a deglutição, utilização da corrente FES, e eletrodos posicionados na região submentual ou de pescoço. Novas pesquisas são necessárias, com grupos etiológicos definidos, para comprovação do efeito terapêutico a médio e longo prazo.

Palavras-chave: Terapia por Estimulação Elétrica, Transtornos de Deglutição, Reabilitação

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The Journal of Physical Therapy Science

Case Study

Effects of electrical stimulation combined with dysphagia therapy in elderly individual with oropharyngeal dysphagia: a case study

Doo-Ho Lee[1)], Ji-Su Park[1)], Seung-Woong Lee[2)], Jong-Bae Choi[3)*]

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Abstract. [Purpose] The purpose of the present study was to investigate the effects of dysphagia therapy in an old man with difficulty swallowing in the oral and pharyngeal phases. [Subjects and Methods] The subject was a 72-year-old man with no history of neurological disorders. He was admitted to local hospital because of the complaint of swallowing difficulty. The interventions performed were electrical stimulation and conventional dysphagia therapy. We assessed the tongue and lip muscle strengths. Swallowing function was evaluated by using the videofluoroscopic dysphagia and penetration-aspiration scales. [Results] After the intervention, the tongue and lip muscle strengths increased from 35 to 39 kPa and from 18 to 23 kPa, respectively. Moreover, the oral and pharyngeal phases of the videofluoroscopic dysphagia scale were improved. Furthermore, aspiration decreased from 4 to 2 points in the penetration-aspiration scale. [Conclusion] Our results suggest that electrical stimulation and conventional dysphagia therapy were effective in improving the swallowing function in an elderly individual with dysphagia.

Key words: Aging, Electrical stimulation, Presbyphagia

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J Oral Rehabil. 2018 Jun;45(6):436-441. doi: 10.1111/joor.12625. Epub 2018 Mar 30.

Transcutaneous electrical stimulation on the anterior neck region: The impact of pulse duration and frequency on maximum amplitude tolerance and perceived discomfort.

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Author information

Abstract

Maximum amplitude tolerance (MAT) has been known as a primary factor determining the depth of electrical current penetration. However, the effect of varying transcutaneous electrical stimulation (TES) parameters on MAT and discomfort level is poorly understood. Furthermore, limited information exists regarding the biopsychological factors that may impact MAT and discomfort. The primary aims of this study were to compare the effects TES protocol with varying levels of pulse duration (300 μs vs. 700 μs) and frequency (30 Hz vs. 80 Hz) on the MAT and discomfort in healthy older adults. The exploratory aim of this study was to examine relationships between submental adipose tissue thickness, pain sensitivity and gender with MAT and discomfort. Twenty-four healthy older adults participated in this study. Transcutaneous electrical stimulation was delivered to the submental region. Maximum amplitude tolerance and discomfort were measured for each condition. Furthermore, submental adipose tissue thickness and pain sensitivity were measured for each subject. Maximum amplitude tolerance was significantly increased for the TES protocols with short-pulse duration [$F(3, 69) = 38.695$, $P < .0001$]. Discomfort was similar across different TES protocols. Submental adipose tissue thickness ($r = .30$, $P < .003$) and pain sensitivity ($r = -.43$, $P < .0001$) were related to MAT. Pain sensitivity rating was also related to discomfort ($r = .45$, $P < .0001$). In conclusion, using TES protocols with short-pulse duration may increase the MAT. Higher amplitude stimulation may increase the impact on deep swallowing muscles. In addition, submental adipose tissue thickness and pain sensitivity are potential biopsychological factors that may affect MAT and discomfort.

KEYWORDS:

ageing; deglutition; deglutition disorders; electric stimulation therapy; neck muscles; rehabilitation

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ORIGINAL ARTICLE

Effects of Neuromuscular Electrical Stimulation on Swallowing Functions in Children with Cerebral Palsy: A Pilot Randomised Controlled Trial

CrossMark

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Available online 1 September 2015

KEYWORDS
cerebral palsy;
dysphagia;
electrical stimulation;
oral sensory stimulation

Summary *Objective/Background:* Oral-motor and sensory dysfunctions are primary reasons for difficulties with swallowing in children with cerebral palsy (CP). Neuromuscular electrical stimulation (NMES) has been shown to provide positive effects on the swallowing function in adult populations with various neurological disorders. However, there is a lack of studies regarding the effects of NMES in children with dysphagia. The aim of the present study was to investigate the effects of NMES and oral sensorimotor treatment (OST) by occupational therapists in children with CP and dysphagia.
Methods: The present study was a two-group experimental design. Participants were randomly assigned to either the experimental group ($n = 10$) or the control group ($n = 10$). The NMES group received both NMES and OST, with NMES on the pharyngeal level for 20 minutes after OST, while the control group received OST and sham–NMES only. The treatment sessions occurred twice a week for 8 weeks.
Results: The experimental group demonstrated a significant improvement in: lip closure while swallowing, ability to swallow food without excess loss, ability to sip liquid, ability to swallow liquid without excess loss, and ability to swallow without cough ($p < .05$).
Conclusion: This study demonstrated that OST and NMES facilitated swallowing functions than OST and sham–NMES in children with CP and dysphagia. Future studies need to utilise

Structural organization of the orbicular muscle of the mouth in children with a congenital cleft of the upper lip undergoing electrostimulation

(PMID:3502241)

Abstract

Citations

Related Articles

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Arkhiv Anatomii, Gistologii i Embriologii [1987, 93(11):81-87]

Type: Journal Article, Comparative Study, English Abstract (lang: rus)

Abstract

Highlight Terms

Gene Ontology(1) Diseases(1)

At light optic and electron microscopical levels with application of morphometric analysis the mouth orbicular muscle has been studied in 6-8-month-old children with a complete unilateral cleft lip. The muscle is characterized by distinctly manifested signs of hypertrophy: high contents of the connective tissue, poor capillarization, presence of focal destructive-degenerative changes in the muscle fibers; they result from decreased function of the muscle activity. Preoperative physiotherapeutic treatment with pulsed low-frequency electrical current stimulates development of the muscle tissue. In the muscle specific share of muscle fibers increases, and contents of the connective tissue decreases, respectively, indices of capillarization improve, mitochondrial apparatus of the muscle fibers becomes more powerful.

Monaco et al. BMC Musculoskeletal Disorders 2013, 14:168
http://www.biomedcentral.com/1471-2474/14/168

BMC Musculoskeletal Disorders

RESEARCH ARTICLE **Open Access**

Comparison between sensory and motor transcutaneous electrical nervous stimulation on electromyographic and kinesiographic activity of patients with temporomandibular disorder: a controlled clinical trial

Annalisa Monaco*, Fabrizio Sgolastra, Davide Pietropaoli, Mario Giannoni and Ruggero Cattaneo

Abstract

Background: The purpose of the present controlled clinical trial was to assess the effect of a single 60 min application of transcutaneous electrical nervous stimulation (TENS) at sensory stimulation threshold (STS), compared to the application of motor stimulation threshold (MTS) as well as to untreatment, on the surface electromyographic (sEMG) and kinesiographic activity of patients with tempormanbibular disorder (TMD).

Methods: Sixty female subjects, selected according to the inclusion/exclusion criteria, suffering from unilateral TMD in remission were assigned to MTS, STS or untreatment. Pre- and post-treatment differences in the sEMG activity of temporalis anterior (TA), masseter (MM), digastric (DA) and sternocleidomastoid muscles (SCM), as well in the interocclusal distance (ID), within group were tested using the Wilcoxon test, while differences among groups were assessed by Kruskal-Wallis test; the level of significance was set at $p \leq 0.05$.

Results: Significant pre- and post-treatment differences were observed in MTS and STS groups, for TA and MM of both sides; no significant difference was detected between MTS and STS groups. Kinesiographic results showed that the vertical component of ID was significantly increased after TENS in MTS and STS groups.

Conclusions: STS TENS could be effective, as well as MTS, in reduce the sEMG activity of masticatory muscles and to improve the ID of TMD patients in remission. Future studies are needed to confirm the results of the present study. Clinical relevance. The present study demonstrates that the application of TENS is effective in reduce the sEMG activity, as well as in increasing the ID of patients with TMD; our study did not support superior effectiveness of MTS or STS.

Trial registration: ClinicalTrials.gov: NCT01832207

Keywords: Surface electromyography, Kinesiography, Temporomandibular disorder, Transcutaneous electrical nervous stimulation

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(onlinelibrary.wiley.com) DOI: 10.1111/j.1525-1403.2011.00331.x

Hyoid Bone and Larynx Movements During Electrical Stimulation of Motor Points in Laryngeal Elevation Muscles: A Preliminary Study

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Objectives: This study aimed to determine the laryngeal elevation muscle motor points, evaluate the movement of hyoid bone and larynx during stimulation of the motor points, and examine the potential for treating severe dysphagia by functional electrical stimulation.

Methods: The motor points of the laryngeal elevation muscles were anatomically determined from four cadavers. Those motor points in two healthy subjects and one lateral medullary syndrome patient were electrically stimulated by surface or implanted electrodes.

Results: The movements elicited by electrical stimulation of the motor points were greater in implanted than in surface electrodes. Elevation of the hyoid bone and the larynx in a lateral medullary syndrome patient were achieved with the implanted electrodes, but the upper esophageal sphincter opening was not obtained unless an additional cricopharyngeus muscle block was provided.

Conclusion: The hyoid bone and larynx were elevated by electrically stimulating the motor points of the laryngeal elevation muscles.

Keywords: Dysphagia, functional electrical stimulation, hyoid bone, larynx, motor point

Conflict of Interest: The authors reported no conflicts of interest.

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EFEITOS DA ELETROTERAPIA NA PARALISIA FACIAL DE BELL: REVISÃO DE LITERATURA

RESUMO

A Paralisia Facial Periférica é uma lesão do neurônio motor inferior, que consiste no acometimento do nervo facial em todo o seu trajeto ou parte dele, sendo que a Paralisia de Bell (PB) é a sua forma mais comum e de etiologia desconhecida. A eletroterapia tem como objetivo a regeneração neural e redução da atrofia muscular. Contudo, há controvérsias sobre os benefícios da sua utilização e o surgimento de sincinesias. O objetivo deste estudo foi revisar e descrever o uso da eletroterapia e seus efeitos no tratamento da PB. As correntes de baixa e média freqüência foram eleitas para o tratamento, contudo ainda não há consenso entre os pesquisadores sobre o tempo de aplicação da terapia, a contra-indicação da eletroestimulação e o aparecimento de sincinesias faciais. A corrente galvânica também foi utilizada na reabilitação. Preconizou-se o uso da eletroterapia nas primeiras semanas da PB.

Palavras-Chave: paralisia facial; terapia por estimulação elétrica; paralisa de Bell; reabilitação.

Estimulação elétrica nervosa transcutânea em mulheres disfônicas********

Transcutaneous electrical nerve stimulation in dysphonic women

Rinaldo Roberto de Jesus Guirro*
Delaine Rodrigues Bigaton**
Kelly Cristina Alves Silvério ***
Kelly Cristina dos Santos Berni****
Giovanna Distéfano*****
Fernanda Lopes dos Santos******
Fabiana Forti*******

Abstract
Background: studies indicate correlation between dysphonia and muscle tension. Aim: to evaluate bilaterally the electrical activity of the suprahyoid muscles (SH), sternocleidomastoid (SCM), and trapezius (T), the presence of pain and the voice, after applying transcutaneous electrical nerve stimulation (TENS). Method: ten (10) women with nodules or bilateral mucus thickening, and phonation fissure. Volunteers were submitted to 10 TENS sessions (200µs and 10Hz) for 30 minutes. Pain was evaluated using an analogical visual scale; the voice was evaluated through laryngoscopy and through a perceptive-auditory and acoustic analysis; and the myoelectric signal was converted using the Root Media Square (RMS). Voice and EMG data gathering was performed during the production of the E/vowel and during spontaneous speech (SS). Statistical analysis: Shapiro-Wilk Test followed by the Wilcoxon Test, or t Student, or Friedman Test ($p < 0.05$). Results: It was observed that the TENS decreased the RMS readings, pre and pos treatment, for the Right T (RT) (2.80 ± 1.36 to 1.77 ± 0.93), the Left T (LT) (3.62 ± 2.10 to 2.10 ± 1.06), the Left SCM (LSCM) (2.64 ± 0.69 to 1.94 ± 0.95), and the SH (11.59 ± 7.72 to 7.82 ± 5.95) during the production of the E/vowel; and for the RT (3.56 ± 2.77 to 1.93 ± 1.13), the LT (4.68 ± 2.56 to 3.09 ± 2.31), the Right SCM (RSCM) (3.94 ± 2.04 to 2.51 ± 1.87), and the LSCM (3.54 ± 1.04 to 3.12 ± 3.00) during SS. A relieve in pain was also observed. Regarding the voice analysis, there was a decrease in level of laryngeal injuries; no difference was observed during the production of the E/vowel in the perceptive-auditory analysis; there was a decrease in the level of dysphonia and hoarseness during SS. Conclusion: TENS is effective in improving the clinical and functional signs of dysphonic women.
Key Words: TENS; Analgesia; Voice Disorders; Electromyography.

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JOURNAL OF APPLIED ORAL SCIENCE

J Appl Oral Sci. *2006;14(2):130-5*

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TENS AND LOW-LEVEL LASER THERAPY IN THE MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS

APLICAÇÃO DE TENS E LASER DE BAIXA FREQÜÊNCIA NO TRATAMENTO DAS DISFUNÇÕES TEMPOROMANDIBULARES

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ABSTRACT

Pain relief and reestablishment of normal jaw function are the main goals of conservative management of Temporomandibular Disorders (TMD). Transcutaneous electrical nerve stimulation (TENS) and laser therapy are part of these modalities, although little is known about their real efficacy in controlled studies. This research compared these two treatments in a sample of 18 patients with chronic TMD of muscular origin, divided into two groups (LASER and TENS). Treatment consisted of ten sessions, in a period of 30 days. Active range of motion (AROM), visual analogue scale (VAS) of pain and muscle (masseter and anterior temporalis) palpation were used for follow-up analysis. Data were analyzed by Friedman test and ANOVA for repeated measurements. Results showed decrease in pain and increase in AROM for both groups ($p<0.05$), and improvement in muscle tenderness for the LASER group. Authors concluded that both therapies are effective as part of TMD management and a cumulative effect may be responsible for the improvement. Caution is suggested when analyzing these results because of the self-limiting feature of musculoskeletal conditions like TMD.

Uniterms: Temporomandibular joint disorders; Physical therapy.

PLOS | ONE

RESEARCH ARTICLE

Effects of Neuromuscular Electrical Stimulation on the Masticatory Muscles and Physiologic Sleep Variables in Adults with Cerebral Palsy: A Novel Therapeutic Approach

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Data Availability Statement: Data are from the "Effects of neuromuscular electrical stimulation on the masticatory muscles and physiologic sleep variables in adults with cerebral palsy: a novel therapy approach" study whose authors may be contacted at odontogiannasi@uol.com.br

Abstract

Cerebral palsy (CP) is a term employed to define a group of non-progressive neuromotor disorders caused by damage to the immature or developing brain, with consequent limitations regarding movement and posture. CP may impair orapharygeal muscle tone, leading to a compromised chewing function and to sleep disorders (such as obstructive sleep apnea). Thirteen adults with CP underwent bilateral masseter and temporalis neuromuscular electrical stimulation (NMES) therapy. The effects on the masticatory muscles and sleep variables were evaluated using electromyography (EMG) and polysomnography (PSG), respectively, prior and after 2 months of NMES. EMG consisted of 3 tests in different positions: rest, mouth opening and maximum clenching effort (MCE). EMG values in the rest position were 100% higher than values recorded prior to therapy for all muscles analyzed ($p < 0.05$); mean mouth opening increased from 38.0 ± 8.0 to 44.0 ± 10.0 cm ($p = 0.03$). A significant difference in MCE was found only for the right masseter. PSG revealed an improved in the AHI from 7.2±7.0/h to 2.3±1.5/h ($p < 0.05$); total sleep time improved from 185 min to 250 min ($p = 0.04$) and minimun SaO2 improved from 83.6 ± 3.0 to 86.4 ± 4.0 ($p = 0.04$). NMES performed over a two-month period led to improvements in the electrical activity of the masticatory muscles at rest, mouth opening, isometric contraction and sleep variables, including the elimination of obstructive sleep apnea events in patients with CP.

- **"Em conjunto com a terapia miofuncional comprovamos melhores resultados na função de deglutição"**

  (Crary, Carnaby-Mann e Faunce, 2007)

- **"Utilizada a EE em função verificamos melhorias."**

  (Guimarães, 2013)

- **"Utilizada a EE simultâneamente com a estimulação térmica/táctil (ETT) é mais eficaz na melhora da deglutição e diminui o grau de gravidade da aspiração laríngea, do que quando só se utiliza a ETT."**

  (Lim, Lee, Lim & Choi, 2009)

A EET NÃO EXCLUIE O TRABALHO DO TF… APESAR DE QUE O APARELHO SEJA MAIS RÁPIDO QUE QUALQUER OUTRO ESTÍMULO NO PONTO MOTOR - NÃO TRABALHA A FUNCIONALIDADE DO MÚSCULO - IMPORTANTE PARA A REABILITAÇÃO

EE em Portugal....

2560 *Diário da República, 1.ª série — N.º 80 — 24 de abril de 2013*

Código	Designação	Preço (euros)	Pond.
61140	Reabilitação cardíaca (grupo 6)	18,90	3,6
61151	Reabilitação de incontinência esfincteriana, por biofeedback, com EMG	16,50	3,2
61152	Reabilitação de incontinência esfincteriana, por biofeedback, com manometria	16,50	3,2
61153	Reabilitação de incontinência esfincteriana, por biofeedback, domiciliária (faturação mensal), com EMG	108,00	20,7
61154	Reabilitação de incontinência esfincteriana, por biofeedback, domiciliária (faturação mensal), com manometria	108,00	20,7
61145	Reabilitação de incontinência esfincteriana, por estimulação elétrica	20,70	4,0
61144	Reabilitação de incontinência esfincteriana, por estimulação elétrica, domiciliária (faturação mensal)	60,90	11,7
61149	Reeducação dinâmica do pavimento pélvico	11,10	2,1
61027	Treino de algaliação intermitente	36,60	7,0
61029	Treino de familiares / cuidadores	9,00	1,7
	Terapia da Fala		
61061	Terapia da fala	7,80	1,5
61190	Reeducação da linguagem	7,80	1,5
61191	Reeducação da articulação verbal	7,80	1,5
61192	Reeducação da fonação	7,80	1,5
61193	Reeducação da deglutição	7,80	1,5
61194	Reeducação da deglutição por estimulação elétrica	8,80	1,7
61195	Treino da sucção	7,80	1,5
61196	Treino de sistemas alternativos de comunicação — simples	7,80	1,5
61197	Treino de sistemas alternativos de comunicação — complexos	15,60	3,0
61062	Qualquer dos códigos de terapia da fala quando em grupo	4,20	0,8
	Terapia Ocupacional		

Conduta face à utilização da EE...

- Mais estudos científicos: metodologia bem definida.
- Conhecimento profundo dos distintos protocolos e meios de avaliação (Inicial e Reavaliação – Importante medir!)
- Conhecimento de abordagens, métodos, metodologias de intervenção, e possibilidades e importância da utilização de técnicas combinadas.
- Raciocínio clínico + trabalho em equipa antes e durante a aplicação desta técnica – MUITO IMPORTANTE
- Formação continua – IMPORTANTE!

Ter muitas “ferramentas” não é sinónimo de melhor intervenção...

Casos práticos

Raciocínio Clínico

Casos práticos - vossos

- Raciocínio clínico

MUITO OBRIGADA!

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