Repenser la réhabilitation : Contrôle moteur de la déglutition ou force musculaire?

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Rethinking Rehabilitation : Swallowing motor control or muscle strength?

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Déclaration d'intérêt

- ML Huckabee est employée par l'Université de Canterbury, créatrice et propriétaire du BiSSkiT, logiciel dont il est question dans cette présentation.

Disclosures

- ML Huckabee is employed by the University of Canterbury, who is the owner and manufacturer of the BiSSkiT software that will be discussed.

Caractéristiques communes aux exercices de déglutition…

- Augmenter la force
- Ces exercices visent à générer une déglutition plus **sûre** et **efficiente** en **renforçant** les muscles impliqués dans la déglutition (Burkhead et al., 2007).
- Besoin de **renforcer** ce qui est **faible**. Mais… la faiblesse est-elle toujours en cause ?

Common feature in current swallowing exercise is…

- Increasing strength
- These exercises are focused on generating a **safer** and a more **efficient** swallow by **strengthening** muscles that contribute to swallowing through exercise (Burkhead et al., 2007).
- We usually need to **strengthen** something if it is **weak**. But… is weakness always the case?

Le biais sur le renforcement qui nous affaiblit

- L'accent mis sur le renforcement musculaire est fondé sur
  - Notre vision de la déglutition comme réflexe
  - Les limites de nos techniques instrumentales
    - Biomécanique *vs* physiologie

Our Weakening Bias on Strengthening

- Emphasis on muscle strengthening driven by
  - Our conceptualization of swallowing as a reflex
  - Limitations of our instrumental techniques
    - Biomechanics vs physiology

Effets indésirables de l'entraînement de la force

- Effets indésirables possibles
  - Fatigue (Moldover & Borg-Stein, 1994),
  - Augmentation du tonus musculaire (Clark, 2003),
  - Désentraînement (Clark et al., 2009: Baker, Davenport & Sapiena, 2005)
- Liste d'effets indésirables sur la déglutition (Garcia, Hakel & Lazarus, 2004; Bülow and colleagues, 2001; Huckabee, 2011, Huckabee & Lamvik, 2014)

Adverse effects of strength training

- Potential adverse effects of strength training –
  - Fatigue (Moldover & Borg-Stein, 1994),
  - Increase muscle tone (Clark, 2003),
  - Detraining (Clark et al., 2009: Baker, Davenport & Sapiena, 2005)
- Specific suggestions for adverse effects on swallowing (Garcia, Hakel & Lazarus, 2004; Bülow and colleagues, 2001; Huckabee, 2011, Huckabee & Lamvik, 2014)

Étiologies des troubles biomécaniques

- Troubles de type
  - Hyperfonction (spasticité)
  - Hypofonction (flaccidité)
  - Contrôle moteur (ataxie)
  - Planification motrice (apraxie)
- Nature du trouble fonction de la localisation de la lésion
- Diagnostic fondé sur une constellation de symptômes, de caractéristiques comportementales et de tests diagnostiques

Aetiologies of Biomechanical Impairment

- Impairments of
  - Hyperfunction (Spasticity)
  - Hypofunction (Flaccidity)
  - Motor control (Ataxia)
  - Motor planning (Apraxia)
- Nature of impairment dependent on site of lesion
- Diagnosis based on constellation of symptoms, behavioural characteristics and diagnostic tests.

Dysarthrie : Darley, Aaronson, Brown

- Dysarthrie flasque / paralytique
- Dysarthrie spastique
- Dysarthrie ataxique
- Apraxie de la parole
- Dysarthrie hypokinétique
- Dysarthrie hyperkinétique
- Dysarthrie mixte

Diagnostic posé en fonction de la localisation de la lésion et des propriétés perceptives / acoustiques.

Dysarthria: Darley, Aaronson, Brown

- Flaccid Dysarthria
- Spastic Dysarthria
- Ataxic Dysarthria
- Apraxia of Speech
- Hypokinetic Dysarthria
- Hyperkinetic Dysarthria
- Mixed

Diagnosis made on basis of site of lesion and acoustic/perceptual characteristics.

Dysphagie

- Dysphagie flasque ?
- Dysphagie spastique ?
- Dysphagie ataxique ?
- Apraxie de la déglutition ?

Non… Seulement dysphagie !

Manque de spécificité

Dysphagia

- Flaccid Dysphagia?
- Spastic dysphagia?
- Ataxia Dysphagia?
- Apraxia of Swallowing?

Nah….mostly just dysphagia!

Lack of specificity

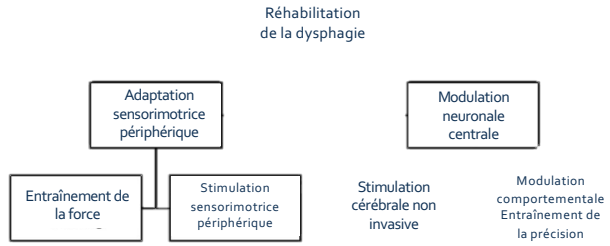
Le tournant…

- Apparition de nombreuses études démontrant le rôle du cortex dans la modulation de la réponse pharyngée
  - Études IRMf
  - Études TMS *(stimulation transcrânienne magnétique)*

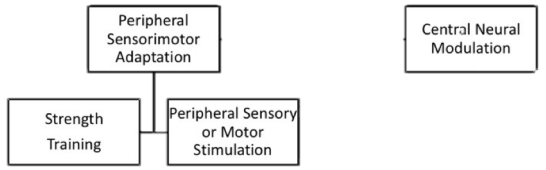
The shift up…

- Emergence of a large corpus of research supporting the role of the cortex in modulating the pharyngeal response
  - fMRI studies
  - TMS studies

Arbre décisionnel pour la rééducation de la déglutition



Framework for Dysphagia Rehabilitation



Le futur frappe à notre porte…

- Techniques de neuromodulation
  - Stimuler les structures nerveuses centrales pour améliorer la périphérie
    - (NMES) *(stimulation électrique neuromusculaire)*
    - rTMS *(stimulation transcrânienne magnétique répétitive)*
    - tDCS *(stimulation transcrânienne directe à courant continu)*
  - De nombreuses polémiques en prévision…

The future is at the threshold…

- Neuromodulatory techniques
  - Stimulate central structures with end result of improvement at periphery
    - (NMES)
    - rTMS
    - TDCS
  - Potential for even more controversy

Repenser la réhabilitation…

- NIBS *(stimulation cérébrale non invasive)* modification au niveau cérébral -> modification de la déglutition
  - Léger manque de spécificité
- Réhabilitation comportementale ?
  - Modification de la déglutition -> modification au niveau cérébral

Rethink rehab…

- NIBS change brain first -> change swallowing as an outcome
  - Lacks some degree of specificity
- ?Behavioural rehab
  - Change swallowing first -> change in brain

Deb… Mon point de basculement

- Autour de 40 ans, commence à sentir des changements subtils sur le plan neurologique : dysphagie, dysphonie, perturbations visuelles, troubles de la marche
  - 7 ans plus tard : méningiome du foramen magnum révélé par l'IRM
  - Exérèse chirurgicale
    - hémorragie per-opératoire
  - Suites post-opératoires compliquées

Deb…my tipping point

- Early 40's began experiencing subtle neuro changes: dysphagia, dysphonia, visual disturbance, gait disturbance.
  - 7 years later: MRI revealed foramen magnum meningioma
  - Resected surgically
    - intra-operative hemorrhage
  - Post-op very difficult course

Deb

- Approche thérapeutique
  - Comment faire une déglutition d'effort quand on ne peut pas avaler ?
  - Rééducation à l'aide de sEMG *(électromyographie de surface)*
    - « Essayez de faire bouger cette ligne comme moi »
    - « Essayez de vous rappeler comment ça fait d'avaler »
  - Ingestion et expectoration d'aliments en guise de stimulation sensorielle
  - Progressivement parvient à faire des déglutitions type déglutition d'effort

Deb

- Treatment approach
  - How do you do effortful swallow when you don't swallow?
  - sEMG guided rehabilitation
    - 'make the line move like mine'
    - 'try to remember what it was like to swallow'
  - Ingestion and expectoration of food for sensory stim
  - Move to effortful-type swallowing

Résultat clinique…

- Retour à un régime alimentaire oral exclusif dans les 6 mois
  - Va bien, 26 ans après son traitement
  - Pas de pneumopathie
  - Prise de poids significative

Clinical outcome…

- Return to full oral diet within 6 months
  - Continuing to do very well, now 26 yrs post treatment
  - No pneumonia
  - Significant weight gain

Que s'est-il passé ?

- Entraînement de la force ?
  - L'avons-nous fortifiée ?
- A-t-elle acquis une nouvelle « précision » générée par le cortex ?
  - Encéphalisation de la déglutition ?
  - Utilisation des régions corticales de programmation motrice pour le contrôle moteur pharyngé
- Ou augmentation de la modulation corticale de la réponse du tronc cérébral ?

What happened…

- Strength training?
  - Did we make her stronger?
- Did she acquire a new cortically generated 'skill'?
  - Encephalisation of swallowing?
  - Using cortical motor programming regions for pharyngeal motor control
- Or increase cortical modulation of brainstem response?

Donc…

- Plasticité neuronale : capacité qu'a le cerveau à se modifier (Cohen et al., 1998).
  - Il est important d'exploiter le pouvoir de la plasticité neuronale pour optimiser les résultats et les modifications fonctionnelles
- L'entraînement de la précision *(skill training)* induit des modifications au niveau neuronal
- Hypothèse : l'entraînement de la précision en tant qu'approche rééducative permettrait d'adapter les entrées neuronales de façon à modifier la biomécanique de la déglutition

So…

- Neural plasticity describes the ability of the brain to change (Cohen et al., 1998).
  - Important to harness the power of neural plasticity to maximize outcomes and functional change.
- Skill training results in neural change
- So the presumption is that skill training as a rehabilitative approach is focused on adapting neural input for modification of biomechanical swallowing

Biofeedback par sEMG

- Électrodes de surface pour mesurer l'activité électrique des muscles
- Permet de contrôler un groupe de muscles impliqués dans le processus de déglutition et de quantifier les caractéristiques d'amplitude et de durée de la contraction musculaire

SEMG Biofeedback

- Surface electrodes are used to measure electrical activity of muscles
- Allows monitoring of one collective group of muscles involved in the swallowing process and quantification of the magnitude and temporal characteristics of muscle contraction

Applications du biofeedback par sEMG

- Utilisé pendant des années pour l'entraînement de la force musculaire… Deb
- Huckabee & Cannito 1999:
  - 10 patients avec traumatisme crânien
  - Durée moyenne après la survenue 22 mois
  - 8/10 ont repris un régime alimentaire oral exclusif à la suite de la rééducation
- Mais peut-on faire mieux ?

sEMG biofeedback applications

- Used for years as means of feedback for muscle strengthening…Deb
- Huckabee & Cannito 1999:
  - 10 patients with brain stem injury
  - Mean time post onset 22 months
  - 8/10 returned to full oral intake following treatment
- But can we do more?

Linda

- Dame de 42 ans avec paralysie cérébrale spastique avec majoration de la dysarthrie / dysphagie
- Intelligibilité de la parole pour les mots simples (par un interlocuteur non familier) : 35% environ
- Cliniquement : déglutition caractérisée par
  - Préparation orale du bolus prolongée et sensation de globus à la déglutition, nécessité de déglutitions multiples pour vidanger les stases pharyngées ressenties ; dysphonie à voix mouillée intermittente

Linda

- 42 year old female with spastic cerebral palsy with increasing speech dysarthria and dysphagia
- Intelligibility of speech at the single word level was approximately 35% to the unknown listener
- Clinically, swallowing characterised by
  - Prolonged oral bolus preparation and a globus sensation on swallowing, with multiple swallows required to clear perceived pharyngeal residual; intermittent wet dysphonia

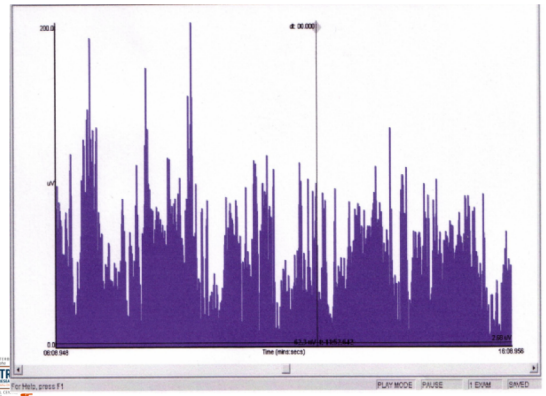
Linda - Rééducation

- Prend part à un programme de rééducation visant à diminuer la spasticité des substrats musculaires
  - Biofeedback par sEMG pour contrôler la musculature sous-mentonnière : Linda doit se concentrer sur le tracé du biofeedback et diminuer progressivement son amplitude

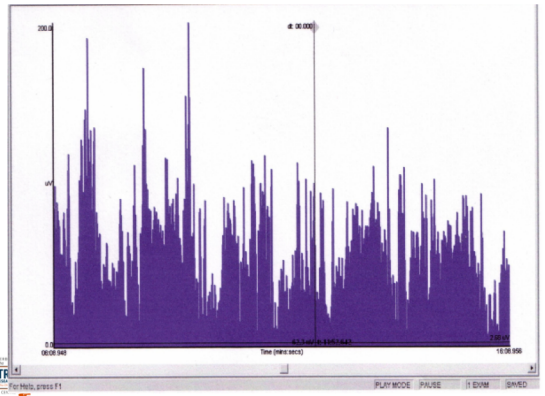
Linda - Rehab

- She was enrolled in a rehabilitation programme with a goal of decreasing underlying spasticity of the muscular substrates
  - Using sEMG biofeedback monitoring of submental musculature, Ms. S was asked to concentrate on the biofeedback tracing and progressively decreased amplitude of that tracing

- Pré-traitement : amplitude moyenne au repos (sans parole ou déglutition) de 52.79 mV, variation de 2.79 mV à > 200 mV



- Pre-treatment: Mean amplitude during quiet rest (without speech or swallowing) at 52.79 mV, ranging 2.79 mV to > 200 mV



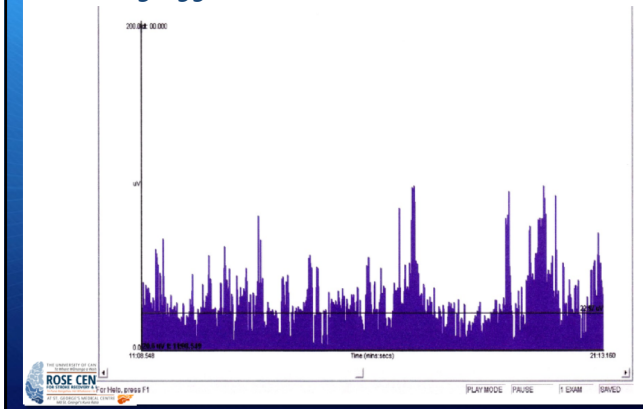
Explication possible

- Wolf (1994) explique que le contrôle par biofeedback est une forme de proprioception alternative dans la population avec troubles neurologiques, ce qui aide le patient à recalibrer ses réseaux sensoriels internes. Ainsi, lorsque l'amplitude du tracé sEMG augmente, le patient se concentre sur la perception de sa tension musculaire et peut modifier son comportement de façon à revenir à des niveaux d'amplitude plus faibles visualisés par le tracé

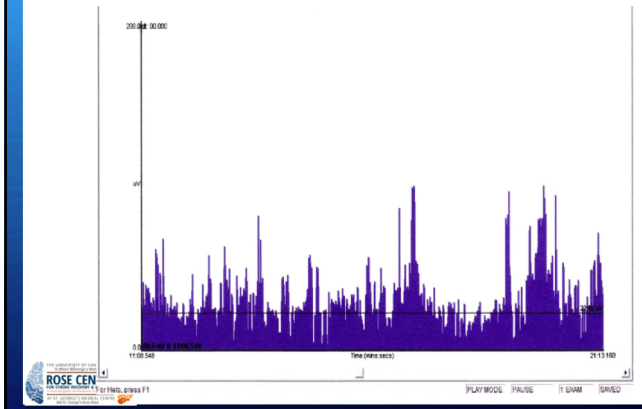
Possible explanation

- Wolf (1994) comments that biofeedback monitoring serves as an alternate form of proprioception in the neurologically impaired population thus allowing the patient to recalibrate their own internal sensory networks. Thus as sEMG amplitude increased, the patient focuses on perception of muscle tension and subsequently alters behaviour to restore a lower amplitude recording

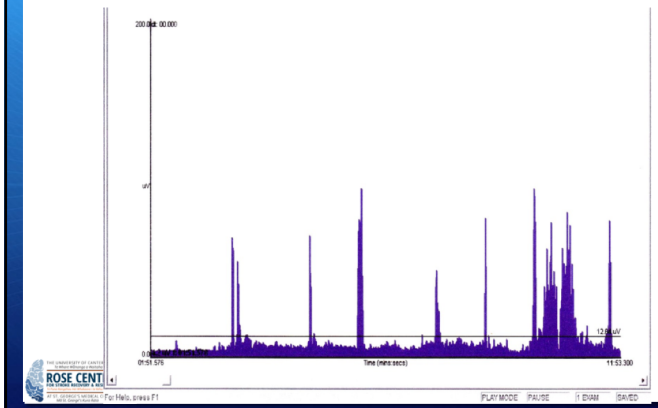
- Après 2 mois de rééducation quotidienne : amplitude moyenne au repos de 28.67 mV, variation de 2.15 à 99.8 mV



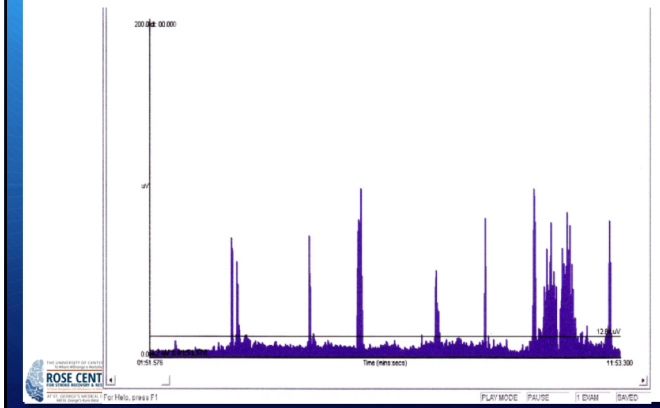
- After 2 weeks of daily tx: mean amplitude at rest, measured at 28.67 mV, range between 2.15 and 99.8 mV



- À la sortie : amplitude moyenne au repos de 9.70 mV, variation de 1.54 à 21.6 mV



- At first discharge: Mean amplitude at rest at 9.70 mV, range from 1.54 to 21.6 mV



Linda

- Au fur et à mesure que le tonus musculaire s'abaisse (traduit par une réduction de l'amplitude mesurée par sEMG), elle décrit une amélioration progressive de la fonction :
  - Intelligibilité finale pour les mots simples (par un interlocuteur non familier) : 87%
  - Déglutition également améliorée avec augmentation de la quantité prise par la bouche et de l'efficience orolinguale, diminution des signes cliniques de la dysphagie pharyngée et meilleur confort et tolérance lors des prises orales

Linda

- As muscle tone decreased, measured by declination in measured sEMG amplitude, she experienced progressively improved function:
  - Final speech intelligibility of single words to an unfamiliar listeners measured at 87%
  - Swallowing also improved with increased rate of oral intake and orolingual efficiency, decreased clinical signs of pharyngeal dysphagia, and increased comfort with and tolerance of oral intake

Au total, cette approche a ciblé le tonus musculaire, mais pas spécifiquement la déglutition

Quoi d'autre ?

So this approach addressed muscle tone, but not swallowing specifically.

What else?

Aux origines du BiSSkiT…

- Patients avec maladie de Parkinson (MP)
- Sentent de manière instinctive que travailler la force du muscle n'est pas pertinent dans leur cas
- Utilisation sEMG pour vérifier et contrôler l'activité motrice non fonctionnelle de pré-déglutition

Where did BiSSkiT come from?

- Patients with Parkinson's disease
- Felt instinctively wrong to work on muscle strengthening
- Used sEMG to monitor and control non-functional, pre-swallow motor activity

BiSSkiT

- Biofeedback in Strength *(force)* and Skill *(précision)* Training
  - Logiciel conçu sur mesure
  - Plateforme matérielle de sEMG
- Évaluation de la force et paradigme d'entraînement
- Évaluation de la précision et paradigme d'entraînement
- Fondé sur les principes de l'apprentissage moteur :
  - Tâche variable mais adaptée à la performance recherchée
  - Feedback immédiat et à distance

BiSSkiT

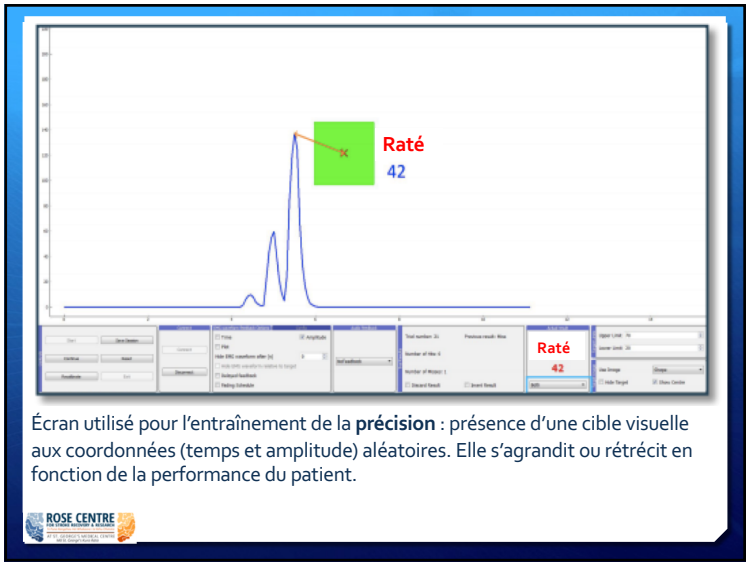
- Biofeedback in Strength and Skill Training
  - Custom designed software
  - sEMG as hardware platform
- Strength assessment and training paradigm
- Skill assessment and training paradigm
- Based on principles of motor learning:
  - Adaptive target performance
  - Immediate and delayed feedback

BiSSkiT: entraînement de la PRÉCISION

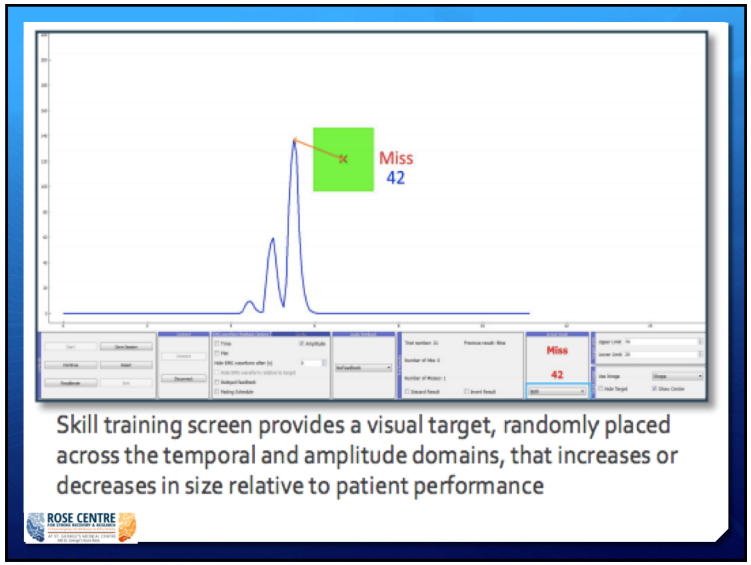
- Objectif : améliorer la précision du mouvement plutôt que la force de contraction
  - S'entraîner à « toucher la cible »
  - Fondé sur les principes de l'apprentissage moteur :
    - Tâche variable mais adaptée à la performance recherchée
    - Feedback immédiat et à distance

BiSSkiT: Skill training

- Goal: Improve the precision of movement rather than strength of contraction
  - 'Target practice'
  - Based on principles of motor learning:
    - Adaptive target performance
    - Immediate and delayed feedback



Écran utilisé pour l'entraînement de la **précision** : présence d'une cible visuelle aux coordonnées (temps et amplitude) aléatoires. Elle s'agrandit ou rétrécit en fonction de la performance du patient.



Skill training screen provides a visual target, randomly placed across the temporal and amplitude domains, that increases or decreases in size relative to patient performance

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ORIGINAL ARTICLE

Skill Training for Swallowing Rehabilitation in Patients With Parkinson's Disease

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Objective: To examine the effects of skill training on swallowing in individuals with dysphagia secondary to Parkinson's disease (PD) and to explore skill retention after treatment termination.
Design: Within-subject pilot study with follow-up after 2 weeks of treatment and after a 2-week nontreatment period.
Setting: Clinic in a research institute.
Participants: Patients (N=10; mean age, 67.4y) included 3 women (mean Hoehn and Yahr score, 2.6) and 7 men (mean Hoehn and Yahr score, 2.4).
Intervention: Patients underwent 10 daily sessions of skill training therapy focused on increasing precision in muscle contraction during swallowing using visual feedback.
Main Outcome Measures: Data from the timed water swallow test, Test of Mastication and Swallowing Solids, surface electromyography (sEMG) of submental muscles, and swallowing-related quality of life questionnaire were collected at 2 baseline sessions (conducted 2wk apart) at the end of treatment and after 2 nontreatment weeks to assess skill retention.

- Ligne de base 1: mesure
- 2 sem sans rééducation
- Ligne de base 2
- 2 semaines avec rééducation
- Résultats 1
- 2 semaines sans rééducation
- Résultats 2

Méthodes

+ Étude pilote : 10 patients avec MP
+ Auto-identifiés ; évaluation clinique
+ 2 lignes de base ; 2 évaluations post traitement
+ 2 semaines de rééducation quotidienne (1 h/j)

Baseline 1: intake

2 weeks no tx

Baseline 2

2 weeks daily tx

Outcome 1

2 weeks no tx

Outcome 2

Methods

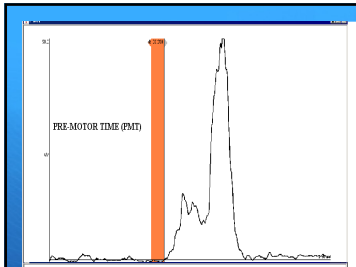
- Pilot study: 10 patients with PD
- Self identified; clinical screen
- 2 baseline evals; 2 post treatment evals
- 2 weeks of daily treatment (1 hr)

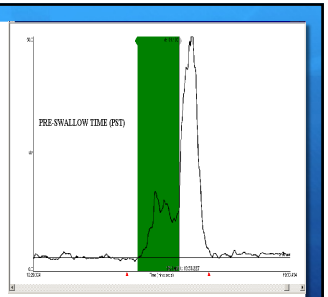
Mesures

- Mesures (lignes de base + résultats) à l'aide des tests suivants :
  - Timed Water Swallow Test (TWST) (Hughes & Wiles, 1996)
  - Test Of Mastication And Swallowing of Solids (TOMASS)
  - Électromyographie de surface (sEMG)
  - Échographie (ultrasons)
  - Swallowing related Quality of Life questionnaire (SWAL-QOL)

Outcome measures

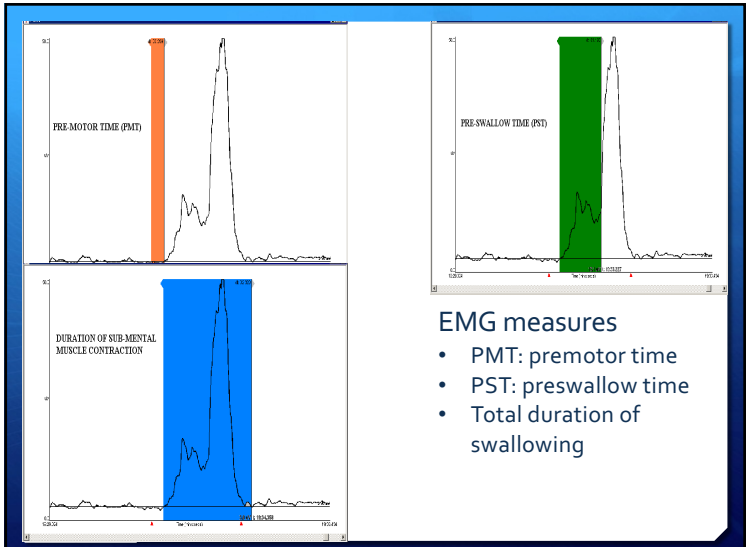
- During each baseline sessions and outcome sessions following tests were conducted:
  - Timed water swallow test (Hughes & Wiles, 1996)
  - Test of mastication and swallowing of solids (TOMASS)
  - Surface Electromyography (sEMG)
  - Ultrasound
  - Swallowing related quality of life questionnaire (SWAL-QOL)





Mesures sEMG

- PMT: temps prémoteur
- PST: temps pré-déglutition
- Durée totale de la déglutition



EMG measures

- PMT: premotor time
- PST: preswallow time
- Total duration of swallowing

En résumé

- Amélioration significative :
  - TWST : vol/déglutition, temps/déglutition, volume/durée
  - sEMG: PMT (temps de réaction), PST (mouvement anticipatoire) et durée totale de la déglutition
  - SWAL-QOL

Summary

- Statistically significant improvement in:
  - Water swallow test: vol per swallow, time per swallow, volume over time
  - sEMG: premotor time (reaction time) pre-swallow time (anticipatory movement) and total duration of swallowing
  - SwalQOL

En résumé

- TOMASS : pas de tendance significative pour la composante temps/déglutition, cycle masticatoire, cycle/déglutition, déglutition/bouchée
- Absence d'amélioration :
  - Taille du muscle (ventre antérieur du digastrique et géniohyoïde)
  - Antériorisation de l'os hyoïde

Summary

- TOMASS: nonsignificant trend for time per swallow, masticatory cycle per swallow, swallow per bite
- No improvement in:
  - Muscle size for anterior belly and geniohyoid
  - Degree of anterior hyoid movement

Discussion – Vue d'ensemble

- Effets significatifs du traitement pour de nombreuses composantes – congruent avec les commentaires informels des patients / familles / amis sur la fonction de déglutition
- Stabilité entre les 2 lignes de base
- Phase de rétention de la précision *(skill)* : aucun des éléments mesurés ne présente de détérioration

Discussion - Overview

- Overall significant effects of treatment in many outcomes – congruent with informal reports from patient/family members/friends reports on functional swallowing.
- Non treatment baseline phase- stable
- Skill retention phase- no deterioration in any of the outcome measures.

Au total, sEMG utilisé dans de nombreux protocoles de rééducation, mais pas spécifiquement pour étudier la biomécanique fine puisqu'il ne mesure qu'un groupe musculaire

So sEMG has been used in several protocols for rehabilitation, but not specific to specific biomechanics as it measures only a single muscle group.

Pour rappel

- La déglutition naïve, « réflexe », est déclenchée par la stimulation du SLN (nerf laryngé supérieur) et exécutée par le CPG (générateur central de rythme) au niveau du tronc cérébral. C'est un mécanisme constitué d'une cascade d'événements moteurs qui a été relativement bien étudié
  - Réponse primaire, bien organisée, considérée comme invariante

A reminder

- The 'reflexive', naïve swallow is a reasonably well explored cascade of motor events, triggered by stimulation of SLN and executed by CPG in brainstem
  - Primitive, hard wired response that is generally considered to be fairly invariant

- La déglutition d'ingestion requiert une modulation de cette réponse
  - Adaptation de la force et de la durée des événements pharyngés, mais ce n'est pas une planification motrice basique
    - Avaler fort
    - Avaler longtemps

      pour s'adapter aux textures variées
    - Mais maintenir la séquence motrice

- Ingestive swallowing requires modulation of this response
  - Adapts strength and duration of pharyngeal events, but not the basic motor plan
    - Swallow harder
    - Swallow longer
      to accommodate varied textures
    - But maintain the sequence of motor events

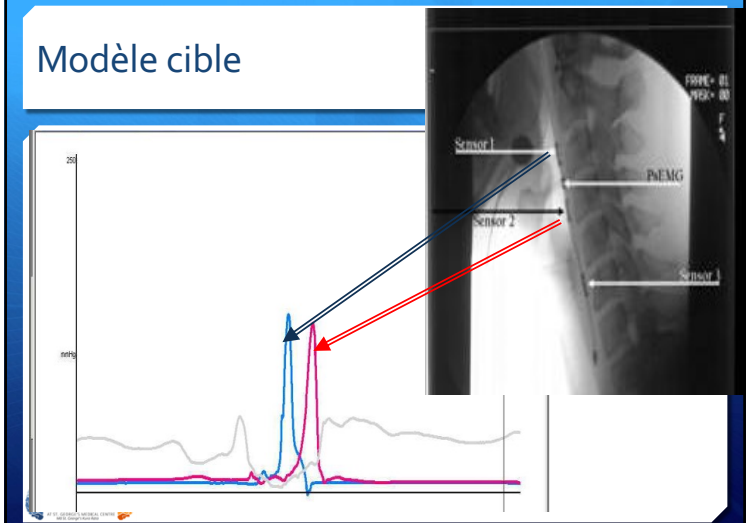
Mauvais séquençage pharyngé

- Expérience clinique récente auprès de patients présentant des changements atypiques au niveau du pharynx
- Pas de littérature scientifique sur ce sujet à ce jour
  - Limités par les outils diagnostiques disponibles
- Difficilement observable en VFSS chez les sujets présentant des troubles neurologiques
- Tout d'abord, savoir ce qu'est une motilité pharyngée normale

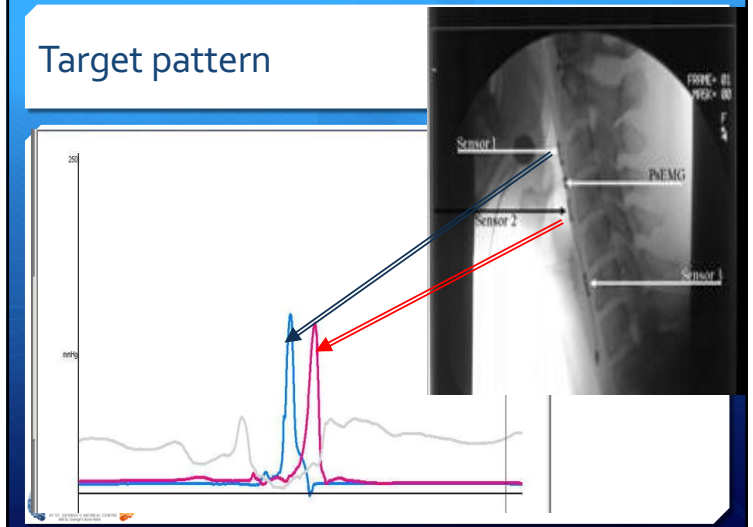
Pharyngeal Mis-sequencing

- Recent clinical experience of patients with atypical pharyngeal motor pattern.
- Not yet reported in the literature
  - Hindered by available diagnostic tools
- Not easily observable on VFSS in neurologically impaired patient
- But first, need to identify what is normal pharyngeal motility

Modèle cible



Target pattern



Dave

- Homme de 47 ans, ayant bénéficié d'une résection d'un méningiome intracrânien pontreux-clival par voie d'abord latérale
  - Sort de l'hôpital en texture mixée et liquides épaissis
  - Vient de lui-même en rééducation à 10 mois post chirurgie
  - VFSS→ phase orale OK, pas de retard, motilité pharyngée faible avec stases résiduelles diffuses (sinus piriformes > vallécules), antériorisation hyoïde réduite, reflux pharyngonasal sur les liquides, signes d'inhalation sur les liquides et semi-solides

Dave

- 47 year old s/p lateral entry resection of clival meningioma
  - DC'd from hospital to home on puree & thickened liquids.
  - Self-referred at 10 mos post surgery for rehab
  - VFSS→ good oral, no delay, poor pharyngeal motility with diffuse (pyriform> vallecular residual), reduced anterior hyoid movement, nasal redirection of liquids, trace aspiration of liquids & semi-solids

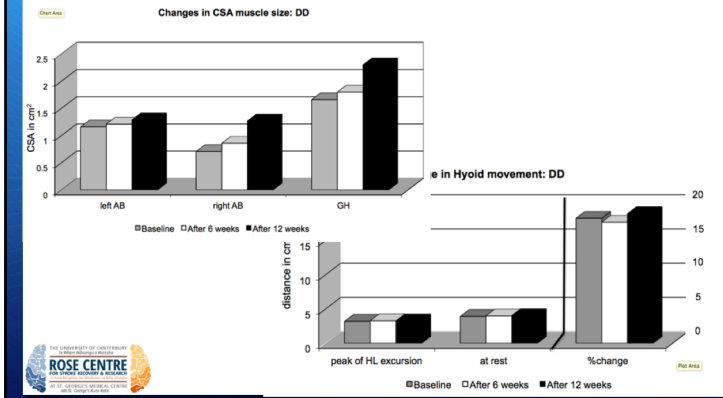
Dave

- Rééducation ciblée sur l'amélioration de la contraction des groupes musculaires suprahyoïdens → « head lifts »
- Ligne de base : mesure en 2D de la surface et du mouvement de l'os hyoïde par échographie
- 6 semaine d'exercices de type « head lift »
  → très légère amélioration fonctionnelle
- 2nde période de 6 semaine d'exercices « head lift »
  → pas mieux

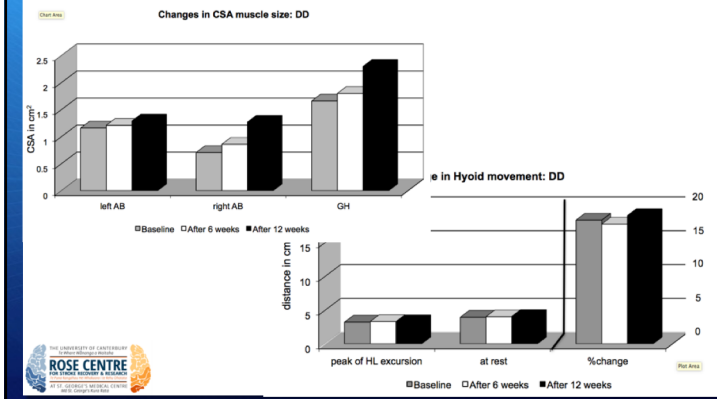
Dave

- Rehab to focus on increased anterior suprahyoid muscle group → head lifts
- Baseline ultrasound completed to measure 2D surface area and hyoid movement
- 6 weeks of head lift →
  only slight functional improvement
- 2nd 6 weeks of head lift →
  not much better than before

Dave : échographie / ultrasound



Dave: ultrasound



Dave

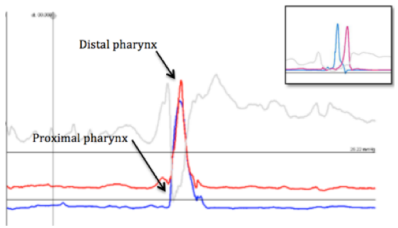
- Manométrie basse résolution (LRM) du pharynx
  - Pression phayngée dans la norme
    - Moy = 132 mmHg, [norme 127.9 mmHg (95%CI 103.7–152.0)]
    - Moy = 118 mmHg [norme 109.1 mmHg (95%CI 96.8–121.4)]
  - MAIS pression négative du SSO hors valeurs normatives physiologiques
    -3 mmHg, norme −9.6 mmHg (95%CI −12.4 à −6.8)
    - Donc… est-ce un manque de compliance du SSO ?

Dave

- Low resolution pharyngeal manometry
  - Pharyngeal pressure WNL
    - Mean= 132 mmHg, [norm of 127.9 mmHg (95%CI 103.7–152.0)]
    - Mean = 118 mmHg [norm of109.1 mmHg (95%CI 96.8–121.4)]
    - BUT UES produced negative pressure outside the range of normal physiology
      -3 mmHg, compared to normal range of –9.6 mmHg (95%CI –12.4 to –6.8
  - So is this a non-compliant UES?

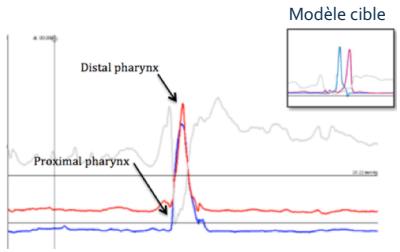
Dave : Manométrie basse résolution

- Distance inter-pic moyenne = -5 msec, bien en dessous des valeurs normatives de la déglutition (norme 258 msec, 95% CI 250–270)



Dave: low res manometry

- Average peak–to–peak separation was calculated at -5 msec, well out of range or normal swallowing behaviour (normal 258 msec, 95% CI 250–270



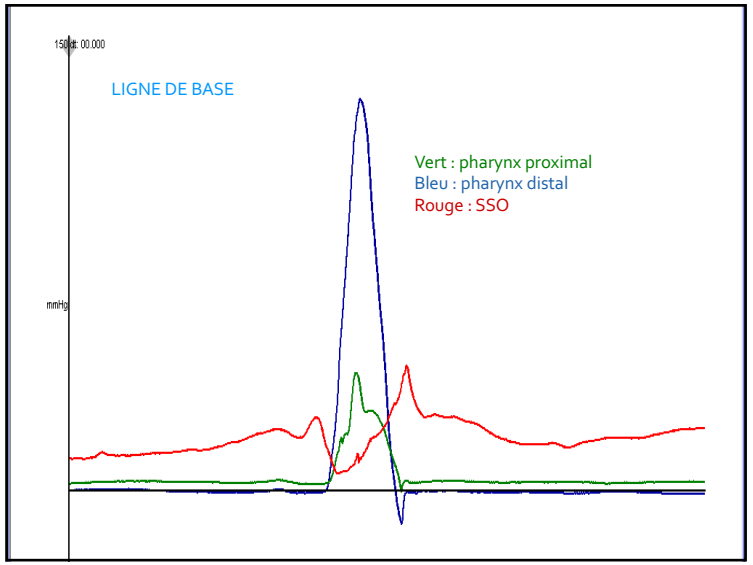
Dave : rééducation

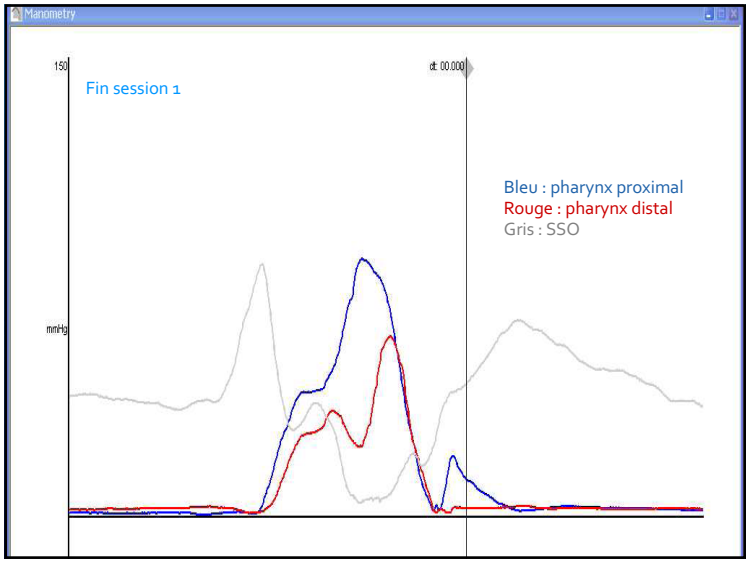
- Réorientation de la rééducation : biofeedback par manométrie
  - « Faites en sorte que la ligne bleue apparaisse en premier »

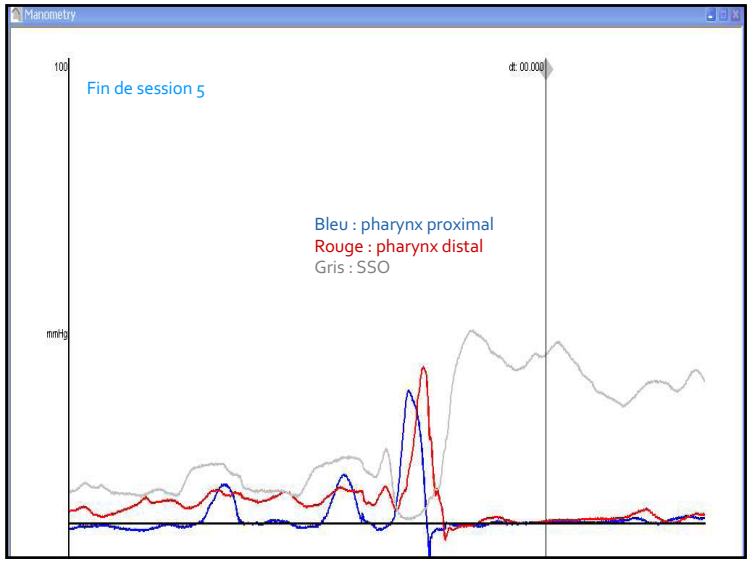
Dave: rehab

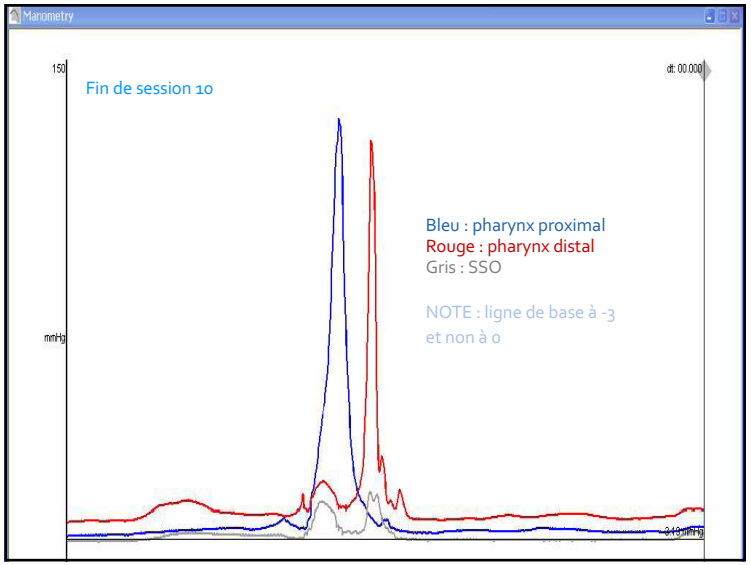
- Refocus of rehab: Mano as biofeedback
  - 'Make the blue line come first'

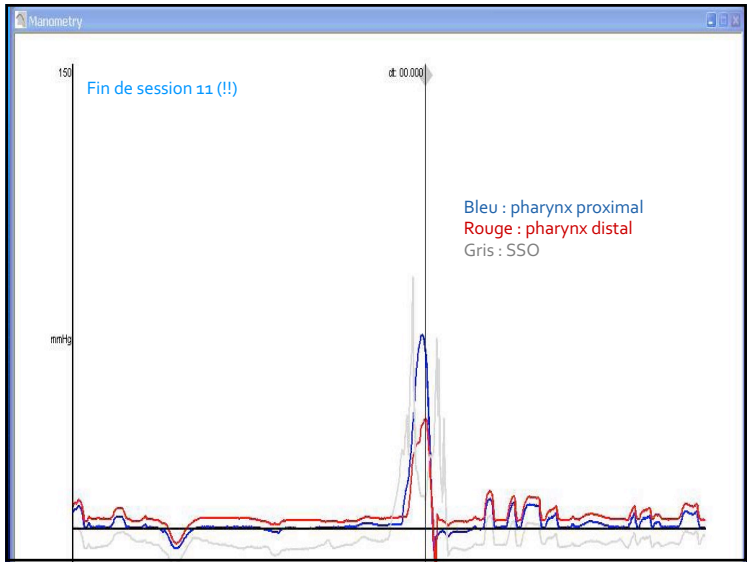
[redacted]





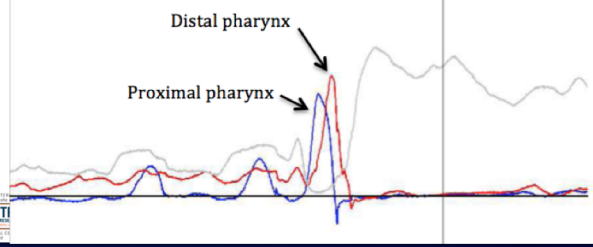






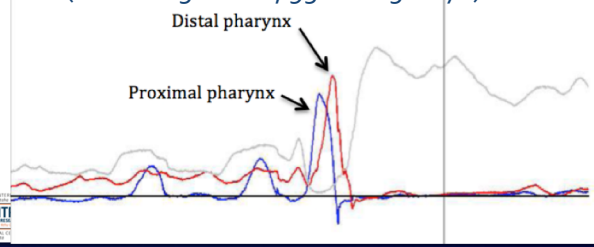
Dave : post traitement

+ Distance inter-pic moyenne (entre le pharynx proximal et distal) = 239 msec, très légèrement en dessous des valeurs normatives pour l'âge et le sexe (norme 258 msec, 95% CI 250–270)



Dave: post-tx

+ Peak–to–peak separation between the proximal and distal pharynx averaged 239 msec, only very slightly below the range of normal for age and gender (normal 258 msec, 95% CI 250–270)

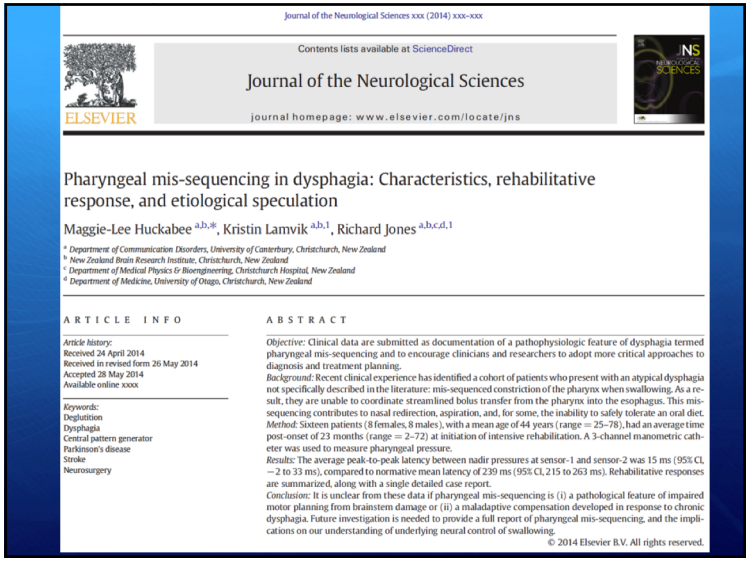


Dave : rééducation

- Manofluoroscopie : mouvement hyolaryngé inchangé, très faibles résidus pharyngés pour le pain ce qui est attendu à cet âge, pas de reflux pharyngonasal
- Peu après le traitement : texture normale… avec quelques exceptions dues à l'anxiété
- Va bien depuis !

Dave: rehab

- Manofluoroscopy : apparently unchanged hyolaryngeal movement, but only very slight pharyngeal residual of bread, likely consistent with age expectations, and no nasal redirection of the bolus.
- Shortly after was DC'd from treatment on normal diet…exceptions due to anxiety
- Continues to do well



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Pharyngeal mis-sequencing in dysphagia: Characteristics, rehabilitative response, and etiological speculation

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ABSTRACT

Objective: Clinical data are submitted as documentation of a pathophysiologic feature of dysphagia termed pharyngeal mis-sequencing and to encourage clinicians and researchers to adopt more critical approaches to diagnosis and treatment planning.
Background: Recent clinical experience has identified a cohort of patients who present with an atypical dysphagia not specifically described in the literature: mis-sequenced constriction of the pharynx when swallowing. As a result, they are unable to coordinate streamlined bolus transfer from the pharynx into the esophagus. This mis-sequencing contributes to nasal redirection, aspiration, and, for some, the inability to safely tolerate an oral diet.
Method: Sixteen patients (8 females, 8 males), with a mean age of 44 years (range = 25–78), had an average time post-onset of 23 months (range = 2–72) at initiation of intensive rehabilitation. A 3-channel manometric catheter was used to measure pharyngeal pressure.
Results: The average peak-to-peak latency between nadir pressures at sensor-1 and sensor-2 was 15 ms (95% CI, −2 to 33 ms), compared to normative mean latency of 239 ms (95% CI, 215 to 263 ms). Rehabilitative responses are summarized, along with a single detailed case report.
Conclusion: It is unclear from these data if pharyngeal mis-sequencing is (i) a pathological feature of impaired motor planning from brainstem damage or (ii) a maladaptive compensation developed in response to chronic dysphagia. Future investigation is needed to provide a full report of pharyngeal mis-sequencing, and the implications on our understanding of underlying neural control of swallowing.

Résultats

Table 2
Quantitative findings from manometric assessment.

	Normative data (95% confidence interval)	Pre-treatment baseline averages (95% confidence interval)	Post-treatment averages (95% confidence interval)
Temporal data			
Peak 1–Peak 2	239 ms (215–263 ms)	15 ms (−2 to 33 ms)	137 ms (86–187 ms)
Swallowing duration	479 ms (409–549 ms)	620 ms (469–770 ms)	536 ms (454–617 ms)
Pressure/Amplitude data			
Proximal pharynx	114.7 mm Hg (104.1–125.4 mm Hg)	46.4 mm Hg (25.1–67.6 mm Hg)	46.6 mm Hg (31.1–62.1 mm Hg)
Distal pharynx	114.9 mm Hg (104.9–124.9 mm Hg)	39.7 mm Hg (23.8–55.6 mm Hg)	47.1 mm Hg (29.7–64.5 mm Hg)
UES nadir pressure	−9.7 mm Hg (−11.0 to −8.5 mm Hg)	0.2 mm Hg (−7.0 to 7.5 mm Hg)	−3.5 mm Hg (−7.9 to 0.9 mm Hg)

- 11/16 patients ont repris une alimentation orale exclusive avec liquides normaux, 6 d'entre eux ayant auparavant une dysphagie chronique
  - Sur les 5 patients n'ayant pas repris d'alimentation orale, 4 n'ont pas été en mesure de suivre la rééducation au-delà d'une semaine de traitement intensif en raison de contraintes géographiques.

Outcomes

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Quantitative findings from manometric assessment.

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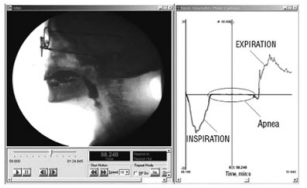
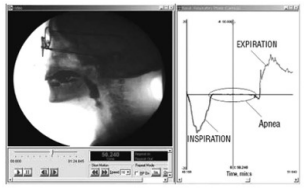
- 11/16 patients resumed a full oral diet with thin liquids, including 6 patients with chronic dysphagia
  - Of the 5 patients who were unable to return to oral intake, 4 were unable to participate in continued treatment beyond an initial week of intensive treatment due to geographical constraints.

Coordination Déglutition / Respiration



Phase Categorization	Abbreviation	Example
Mid-expiration	E-E	
At the transition between expiration and inspiration	E-I	
Mid-inspiration	I-I	
At the transition between inspiration and expiration	I-E	

Swallowing Respiratory Coordination



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ORIGINAL RESEARCH

Respiratory-Swallow Training in Patients With Head and Neck Cancer

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Objective: To test a novel intervention to train swallowing to occur in the midexpiratory to low expiratory phase of quiet breathing to improve swallowing safety and efficiency.
Design: Safety and efficacy nonrandomized controlled trial with 1-month follow-up.
Setting: Ambulatory clinics.
Participants: Patients (N=30) with head and neck cancer (HNC) and chronic dysphagia completed the intervention. Fifteen of these patients participated in a 1-month follow-up visit.
Interventions: Training protocol based on hierarchy of motor skill acquisition to encourage autonomous and optimal respiratory-swallowing coordination. Visual feedback of respiratory phase and volume for swallowing initiation was provided by nasal airflow and rib cage/abdomen signals.
Main Outcome Measures: Respiratory-swallow phase pattern, Modified Barium Swallow Impairment Profile (MBSImP) scores, Penetration-Aspiration Scale (PAS) scores, and MD Anderson Dysphagia Inventory scores.
Results: Using visual feedback, patients were trained to initiate swallows during the midexpiratory phase of quiet breathing and continue to expire after swallowing. This optimal phase patterning increased significantly after treatment ($P<.0001$). Changes in respiratory-swallowing coordination were associated with improvements in 3 MBSImP component scores: laryngeal vestibular closure ($P=.0004$), tongue base retraction ($P<.0001$), and pharyngeal residue ($P=.01$). Significant improvements were also seen in PAS scores ($P<.0001$). Relative to pretreatment values, patients participating in 1-month follow-up had increased optimal phase patterning ($P<.0001$), improved laryngeal vestibular closure ($P=.01$), tongue base retraction ($P=.003$), and pharyngeal residue ($P=.006$) MBSImP scores and improved PAS scores ($P<.0001$).
Conclusions: Improvements in respiratory-swallowing coordination can be trained using a systematic protocol and respiratory phase-lung volume-related biofeedback in patients with HNC and chronic dysphagia, with favorable effects on airway protection and bolus clearance.
Archives of Physical Medicine and Rehabilitation 2015;96:885-93

Protocole

- Séances d'1h, 2x/j, aussi longtemps que nécessite l'acquisition et la maîtrise de la précision (4-8 séances)

Table 1 Description of goals for each training module

Module	Goal Description	Criteria Level (%)
Identification	Identification of target respiratory phase (expiration) (goal 1) and swallow event (goal 2) using simulated tracings.	80
	Identification of target respiratory phase (expiration) (goal 3) and swallow event (goal 4) using visually guided feedback provided by respiratory movements during self-swallowing.	80
	Identification of target respiratory phase (expiration) and swallow event during swallowing at high, mid, and low lung volumes relative to a tidal volume cycle using simulated tracings (goal 5) and visually guided feedback during self-swallowing (goal 6).	80
Acquisition	Swallow initiation at target phase (expiration) using visually guided feedback for thin (goal 7), nectar-thickened (goal 8), and honey-thickened (goal 9) liquids during self-swallowing.	80
	Swallow initiation at target phase (expiration) without visually guided feedback for thin (goal 10), nectar-thickened (goal 11), and honey-thickened (goal 12) liquids during self-swallowing.	80
	Target phase (expiration) after completion of a swallow event using visually guided feedback for thin (goal 13), nectar-thickened (goal 14), and honey-thickened (goal 15) liquids during self-swallowing.	80
	Target phase (expiration) after completion of a swallow event without visually guided feedback for thin (goal 16), nectar-thickened (goal 17), and honey-thickened (goal 18) liquids during self-swallowing.	80
Mastery	Swallow initiation at target phase around mid to low lung volume followed by target phase (expiration) after completion of the swallow without visually guided feedback for thin (goal 19), nectar-thickened (goal 20), and honey-thickened (goal 21) liquids during self-swallowing.	90

NOTE. Visually guided feedback provided to the patient using rib cage tracing on the KayPENTAX Digital Swallowing Workstation.

Protocol

- Twice weekly for one hour for as long as needed to acquire skill mastery (4-8 sessions)

Table 1 Description of goals for each training module

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Acquisition	Swallow initiation at target phase (expiration) using visually guided feedback for thin (goal 7), nectar-thickened (goal 8), and honey-thickened (goal 9) liquids during self-swallowing.	80
	Swallow initiation at target phase (expiration) without visually guided feedback for thin (goal 10), nectar-thickened (goal 11), and honey-thickened (goal 12) liquids during self-swallowing.	80
	Target phase (expiration) after completion of a swallow event using visually guided feedback for thin (goal 13), nectar-thickened (goal 14), and honey-thickened (goal 15) liquids during self-swallowing.	80
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NOTE. Visually guided feedback provided to the patient using rib cage tracing on the KayPENTAX Digital Swallowing Workstation.

Résultats

- Après traitement : augmentation significative du nombre de schémas de type « mi-expiration »
- Associés à une amélioration de :
  - Fermeture du vestibule laryngé
  - Recul de la base de langue
  - Stases pharyngées
  - Scores PAS

Outcomes

- Optimal mid-expiratory pattern increased significantly after treatment
- Associated with:
  - Improved laryngeal vestibule closure
  - Tongue base retraction
  - Pharyngeal residual
  - PAS scores

Émergence de la recherche sur l'entraînement de la précision

- Les patients parviennent à modifier de petites composantes individuelles de la réponse pharyngée « réflexe »
  - Ex. coordination déglutition / respiration, déroulement temporel des événements pharyngés…
  - En toute logique, modifier des traits spécifiques nécessite un feedback spécifique… ainsi que des outils

Emerging research on Skill Training

- Patients demonstrate remarkable capacity to change even individual components of the 'reflexive' pharyngeal response
  - Eg…swallowing respiratory coordination, pharyngeal timing events
  - Logically, changing specific features requires specific feedback…and instrumentation

Author, Year	Level of evidence*	Study Design	Intervention	Outcome Measures	Results
Lan et al., (2022)	2b	N=8 (6 male, average 57.5 years) chronic dysphagia secondary to oropharyngeal cancer; 3 also had neurological deficits. Control group n=34 healthy participants (14 males, average age 44 years).	3 weeks of MDTP (15 sessions of 1 hour). Systematic exercise program with strength and skill components. Task specific, hierarchical presentation of increasingly challenging bolus consistencies, volume and eating rate.	Lingual-palatal and pharyngeal manometric pressures during swallowing. Timing of lingual pressure peaks and manometric peaks from base of tongue, hypopharynx, and nadir of the pharyngoesophageal segment. Functional Oral Intake Score (FOIS) and Mann Assessment of Swallowing Ability (MASA).	All patients significantly improved on FOIS (p< 0.05) and MASA (p< 0.05). 5/8 tube fed patients returned to oral feeding. Lingual-palatal and pharyngeal manometric pressures significantly improved with thin fluids. Post therapy, there were no significant differences in these parameters compared to healthy controls.
Crary et al., (2012)	2b	N=9 (7 male, average 55.89 years) with chronic dysphagia secondary to oropharyngeal cancer; 3 also had neurological deficits. 3 month follow up.	3 weeks of MDTP (15 sessions of 1 hour). Systematic exercise program with strength and skill components. Task specific, hierarchical presentation of increasingly challenging bolus consistencies, volume and eating rate.	Hyolaryngeal elevation, lingual-palatal and pharyngeal manometric pressures during swallowing. Surface electromyographic amplitude of the submental muscles. Functional Oral Intake Score (FOIS), Mann Assessment of Swallowing Ability (MASA) and patient rated visual analogue scale (VAS).	All patients significantly improved on FOIS (p< 0.01) MASA (p=0.02) and VAS (p=0.001). Hyolaryngeal excursion and lingual-palatal pressures increased. Pharyngeal manometric pressures decreased but not significantly. Duration of swallowing pudding bolus increased on sEMG measurement (p=0.02). Functional and physiological changes were maintained 3 months post therapy. 4/7 patients returned to oral intake.
Sia et al., (2015)	2b	As above; N=8 (6 male, average 57.5 years) chronic dysphagia secondary to oropharyngeal cancer; 3 also had neurological deficits. Secondary analysis of data preiented in Lan et al. (2012).	3 weeks of MDTP (15 sessions of 1 hour). Systematic exercise program with strength and skill components. Task specific, hierarchical presentation of increasingly challenging bolus consistencies, volume and eating rate.	Hyoid and laryngeal excursion magnitude, duration and excursion velocity measured using videofluoroscopic swallowing studies pre and post therapy (thin liquid, thick liquid, and pudding bolus).	Hyoid and laryngeal superior, anterior and total excursion magnitude measures increased post therapy. These measures were only significant with thin liquid bolus. Hyoid excursion duration significantly increased with thin liquid (P = 0.003) and thick liquid bolus (p=0.053). There was no significant difference in anterior excursion velocity. But superior hyoid excursion velocity significantly increased post therapy with thin liquids only (p=0.047).
Steele et al., (2015)	2b	N=64 male, average 43.3 years) acquired brain injury and dysphagia. 4 PEG fed, 2 modified diet and thickened liquids.	Mixed strength and accuracy training using the Iowa Oral Performance Instrument (IOPI). 24 sessions over 12-12 weeks.	Penetration Aspiration Scale (PAS), bolus residue scale using VFSS (thin and spoon-thick liquids). Lingual pressures (maximum isometric pressures).	Increased lingual pressures. Increased saliva swallowing pressures over 3 sessions, but not maintained over therapy. Improved PAS with thin liquids in 5/6 patients. Worsened pharyngeal residue in 5/6 patients as measured on VFSS on at least one bolus.
Athukorala et al., (2014)	2b	N=10 (3 female, average 67.4 years) with Parkinson's Disease Within-subject pilot study with 2 weeks retention period.	Skill-based swallowing training using sEMG. 2 weeks of daily treatment (10 sessions).	Timed water swallow test, Test of Mastication and Swallowing Solids, sEMG of submental muscles & SWAL-QoL	Significant improvement post therapy in swallowing rate for liquids (p= .034), premotor time (p= .003) and pre-swallow time (p<.001) as measured by sEMG. Patient reported swallowing specific quality of life improved (p=.028).
Stepp et al., (2011)	3b	N=6 Healthy participants (3 female, average 30.9 years) & N=1 (female, 58 years) with brainstem stroke and severe oropharyngeal dysphagia.	Skill-based swallowing training using sEMG. Healthy controls completed 1 session of training. Patient with dysphagia completed 6 sessions over 3 weeks.	Accuracy of target task and intermuscular beta coherence (correlated to cortical control of peripheral muscles). Qualitative reports of swallowing function.	Dysphagic patient improved accuracy of task (average 0.9 targets in session 1, average 1.8 targets in subsequent 5 sessions). Increased average beta coherence 0.06 to 0.14 over 6 sessions. Qualitative reports of reduced suctioning required and increased speed of voluntarily initiated laryngeal elevation.
Huckabee et al., (2014)	4	N=16 (8 female, average 44 years) with atypical pathophysiological features of dysphagia identified at m-n-sequenced pharyngeal motility. 11 PEG fed, 5 on modified diet/fluids.	Intensive treatment using pharyngeal manometry as biofeedback. 1 hour treatment sessions, twice daily for a minimum of 1 week.	Manometric assessment of pharyngeal pressures including latency between sensors and swallowing duration. Oral intake.	Average peak to peak latency of proximal to distal pharyngeal pressures significantly increased 15m s to 137ms after 1 week of treatment. Swallowing duration decreased. 11/16 patients returned to normal diet.
Martin-Harris et al., (2015)	2b	N=30 (16 male, average 61 years) with head and neck cancer and chronic dysphagia.	Respiratory-swallowing coordination training using nasal airflow and respiratory movements as biofeedback. 1 hour sessions, twice weekly for 4 weeks.	Respiratory-swallow phase pattern, Modified Barium Swallow Impairment Profile (MBSImP) scores, Penetration Aspiration Scale (PAS) scores, M.D. Anderson Dysphagia Inventory scores. 1 month follow up (n=25)	Optimal respiratory-swallowing phase pattern increased significantly post therapy (p <0.0001). MBSImP component scores significantly improved: laryngeal vestibular closure (p = 0.0004), tongue base retraction (p <0.0001), and pharyngeal residue (p = 0.01). Significant improvements in PAS scores (p <0.0001). Improvements were maintained at 1 month follow up.

Auteur, année	Niveau de preuve*	Design expérimental	Intervention	Mesures	Résultats
Lan et al., (2022)	2b	N=8 (6 male, average 57.5 years) chronic dysphagia secondary to oropharyngeal cancer; 3 also had neurological deficits. Control group n=34 healthy participants (14 males, average age 44 years).	3 weeks of MDTP (15 sessions of 1 hour). Systematic exercise program with strength and skill components. Task specific, hierarchical presentation of increasingly challenging bolus consistencies, volume and eating rate.	Lingual-palatal and pharyngeal manometric pressures during swallowing. Timing of lingual pressure peaks and manometric peaks from base of tongue, hypopharynx, and nadir of the pharyngoesophageal segment. Functional Oral Intake Score (FOIS) and Mann Assessment of Swallowing Ability (MASA).	All patients significantly improved on FOIS (p< 0.05) and MASA (p< 0.05). 5/8 tube fed patients returned to oral feeding. Lingual-palatal and pharyngeal manometric pressures significantly improved with thin fluids. Post therapy, there were no significant differences in these parameters compared to healthy controls.
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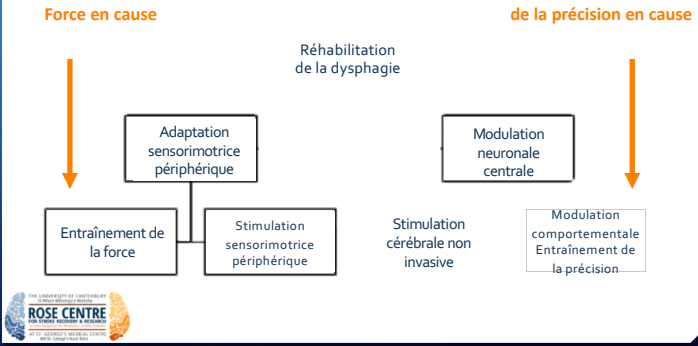
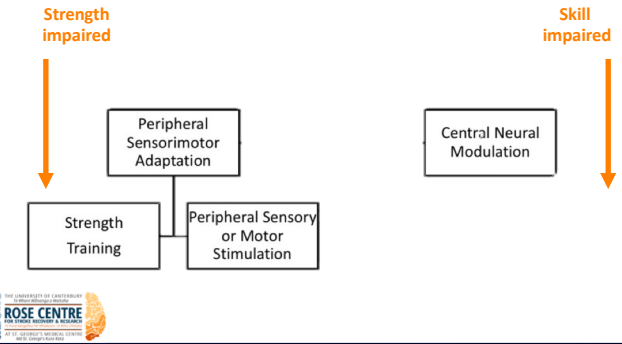
Arbre décisionnel pour la rééducation de la déglutition



Framework for Dysphagia Rehabilitation



Et maintenant, comment planifier une thérapie si on ne peut par faire en sorte que les gens deviennent « plus fort » ?

So how do you plan treatment if we can't make everyone stronger?

Commençons par le commencement…

- Quelle est la cause sous-jacente de la dysphagie et comment ce trouble se caractérise-t-il ?
  - On ne peut pas affirmer qu'il y a une corrélation directe entre les tâches corticospinales voire corticobulbaires et la déglutition mais c'est un bon début
  - Apraxie – aire motrice supplémentaire, aire prémotrice
  - Ataxie – implication du cervelet
  - Spasticité – système extrapyramidal
  - Flaccidité – motoneurones sup, motoneurone inf

First things first….History

- What is the underlying source of dysphagia and how does that illness characteristically present?
  - We can't necessarily assume that there will be directly correlation between corticospinal or even other corticobulbar tasks presentations and swallowing presentation, but it's a start.
  - Apraxia – supplemental motor region, premotor region
  - Ataxia – cerebellar involvement
  - Spasticity – extrapyramidal system
  - Flaccidity – upper motor neuron, lower motor neuron

À l'examen clinique

- Pas de tableau neurologique à l'examen des nerfs crâniens NC ?
  - Faiblesse possible en cas d'altération générale → dysphagie sarcopénique le plus souvent diffuse et symétrique
  - En règle générale, en l'absence de tableau neuro (NC), il s'agit probablement d'une question de précision

On clinical assessment…

- No Cranial nerve presentation?
  - Might be weak if in the context of systematic decline → Sarcopenic dysphagia likely presents as diffuse and symmetrical
  - Generally if no CN presentation, would more likely be skill

Lors des essais alimentaires ou sous vidéofluoroscopie…

- Si présence de signes neuro (NC), sont-ils en accord avec les observations faites sous VFSS ou bien la biomécanique ne s'accorde pas avec un schéma dysfonctionnel ?
  - Absence de preuve d'une lésion nerf trijumeau mais limitation du mouvement d'antériorisation de l'os hyoïde
  - Absence de preuve d'une lésion du plexus pharyngé mais stases siffuses

On oral trials or videofluoroscopy…

- If there are CN signs, do these align with observations on VFSS or does biomechanical presentation not 'fit' with a pattern of impairment?
  - No evidence of trigeminal nerve damage but reduced anterior hyoid movement
  - No evidence of pharyngeal plexus damage, but diffuse residual

Lors des essais alimentaires ou sous vidéofluoroscopie…

- Comportement consistant / stable ?
  - La faiblesse reste faiblesse qui reste faiblesse
    - Faiblesse permanente mais possible aggravation lors de la présentation de différentes tailles et textures de bolus
    - Les déglutitions successives peuvent diminuer en fonction de la fatigue ou de l'accumulation de résidus
  - La précision est variable
    - Le tableau du trouble ou sa consistance est aléatoire et fluctuant, pas toujours influencé par le type de bolus ou sa texture ?

On oral trials or videofluoroscopy…

- Is there consistency in behaviour?
  - Weakness is weakness is weakness.
    - Always weak but perhaps more exaggerated in presentation with various bolus sizes or textures.
    - Subsequent swallows may progressively decline as a function of fatique or build up of residual
  - Skill may be variable:
    - Is presentation of impairment or consistency of impairment seemingly random and variable, perhaps not systematically influenced by bolus type or texture?

Évaluation ciblée

- 3 groupes :
  - Dysphagie post-AVC (n=55)
  - Myopathie (n=19)
  - Sujets sains (n=40)
- Évaluation objective
  - Force musculaire sous-mentonnière et précision temporospatiale
    - Pendant les épreuves de déglutition et d'ouverture des mâchoires
    - Protocoles d'évaluation de la précision et de la force du BiSSkiT et dynamométrie

Ng et al. (in prep)

Targeted assesssment

- Three groups:
  - dysphagia due to stroke (n=55)
  - myopathy (n=19)
  - healthy controls (n=40)
- Objective assessment
  - submental muscular force and temporospatial accuracy
    - during swallowing and jaw-opening tasks
    - BiSSkiT skill and strength assessment protocols and dynamometry.

Ng et al. (in prep)

Résultats

- Répartition des données entre 4 groupes d'analyse
  - Groupe 1 : sujets sains présentant une force et une précision intactes
  - Groupe 2 : patients post-AVC et myopathiques, diminution de la force mais précision intacte
  - Groupe 3 & 4 : patients post-AVC
    - Diminution de la force et de la précision des mâchoires
    - Diminution de la force et de la précision de la déglutition
  - Performance aux tests de précision davantage prédictive de la répartition des groupes que pour la force

Results

- Data clustered in 4 groups analysis
  - Cluster 1: primarily healthy controls and presented with relatively intact strength and precision.
  - Cluster 2: both myopathic and stroke patients, decreased strength tasks but intact precision.
  - Clusters 3 & 4: primarily stroke patients
    - Reduced strength and jaw precision
    - Reduced strength and swallowing precision
  - Performance on precision tests was more predictive of cluster assignment than strength performance.

Si vous n'arrivez toujours pas à décider ?

- Ne pas faire de mal
- Davantage de probabilité de survenue d'événements indésirables lors de l'entraînement de la force (autant qu'on sache)
  - Augmenter la force ne se traduira pas par une amélioration de la précision
  - Augmenter la précision améliorera également la force musculaire grâce à la répétition

If you still can't decide?

- Do no harm
- Likely greater potential for adverse effects from strength training (as far as we know)
  - Increasing strength will not translate to improved skill
  - Increasing skill will also improve muscle strength through repetition

Quelques points-clés

- Manque de spécificité du diagnostic empêche la spécificité de la rééducation
  - VFSS : mouvement des structures et du flux du bolus
  - Pas d'information sur l'étiologie neuromusculaire des troubles de mobilité ou de flux de bolus [Huckabee & Kelly, 2006]
    - Faiblesse, spasticité, incoordination
- Il faut avoir une vision d'ensemble

Key points:

- Lack of diagnostic specificity hinders rehabilitative specificity
  - VFSS: movement of structures and bolus flow
  - No information regarding neuromuscular aetiology of impaired movement or bolus flow [Huckabee & Kelly, 2006]
    - Weakness, Spasticity, Dyscoordination
- Need to look outside the box

À retenir…

- Pour être efficace, le traitement doit être spécifique de la physiologie
- L'émergence des paradigmes d'entraînement de la précision offrent des options plus étendues que nos approches traditionnelles
- Le BiSSkiT est une première étape dans le transfert des paradigmes d'entraînement de la précision en pratique clinique

Take home points…

- Treatment should be physiology specific to be effective
- Emergence of skill training paradigms may hold much greater options for rehabilitation than our traditional course
- BiSSkiT offers a first step toward translation of skill-training paradigms to clinical practice

L'intervention n'est pas anodine

- Que ce soit en termes de modification de texture, de techniques compensatoires ou d'approches rééducatives :
  - Si une intervention est suffisamment puissante pour induire un changement positif…
  - Elle est également, de manière inhérente, suffisamment puissante pour induire un changement négatif.
  - Si vous ne faites rien, votre intervention n'a aucun pouvoir de changement….ce qui peut être pire que tout

Intervention is not benign

- Whether it be diet modification, compensatory techniques, or rehabilitation approaches:
  - If an intervention is powerful enough to effect a positive change…
  - It is inherently powerful enough to effect a negative change.
  - If you do nothing, intervention has no power to change….this may be the worst yet.

Des questions ??

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- http://www.rosecentre.canterbury.ac.nz/BiSSkiT/
- https://www.facebook.com/SwallowALot/