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Master Universitario di primo livello in "Deglutologia geriatrica" A.A. 2023/24

LA DISFAGIA NELLA MALATTIA DI PARKINSON

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OUTLINE

- Inquadramento clinico-diagnostico
- Epidemiologia, fisiopatologia e complicanze
- Peculiarità nella valutazione
- Il trattamento della disfagia

INQUADRAMENTO CLINICO-DIAGNOSTICO, EPIDEMIOLOGIA, FISIOPATOLOGIA E COMPLICANZE

Sindromi parkinsoniane

MALATTIA DI PARKINSON IDIOPATICA

Più comune

ALTRE SINDROMI PARKINSONIANE

Dovute a malattie neurodegenerative o secondarie all'assunzione di farmaci o condizioni cerebrovascolari

Parkinsonismo atipico	Parkinsonismo secondario
Demenza da corpy di Lewy (sinucleinopatia) Atrofia multisistemica (sinucleinopatia) Paralisi sopranucleare progressiva (taupatia) Degenerazione cortico-basale (taupatia)	Iatrogeno (antipsicotici, antiemetici, tetrabenazina, litio) Vascolare (multi-infarto o leucoaraiosi) Idrocefalo normoteso Postencefalitico

Parkinsonismo idiopatico

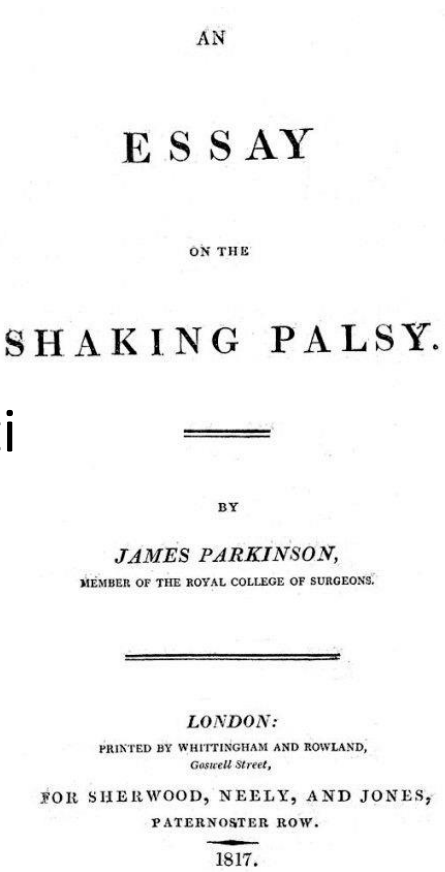
Incidenza media annua 10-18 casi annui su 100.000 abitanti

Prevalenza cruda per tutte le età in Europa: 66–1500 per 100.000 abitanti

Più frequente negli uomini e la prevalenza aumenta con l'eta'

5-10% prima dei 40 anni

Eziologia genetica + ambientale


AN

ESSAY

ON THE

SHAKING PALSY.

BY

JAMES PARKINSON,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS.

LONDON:

PRINTED BY WHITTINGHAM AND ROWLAND,
Goswell Street,

FOR SHERWOOD, NEELY, AND JONES,
PATERNOSTER ROW.

1817.

CrossMark

Parkinson's disease

Lorraine V Kalia, Anthony E Lang

Lancet 2015; 386: 896–912

Parkinson idiopatico
Fisiopatologia

Progressiva perdita dei neuroni dopaminergici nella porzione compatta della sostanza nera, ma colpiti anche altri nuclei (*locus coeruleus*, nuclei del rafe, nucleo basale di Meynert, colonne mediolaterali del midollo, gagli simpatici e parasimpatici, ipotalamo, amigdala)

Deficit dopaminergico dello striato e riduzione dell'input eccitatorio della corteccia motoria

Marker anatomopatologico = corpi di Lewy formati da accumuli intraneuronali di α-sinucleina + degenerazione della porzione compatta della sostanza nera

Clinica

SINTOMI MOTORI (GENERALMENTE ASIMMETRICI) + NON MOTORI

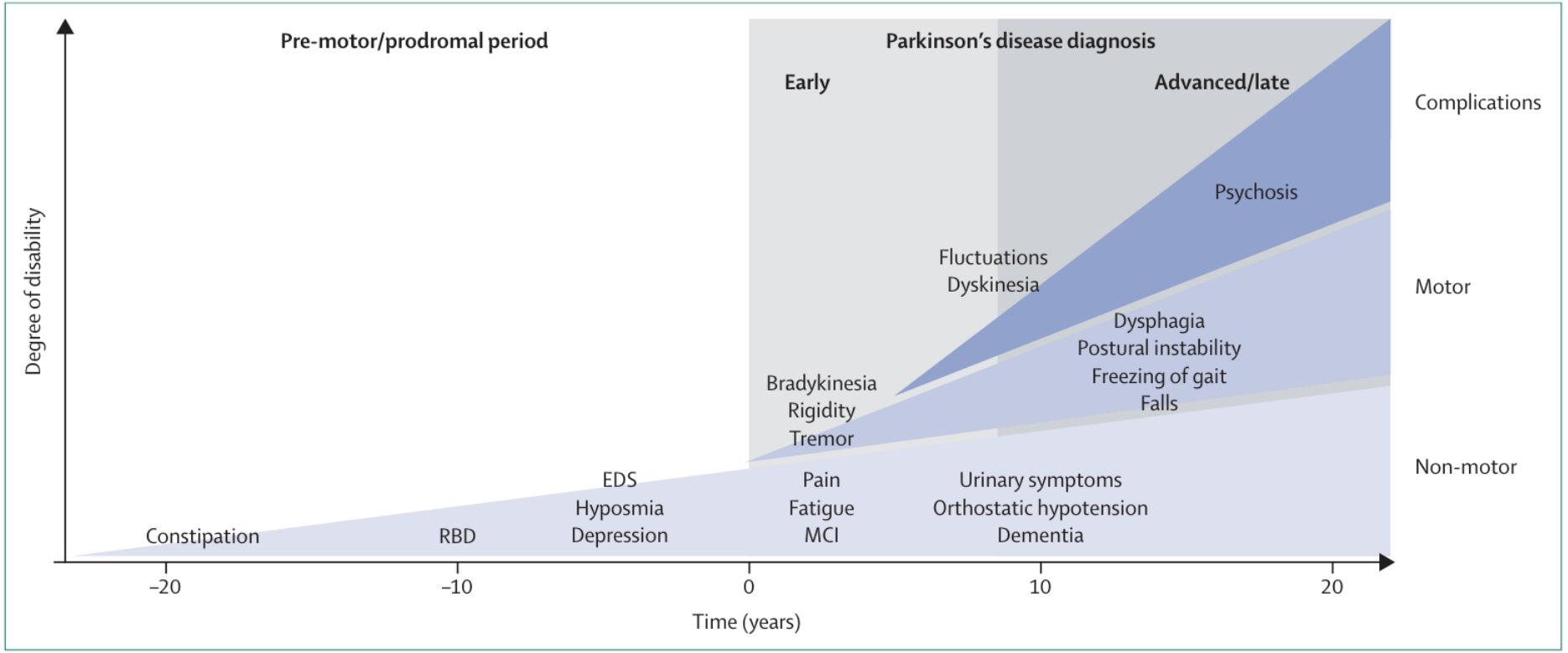


Figure 1: **Clinical symptoms and time course of Parkinson's disease progression**
Diagnosis of Parkinson's disease occurs with the onset of motor symptoms (time 0 years) but can be preceded by a premotor or prodromal phase of 20 years or more. This prodromal phase is characterised by specific non-motor symptoms. Additional non-motor features develop following diagnosis and with disease progression, causing clinically significant disability. Axial motor symptoms, such as postural instability with frequent falls and freezing of gait, tend to occur in advanced disease. Long-term complications of dopaminergic therapy, including fluctuations, dyskinesia, and psychosis, also contribute to disability. EDS=excessive daytime sleepiness. MCI=mild cognitive impairment. RBD=REM sleep behaviour disorder.

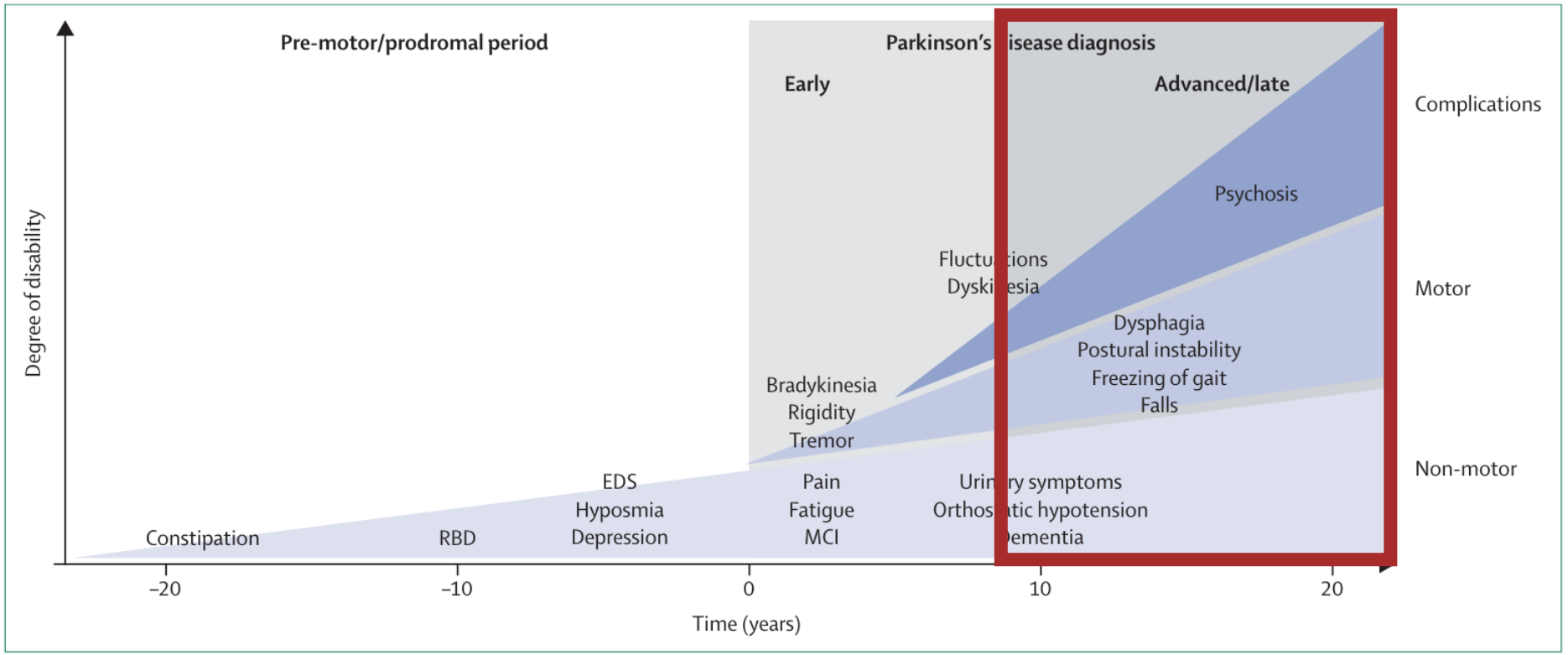
Kalia & Lang, 2015

Clinica

80% freezing of gait and falls

50% of patients report choking

83% dementia



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Kalia & Lang, 2015

Clinica

ALTRI SINTOMI NON-MOTORI ipomimia facciale, voce ipofonica e monotona,disartria ipocinetica, micrografia, difficoltà di elaborazione del discorso

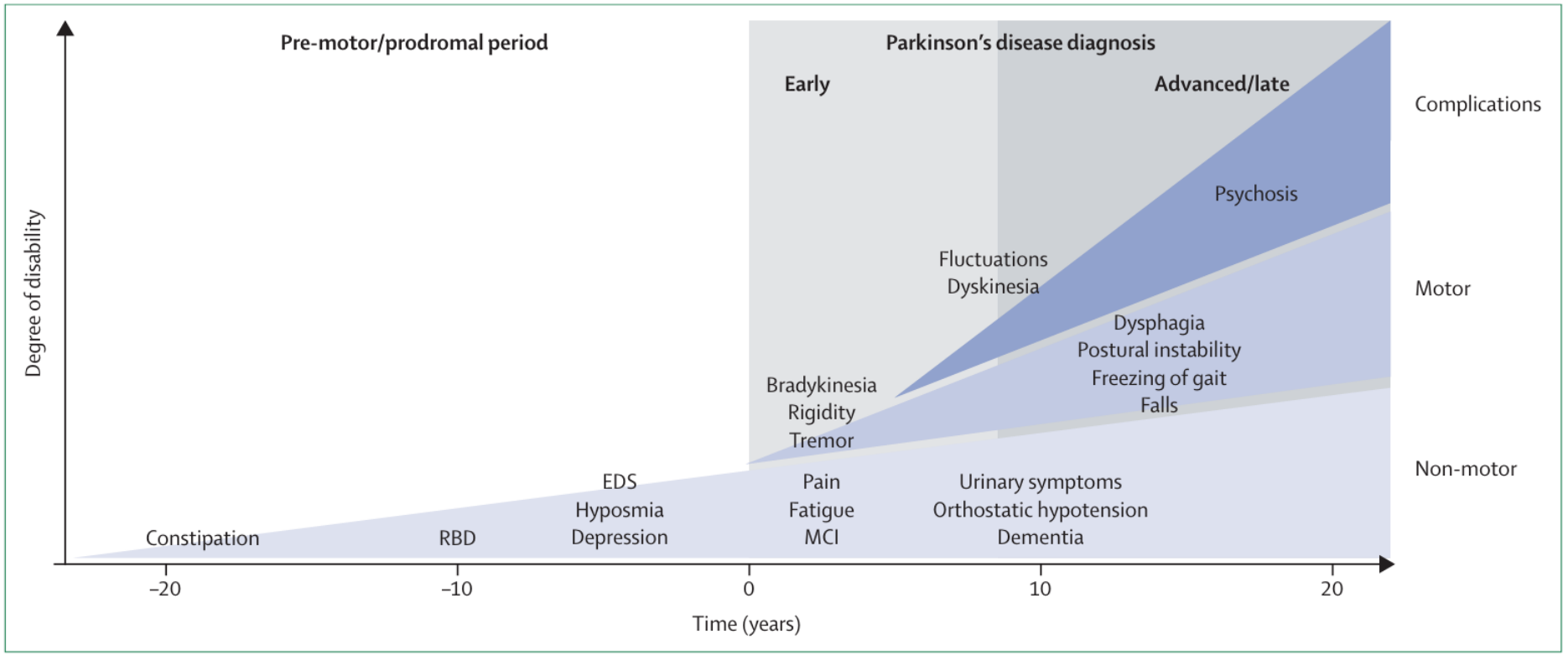

Figure 1: **Clinical symptoms and time course of Parkinson's disease progression**
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Kalia & Lang, 2015

Sintomi motori - Sottotipi

1. Tremor-dominant (slower progression rate and less functional disability)
2. Non-tremor-dominant = akinetic-rigid syndrome and postural instability gait disorder
3. Mixed

Diagnosi

Panel 1: **UK Parkinson's Disease Society Brain Bank clinical diagnostic criteria**[2]

Step 1: diagnosis of parkinsonian syndrome

Bradykinesia (ie, slowness of initiation of voluntary movement with progressive reduction in speed and amplitude of repetitive actions) plus one or more of the following features:

- Muscular rigidity
- 4–6 Hz rest tremor
- Postural instability not caused by primary visual, vestibular, cerebellar, or proprioceptive dysfunction

Step 2: exclusion criteria for Parkinson's disease

One or more of the following features suggest an alternate diagnosis:

- History of repeated strokes with stepwise progression of parkinsonian features
- History of repeated head injury
- History of definite encephalitis
- Neuroleptic treatment at onset of symptoms
- 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) exposure
- Negative response to large doses of levodopa (if malabsorption excluded)
- ~~More than one affected relative*~~
- Sustained remission
- Strictly unilateral features after 3 years
- Early severe autonomic involvement
- Early severe dementia with disturbances of memory, language, and praxis
- Oculogyric crises
- Supranuclear gaze palsy
- Babinski sign
- Cerebellar signs
- Presence of a cerebral tumour or communicating hydrocephalus on CT scan or MRI

Step 3: supportive prospective positive criteria for Parkinson's disease

Three or more of the following features are required for diagnosis of definite Parkinson's disease:

- Unilateral onset
- Rest tremor present
- Progressive disorder
- Persistent asymmetry affecting the side of onset most
- Excellent response (70–100%) to levodopa
- Severe levodopa-induced chorea
- Levodopa response for 5 years or more
- Clinical course of 10 years or more

Gait

Difficcoltà a iniziare il movimento, camptormia (atteggiamento posturale caratterizzato flessione anteriore del tronco), piccoli passi trascinando i piedi, perdita del movimento oscillatorio delle braccia, marcia festinante (progressiva ma irrefrenabile accellerazione con piccoli passi)

Gait

Difficcoltà a iniziare il movimento, camptormia (atteggiamento posturale caratterizzato flessione anteriore del tronco), piccoli passi trascinando i piedi, perdita del movimento oscillatorio delle braccia, marcia festinante (progressiva ma irrefrenabile accellerazione con piccoli passi)

Terapia

Sintomatica, azione ↑ concetrazione di dopamina o stimolare direttamente i recettori dopaminergici

- Levodopa terapia di prima linea. Negli anni spesso effetti secondari (3-8 anni) con comparsa di fluttuazioni motorie (femonemo del wearing off o deterioramento di fine dose, fenomeno on-off, freezing, on ritardato) e discinesie (di picco dose o distonia da fine dose). Somministrata insieme a agonisti dopaminergici per un controllo parziale delle stesse e una riduzione delle dosi di levodopa
- Deep brain stimulation DBS stimolazione cerebrale profonda bilaterale del nucleo subtalamico o del globo pallido interno generalmente indicata nei pazienti con fluttuazioni motorie
- Infusione duodenale di Levodopa/cardidopa il farmaco viene infuso con una pompa portatile durante tutto il giorno attraverso una gastrostomia direttamente nell'intestino (Duodopa®)

Levodopa e deglutizione

Journal of the Neurological Sciences 430 (2021) 120008

Consensus on the treatment of dysphagia in Parkinson's disease

Antonio Schindler [a,l], Nicole Pizzorni [a,*,1], Emanuele Cereda [b], Giuseppe Cosentino [c,d], Micol Avenali [c,e], Cristina Montomoli [f], Giovanni Abbruzzese [g], Angelo Antonini [h], Filippo Barbiera [i], Marco Benazzo [j], Eduardo Benarroch [k], Giulia Bertino [j], Pere Clavè [l,m], Pietro Cortelli [n,o], Roberto Eleopra [p], Chiara Ferrari [a], Shaheen Hamdy [q], Maggie-Lee Huckabee [r], Leonardo Lopiano [s], Rosario Marchese-Ragona [t], Stefano Masiero [u], Emilia Michou [v], Antonio Occhini [i], Claudio Pacchetti [w], Ronald F. Pfeiffer [x], Domenico A. Restivo [y], Mariangela Rondanelli [z,ag], Giovanni Ruoppolo [aa], Giorgio Sandrini [c], Anthony Schapira [ab], Fabrizio Stocchi [ac], Eduardo Tolosa [ad], Francesca Valentino [w], Mauro Zamboni [ae], Roberta Zangaglia [w], Mario Zappia [af], Cristina Tassorelli [c,e], Enrico Alfonsi [d]

Evidenze contraddittorie da 8 studi di Classe III e IV con basse numerosità campionarie e follow-up brevi:

- 50% con miglioramento della deglutizione in stato ON (migliore risposta in pazienti con disfagia meno grave)
- Lievi miglioramenti nell'efficienza ma non nella sicurezza
- Nessun cambiamento nella biomeccanica deglutitoria
- Effetti detrimentali in 1:4 pazienti

La disfagia non dipende solo da un deficit dopaminergico?

DBS e deglutizione

Journal of the Neurological Sciences 430 (2021) 120008

Consensus on the treatment of dysphagia in Parkinson's disease

Antonio Schindler [a,l], Nicole Pizzorni [a,*,1], Emanuele Cereda [b], Giuseppe Cosentino [c,d], Micol Avenali [c,e], Cristina Montomoli [f], Giovanni Abbruzzese [g], Angelo Antonini [h], Filippo Barbiera [i], Marco Benazzo [j], Eduardo Benarroch [k], Giulia Bertino [j], Pere Clavè [l,m], Pietro Cortelli [n,o], Roberto Eleopra [p], Chiara Ferrari [a], Shaheen Hamdy [q], Maggie-Lee Huckabee [r], Leonardo Lopiano [s], Rosario Marchese-Ragona [t], Stefano Masiero [u], Emilia Michou [v], Antonio Occhini [i], Claudio Pacchetti [w], Ronald F. Pfeiffer [x], Domenico A. Restivo [y], Mariangela Rondanelli [z,ag], Giovanni Ruoppolo [aa], Giorgio Sandrini [c], Anthony Schapira [ab], Fabrizio Stocchi [ac], Eduardo Tolosa [ad], Francesca Valentino [w], Mauro Zamboni [ae], Roberta Zangaglia [w], Mario Zappia [af], Cristina Tassorelli [c,e], Enrico Alfonsi [d]

12 studi di classe II e IV (prevalentemente DBS al nucleo subtalamico bilaterale e alta frequenza):

- Bassi livelli di evidenza (IV) di miglioramenti nel transito del bolo e nella cinematica faringea
- Evidenza (II e IV) di effetti detrimentali a lungo termine (>6 mesi) sia a livello faringeo che a livello orale nella DBS-SNT, mentre outcome deglutitori migliori nella DBS al globo pallido interno

Terapia

	Drug class	Drug name
Cognitive impairment		
Dementia	Acetylcholinesterase inhibitor	Rivastigmine
Psychiatric symptoms		
Depression	Dopamine agonist Serotonin reuptake inhibitor Serotonin and norepinephrine reuptake inhibitor Tricyclic antidepressant	Pramipexole Citalopram, escitalopram, fluoxetine, paroxetine, sertraline Venlafaxine extended release Desipramine, nortriptyline
Psychosis	Atypical antipsychotic Acetylcholinesterase inhibitor	Clozapine, quetiapine Rivastigmine
Sleep disorders		
REM sleep behaviour disorder	Benzodiazepine Hormone	Clonazepam Melatonin
Autonomic dysfunction		
Constipation	Osmotic laxative Chloride channel activator	Polyethylene glycol Lubiprostone
Gastrointestinal motility	Peripheral dopamine antagonist	Domperidone
Orthostatic hypotension	Peripheral dopamine antagonist Mineralocorticoid Vasopressor Acetylcholinesterase inhibitor Norepinephrine prodrug	Domperidone Fludrocortisone Midodrine Pyridostigmine Droxidopa
Sialorrhoea	Anticholinergic Neurotoxin	Atropine drops, glycopyrrolate Botulinum toxin A, botulinum toxin B
Other		
Fatigue	Stimulant	Methylphenidate, modafinil

REM=rapid eye movement.

Table 3: **Pharmacological treatments for non-motor symptoms**

Scale neurologiche

HOEHN & YAHR

Stadio	Scala di Hoehn e Yahr	Scala di Hoehn e Yahr modificata
1	Coinvolgimento unilaterale, solitamente con solo una minima o nessuna disabilità funzionale	Solo coinvolgimento unilaterale
1.5	-	Coinvolgimento unilaterale e assiale
2	Coinvolgimento bilaterale o mediano senza compromissione dell'equilibrio	Coinvolgimento bilaterale senza compromissione dell'equilibrio
2.5	-	Lieve coinvolgimento bilaterale senza recupero sul test a trazione
3	Coinvolgimento bilaterale da medio a moderato; alcune difficoltà posturali; fisicamente indipendente	Da lieve a moderato coinvolgimento bilaterale; instabilità posturale; fisicamente autosufficiente
4	Malattia gravemente debilitante, ancora in grado di camminare o stare in piedi senza assistenza	Grave disabilità; ancora in grado di camminare o stare in piedi senza assistenza
5	Costretto a letto o sulla sedia a rotelle	Costretto a letto o sulla sedia a rotelle

Scale neurologiche

UPDRS

UPDRS I esperienze non-motorie della quotidianità (autovalutazione)

UPDRS II esperienze motorie della quotidianità (autovalutazione)

UPDRS III esame motorio

UPDRS IV

Punteggio maggiore per gravità maggiore

Disfagia - Prevalenza

Table 2
Prevalence of dysphagia in PD, based on objective or clinician-rated measures.

Study	Study population	P/C	Age (y)	Disease severity	Disease duration	APM	Assessment, diagnostic criteria	Patients (%)	Controls (%)
Nilsson et al., 1996 [12]	Regularly attending depart of neurology; excluding dementia (Sweden)	75/–	Mean 71 (43–85)	H&Y stage: 1–2: 34% 3: 43% 4–5: 23%	9	Optimally treated	ROSS test: –Any abnormality in single swallow or forced repetitive swallow	87	
Coates &Bakheit, 1997 [13]	IPD patients diagnosed by neurologist (UK)	53/–	Mean 69.9 (52–87)	–	6.7 (1–24)	All but 2; state NR	CAS (10 swallow items on 5-point scale): –Score < 5 on at least one item	81	
Clarke et al., 1998 [14]	Consecutive series of idiopathic PD patients attending MDC (UK)	58/80	Mean 66.7 (controls: 67.1)	H&Y median 3 (1.5–5)	9 (1–43)	All in Off state	Swallowing speed (ml/s): –< 10 ml/s	72[a]	23
Miller et al., 2009 [16]	Community-based and hospital-based cohort (UK)	137/–	Median 73 (IQR 68–77)	H&Y median 2 (IQR 2–3)	5 (IQR 3.5–11)	All in Off state	Swallowing speed (ml/s): –> 1 SD below norm	84	

Abbreviations: P/C = patients/controls; NR = not reported; GI = gastrointestinal; APM = anti-parkinson medication; CAS = Chicago Assessment Scale; ROSS-test = Repetitive Oral Suction Swallow.
[a] $p < 0.05$.

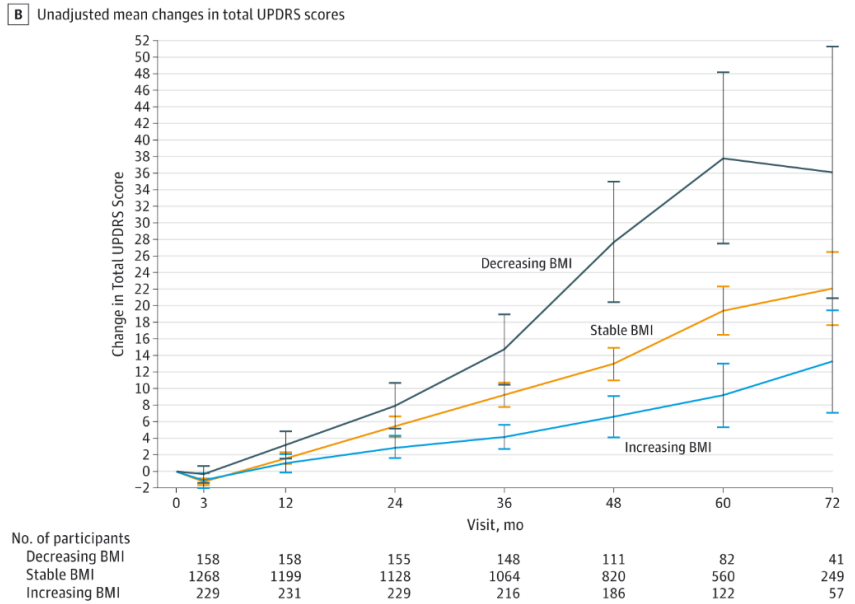
Kalf et al, 2014

Disfagia - Complicanze

Follow up duration	Mortality rate (percent)
	Patients with PD (%)
1 month	23.9
3 months	41.8
6 months	54.1
12 months	65.2
24 months	76.3
36 months	84.4
48 months	88.3
60 months	91.8

Table 4. Mortality after occurrence of aspiration pneumonia among PD patients

Won et al, 2021



n=1,673 pazienti con PD

Wills et al, 2016

Caratteristiche

Table 2 Patterns of Parkinson-related dysphagia in different phases of swallowing: oral phase, pharyngeal phase, and esophageal phase

Phase of swallowing	Frequent findings
Oral	Repetitive pump movements of the tongue
	Oral residue
	Premature spillage
	Piecemeal deglutition
Pharyngeal	Residue in valleculae >>> pyriform sinuses
	Aspiration in 50 % of dysphagic PD patients
	Somatosensory deficits
	Reduced rate of spontaneous swallows (48/h vs. 71/h)
Esophageal	Hypomotility
	Spasms
	Multiple contractions

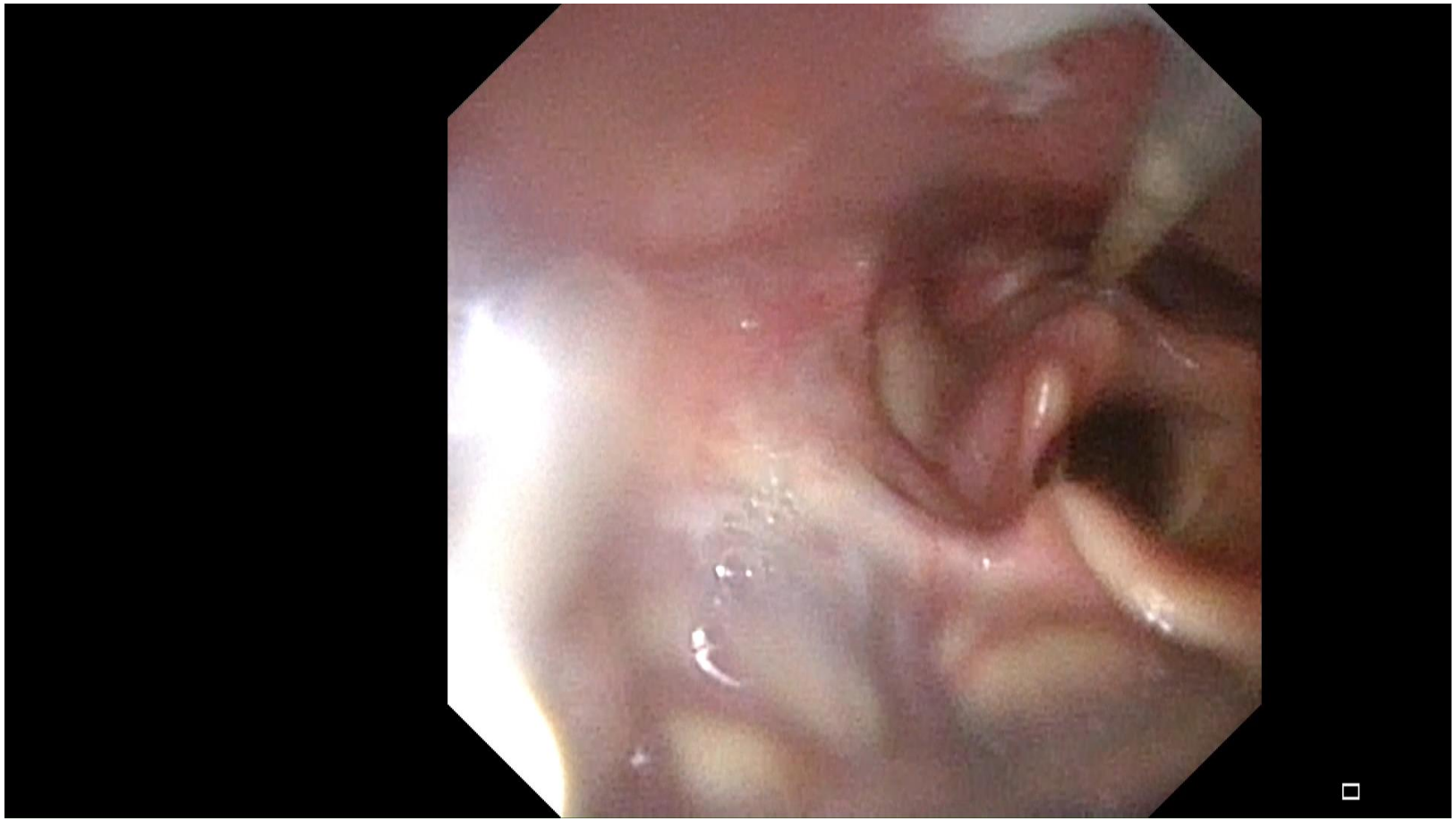
Dysphagia (2016) 31:24–32
DOI 10.1007/s00455-015-9671-9

REVIEW ARTICLE

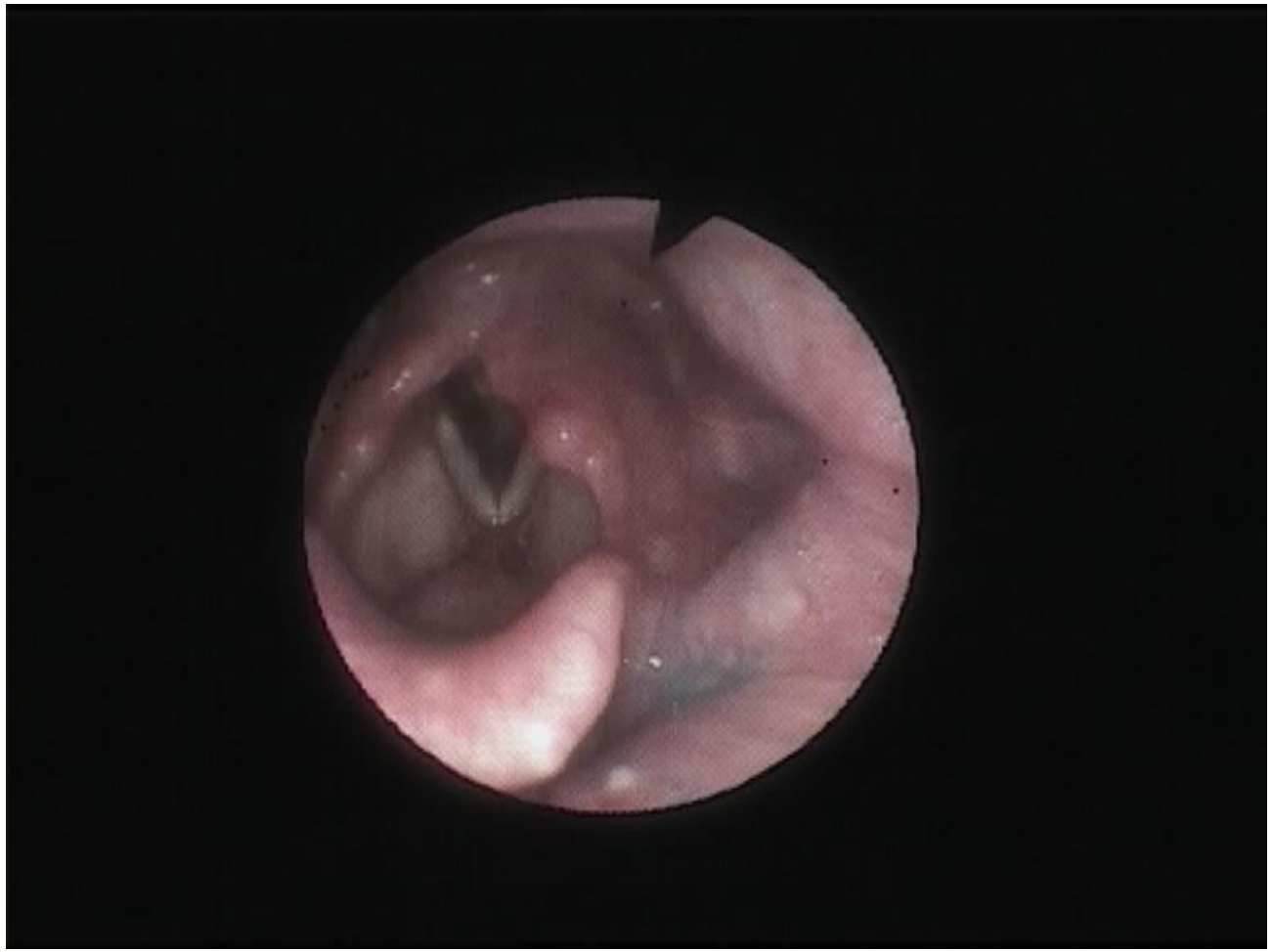
Dysphagia in Parkinson's Disease

Inga Suttrup[1] · Tobias Warnecke[1]

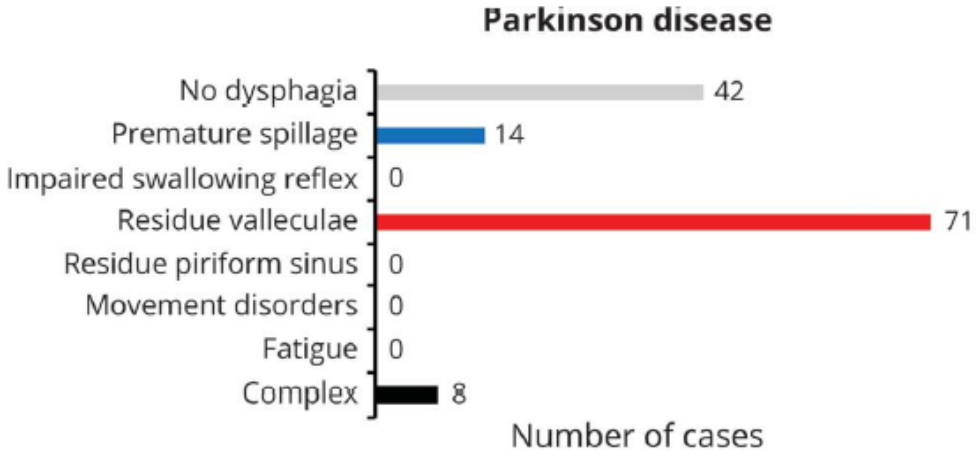
Tongue pumping

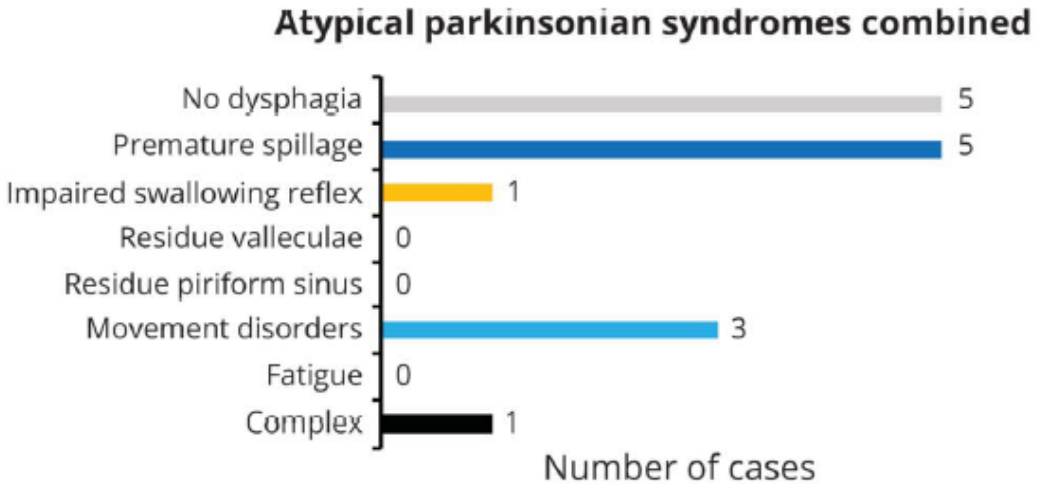


Freezing deglutitorio



Fenotipi





Warnecke et al, 2020

Durata del white-out

25 pazienti con MP vs 10 controlli sani

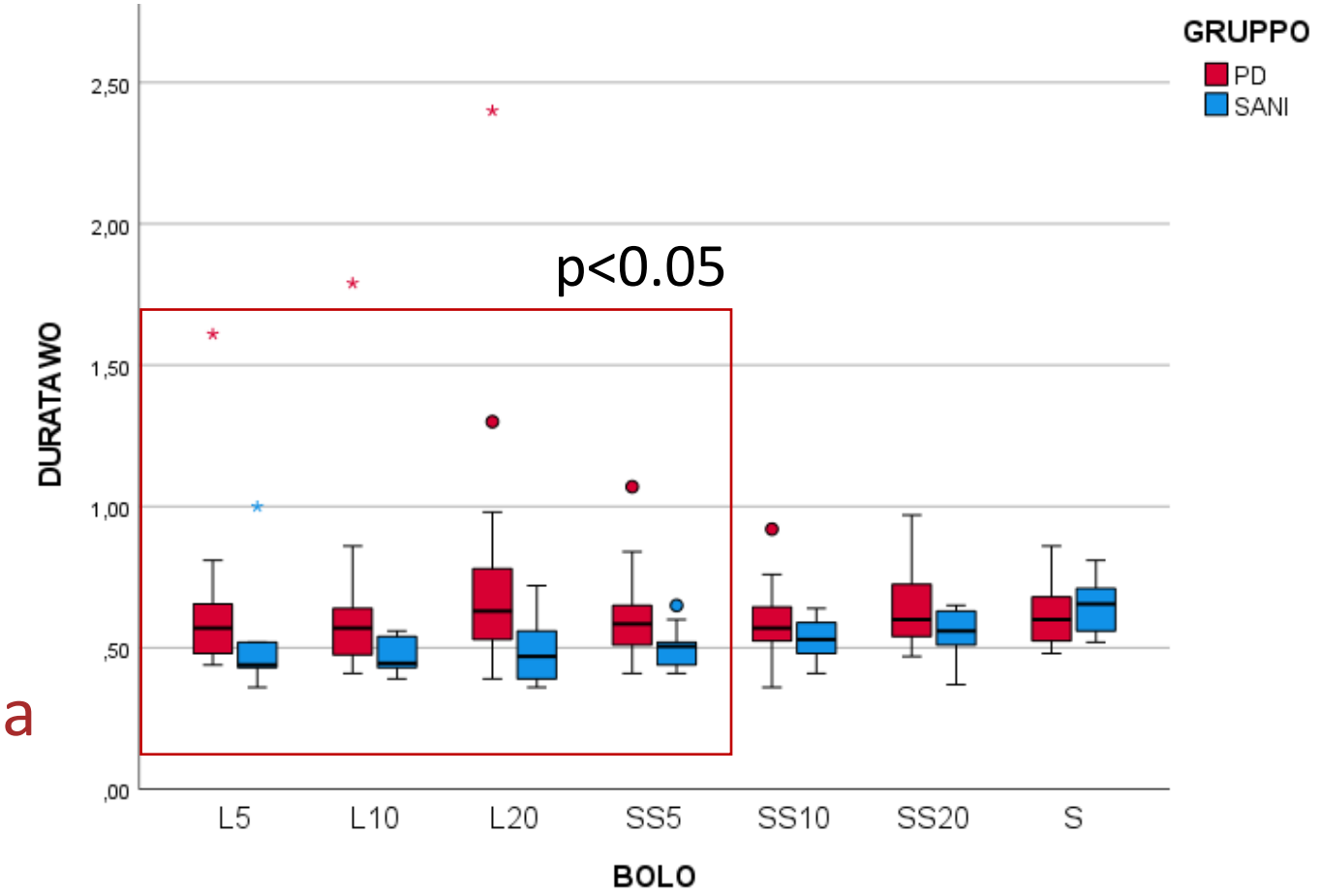
<u>Protocollo FEES</u>

5-10-20ml IDDSI 0

5-10-20ml IDDSI 4 (mousse frutta)

8gr IDDSI 7 (cracker)

Segno di bradicinesia faringea



Pizzorni, Lorusso, Micheletti, Schindler; In corso

Ipertono UES

Una riduzione del rilassamento del muscolo cricofaringeo è stato riportato con principale meccanismo fisiopatologico nel 20-30% dei pazienti con Malattia di Parkinson

Ali et al, 1996, Alfonsi et al, 2007

Riproducibilità deglutitoria

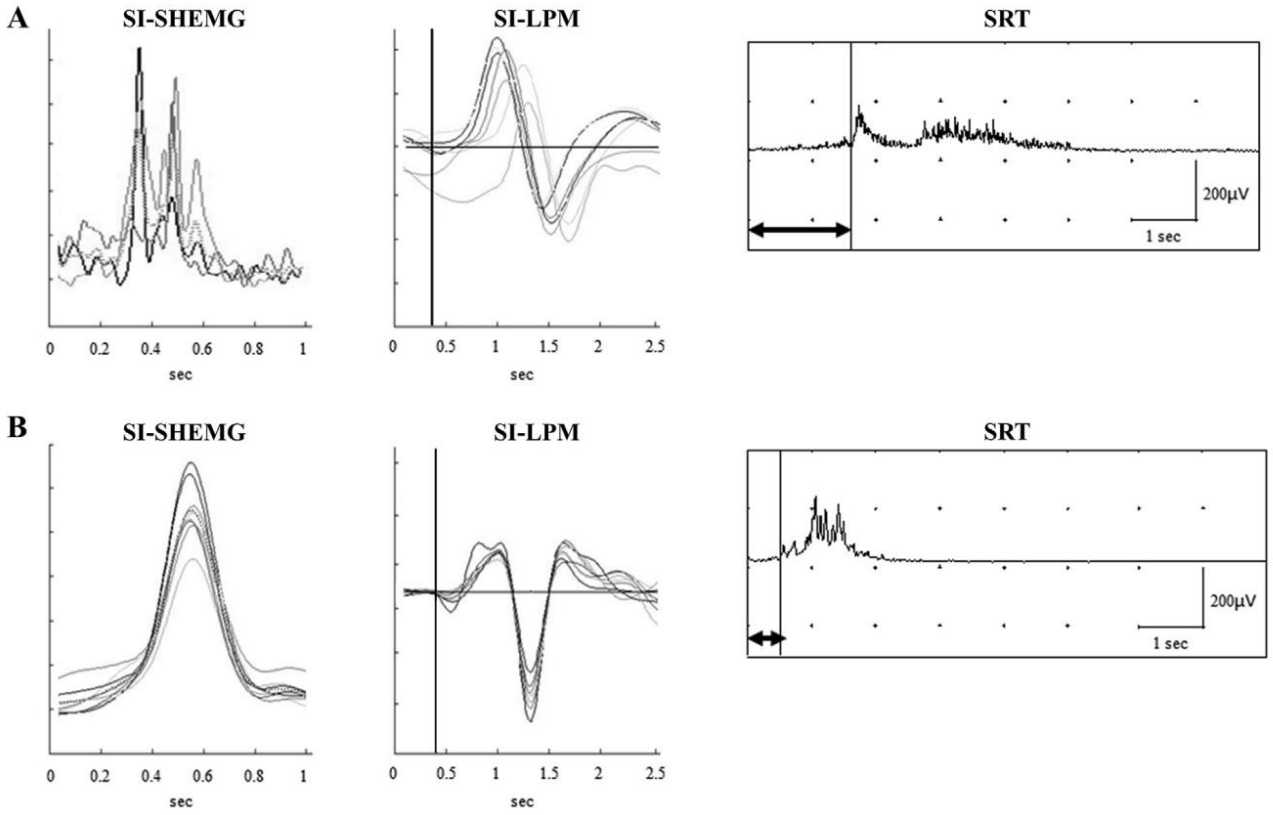
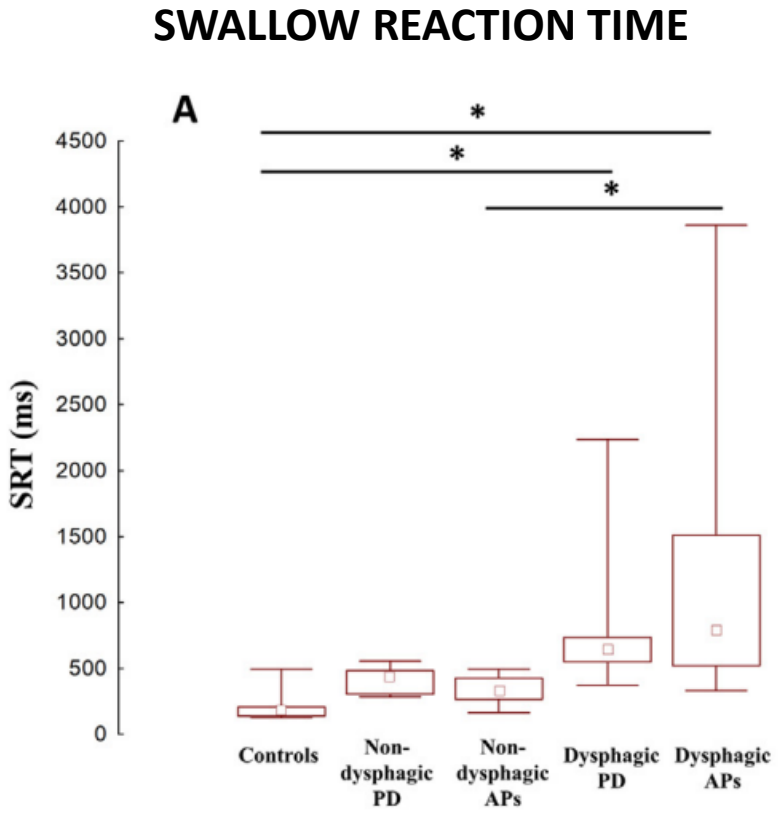


Fig. 4. Examples of similarity index of the submental/suprahyoid electromyography (SI-SHEMG), similarity index of the laryngeal-pharyngeal mechanogram (SI-LPM) and Swallowing Reaction Time (SRT) in Parkinson's disease (PD) patients with **(A)** and without dysphagia **(B)**. PD patients with dysphagia showed reduced SI-SHEMG and prolonged SRT with respect to PD patients without dysphagia. SI-LPM was within normal limits in both patients' groups. Healthy controls did not differ as compared to PD patients without dysphagia.



Cosentino et al, 2020

Scialorrea

Sintomo riscontrato dal 10% al 84% dei pazienti con MP.

Dovuta a :

- Postura del capo e del tronco
- Postura delle labbra a riposo
- Riduzione della frequenza deglutitoria
- Propriocezione diminuita
- Stato attentivo

Srivanitchapoom et al, 2014

Dysphagia (2018) 33:809–817
https://doi.org/10.1007/s00455-018-9906-7

ORIGINAL ARTICLE

Drooling in Parkinson's Disease: Evidence of a Role for Divided Attention

Hannah Reynolds[1] · Nick Miller[2] · Richard Walker[3,4]

Table 5 Drooling severity and frequency and swallow frequency (number of swallows/5 min) median and interquartile scores

Measure	At rest Median (IQR)	With distraction Median (IQR)	*p* values Wilcoxon signed rank test
Drooling severity	1.3 (1.0–1.60)	1.6 (1.0–1.85)	$z = -1.724$, $p = 0.085$
Drooling frequency	1.6 (1.0–1.85)	1.8 (1.0–2.00)	$z = -2.041$, $p = 0.041$
Swallow frequency	2.4 (1.33–4.23)	1.1 (0.50–1.53)	$z = -3.054$, $p = 0.002$

Fisiopatologia

npj | parkinson's disease www

REVIEW ARTICLE OPEN 2022

Gastrointestinal involvement in Parkinson's disease: pathophysiology, diagnosis, and management

T. Warnecke[1], K-H. Schäfer[2], I. Claus[1], K. Del Tredici[3,5] and W. H. Jost[4,5]✉

Table 1. Overview of PD-related oropharyngeal dysphagia clinical manifestations and postulated pathomechanisms.

Clinical manifestation	Pathomechanisms
Prolonged oral transit time:	Dopaminergic + non-dopaminergic (especially Lewy pathology in swallowing cortex?)
Premature spillage:	Dopaminergic + non-dopaminergic (Lewy pathology in swallowing cortex?)
Delayed swallow reflex:	Dopaminergic + decreased Substance P concentration
Prolonged pharyngeal transit time:	Dopaminergic + non-dopaminergic (Lewy pathology in brainstem?)
Penetration:	Dopaminergic + non-dopaminergic
Aspiration:	Dopaminergic + non-dopaminergic
Residue in valleculae:	Primarily dopaminergic
Residue in piriform sinus:	Dopaminergic + non-dopaminergic
Dysfunction of upper esophageal sphincter:	Primarily non-dopaminergic (Lewy pathology in swallowing centers of medulla oblongata?)
Insufficient cough reflex:	Decreased Substance P concentration

Source[108].

Sostanza P

Neuropeptide che modula la risposta locale nella mucosa faringea e facilita il riflesso di deglutizione e di tosse

frontiers in Neurology

Substance P Saliva Reduction Predicts Pharyngeal Dysphagia in Parkinson's Disease

Jens Burchard Schröder, Thomas Marian, Inga Claus, Paul Muhle, Matthias Pawlowski, Heinz Wiendl, Sonja Suntrup-Krueger, Sven G. Meuth, Rainer Dziewas, Tobias Ruck and Tobias Warnecke*

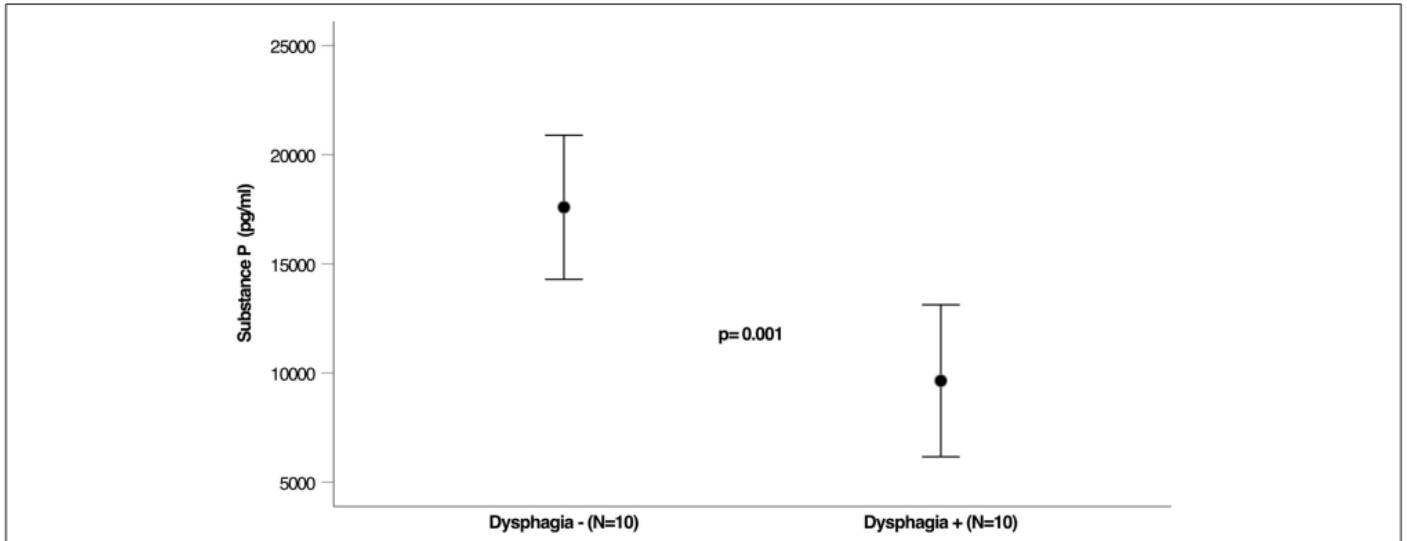


FIGURE 1 | Levels of Substance P in saliva of dysphagic and not dysphagic PD patients.

Diagnosi differenziale con altri sindromi parkinsoniane

- Segni cerebellari evidenti (MSA)
- Progressione molto rapida (MSA)
- Disautonomia severa precoce (MSA)
- Paralisi dello sguardo verso il basso (PSP)
- Cadute frequenti precoci, soprattutto se all'indietro (PSP)
- Assenza completa di risposta alla levodopa (parkinsonismi secondari)
- Demenza nel 1° anno (demenza da corpi di Lewy)
- Assenza di tremore e sintomi motori simmetrici

Paralisi sopranucleare progressiva PSP

- Sindrome parkinsoniana simmetrica con bradicinesia, rigidità, scarso tremore ed instabilità posturale molto precoce, con frequenti cadute, specialmente all'indietro (retropulsione). La rigidità è più evidente nella muscolatura assiale che negli arti e porta ad una postura in estensione cervicale. Andatura rigida e con base ampia
- Scarsa o nessuna risposta al trattamento con Levodopa
- Distonia che interessa prevalentemente il collo
- Disfunzione corticobulbare o corticospinale con aumento dei riflessi miotatici, segno di Babinski, disartria, disfagia e labilità emotiva (sindrome pseudobulbare)
- Paralisi dello sguardo coniugato verticale, specialmente verso il basso, fin dalle fasi iniziali
- Contrazione dei muscoli frontali
- Demenza più precoce rispetto alla malattia di Parkinson
- Sopravvivenza media 3-4 anni dalla diagnosi

Disfagia e PSP

Dysphagia
https://doi.org/10.1007/s00455-024-10681-7

ORIGINAL ARTICLE

Dysphagia Prevalence in Progressive Supranuclear Palsy: A Systematic Review and Meta-Analysis

Julia Glinzer[1,2] · Éadaoin Flynn[1,3] · Eleni Tampoukari[1] · Isolde Harpur[4] · Margaret Walshe[1]

Received: 2 September 2023 / Accepted: 2 February 2024

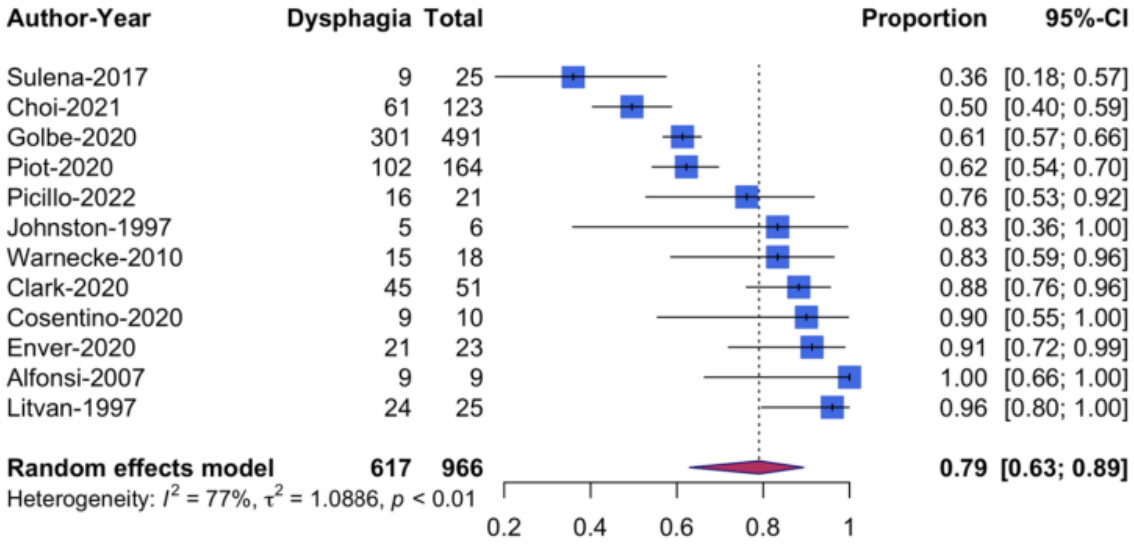


Fig. 2 Forest plot of pooled dysphagia prevalence rates based on patient or clinician reported outcome measures, instrumental and clinical assessment

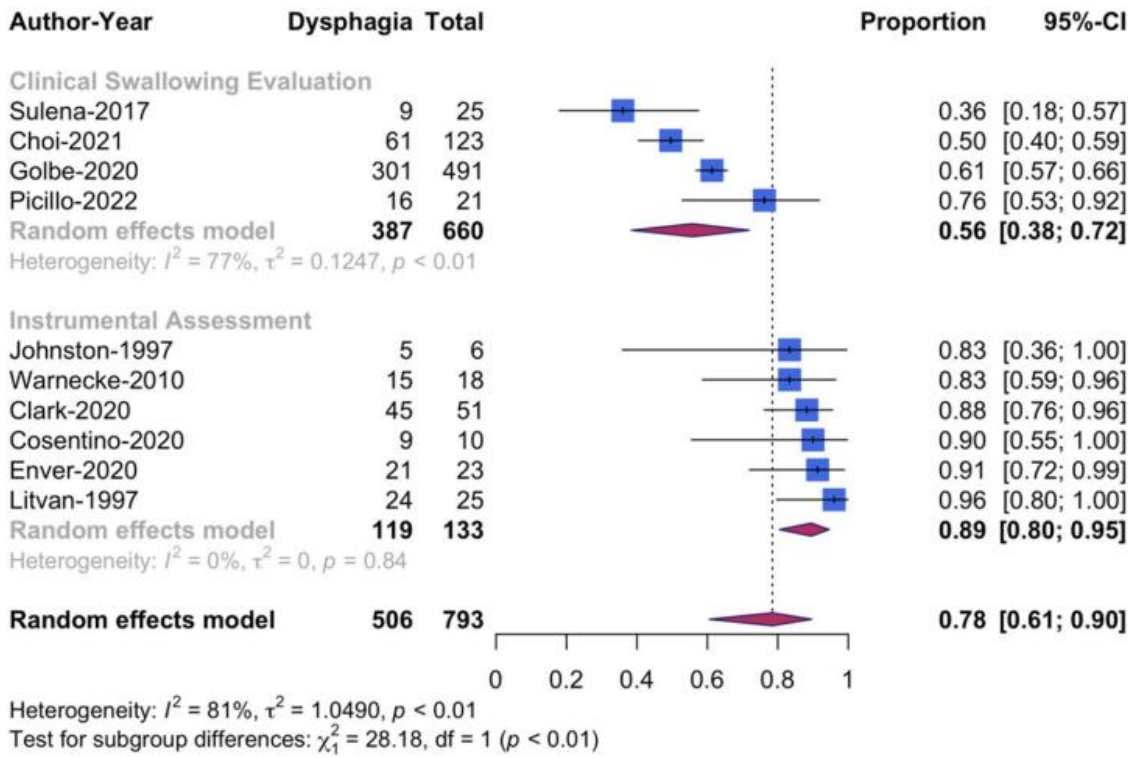


Fig. 3 Forest plot of pooled dysphagia prevalence rates by assessment type

Disfagia e PSP

2015

Impact of Aspiration Pneumonia on the Clinical Course of Progressive Supranuclear Palsy: A Retrospective Cohort Study

Satoshi Tomita[1,2], Tomoko Oeda[1,2], Atsushi Umemura[1,2], Masayuki Kohsaka[1,2], Kwiyoung Park[1,2], Kenji Yamamoto[1,2], Hiroshi Sugiyama[2], Chiaki Mori[3], Kimiko Inoue[3], Harutoshi Fujimura[3], Hideyuki Sawada[1,2]*

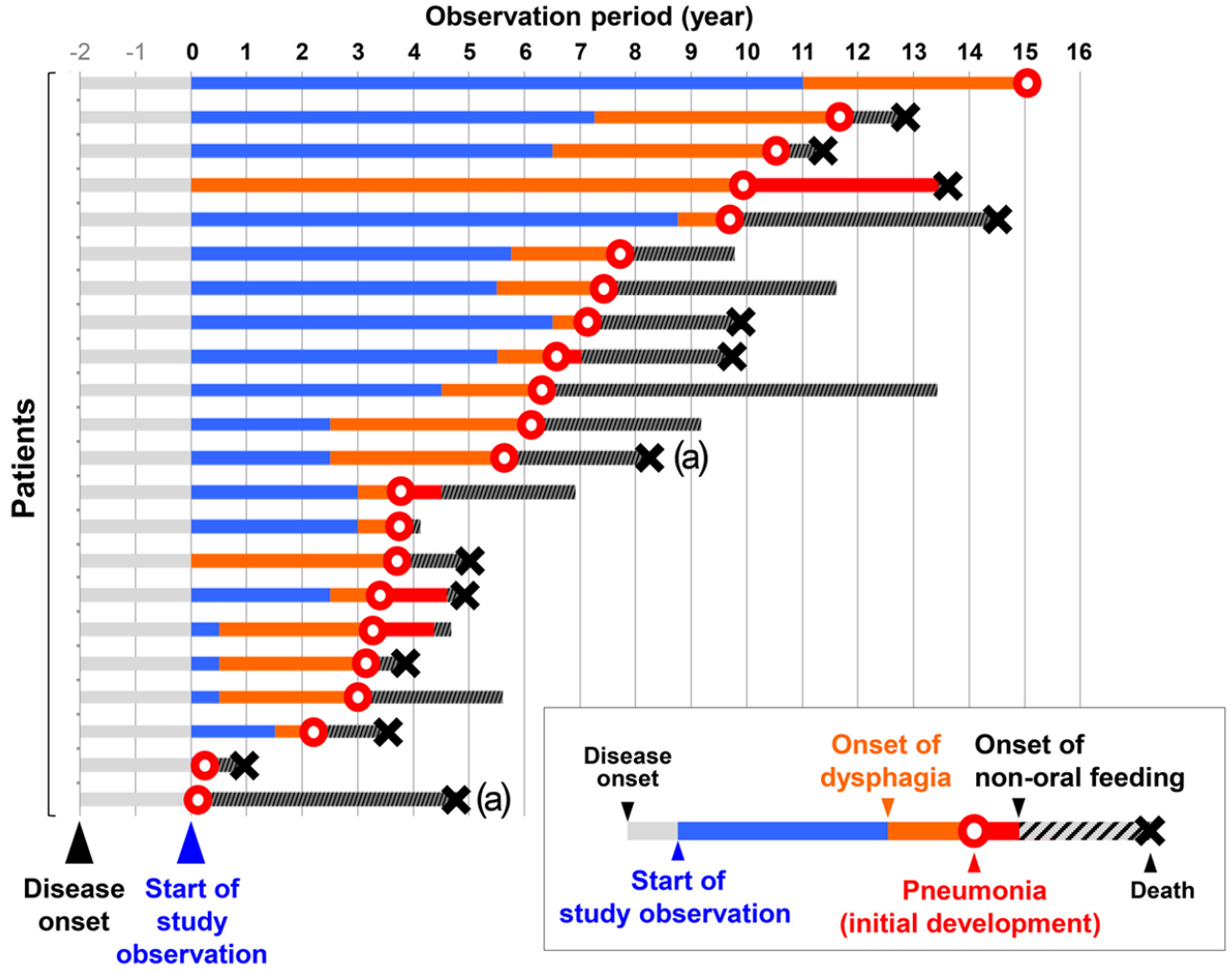


Fig 1. Clinical courses of 22 patients with experience of pneumonia. Pneumonia developed in 22 patients and 13 patients died in the observation period.
[a]Pathologically confirmed cases of progressive supranuclear palsy.

doi:10.1371/journal.pone.0135823.g001

Insorgenza della disfagia generalmente precoce

Dysphagia. 2020 August ; 35(4): 667–676. doi:10.1007/s00455-019-10073-2.

Dysphagia in Progressive Supranuclear Palsy

Heather M Clark, PhD[1], Julie A G Stierwalt, PhD[1], Nirubol Tosakulwong, BS[2], Hugo Botha, MB, ChB[1], Farwa Ali, MBBS[1], Jennifer L Whitwell, PhD[3], Keith A Josephs, MD[1]

55 pz con PSP valutati con MBSImP

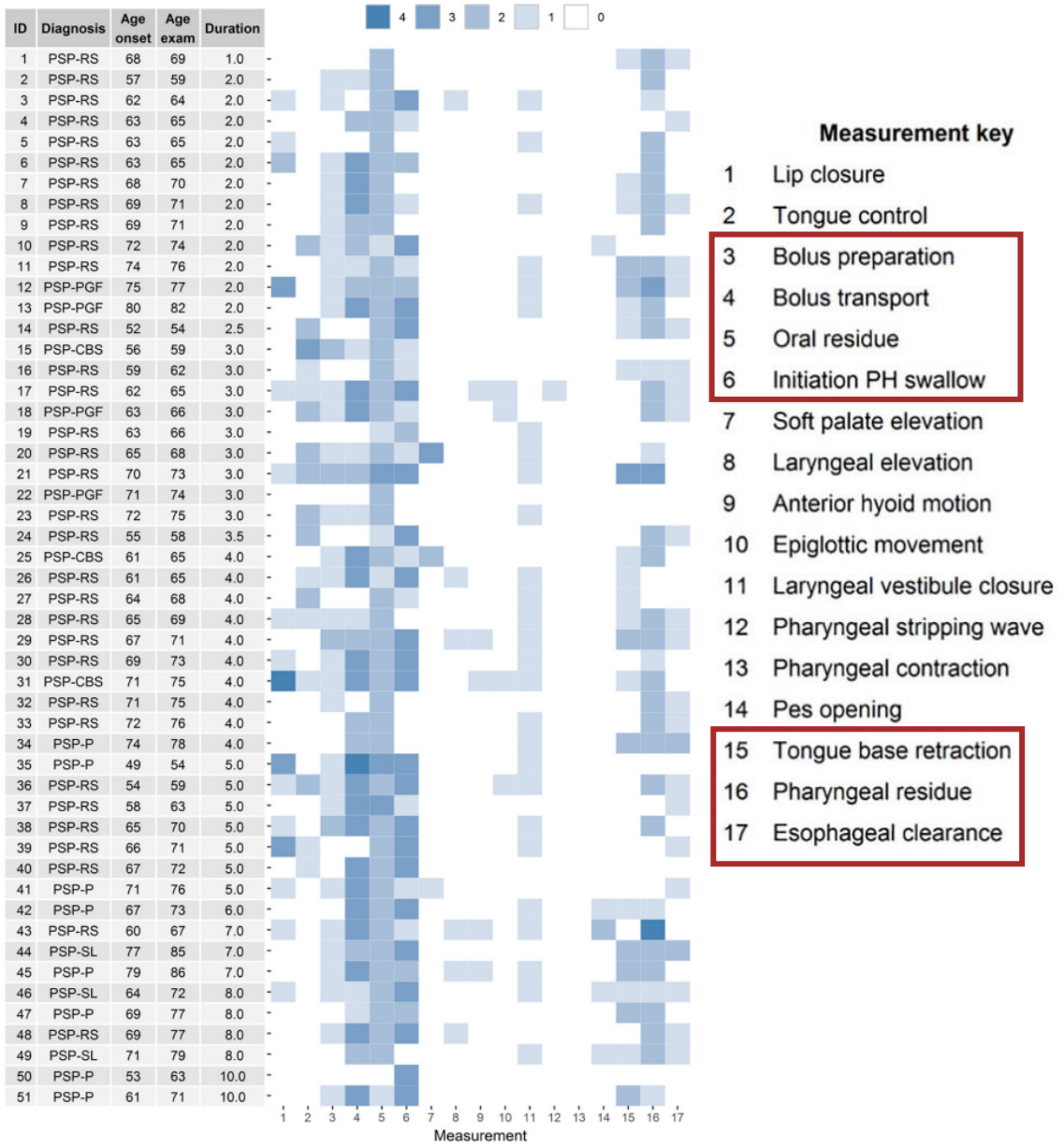
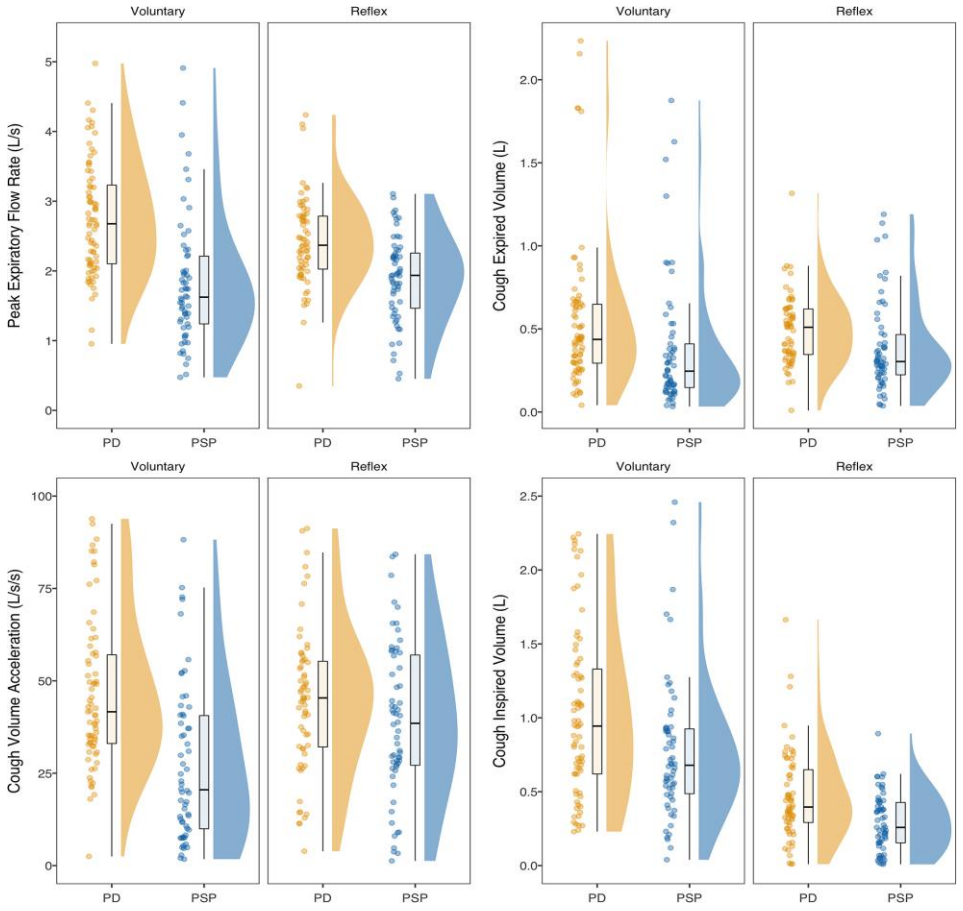


Figure 1.
MBSImP ratings for individual participants organized by disease duration. Age, age of onset, and disease duration are listed in years. The far-right graph depicts the severity rating for each MBSImP component. A higher score, depicted with a darker shade, reflects greater impairment.

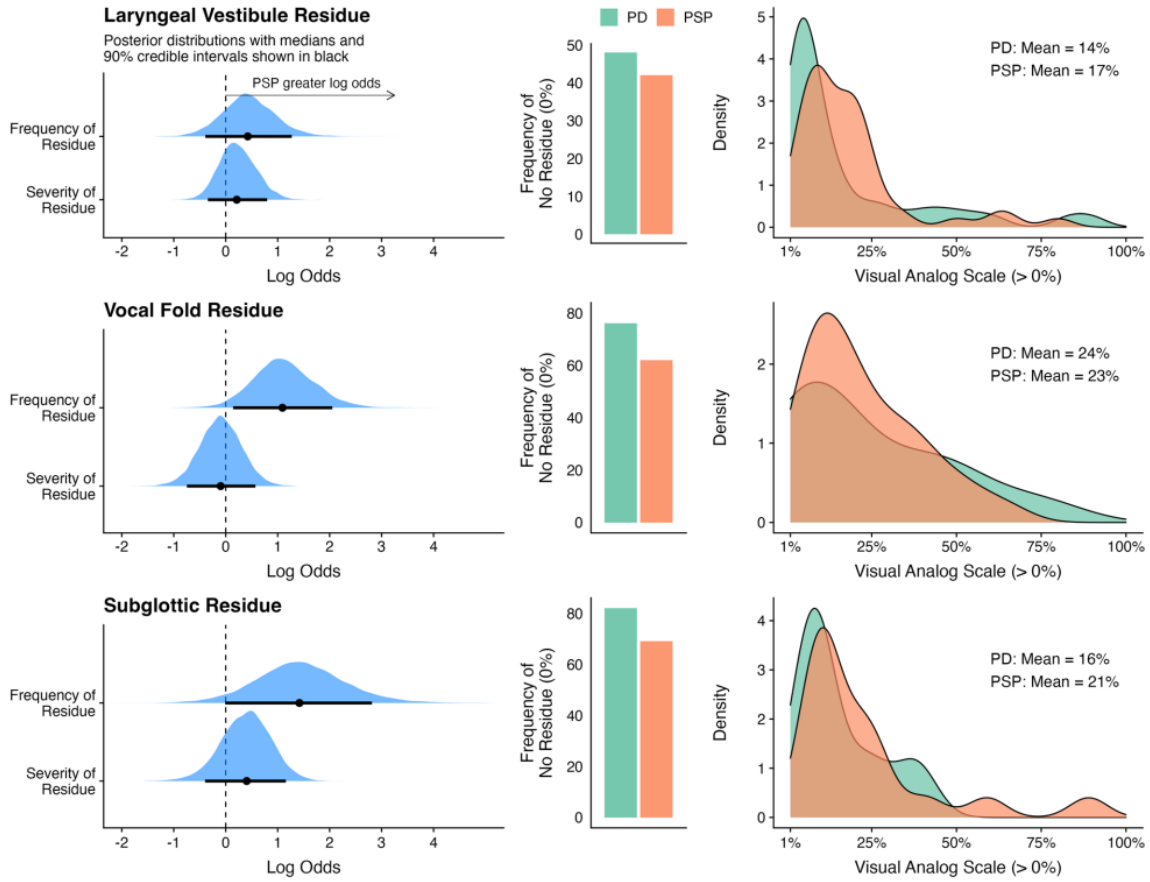
PSP vs MP: tosse e deglutizione

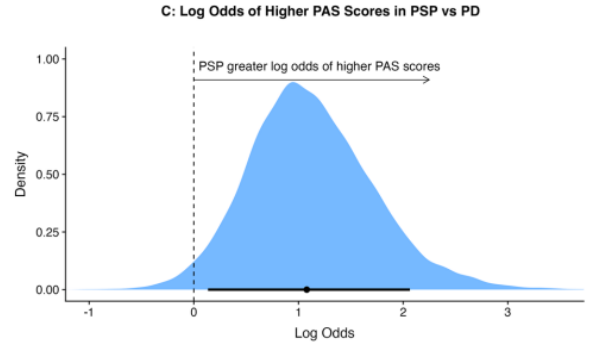
TOSSE



Borders et al, 2021

DEGLUTIZIONE





= Maggior rischio di complicanze polmonari

Borders et al, 2023

Atrofia multisistemica MSA

Gruppo eterogeneo di patologie degenerative del sistema nervoso.

Clinicamente si manifestano con una combinazione di:

- Clinica parkinsoniana (in genere simmetrica)
- Segni e sintomi autonomici precoci (ipertensione ortostatica, stipsi, disfunzione erettile e urinaria)
- Segni e sintomi cerebellari (atassia della marcia, dismetria)
- Sindrome piramidale (riflessi tendinei aumentati, segno di Babinski)

No deteriormamento cognitivo

Presente accumulo di α-sinucleina ma non si formano i corpi di Lewy

MSA

- MSA-P -> predominanza di clinica parkinsoniana
- MSA-C -> predominanza di clinica cerebellare

Il quadro può variare nel medesimo paziente durante la progressione di malattia

Sopravvivenza media 6-10 anni

La levodopa puù essere parzialmente efficace

MSA – Alterazione dei movimenti laringei

- Stridor laringeo
- Motilità cordale paradossa
- Ridotta motilità cordale
- Movimenti della cartilagene aritenoidea irregolari e/o involontari

Marker per la diagnosi differenziale con la MP

Warnecke et al, 2019

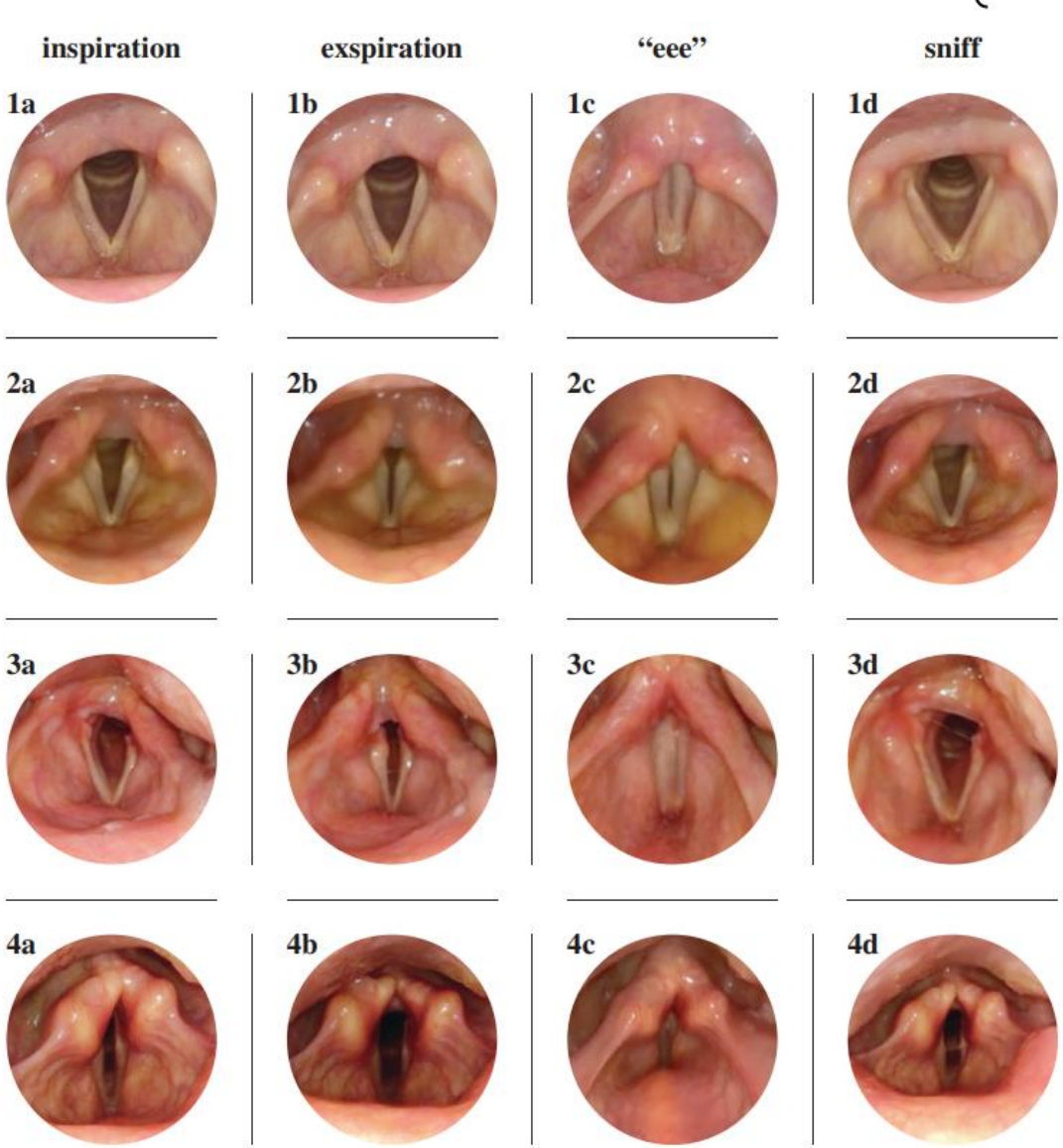


FIG. 1. Vocal fold position during normal inspiration (**a**), normal expiration (**b**), phonation of "eee" (**c**), and sniffing (**d**) in a healthy subject (**1**) and patients with multiple system atrophy (MSA) (**2**,**3**,**4**). (**1**) Normal vocal fold motion with abduction during inspiration (**a**), slight adduction during expiration (**b**), near complete adduction during phonation (**c**), and near complete abduction during sniffing (**d**). (**2**) Example of vocal fold motion impairment (VFMI) in a patient with MSA with restricted vocal fold abduction during inspiration (**a**), pronounced vocal fold adduction during expiration (**b**), insufficient vocal fold adduction during phonation (**c**), and incomplete vocal fold abduction during sniffing (**d**). (**3**) Example of vocal fold fixation (VFF) in a patient with MSA with absent left vocal fold motion during inspiration (**a**), expiration (**b**), and sniffing (**d**) but normal vocal fold adduction during phonation (**c**). (**4**) Example of paradoxical vocal fold motion (PVFM) in a patient with MSA with paradoxical vocal fold adduction during inspiration (**a**), paradoxical vocal fold abduction during expiration (**b**), incomplete vocal fold adduction during phonation with consecutive activation of the false vocal folds (**c**), and paradoxical vocal fold adduction during sniffing (**d**).

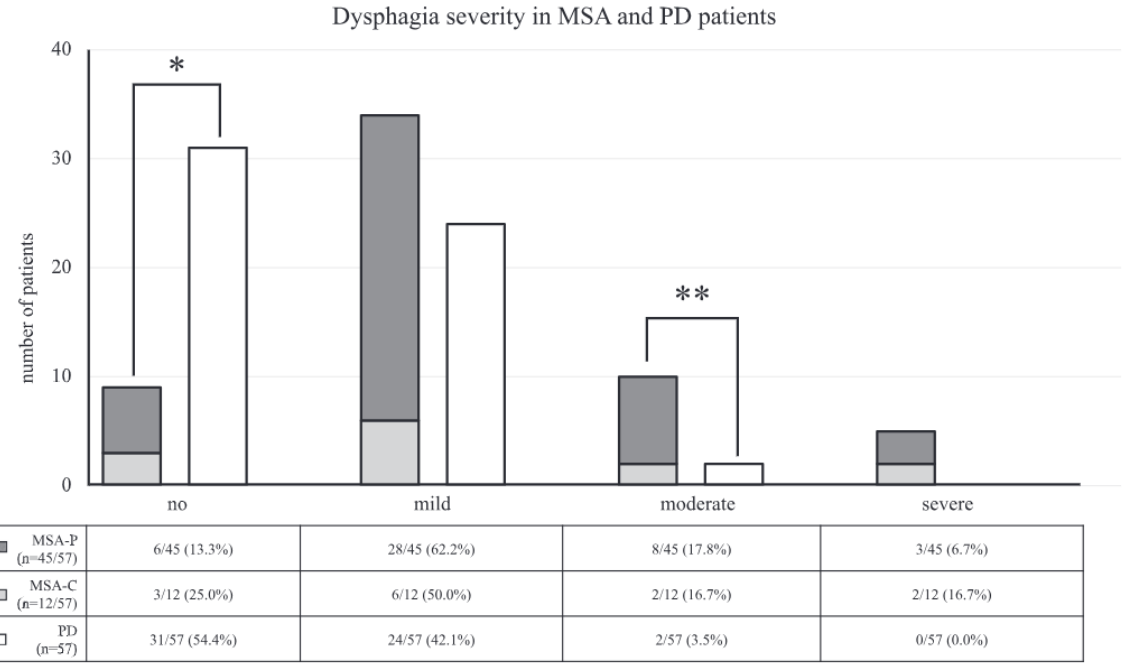
Gandor et al, 2020

MSA e disfagia

2021

Endoscopic Characteristics of Dysphagia in Multiple System Atrophy Compared to Parkinson's Disease

Annemarie Vogel, MSc,[1] Inga Claus, MD,[2] Sigrid Ahring, BSc,[2] Doreen Gruber, MD,[1,3] Aiden Haghikia, MD,[3] Ulrike Frank, PhD,[4] Rainer Dziewas, MD,[5] Georg Ebersbach, MD,[1] Florin Gandor, MD,[1,3*] and Tobias Warnecke, MD[2]



	no	mild	moderate	severe
MSA-P (n=45/57)	6/45 (13.3%)	28/45 (62.2%)	8/45 (17.8%)	3/45 (6.7%)
MSA-C (n=12/57)	3/12 (25.0%)	6/12 (50.0%)	2/12 (16.7%)	2/12 (16.7%)
PD (n=57)	31/57 (54.4%)	24/57 (42.1%)	2/57 (3.5%)	0/57 (0.0%)

FIG. 1. Dysphagia severity as measured by flexible endoscopic evaluation of swallowing in patients with multiple system atrophy (MSA) and Parkinson's disease (PD). Values in n (% of cohort). *$P < 0.05$; **$P < 0.01$. MSA-C, MSA with cerebellar symptoms; MSA-P, MSA with predominant parkinsonian.

Insorgenza precoce (entro 5 anni dall'esordio dei sintomi motori) di disfagia è un marker diagnostico di MSA vs MP

MSA e disfagia

MODIFICAZIONI DIETETICHE

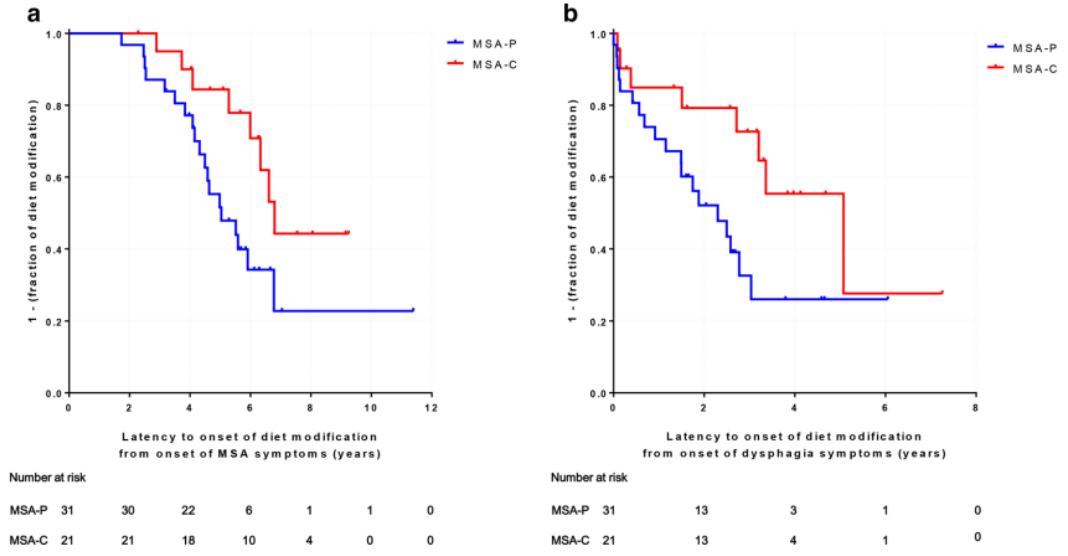


Fig. 1 Trend of diet modification depending on MSA subtypes using Kaplan–Meier survival analysis; **a** from the onset of MSA symptoms, there was a significant difference between MSA-P and MSA-C patients ($P=0.035$); **b** from the onset of dysphagia symptoms, there was a significant difference between MSA-P and MSA-C patients ($P=0.039$)

Mediana dall'onset dei sintomi 6 anni MSA-C e 5 anni MSA-P

NUTRIZIONE ENTERALE

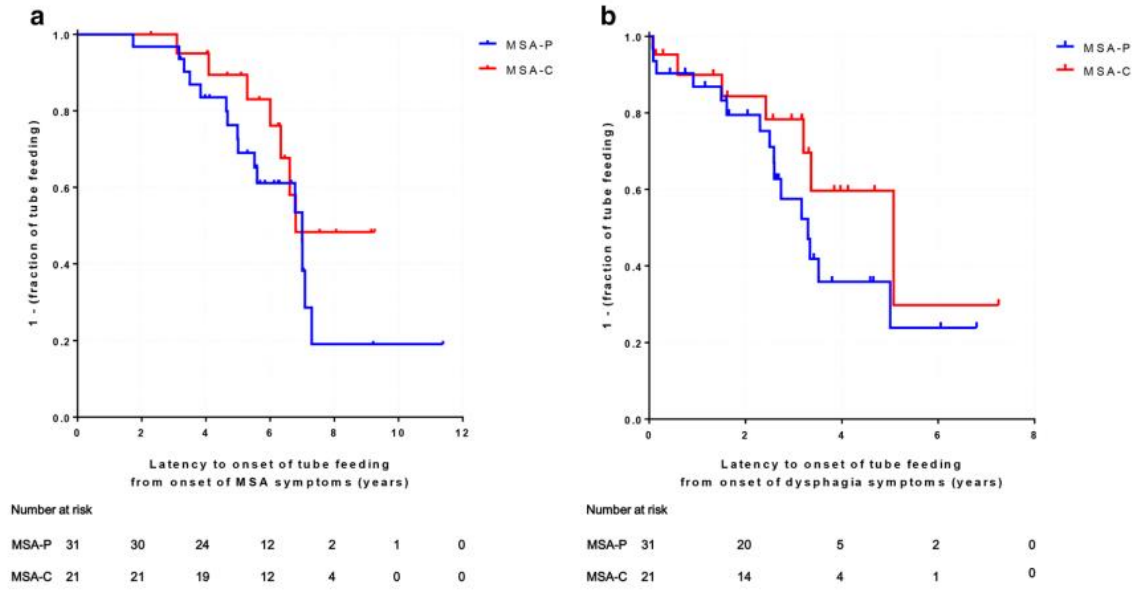


Fig. 2 Trend of tube feeding depending on MSA subtypes using Kaplan–Meier survival analysis; **a** from the onset of MSA symptoms, there was no significant difference between MSA-P and MSA-C patients ($P=0.180$); **b** from the onset of dysphagia symptoms, there was no significant difference between MSA-P and MSA-C patients ($P=0.213$)

Mediana dall'onset dei sintomi 7 anni e dall'insorgenza della disfagia 3 anni

MSA e disfagia

Dysphagia
https://doi.org/10.1007/s00455-023-10619-5

ORIGINAL ARTICLE

Swallowing Characteristics in Patients with Multiple System Atrophy Analyzed Using FEES Examination

Francesco Mozzanica[1,2] · Nicole Pizzorni[3] · Angelo Eplite[3] · Daniela Ginocchio[3] · Anna Colombo[3] · Gabriele Mora[4] · Federico Ambrogi[1] · Tobias Warnecke[5] · Antonio Schindler[3]

Received: 7 March 2023 / Accepted: 14 August 2023

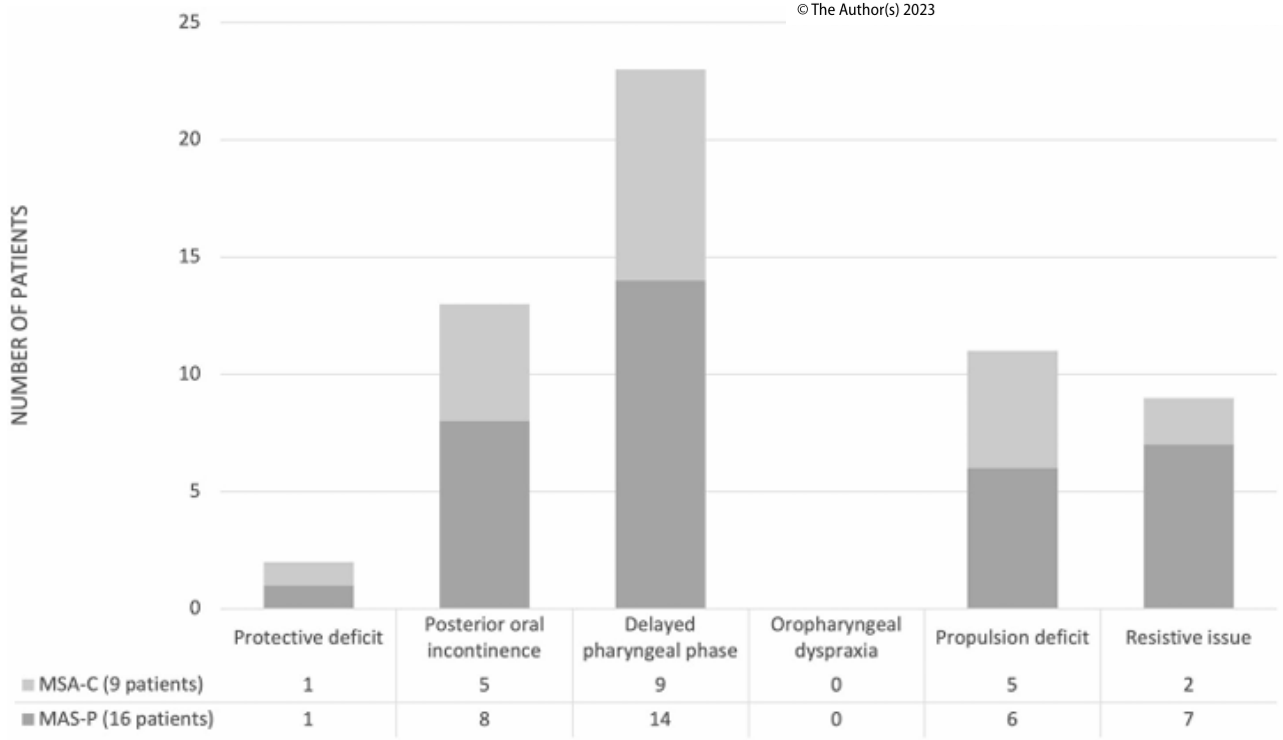


Fig. 2 Pathophysiology of dysphagia within each diagnostic category. The results are reported as percentages. *MSA-P* predominantly parkinsonian multiple system atrophy, *MSA-C* predominantly cerebellar multiple system atrophy

MSA e disfagia

Contents lists available at ScienceDirect

Parkinsonism and Related Disorders

journal homepage: www.elsevier.com/locate/parkreldis

Review article 2021

Dysphagia in multiple system atrophy consensus statement on diagnosis, prognosis and treatment

Giovanna Calandra-Buonaura [a,b,1], Enrico Alfonsi [c,1], Luca Vignatelli [a], Eduardo E. Benarroch [d], Giulia Giannini [a,b], Alex Iranzo [e], Phillip A. Low [d], Paolo Martinelli [b], Federica Provini [a,b], Niall Quinn [f], Eduardo Tolosa [g], Gregor K. Wenning [h], Giovanni Abbruzzese [i], Pamela Bower [j], Angelo Antonini [k], Kailash P. Bhatia [l], Jacopo Bonavita [m], Maria Teresa Pellecchia [n], Nicole Pizzorni [o], François Tison [p,q], Imad Ghorayeb [r,s,t], Wassilios G. Meissner [p,q,u], Tetsutaro Ozawa [v], Claudio Pacchetti [w], Nicolò Gabriele Pozzi [w], Claudio Vicini [x,y], Antonio Schindler [o], Pietro Cortelli [a,b,*,1], Horacio Kaufmann [z,1]

LA VALUTAZIONE DELLA DISFAGIA

Journal of Neurology
https://doi.org/10.1007/s00415-021-10739-8

REVIEW

A multinational consensus on dysphagia in Parkinson's disease: screening, diagnosis and prognostic value

Giuseppe Cosentino[1,2] · Micol Avenali[1,3] · Antonio Schindler[4] · Nicole Pizzorni[4] · Cristina Montomoli[5] · Giovanni Abbruzzese[6] · Angelo Antonini[7] · Filippo Barbiera[8] · Marco Benazzo[9] · Eduardo Elias Benarroch[10] · Giulia Bertino[9] · Emanuele Cereda[11] · Pere Clavè[12,13] · Pietro Cortelli[14,15] · Roberto Eleopra[16] · Chiara Ferrari[4] · Shaheen Hamdy[17] · Maggie-Lee Huckabee[18] · Leonardo Lopiano[19] · Rosario Marchese Ragona[20] · Stefano Masiero[21] · Emilia Michou[22] · Antonio Occhini[9] · Claudio Pacchetti[23] · Ronald F. Pfeiffer[24] · Domenico A. Restivo[25] · Mariangela Rondanelli[26] · Giovanni Ruoppolo[27] · Giorgio Sandrini[1] · Anthony H. V. Schapira[28] · Fabrizio Stocchi[29] · Eduardo Tolosa[30] · Francesca Valentino[23] · Mauro Zamboni[31] · Roberta Zangaglia[23] · Mario Zappia[32] · Cristina Tassorelli[1,3] · Enrico Alfonsi[2]

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VALUTAZIONE

Screening: quando?

Box 1. Recommendations on the screening of dysphagia in PD

a. When is it indicated to screen for dysphagia in patients with PD?

The statement is based on core literature consisting of Class II [21], III [23] and IV [20, 24] level studies and expert opinion.

-The search for symptoms or signs that are suspicious for the presence of dysphagia is recommended at the first neurologic visit. If symptoms or signs are detected, a screening test is always recommended. Re-evaluations are recommended at every follow-up visit, preferably at least once a year.

b. When should dysphagia be suspected in patients with PD?

Statements are based on core literature consisting of Class I [5, 35], III [28, 33] and IV [27, 29–31, 34, 36] level studies and expert opinion.

- In the presence of at least one of the conditions listed below:
Increased eating time (meal duration), post-swallowing coughing, post-swallowing gurgling voice, drooling, choking, breathing disturbance, unintentional weight loss, difficulty to swallow pills, sensation of retention of food, pneumonia episode(s).
- In patients who answer 'yes' to either of the following questions:
"have you experienced any difficulty in swallowing food or drink?"
"have you ever felt choked with food?"

Comment: The risk of dysphagia increases with the number of symptoms or signs observed, age, and disease progression.

Autovalutazione

<20–40 % dei pz con MP sono consapevoli delle loro difficoltà di deglutizione

<10% riporta spontaneamente di avere sintomi di disfagia

Indagare la presenza di disfagia con single domande (es. UPDRS) ha una bassa sensibilità

Pflug et al, 2018

L'utilizzo di specifici questionari con più item permette di identificare la presenza di disfagia con una sensibilità dell'80% e una specificità del 71-82%:

- Swallowing disturbance questionnaire (SDQ) -> più semplice applicazione
- Munich Dysphagia test-Parkinson's disease (MDT-PD) -> anche per disfagia di lieve gravità

Manor et al, 2007; Simons et al, 2014

Swallowing Disturbance Questionnaire

TABLE 1. *Swallowing disturbance questionnaire*

	Questions	0 Never	1 Seldom (once a month or less)	2 Frequently (1–7 times a week)	3 Very frequently (more than 7 times a week)
1.	Do you experience difficulty chewing solid food like an apple, cookie or a cracker?				
2.	Are there any food residues in your mouth, cheeks, under your tongue or stuck to your palate after swallowing?				
3.	Does food or liquid come out of your nose when you eat or drink?				
4.	Does chewed up food dribble from your mouth?				
5.	Do you feel you have too much saliva in your mouth; do you drool or have difficulty swallowing your saliva?				
6.	Do you swallow chewed up food several times before it goes down your throat?				
7.	Do you experience difficulty in swallowing solid food (i.e., do apples or crackers get stuck in your throat)?				
8.	Do you experience difficulty in swallowing pureed food?				
9.	While eating, do you feel as if a lump of food is stuck in your throat?				
10.	Do you cough while swallowing liquids?				
11.	Do you cough while swallowing solid foods?				
12.	Immediately after eating or drinking, do you experience a change in your voice, such as hoarseness or reduced?				
13.	Other than during meals, do you experience coughing or difficulty breathing as a result of saliva entering your windpipe?				
14.	Do you experience difficulty in breathing during meals?				
15.	Have you suffered from a respiratory infection (pneumonia, bronchitis) during the past year?	Yes	No		

SDQ, Swallowing disturbance questionnaire.

Manor et al, 2007

MSA-SDQ

TABLE 3 . *The MSA-SDQ subscore and the correlation of each item with dysphagia detected on flexible endoscopic evaluation of swallowing*

SDQ Item	Question	*P*
1	Do you experience difficulties chewing solid food like an apple, cookie or cracker?	0.02
2	Are there any food residues in your mouth, cheeks, under your tongue or stuck to your palate after swallowing?	<0.0001
6	Do you swallow chewed up food several times before it goes down your throat?	0.02
10	Do you cough while swallowing liquids?	0.02
13	Other than during meals, do you experience coughing or difficulty breathing as a result of saliva entering your windpipe?	0.04

MSA-SDQ, multiple system atrophy Swallowing Disturbance Questionnaire.

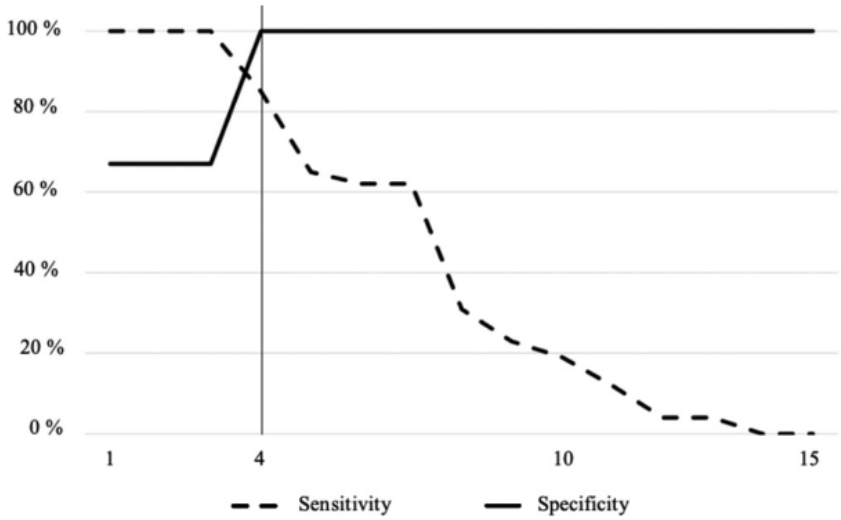


FIG. 2. Receiver operating characteristic (ROC) curve for multiple system atrophy Swallowing Disturbance Questionnaire (MSA-SDQ) subscore. The ROC curve shows the optimum score of crossing sensitivity and specificity curves. At a score of 4 the sensitivity is 85% and the specificity is 100%. Values on the *x* axis are MSA-SDQ sum scores; values on the *y* axis are percentage of sensitivity (dashed line) and specificity (solid line).

Vogel et al, 2021

Patient: Date:

Munich Dysphagia Test– Parkinson's Disease

I	DIFFICULTY SWALLOWING food and liquids	(almost) never	occasional/ monthly (once/ multiple)	frequently/ weekly (once/ multiple)	very often/ daily (once/ multiple)
1.	I have difficulties with the chewing and swallowing of solid/ fibrous/ crumbly food. (e.g. apples, meat, cracker/ chips)	0	1	2	3
2.	During meals, food/ liquid escapes from the mouth (or the nose).	0	1	2	3
3.	I find it difficult to directly/ quickly start the swallowing process when taking in liquids or food.	0	1	2	3
4.	For the complete swallowing of food/ liquids I need to swallow multiple times in a row.	0	1	2	3
5.	Food residues remain in my mouth after swallowing.	0	1	2	3
6.	During the swallowing process, food gets stuck in my throat/ esophagus. (maybe I even have to choke)	0	1	2	3
7.	During (or after) eating food I have to hawk/ cough.	0	1	2	3
8.	During (or after) drinking liquids (or eating soup) I have to hawk/ cough.	0	1	2	3
9.	It happens that I have difficulties breathing/ a sense of suffocation when swallowing food or liquids.	0	1	2	3
10.	Right after eating food/ drinking liquids my voice has changed. (e.g. coated/ weakened/ "wet"/ "gargling")	0	1	2	3

II	DIFFICULTY SWALLOWING independent from food intake	I disagree	I somewhat agree	I mostly agree	I strongly agree
11.	I have increased amount of saliva in my mouth/ I swallow my saliva too rarely or I have general problems swallowing my saliva/ drooling.	0	1	2	3
12.	I have a very dry mouth/ not enough saliva.	0	1	2	3
13.	It happens that I cough or have trouble breathing because I have choked on my saliva/ saliva went into my trachea.	0	1	2	3
14.	I have problems swallowing pills.	0	1	2	3

MDT-PD

Patient: Date:

III	Further swallowing-specific and accompanying BURDEN	I disagree	I somewhat agree	I mostly agree	I strongly agree
15.	During the off-phases (Off-drug-state/ declining levodopa-levels) I have more difficulties to swallow.	0	1	2	3
16.	I avoid specific foods or textures that often make me choke. (e.g. nuts, crumb cake, liquid-filled pralines, raw vegetable salads)	0	1	2	3
17.	It is difficult for me to hawk/ cough after I choke in order to clear my throat.	0	1	2	3
18.	Nowadays, it takes me more time to eat than it used to. (e.g. because I have to chew longer/ foods are longer in my mouth due to longer preparation time or more careful swallowing)	0	1	2	3
19.	It happens that I get tired during meals (or even fall asleep) and don't finish chewing and swallowing my food.	0	1	2	3
20.	During meals I have to have liquids to "flush down" the food in order to be able to better swallow.	0	1	2	3
21.	I can only swallow liquids in small sips.	0	1	2	3
22.	I have a reduced appetite or pleasure to eat than before. (sense of taste and smell are potentially affected)	0	1	2	3
23.	I have problems, such as heartburn/ frequent burping, sense of lump in the throat/ esophagus, sense of pressure behind the breastbone.	0	1	2	3

IV	Swallowing-specific HEALTH QUESTIONS	no, I don't agree	yes, I agree
24.	Within the last year I had a lung infection or unclear fever-infections.	0	3
25.	I involuntarily loose body weight.	0	3
26.	I drink less than 50 oz. of liquid during a given day. (equal to suggested minimum of 7 - 8 glasses/ cups water, juice, tea, coffee, soup)	0	3

To be filled in by doctor/ therapist	
For calculation and weighting please see questionnaire instructions/ web-application	
MDT-PD sum score: (26 Items)	
Diagnosis:	

MDT-PD: Munich dysphagia test – Parkinson's disease – A.Janine Simons (2012)
www.mdt-parkinson.de

Parkinson Society British Columbia

Last Updated February 27, 2019

RADBOUD ORAL MOTOR INVENTORY FOR PARKINSON'S DISEASE

Participant Self-Evaluation

The Radboud Oral Motor Inventory for Parkinson's disease (ROMP) is a self-evaluation tool to evaluate perceived problems with speech, swallowing and saliva control in patients with PD or atypical Parkinsonism. This can be used to identify initial concerns or monitor any changes. Share your results with your physician and health care team to help facilitate support in the areas identified as troublesome. You can complete the ROMP every 6 months to a year, or anytime you think you have experienced changes in drooling, communication or swallowing. We recommend keeping previously completed copies for comparison. Please refer to your responses on the ROMP Questionnaire to help increase your awareness of any difficulties with communication and speech.

https://www.parkinson.bc.ca/media/181268/radboud-oral-motor-inventory-for-parkinson-disease.pdf

PART B - SWALLOWING

1) How many times do you choke when eating or drinking?

a) I do not choke at all or not more than I used to.
b) I choke about once a week.
c) I choke almost daily.
d) I choke about 3 times a day or during every meal.
e) I choke more than 3 times a day or multiple times during meals.

2) Are you limited during drinking?

a) I can drink liquids as easily as I used to.
b) I can easily drink liquids, but I choke a little easier than used to.
c) I can drink safely only when I concentrate on it.
d) To drink safely, I need to use a special cup or technique.
e) I can drink safely only when I take thickened liquids.

3) Are you limited during eating?

a) I can eat as easily as I used to.
b) I can eat everything, but it takes me longer than before.
c) I have to avoid tough or hard solid foods (meat, peanuts, etc.).
d) I can eat only soft or easy chewable food.
e) I have to use supplemental or non-oral feeding.

4) Do you have difficulty swallowing pills?

a) I take my pills just like I used to.
b) I have a little more difficulty swallowing my pills than I used to.
c) I can take my pills only with applesauce or using a specific technique.
d) Swallowing my pills is a struggle nowadays.
e) I cannot swallow pills anymore and need another way of taking medication.

5) Does your swallowing difficulty limit your dining with others?

a) Eating with others is no problem for me at all.
b) I dine and drink with others, but I have to take my swallowing difficulty into a
c) I prefer eating in the presence of familiar people in familiar places.
d) I eat only at home and in the presence of familiar people.
e) I can eat only at home and with the assistance of a skillful caregiver.

6) Are you concerned about your difficulty swallowing?

a) I do not experience difficulty.
b) I have some difficulty swallowing, but I am not concerned about it.
c) I am a little concerned about my difficulty swallowing.
d) I am becoming more concerned about my difficulty swallowing.
e) I am very much concerned about my difficulty swallowing.

7) How bothered are you as a result of your difficulty swallowing?

a) I have no difficulty swallowing.
b) My difficulty swallowing bothers me a little.
c) I am bothered by my difficulty swallowing, but it is not my priority concern.
d) My difficulty swallowing bothers me a lot because it is very limiting.
e) My difficulty swallowing is the worst aspect of my disease.

PART C - SALIVA

1) Do you experience loss of saliva during the day?

a) I do not lose saliva during the day and do not feel accumulation of saliva in my mc
b) I do not lose saliva, but I feel accumulation of saliva in my mouth.
c) I lose some saliva in the corners of my mouth or on my chin.
d) I lose saliva on my clothes.
e) I lose saliva on my clothes, but also on books or on the floor.

2) How often do you experience increased amounts or loss of saliva?

a) Less than once a day.
b) Occasionally: on average, once or twice a day.
c) Frequently: 2 to 5 times a day.
d) Very often: 6 to 10 times a day.
e) Almost constantly.

3) Do you experience loss of saliva during the night?

a) I do not experience loss of saliva during the night at all.
b) My pillow sometimes gets wet during the night.
c) My pillow regularly gets wet during the night.
d) My pillow always gets wet during the night.
e) Every night my pillow and other bedclothes get wet.

4) Does your (loss of) saliva impair your eating and drinking?

a) No, my (loss of) saliva does not impair my eating or drinking.
b) Yes, my (loss of) saliva occasionally impairs my eating or drinking.
c) Yes, my (loss of) saliva frequently impairs my eating or drinking.
d) Yes, my (loss of) saliva very often impairs my eating or drinking.
e) Yes, my (loss of) saliva always impairs my eating or drinking.

5) Does your (loss of) saliva impair your speech?

a) No, my (loss of) saliva does not impair my speech.
b) Yes, my (loss of) saliva occasionally impairs my speech.
c) Yes, my (loss of) saliva frequently impairs my speech.
d) Yes, my (loss of) saliva very often impairs my speech.
e) Yes, my (loss of) saliva always impairs my speech.

6) What do you have to do to remove saliva?

a) I do not have to remove saliva.
b) I always carry a handkerchief to remove possible saliva.
c) I daily use 1 or 2 handkerchiefs to remove some saliva.
d) I daily need more than 2 handkerchiefs to remove saliva.
e) I need to remove saliva so frequently that I always keep tissues near me or use a towel to protect my clothes.

7) Does the loss of saliva limit you in contacts with others?

a) My loss of saliva does not limit me in contacts with others.
b) I have to pay attention, but that does not bother me.
c) I have to pay more attention because I know that others could see me losing saliva.
d) I try to avoid contact when I know that I lose saliva.
e) I notice that others avoid having contact with me because I lose saliva.

8) Does your loss of saliva limit you in doing activities inside or outside your home (work, hobbies)?

a) My (loss of) saliva does not limit me in activities.
b) I have to pay attention when I am busy, but that does not bother me.
c) I have to pay more attention, which is rather effortful.
d) My loss of saliva limits me in being active.

9) How bothered are you as a result of your (loss of) saliva?

a) Due to my loss of saliva, important activities are no longer possible for me.
b) I hardly notice loss of saliva.
c) Feeling more saliva or losing it bothers me a little.
d) I am bothered by my loss of saliva, but it is not my priority concern.
e) My loss of saliva bothers me a lot because it is very limiting.
f) Losing saliva is the worst aspect of my disease.

Swallowing Clinical Assessment Score in Parkinson's disease (SCAS-PD)

Table 1: Score attributed to each sign of alteration in swallowing in the original SCAS-PD. Source: Loureiro et al. [14].

Signs suggesting alteration in swallowing found during assessment	Score	
	For each offering	Max. possible
Oral phase		
Altered lip closure	1.0	3.0
Labial discharge	1.0	3.0
Prolonged oral transit time	2.0	6.0
Residue	2.0	6.0
Total		**18.0**
Pharyngeal phase		
Multiple deglutition	2.0	6.0
Reduced larynx elevation	10.0	30.0
Altered cervical auscultation	10.0	30.0
Total		**66.0**
Signs of penetration/aspiration		
Throat clearing	10.0	30.0
Cough	15.0	45.0
Change voice quality	15.0	45.0
Choking	20.0	60.0
Alteration in breathing	30.0	90.0
Total		**270.0**
Total		**354.0**

Branco et al, 2019

12 items relativi ai segni di disfagia orali e faringei valutati su 3 trial:

- ✓ 20 ml acqua
- ✓ 10 ml liquido addensato IDDSI 4
- ✓ 1 cracker

Buona concordanza con la VFSS (71%)

Fase orale

Caratteristiche tipiche:

- Aumento del tempo di preparazione orale
- Movimenti masticatori lenti e poco ampi
- Difficoltà di controllo linguale (tremore linguale e tongue pumping)
- Incontinenza labiale

Pressioni linguali

Dysphagia (2022) 37:99–115
https://doi.org/10.1007/s00455-021-10254-y

ORIGINAL ARTICLE

A Systematic Review and Meta-analysis of Iowa Oral Performance Instrument Measures in Persons with Parkinson's Disease Compared to Healthy Adults

Laura L. Pitts[1,2,3] · Angie Cox[4] · Sarah Morales[1] · Hannah Tiffany[1]

Study or Subgroup	Experimental Mean [kPa]	SD [kPa]	Total	Control Mean [kPa]	SD [kPa]	Total	Weight	Mean Difference IV, Random, 95% CI [kPa]	Year
Solomon et al. 1995	51.6	15.7	19	60.3	9.2	19	17.4%	-8.70 [-16.88, -0.52]	1995
Solomon et al. 2000	48.1	9.7	16	55.5	9.1	16	27.4%	-7.40 [-13.92, -0.88]	2000
O'Day et al. 2005	38.7	13.2	10	55.1	18.9	9	5.3%	-16.40 [-31.21, -1.59]	2005
Makashay et al. 2015 Raw Data	56	16	9	61.3	9.3	9	8.0%	-5.30 [-17.39, 6.79]	2015
Pitts et al. 2018	45.8	15.4	28	54.5	10.6	28	24.3%	-8.70 [-15.62, -1.78]	2018
Pitts et al. 2019	49.9	16	24	60	12.5	24	17.6%	-10.10 [-18.22, -1.98]	2019
Total (95% CI)			**106**			**105**	**100.0%**	**-8.73 [-12.14, -5.32]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.61$, df = 5 (P = 0.90); $I^2 = 0\%$
Test for overall effect: Z = 5.01 (P < 0.00001)

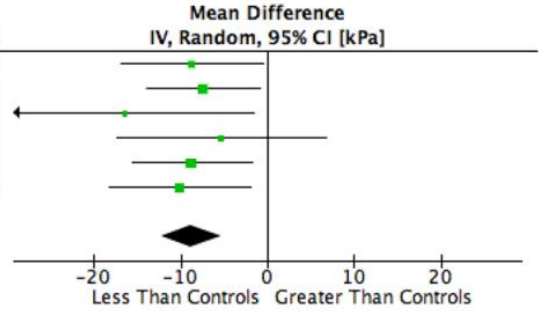


Fig. 2 Forest plot of comparison across included studies and raw data: anterior tongue strength between persons with Parkinson's disease (PD) and matched controls

Study or Subgroup	Experimental Mean [seconds]	SD [seconds]	Total	Control Mean [seconds]	SD [seconds]	Total	Weight	Mean Difference IV, Random, 95% CI [seconds]	Year
Solomon et al. 1995	23	12.4	19	25.8	10.2	19	41.1%	-2.80 [-10.02, 4.42]	1995
Solomon et al. 2000	22.8	11.4	15	36.9	12.1	16	37.1%	-14.10 [-22.37, -5.83]	2000
Makashay et al. 2015 Raw Data	37	11.4	7	41	14.4	7	21.8%	-4.00 [-17.61, 9.61]	2015
Total (95% CI)			**41**			**42**	**100.0%**	**-7.25 [-15.11, 0.60]**	

Heterogeneity: $Tau^2 = 25.48$; $Chi^2 = 4.31$, df = 2 (P = 0.12); $I^2 = 54\%$
Test for overall effect: Z = 1.81 (P = 0.07)

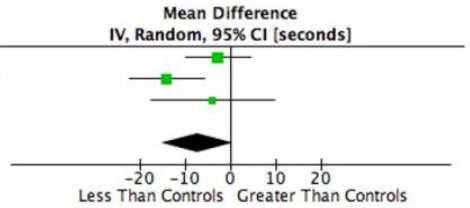


Fig. 3 Forest plot of comparison across included studies and raw data: anterior tongue endurance between persons with Parkinson's disease (PD) and matched controls

MTP significativamente inferiore rispetto ai controlli dallo stadio H&Y 2 e che diminuisce progressivamente con l'avanzare della malattia

Valutazione delle pressioni linguali

<u>CUT-OFF</u>
MIP 52.5 kPa
MSP 25.5 kPa

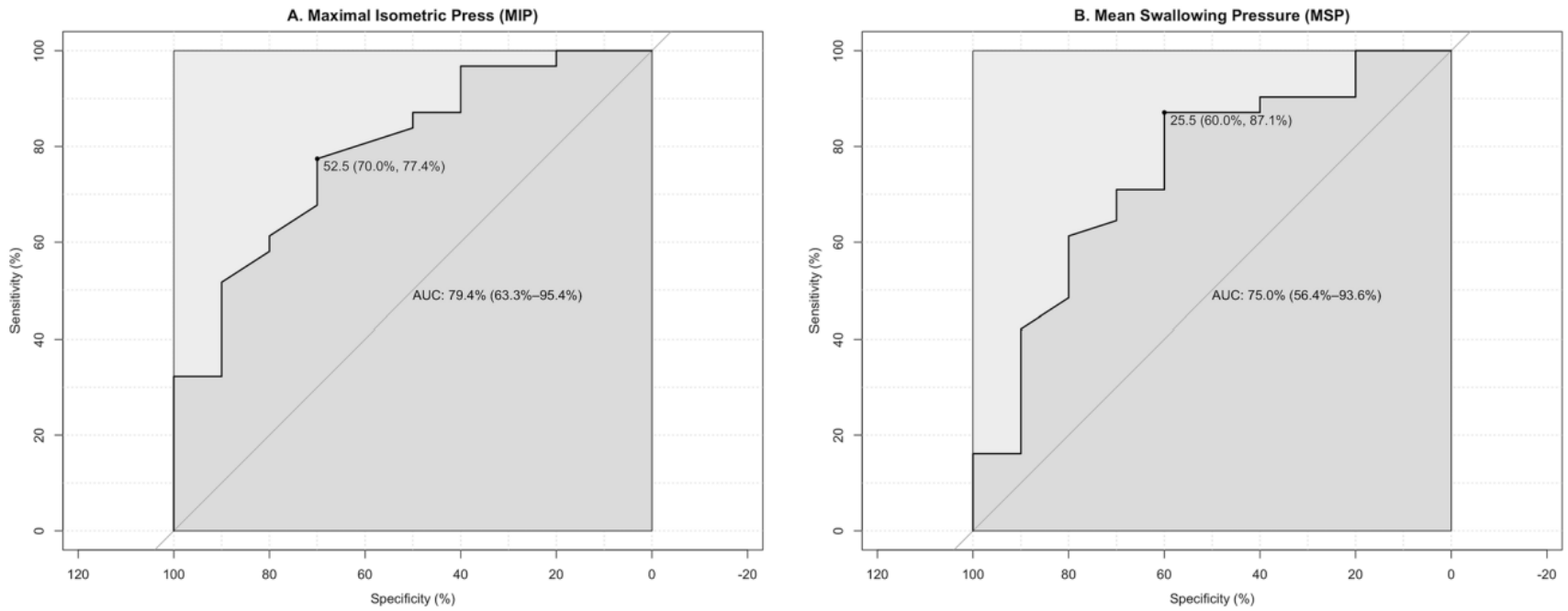


Fig. 3 Sensitivity and specificity of lingual strength to differentiate between those with and without dysphagia

Sevitz et al, 2023

Valutazione della tosse volontaria

I parametri di tosse volontaria sono inconsistenti nei pazienti con MPT

Dysphagia (2021) 36:700–706
https://doi.org/10.1007/s00455-020-10190-3

ORIGINAL ARTICLE

Variability of Voluntary Cough Airflow in Healthy Adults and Parkinson's Disease

James C. Borders[1] · Alexandra E. Brandimore[2] · Michelle S. Troche[1]

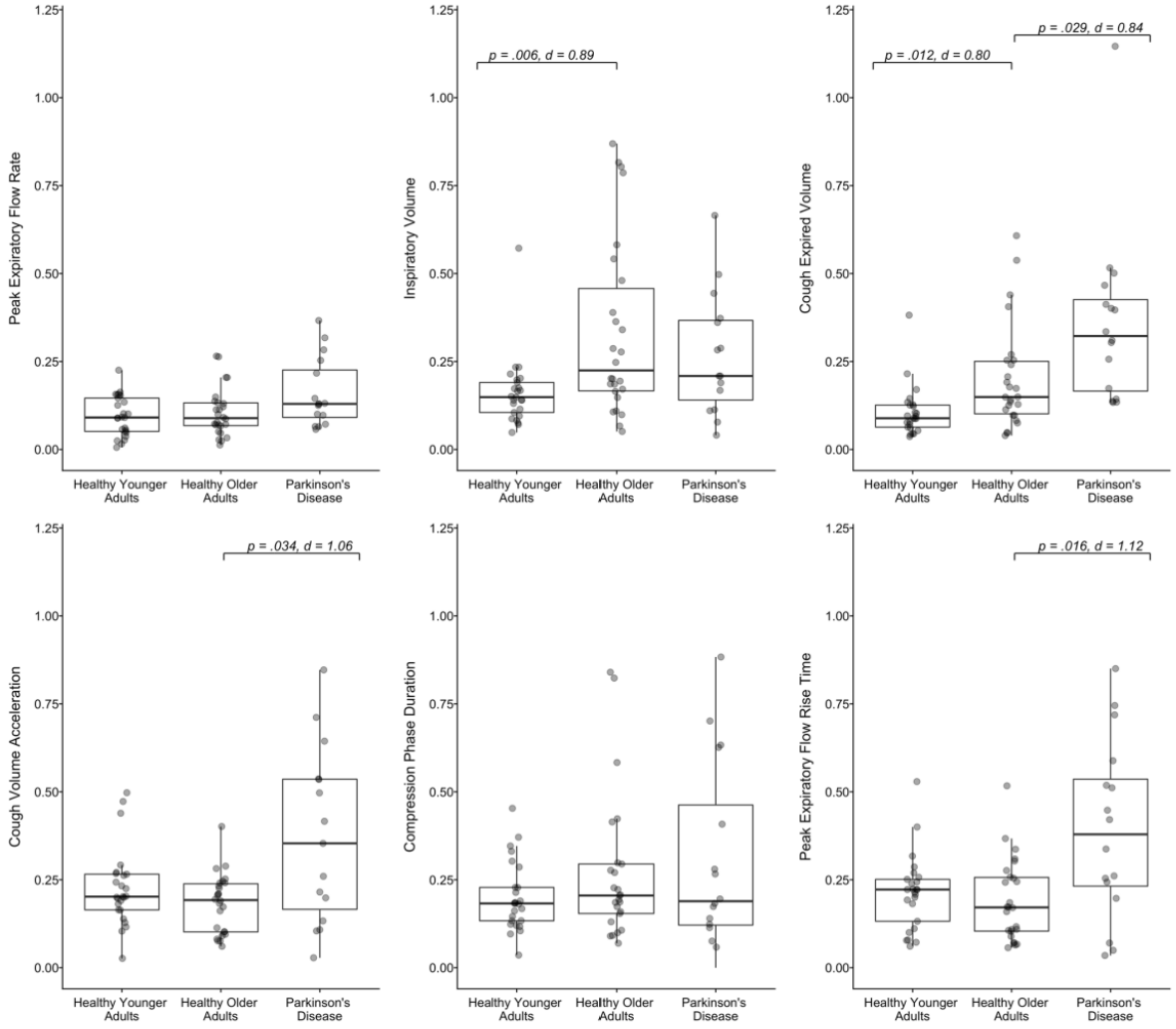


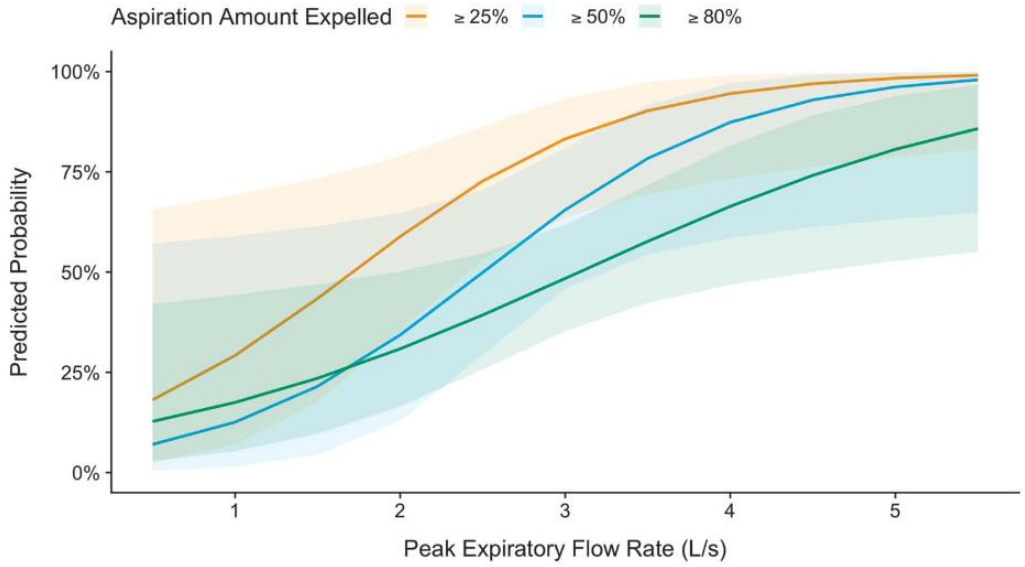
Fig. 2 Coefficients of variation across cough outcomes

Journal of Speech, Language, and Hearing Research • Vol. 65 • 431–449 • February 2022 •

Voluntary Cough Effectiveness and Airway Clearance in Neurodegenerative Disease

James C. Borders[a] and Michelle S. Troche[a]

Figure 3. Probabilities of cough airflow variables to predict aspiration amount expelled. Predicted probabilities for statistically significant binomial mixed-effects models are reported. These models account for additional covariates of sex, number of coughs during flexible endoscopic evaluations of swallowing, and number of coughs during spirometric voluntary cough testing.



N=33 PD e PSP

68 deglutizione con aspirazione

55 deglutizioni con penetrazione

Valutazione della tosse riflessa

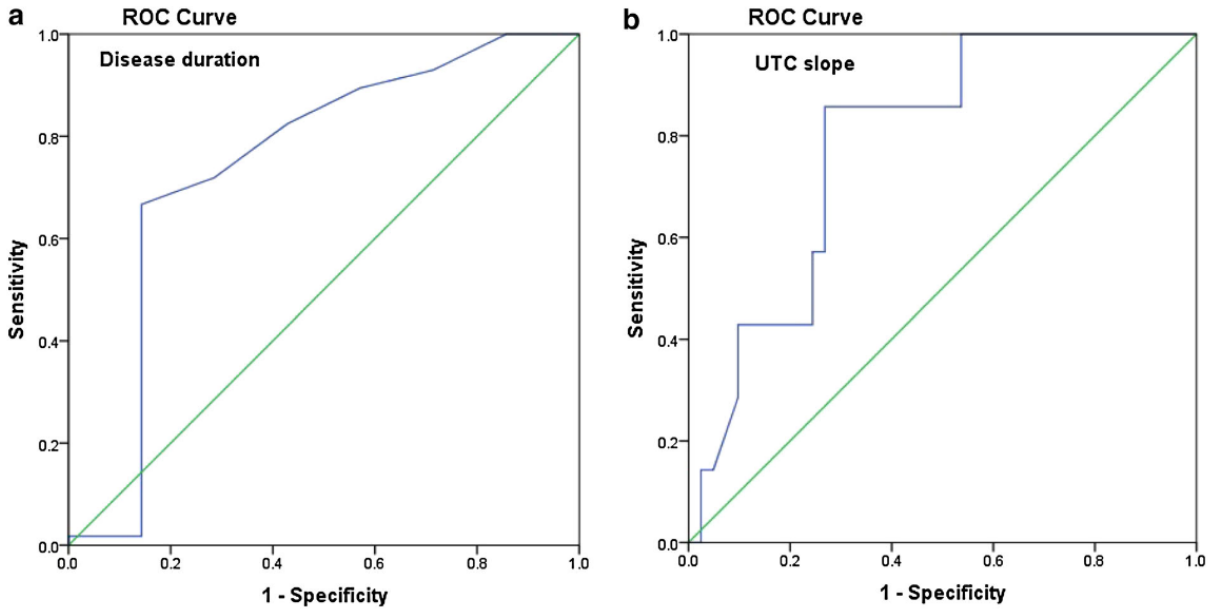
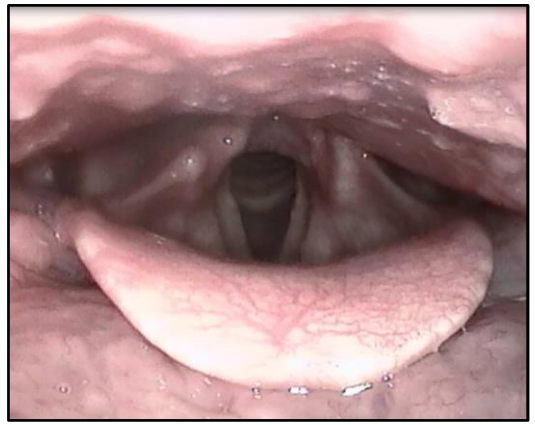


Fig. 2 Receiver operator curve (ROC) analysis for the significant variable disease duration (PA scale score 1 vs. PA scale scores 2–8) and UTC slope (PA scale scores 3–5 vs. PA scale scores 6–8). Disease duration significantly discriminated between patients with PA 1 versus all others (PA 2–8) ($p = 0.027$, sensitivity 71 %, specificity 55.4 %; (**a**). UTC sensitivity (log–log linear slope) was the only variable which significantly discriminated between patients with penetration versus aspiration (PA 3–5 vs. PA 6–8) ($p = 0.017$, sensitivity 85.7 %, specificity 73.2 %; (**b**)

«Urge to cough» discrimina in maniera accurata i pazienti con con e senza aspirazione

Troche et al, 2016

Valutazione strumentale della deglutizione



L'aspirazione silente è stata riscontrata sin dagli stadi precoci della Malattia di Parkinson e anche in pazienti asintomatici

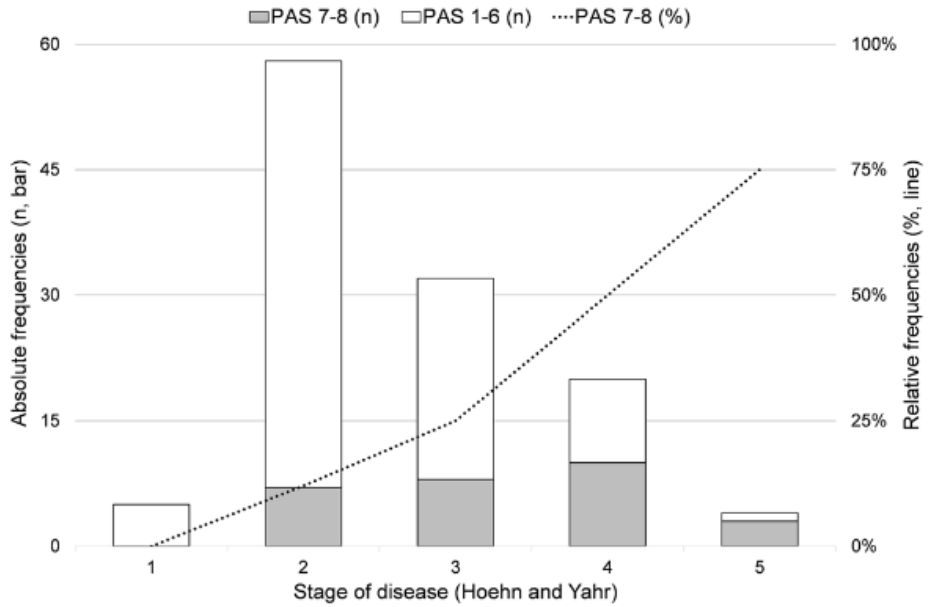
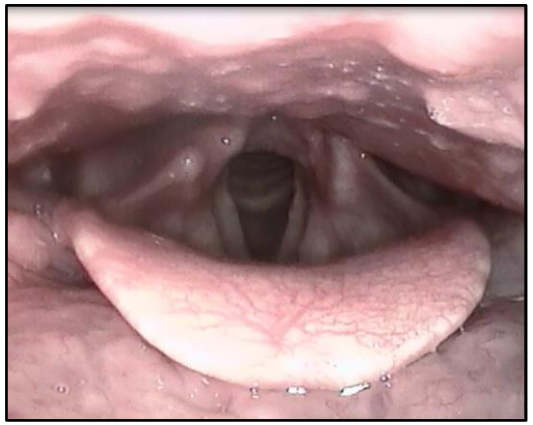


Fig. 3 Shows the critical aspiration (PAS 7–8) for at least one consistency of the swallowed agent depending on Hoehn and Yahr stage. Absolute frequencies are given as *bars*, relative frequencies are given as a *line*

Pflug et al, 2016

Valutazione strumentale della deglutizione



Gli studi mostrano una differenza importante tra ciò che riporta il paziente e la presenza di segni di disfagia nella valutazione strumentali:

- Prevalenza PRO 30% vs Prevalenza FEES/VFSS 80%
- Circa il 50% dei pazienti che non riporta disfagia ha segni alla FEES/VFSS
- Minore cnsapevolezza per ristagni rispetto a aspirazioni

Manoret al. 2007, Fuh et al. 1997,

Kalf et al, 2014, Pflug et al. 2018

FEES-Levodopa-test

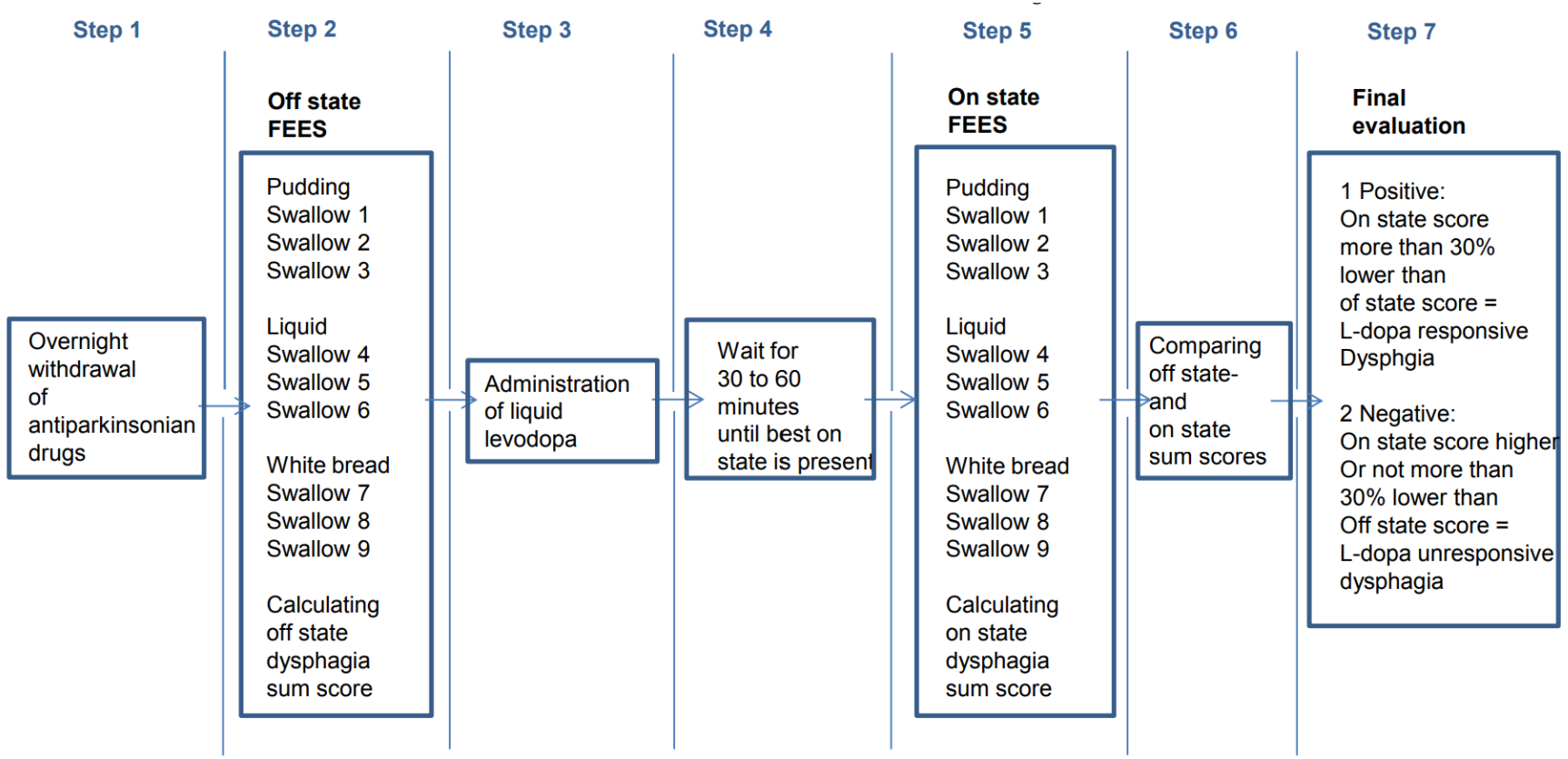


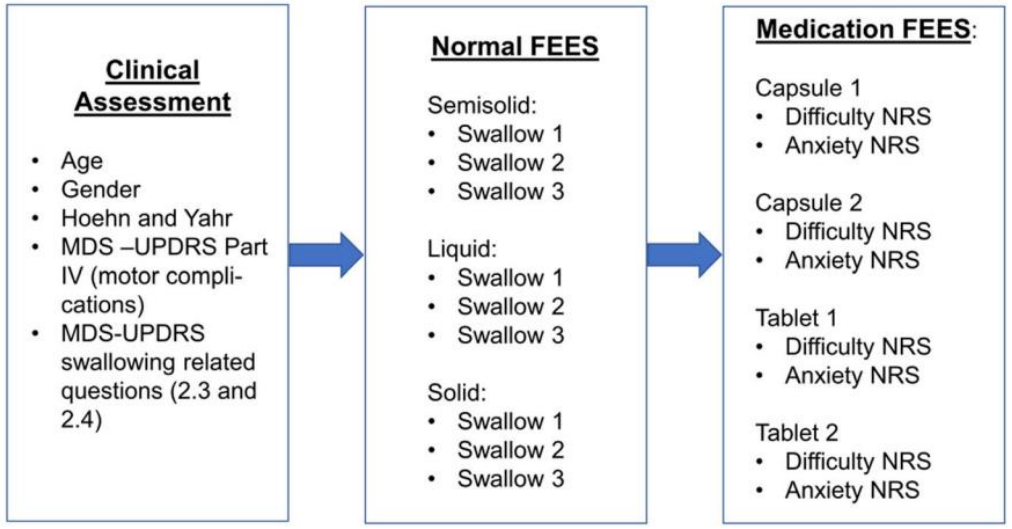
Fig. 1. Flowchart of the FEES-levodopa-test.

Warnecke et al, 2016

FEES farmaci

Fig. 1 Endoscopic detection of a tablet residue in the pharynx of a PD patient after the swallow. The tablet is later on dissolved in the valleculae. In this case, pharyngeal dysphagia accounts for motor fluctuations because dopaminergic medication is not reliably transported into the small intestine where it is usually resorbed

Circa il **70%** dei pazienti con MP presenta disfagia per i farmaci



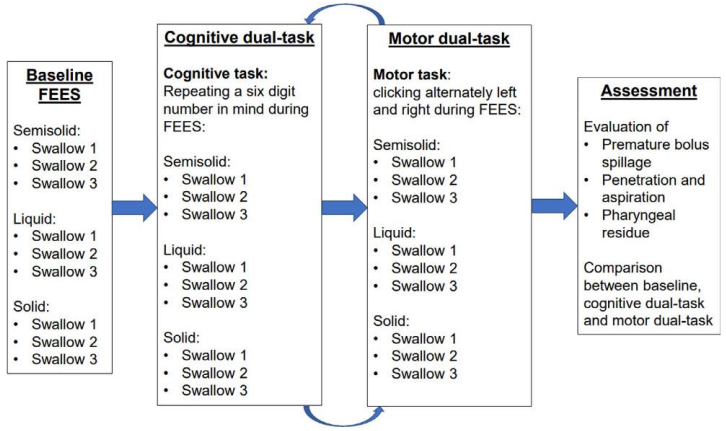
Difficoltà maggiore per le compresse rispetto alle capsule

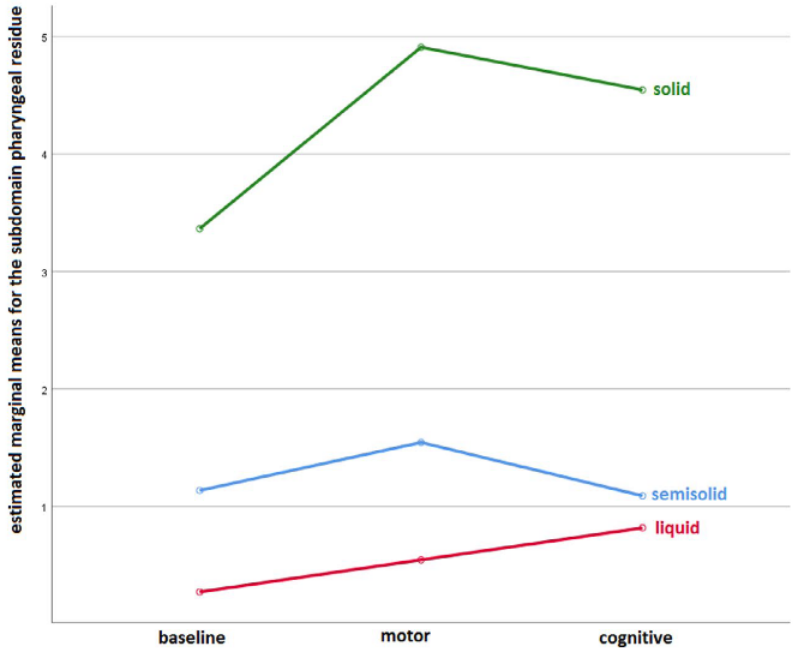
Ordinal level	swallowing efficiency	swallowing safety
0: no impairment	The medication is swallowed completely during the first swallowing attempt without dissolving.	The medication is swallowed without any risk of penetration or aspiration.
1: mild impairment	The medication is not swallowed during the first attempt but is easily swallowed with additional attempts without dissolving.	The medication or water spills prematurely into the pharynx before swallowing or remains there prolonged after swallowing, but no penetration or aspiration occurs.
2: moderate impairment	The medication is temporarily stuck in the oropharynx and can only be cleared with intensive swallowing attempts (≥ 5 attempts or additional water drinking) and/or there are minimal signs of dissolution (coating of the mucosa).	The medication or water penetrates into the laryngeal vestibule, but is effectively cleared by protective reflexes.
3: severe impairment	The medication cannot be swallowed completely and partially dissolves.	The medication or water penetrates into the laryngeal vestibule, despite protective reflexes it is not cleared.
4: very severe impairment	The medication cannot be swallowed at all and/or completely dissolves.	The medication or water penetrates into the laryngeal vestibule without attempts to clear it or is aspirated.

Fig. 1 Classification of Dysphagia for Medication. Illustration of the 5-point ordinal scales of impairment in swallowing efficiency and swallowing safety.

Labeit et al, 2022

Interazione Attenzione-Deglutizione





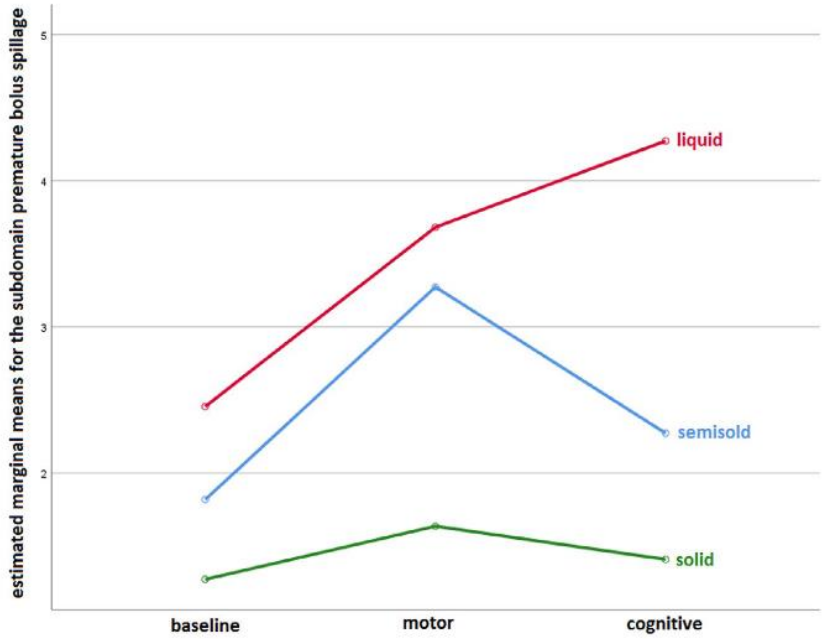


FIGURE 2 estimated marginal means for the subdomains of premature bolus spillage and pharyngeal residue depending on the task-condition

Labeit et al, 2020

FEES-MSA

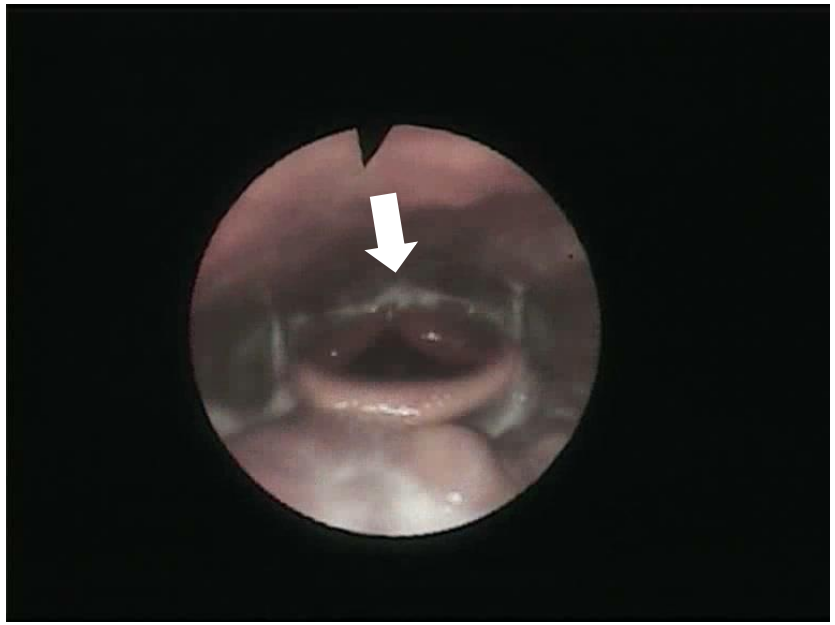
TABLE 2 | Tasks of the FEES-MSA-protocol, assessed functions, and possible findings.

	Task	Physiological function	Possible findings
Laryngeal tasks	Normal breathing	Inspiration: mild VF abduction Expiration: VF relaxation with Mild VF adduction	VFMI Uni- or bilaterally reduced VF movement during inspiration and/or expiration with maximal amplitude to median, paramedian or intermediate position VF fixation Uni- or bilateral lack of respiration-linked VF motion with fixed position in median, paramedian, intermediate, prelateral or lateral PVFM Inspiratory VF adduction with glottic narrowing Irregular ACM Uni- or bilateral irregular movements of the arytenoid cartilages
	Fast and deep inhale	VF abduction	VFMI PVFM Irregular ACM pre and post maneuver
	Sniff through nose	VF abduction	VFMI PVFM Irregular ACM pre and post maneuver
	Phonation of "eee"	VF adduction	VFMI irregular ACM pre and post maneuver
	Imagined non-voiced "eee" ("Prepair youself or imagine to say "eee" without really saying it.")	VF adduction	Irregular ACM pre, during and post maneuver
	sniff - "eee"- sniff – "eee"	VF adduction/ abduction and VF diadochokinesis	VFMI PVFM Irregular ACM pre, during and post maneuver
Swallowing tasks	Dry swallow	Clearing of secretion	Pharyngeal residue Penetration/aspiration
	Oral bolus control ("Keep the water in your mouth until I say to swallow.")	Bolus control without spillage	Premature spillage
	Swallowing of (1) Pudding (2) Liquid (3) Solid consistencies (4) Placebo tablet	Swallowing function for different consistencies	Piecemeal deglutition Premature spillage Pharyngeal residue Penetration/aspiration
	Therapeutic maneuver e.g., Chin tuck maneuver ("Swallow the bolus keeping your neck upright and your chin down.")	Potential improvement of impaired swallowing	Improvement of/unchanged swallowing function

VFMI, vocal fold motion impairment; VF, vocal fold; PVFM, paradoxical vocal fold motion; ACM arytenoid cartilage movement.

Warnecke et al, 2019

Valutazione strumentale - UES



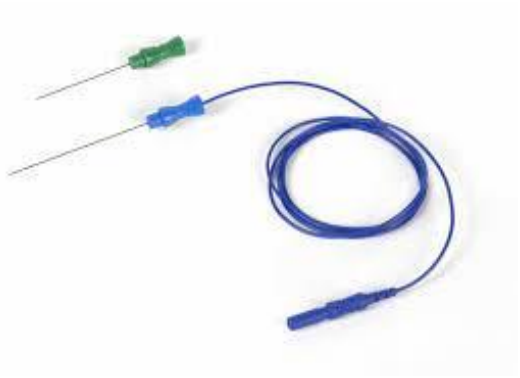
Ristagno retrocricoideo o
rigurgito esofageo

Quale meccanismo?

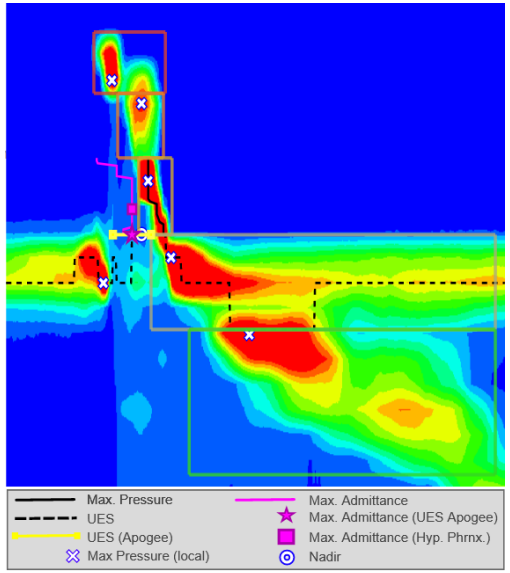
Valutazione strumentale - UES

1. VFSS

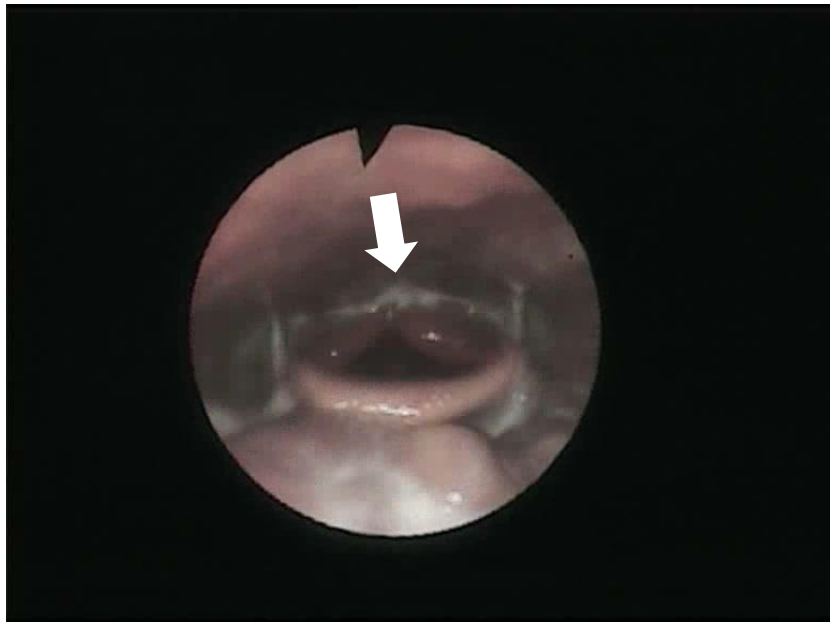
2. EMG



3. HR(I)M



Quale meccanismo?



Ristagno retrocricoideo o rigurgito esofageo

Deficit di apertura dello UES

Conseguente a deficit di elevazione laringea?

Causa ostruttiva? Es. osteofita, diverticolo di Zenker

EMG o Elettrocinesiografia

Registrazione simultanea dell'azione di diversi muscoli coinvolti in un'attività complessa.

Combina dati EMG ed elettromeccanici.

3 canali per la deglutizione:

1) sEMG della muscolatura sovraioidea/sottomandibolare
2) EMG del muscolo cricofaringeo mediante ago elettrodo concentrico inserito inserito attraverso la cute con orientamento postero-mediale a livello della cartilagine cricoidea, circa 1.5 cm lateralmente rispetto al suo margine laterale
3) Transduttore pizioelettrico posizionato sulla cute a livello della membrana cricotiroidea

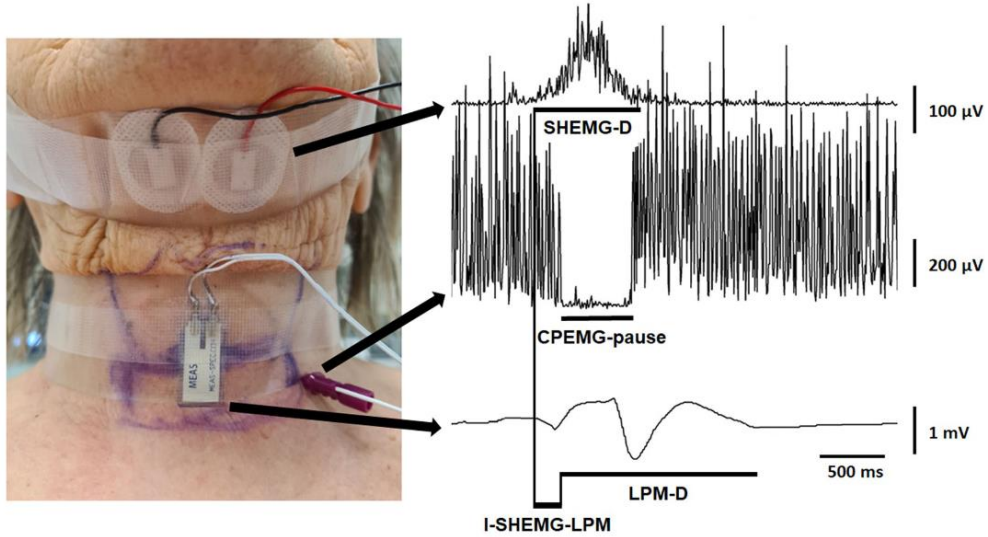
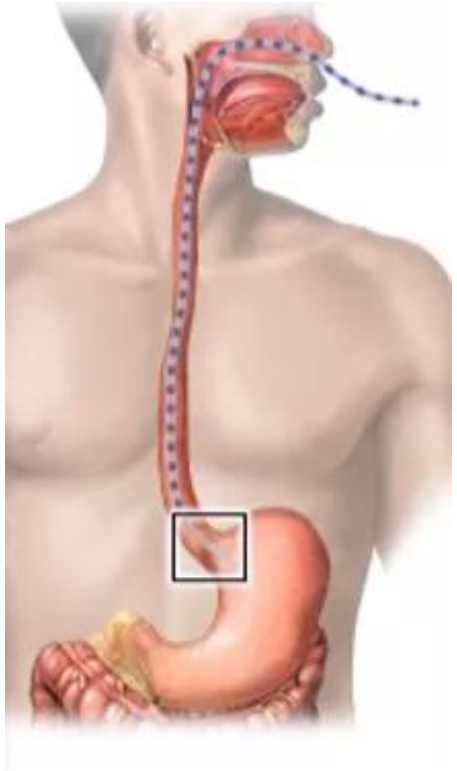


Fig. 1 Electrokinesiographic recording of oropharyngeal swallowing in a healthy subject. Upper trace: rectified electromyographic (EMG) activity of the suprahyoid/submental muscles. Middle trace: rectified EMG activity of the cricopharyngeal muscle, showing a pause during the pharyngeal phase of swallowing. Lower trace: laryngopharyngeal mechanogram. *CPEMG-pause* pause of the EMG activity of the cricopharyngeal muscle, *I-SHEMG-LPM* interval between onset of the EMG activity of the suprahyoid/submental muscles and onset of the laryngopharyngeal mechanogram, *LPM-D* duration of the laryngopharyngeal mechanogram, *SHEMG*-D duration of the EMG activity of the suprahyoid/submental muscles

Alfonsi et al, 2021

HRM

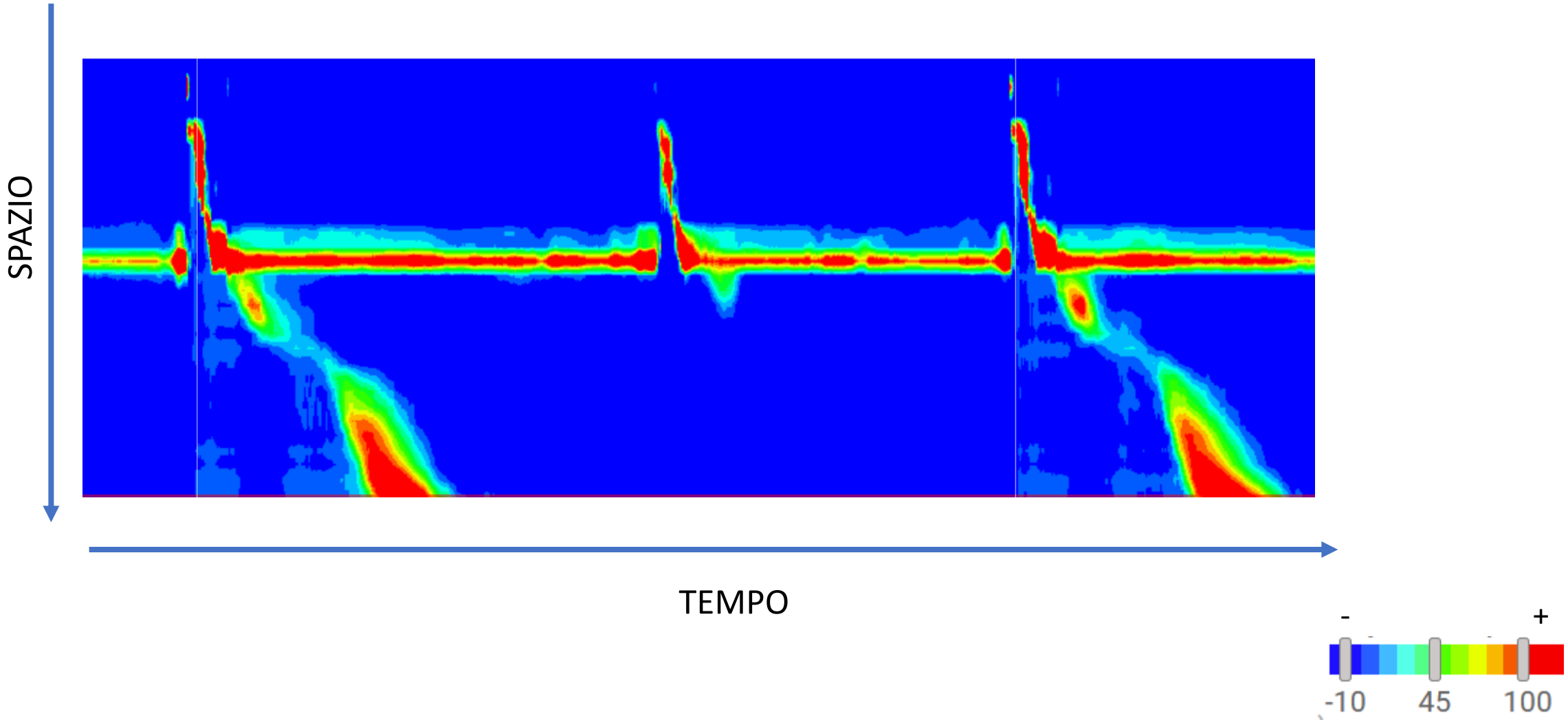


Valutazione strumentale della biomeccanica deglutitoria faringea e/o esofagea

“Manometria” = Pressioni di contatto deglutitorie

1. pressione esercitata dal bolo
2. pressione esercitata dall’attivazione dei muscoli deglutitori
3. fattori passivi (diametro luminale, spessore delle pareti faringee)

“Alta risoluzione” = 36 sensori pressori a 1 cm di distanza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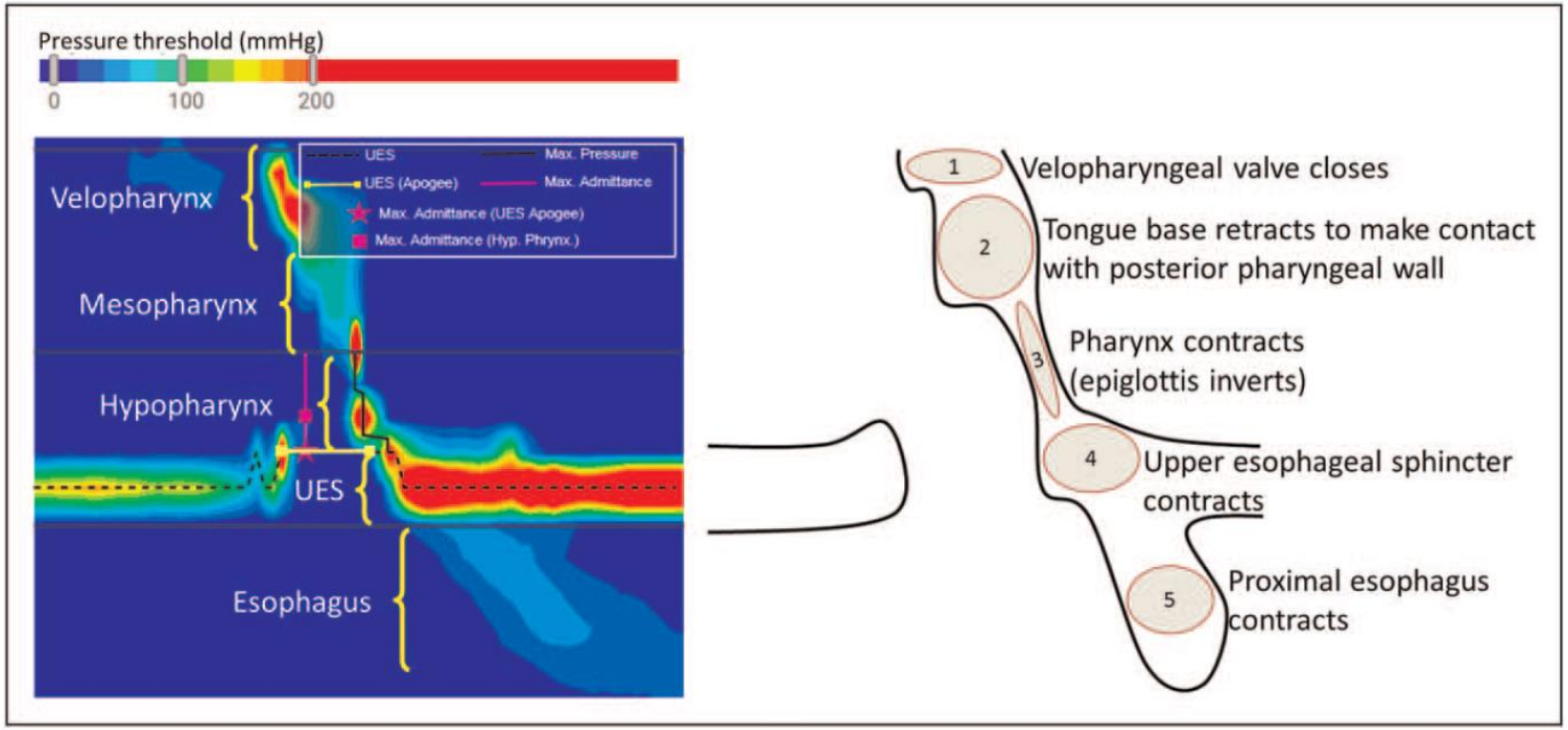


FIGURE 1. High-resolution pharyngeal manometry. The dynamic pressures generated by the different regions of the pharynx can be mapped and measured via a pharyngeal pressure topography plot (left). The higher pressures indicate pharyngeal luminal occlusive forces generated when sequential neural inputs cause the swallowing muscles to contract (schematic right). Technical detail: HRPM performed using a 2.7 mm diameter solid-state high-resolution impedance-manometry catheter with 32, 1-cm-spaced pressure sensors and 16 (2 cm) impedance segments (Unisensor AG, Attikon, Switzerland). Data were acquired at 20 samples/s (Solar GI HRM system, MMS Enschede, the Netherlands) and analyzed via the Swallow Gateway open access analysis portal (https://www.swallowgateway.com). HRPM, high-resolution pharyngeal manometry.

Omari & Schar, 2018

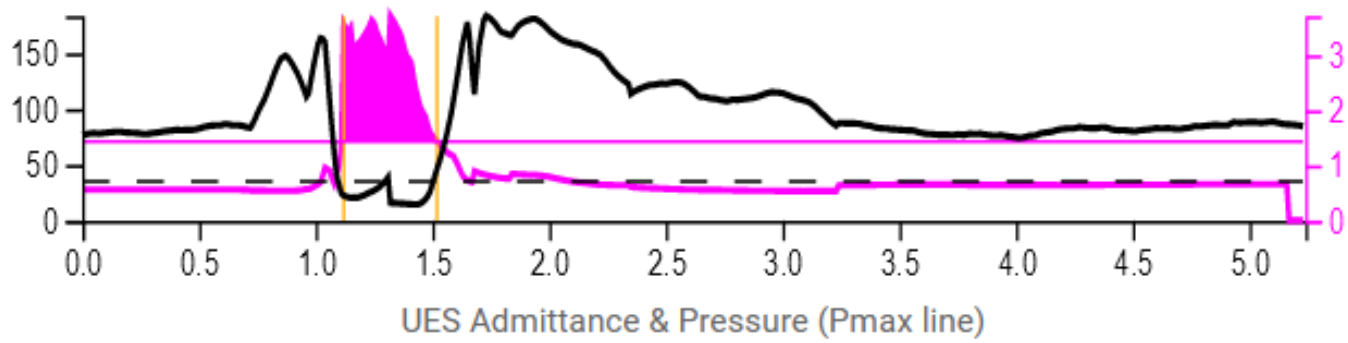
Impedenzo-manometria

Impedenza = l'opposizione o resistenza al flusso

vs

Ammetenza

PRESSURE-FLOW ANALYSIS



HRM

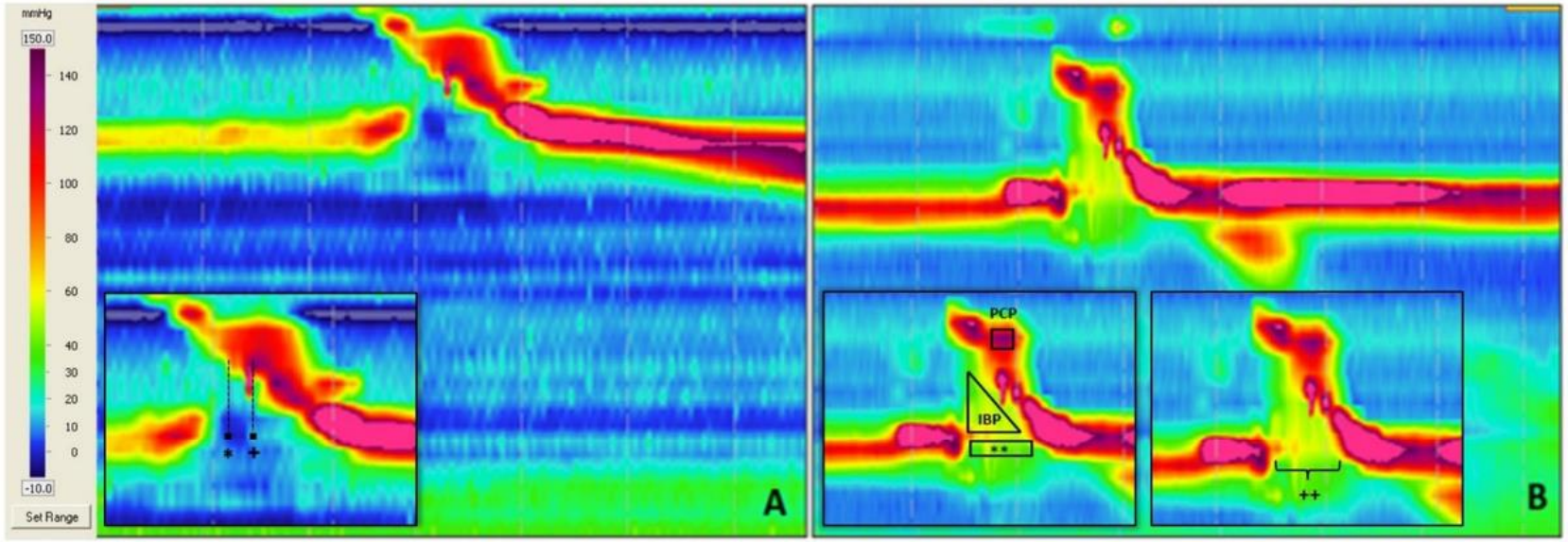
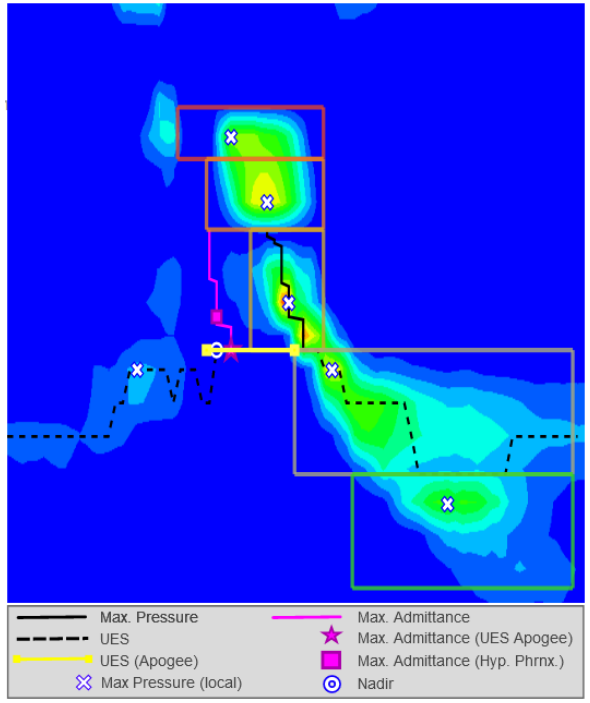


Fig. 5 Visual composition of the UES opening and parameters studied in the HRM (10 ml). **A** healthy volunteer swallow evaluation,. NADIR UES relaxation pressure*, NADIR UES relaxation pressure at pharyngeal contraction peak+. **B** PD patient swalllow evaluation, disease stage 4, *PCP* pharyngeal contraction peak, *IBP* intrabolus pressure, UES opening time**, area of elevated IBP/higher NADIR pressures++

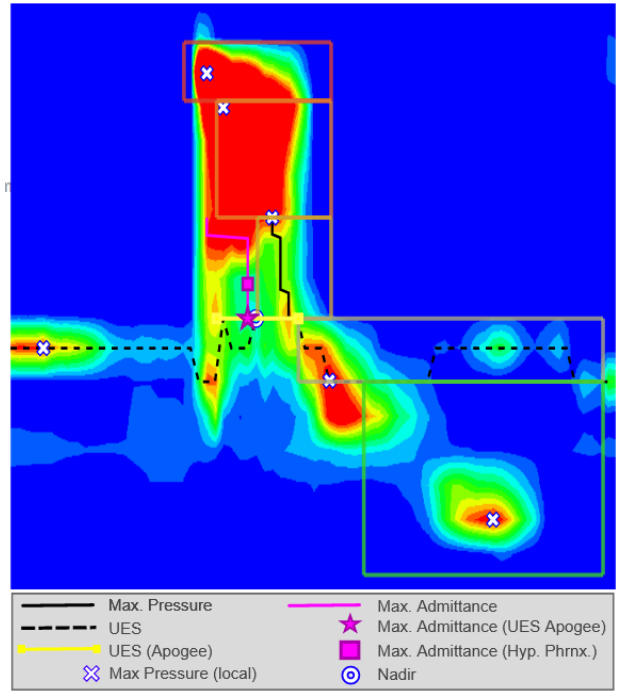
Marques et al, 2023

HR(I)M Faringea

Ridotta contrazione faringea



Alterato timing di contrazione faringea



IL TRATTAMENTO DELLA DISFAGIA

TRATTAMENTO

Journal of the Neurological Sciences 430 (2021) 120008

Consensus on the treatment of dysphagia in Parkinson's disease

Antonio Schindler [a,1], Nicole Pizzorni [a,*,1], Emanuele Cereda [b], Giuseppe Cosentino [c,d], Micol Avenali [c,e], Cristina Montomoli [f], Giovanni Abbruzzese [g], Angelo Antonini [h], Filippo Barbiera [i], Marco Benazzo [j], Eduardo Benarroch [k], Giulia Bertino [j], Pere Clavè [l,m], Pietro Cortelli [n,o], Roberto Eleopra [p], Chiara Ferrari [a], Shaheen Hamdy [q], Maggie-Lee Huckabee [r], Leonardo Lopiano [s], Rosario Marchese-Ragona [t], Stefano Masiero [u], Emilia Michou [v], Antonio Occhini [i], Claudio Pacchetti [w], Ronald F. Pfeiffer [x], Domenico A. Restivo [y], Mariangela Rondanelli [z,ag], Giovanni Ruoppolo [aa], Giorgio Sandrini [c], Anthony Schapira [ab], Fabrizio Stocchi [ac], Eduardo Tolosa [ad], Francesca Valentino [w], Mauro Zamboni [ae], Roberta Zangaglia [w], Mario Zappia [af], Cristina Tassorelli [c,e], Enrico Alfonsi [d]

ASHA American Speech-Language-Hearing Association

AJSLP

Review Article

Effectiveness of Interventions for Dysphagia in Parkinson Disease: A Systematic Review

Pooja Gandhi[a,b] and Catriona M. Steele[a,b]

[a]Swallowing Rehabilitation Research Laboratory, Toronto Rehabilitation Institute—University Health Network, Ontario, Canada [b]Rehabilitation Sciences Institute, Faculty of Medicine, University of Toronto, Ontario, Canada

American Journal of Speech-Language Pathology • Vol. 31 • 463–485 • January 2022

1. Ottimizzare la terapia

B1) Optimization of PD treatments

Statements are based on core literature consisting of Class II-III-IV level studies [37–41,48–59] and expert opinion:

B1i. *Patients should be tested during both the ON- and OFF-state to assess the impact of dopaminergic treatment on swallowing function.*
B1ii. *Dopaminergic treatment should be optimized in patients with PD and dysphagia.*
B1iii. *Patients with PD and dysphagia should preferably consume meals during their best ON-state.*
B1iv. *In patients with PD undergoing DBS, dysphagia should be carefully assessed in the short and long-term to detect changes and provide intervention when necessary.*

- ✓ Patients should be advised to take levodopa-containing medications at least 30–60 min before meals, although more precise adjustments may be necessary on an individual basis
- ✓ Patients' ability to swallow pills should be carefully investigated during instrumental assessment of swallowing

2. Favorire un’alimentazione sicura e efficace

COMPENSI

B2ii. *Liquid thickeners may be beneficial in dysphagia associated to PD provided that the viscosity selection is guided instrumentally and the risk of dehydration is monitored.*

B2iii. *Postures may have positive effects on dysphagia in some patients with PD. In the absence of precise selection criteria, based on expert opinion, effect of postures may be suggested on a case-by-case basis.*

CONSIDERARE

- ✓ Livello cognitivo
- ✓ Alterazioni posturali e tremore
- ✓ Effetti nel breve e medio/lungo termine
- ✓ Preferenze del paziente

Addensare i liquidi

2020

brain sciences

MDPI

Article

Pathophysiology of Swallowing Dysfunction in Parkinson Disease and Lack of Dopaminergic Impact on the Swallow Function and on the Effect of Thickening Agents

Weslania Viviane Nascimento [1,2], Viridiana Arreola [2,3], Pilar Sanz [4], Ediz Necati [5], Mireia Bolivar-Prados [2,3], Emilia Michou [6], Omar Ortega [2,3] and Pere Clavé [2,3,*]

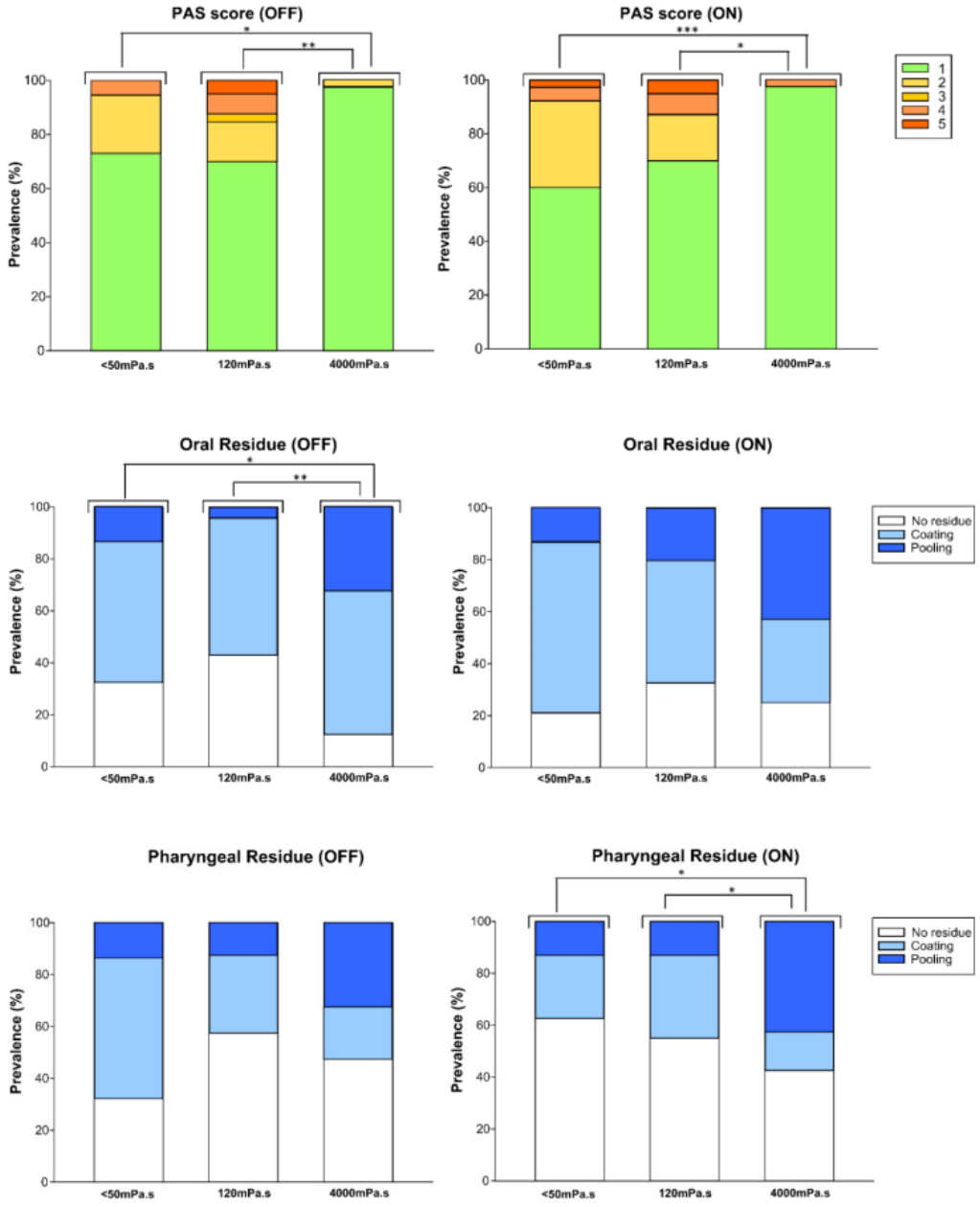
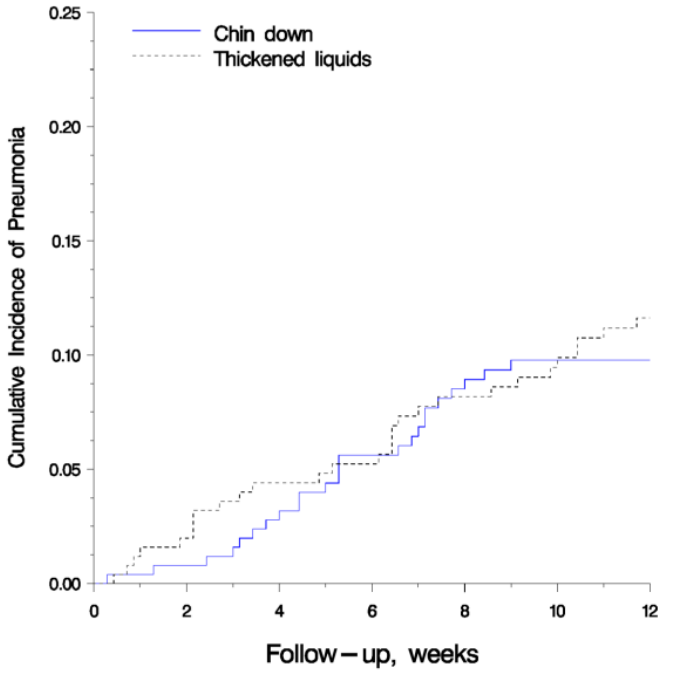


Figure 4. Prevalence of safe swallowing and penetration (PAS score) and oral and pharyngeal residues for three bolus viscosities (<50 mPa·s, 120 mPa·s, and 4000 mPa·s) in the OFF and ON states. OFF *p*-values * <0.05 and ** <0.01; ON *p*-values * <0.05 and *** <0.001.

↑ sicurezza
↓ efficienza

Addensare i liquidi



Persons at risk, *n*

Chin down	259	249	242	229	219	210	208
Thickened liquids	256	243	235	226	217	210	204

Figure 2.
Cumulative incidence of pneumonia in the chin down posture and thickened liquid groups ($P = 0.53$, log-rank test).

Ann Intern Med. 2008 April 1; 148(7): 509–518.

Comparison of 2 Interventions for Liquid Aspiration on Pneumonia Incidence A Randomized Trial

JoAnne Robbins, PhD, Gary Gensler, MS, Jacqueline Hind, MS, Jeri A. Logemann, PhD, Anne S. Lindblad, PhD, Diane Brand, BS, Herbert Baum, PhD, David Lilienfeld, MD, PhD, Steven Kosek, MS, Donna Lundy, PhD, Karen Dikeman, MA, Marta Kazandjian, MA, Gary D. Gramigna, MS, Susan McGarvey-Toler, MS, and **Patricia J. Miller Gardner, JD**

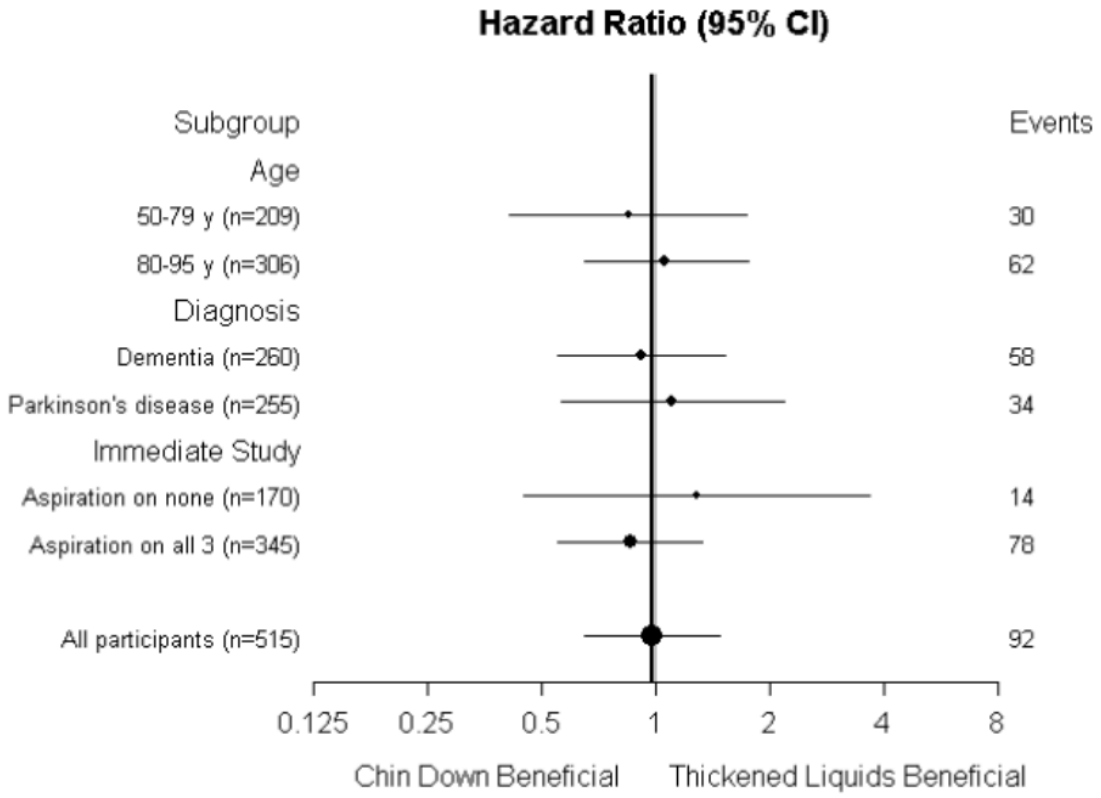


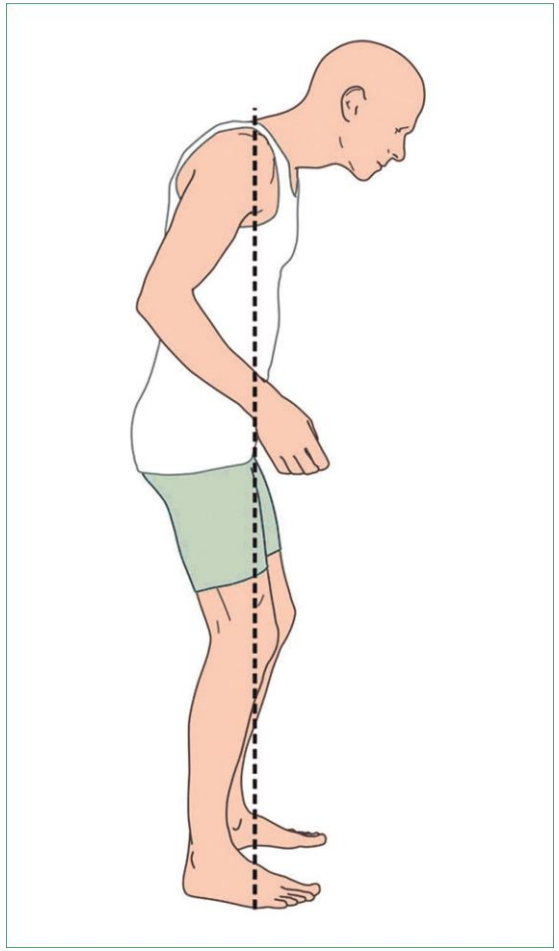
Figure 3.
A.Forest plot showing primary intervention effect for pneumonia in subgroups.
B. Forest plot showing primary intervention effect for pneumonia or death in subgroups.

Posture di compenso

La postura a capo flesso anteriormente è stata riportata efficace nell'eliminare l'apirazione in 1:3 pazienti con MP

Logemann et al, 2008

Molti pazienti adottano spontaneamente la postura a capo flesso anteriormente (camptocormia, antecollis) -> se ancora presente aspirazione la possibilità di utilizzare questa postura come compenso è limitata



3. Trattamento riabilitativo

B2i. *Standard swallowing therapy is recommended for some patients with PD and dysphagia with sufficient cognitive level to follow clinicians' indications. When standard swallowing therapy is prescribed, it should address specific biomechanical and/or pathophysiological mechanisms, based on the instrumental findings.*

B2iv. *Skill-based therapy may be prescribed in non-demented PD patients with dysphagia to increase the precision of muscle contraction during swallowing. When prescribed, it should address specific biomechanical and/or pathophysiological mechanisms, based on the instrumental findings.*

B2v. *LSVT® is designed to treat voice and should not be considered as a primary treatment for dysphagia in patient with PD.*

B2vi. *EMST may be beneficial in some patients with PD and penetration or aspiration and adequate cognition to improve airway protection. When prescribed, it should address specific biomechanical and/or pathophysiological mechanisms, based on the instrumental findings.*

1. Accurata selezione dei candidati (livello cognitivo, stadio di malattia, motivazione)
2. Specificità per il meccanismo biomeccanico/patofisiologico

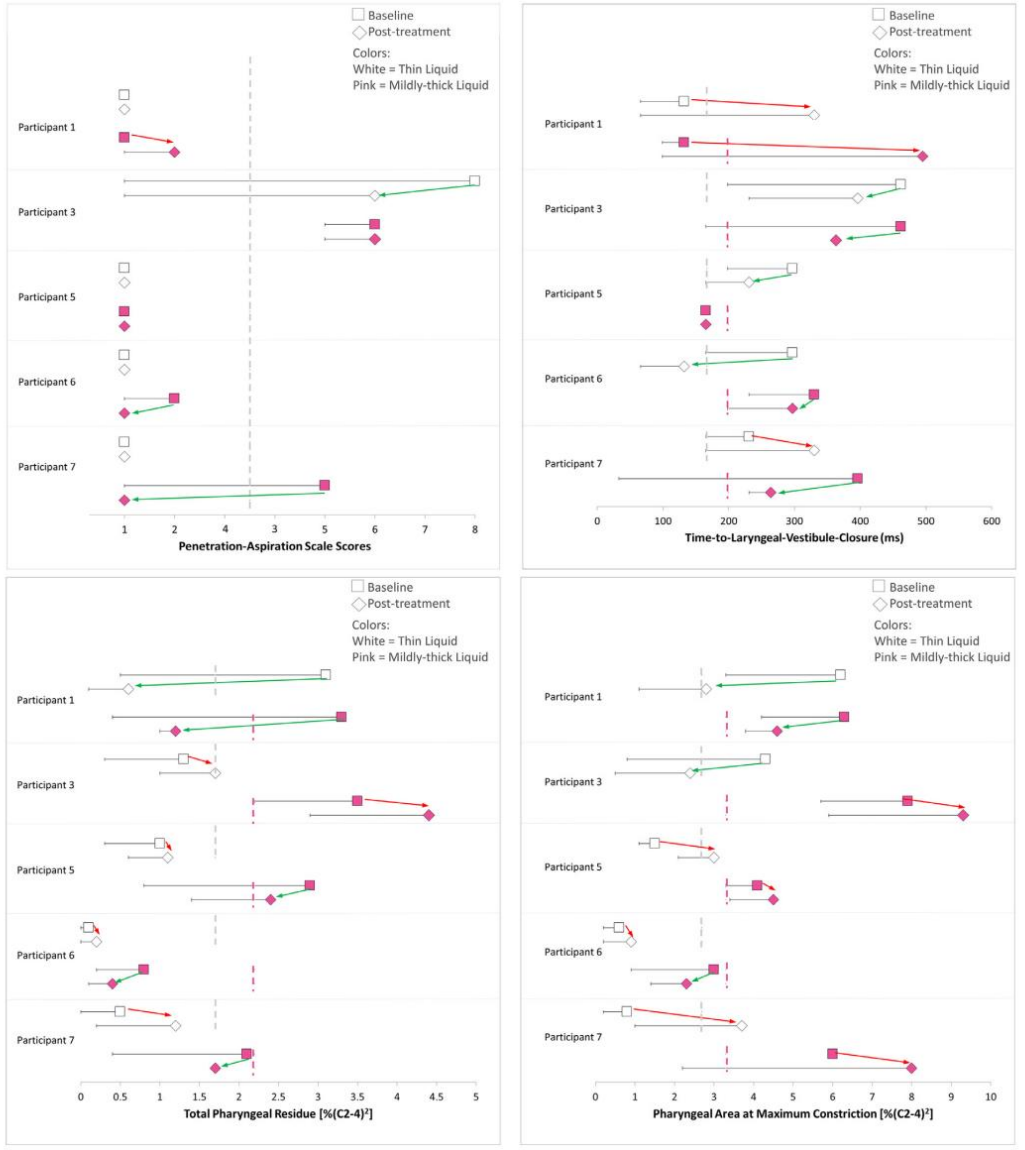
Rinforzo linguale

8 pz con PD con prolungato tempo-to-LVC e/o ridotta costrizione faringea

Deglutizione forzata con biofeedback visivo con IOPI

x 4 settimane x 2 sessioni da 30 minuti x 5 giorni/sett

Gandhi et al, 2023



EMST

30 pz real vs 30 pz sham

Aspiration and swallowing in Parkinson disease and rehabilitation with EMST

A randomized trial

M.S. Troche, PhD
M.S. Okun, MD
J.C. Rosenbek, PhD
N. Musson, MA
H.H. Fernandez, MD
R. Rodriguez, MD
J. Romrell, PA-C
T. Pitts, PhD
K.M. Wheeler-Hegland, PhD
C.M. Sapienza, PhD

Table 3 Mean (SD) values for the 2 groups for the significant outcome measures

	EMST			Sham		
Outcome and measures	Pre	Post	p Value	Pre	Post	p Value
Penetration-aspiration score	2.64 (1.87)	2.07 (1.28)	0.021[a]	2.59 (1.76)	3.30 (1.75)	0.314
Swallow timing						
Duration of hyoid elevation, s	1.91 (1.02)	1.88 (0.97)	0.888	2.57 (1.15)	1.81 (0.59)	0.007[a]
Hyoid displacement						
OBT	1.08 (0.19)	1.18 (0.10)	0.058	1.18 (0.056)	1.14 (0.09)	0.027[a]
UES—opening	1.13 (0.20)	1.25 (0.08)	0.009[a]	1.26 (0.05)	1.22 (0.08)	0.030[a]
UES—widest	1.14 (0.21)	1.26 (0.09)	0.006[a]	1.27 (0.06)	1.23 (0.09)	0.13
UES—closure	1.06 (0.17)	1.15 (0.08)	0.007[a]	1.17 (0.06)	1.13 (0.08)	0.109
Laryngeal closure	1.09 (0.19)	1.18 (0.10)	0.082	1.19 (0.06)	1.17 (0.09)	0.157
Maximum laryngeal closure	1.13 (0.20)	1.21 (0.11)	0.091	1.27 (0.05)	1.19 (0.10)	0.009[a]
Laryngeal opening	1.02 (0.17)	1.09 (0.08)	0.068	1.13 (0.05)	1.07 (0.07)	0.014[a]

Abbreviations: EMST = Expiratory Muscle Strength Training; OBT = onset of bolus transit; UES = upper esophageal sphincter.
[a] Significant.

EMST

EMST x 4 settimane

25 real vs 25 sham

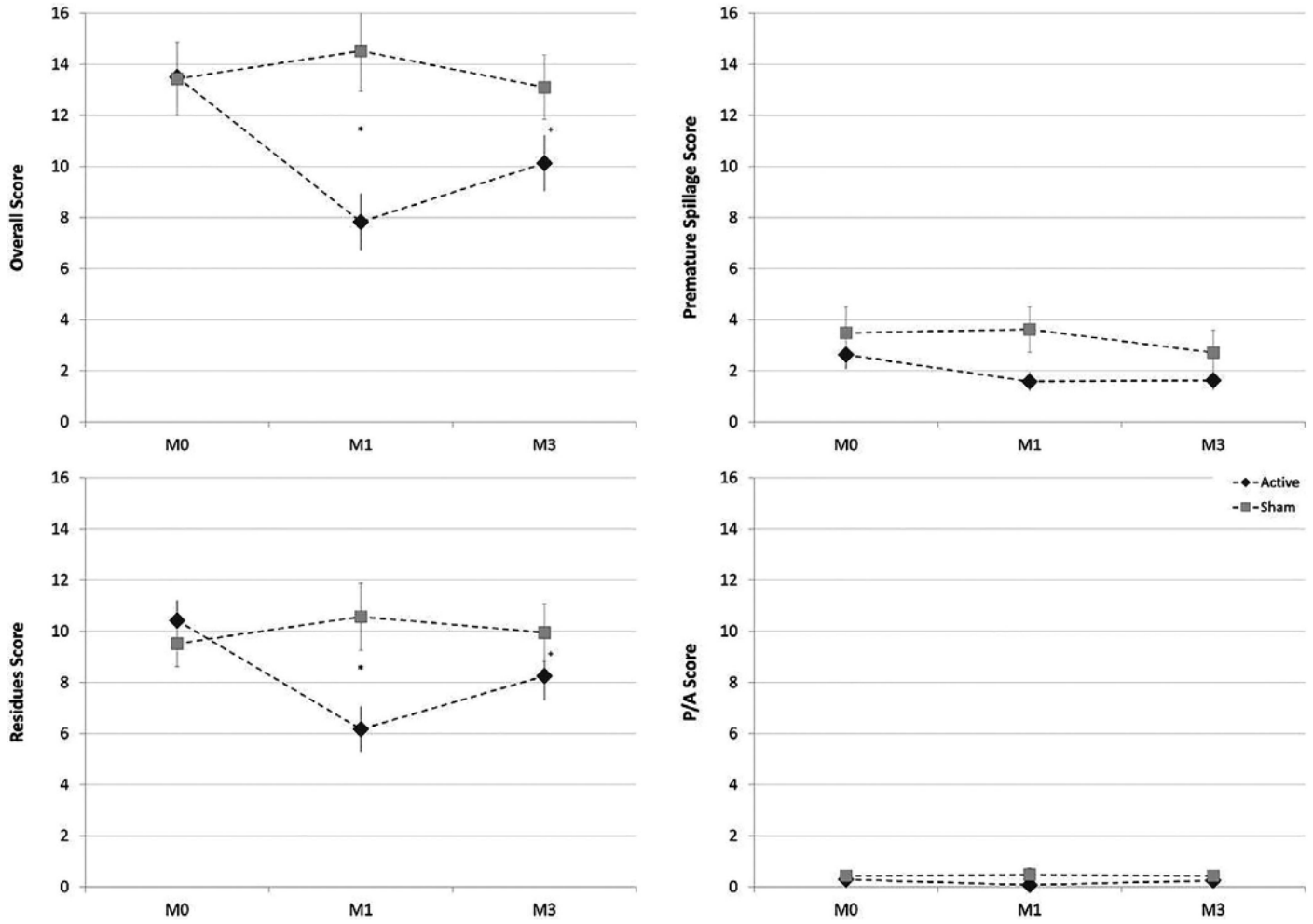


FIG. 3. Results of FEES video rating scores in EMST "active" and "sham" group (mean ± standard error [SE]) over time at different study visits (M0, M1, M3). *Statistically significant (interaction time active vs sham between M0 an M1; overall score, $P < 0.001$; partial $\eta^2 = 0.38$; residue score, $P < 0.001$; partial $\eta^2 = 0.37$); +statistically significant (interaction time active vs sham between M0 and M3; overall score, $P < 0.05$; $\eta^2 = 0.1$; residue score, $P < 0.05$; partial $\eta^2 = 0.14$).

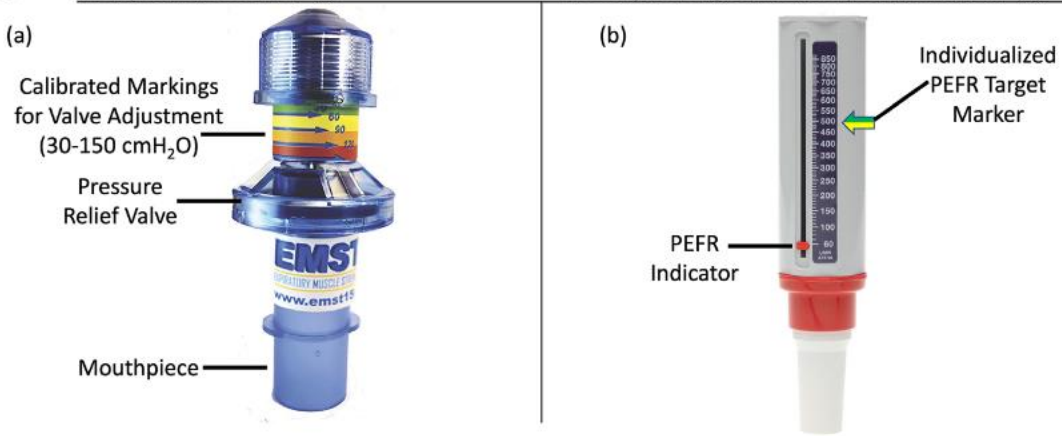
Claus et al, 2021

Riabilitare la tosse

Rehabilitating Cough Dysfunction in Parkinson's Disease: A Randomized Controlled Trial

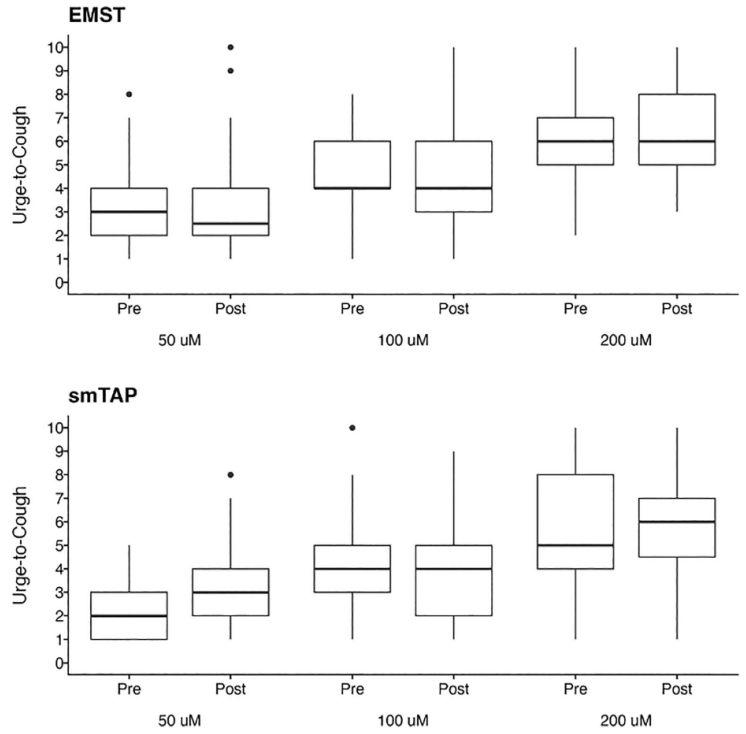
Michelle S. Troche, PhD, CCC-SLP,[1,2*] James A. Curtis, PhD, CCC-SLP,[1] Jordanna S. Sevitz, MS, CCC-SLP,[1] Avery E. Dakin, MS, CCC-SLP,[1] Sarah E. Perry, PhD, CCC-SLP,[3,4,5] James C. Borders, MS, CCC-SLP,[1] Alessandro A. Grande, MPhil,[6] Yuhan Mou, MA, CCC-SLP,[7] Nora Vanegas-Arroyave, MD,[8] and Karen W. Hegland, PhD, CCC-SLP[7,9]

	EMST	smTAP
Primary Tx Target	Maximum Expiratory Pressure (MEP)	Voluntary Cough Peak Expiratory Flow Rate (PEFR)
Type of Training	Primarily strength-based	Primarily skill-based
Treatment Dose	5 sets of 5 breaths = 25 breaths	5 sets of 5 coughs = 25 coughs
Treatment Intensity	EMST @ 75% MEP	Voluntary coughs @ 25% above PEFR
Time Period	5 days a week – with clinician once per week and four days of independent home practice (both tx)	
Tx with Clinician	25 repetitions of EMST	25 coughs via spirometry with sub-threshold capsaicin and real-time visual biofeedback.
Home Program	25 repetitions of EMST (a)	25 coughs using a handheld peak flow meter (b)



Sensorimotor Training for Airway Protection - smTAP

Parametri della **tosse volontaria** migliorati significativamente in entrambi i gruppi (maggiore in EMST)
Parametri della **tosse riflessa** migliorati solo nel gruppo smTAP

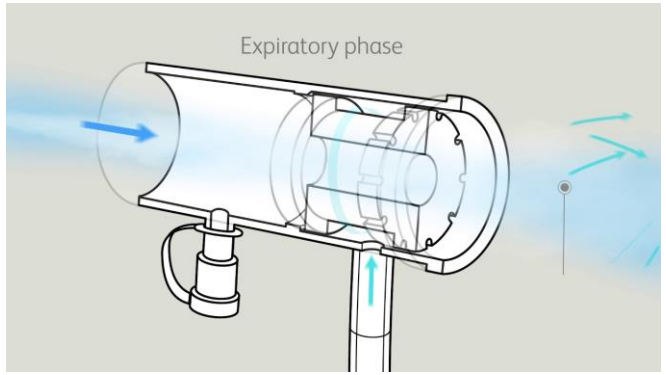


Expiratory Flow Accelerometer EFA

10 pz ST

vs

10 pz ST + EFA a domicilio



Effectiveness of expiratory flow acceleration in patients with Parkinson's disease and swallowing deficiency: A preliminary study 2020

Giulio Riboldazzi [a], Giada Spinazza [b], Laura Beccarelli [c], Paola Prato [c], Bruna Grecchi [d], Francesco D'Abrosca [e], Antonello Nicolini [c,*]

Table 2
Comparison of primary outcomes in the two groups.

Parameter	EFA group at start	EFA group at end	Control group at start	Control group at end	Post-treatment p
Exacerbations, n		1		4	0.302
Admissions, n		0		2	0.470
ED visits, n		0		3	0.210
GP visits, n		1		2	0.999
PDQ-39					
TOTAL Score	40.40 ± 8.86	29.50 ± 6.80	42.50 ± 11.90	48.50 ± 5.50	0.002*
Mobility	53.64 ± 7.24	38.12 ± 6.32	49.44 ± 8.56	53.23 ± 10.01	0.067
Activities of daily living	51.03 ± 12.38	46.24 ± 11.12	52.67 ± 11.98	56.77 ± 25.97	0.070
Emotional well-being	41.35 ± 5.31	20.02 ± 6.04	51.83 ± 6.13	59.78 ± 4.16	0.001*
Stigma	30.54 ± 12.23	23.01 ± 10.86	34.37 ± 15.83	37.27 ± 10.19	0.187
Social support	24.22 ± 18.83	18.12 ± 18.76	23.63 ± 16.14	28.87 ± 14.15	0.073
Cognition	44.61 ± 9.96	40.50 ± 7.45	45.48 ± 21.05	46.68 ± 14.43	0.084
Communication	33.30 ± 14.32	20.93 ± 10.43	35.32 ± 15.93	49.97 ± 4.11	0.003*
Physical discomfort	44.47 ± 15.12	29.04 ± 11.03	47.26 ± 16.18	55.44 ± 12.55	0.003*

EFA, expiratory flow acceleration; Admissions, hospital admissions; ED, Emergency department; GP, general practitioner; PDQ-39, Parkinson's Disease Questionnaire.
* significant difference $p < 0.05$ (95% confidence interval).

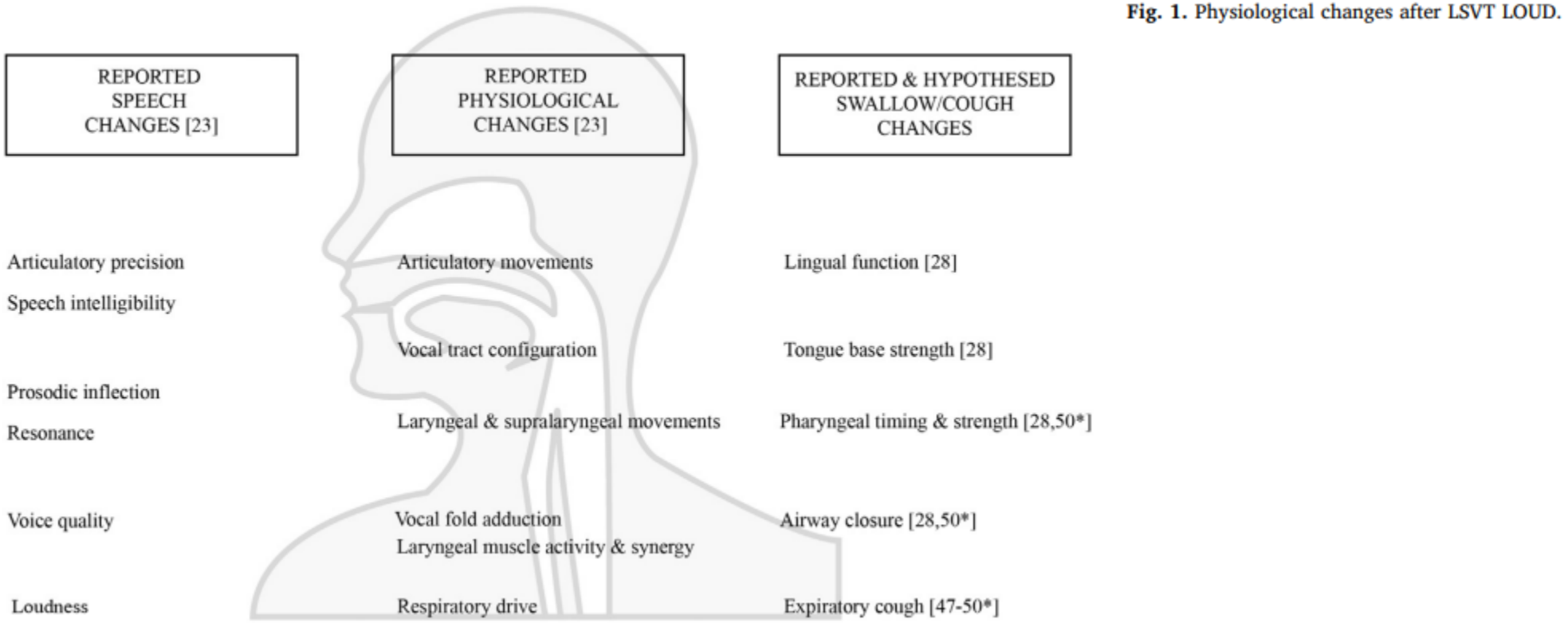
Table 3
Comparison of secondary outcomes in the two groups.

Parameter	EFA group at start	EFA group at end	Control at start	Control at end	Post-treatment p
FVC%	88.78 ± 27.29	94.08 ± 24.60	84.90 ± 16.94	74.80 ± 19.62	0.07
FEV_1%	88.67 ± 31.78	92.00 ± 30.66	81.40 ± 14.50	73.70 ± 14.08	0.009
PEF l/sec	4.47 ± 2.14	5.46 ± 3.61	3.83 ± 1.58	2.30 ± 1.54	0.27
PCEF l/m	150.0 ± 70.89	208.0 ± 73.72	155.0 ± 57.99	130.1 ± 17.74	0.01*
VNS cough	2.11 ± 1.78	0.78 ± 0.67	2.10 ± 1.66	2.60 ± 2.01	0.007*
VNS airway encumbrance	3.12 ± 2.37	0.56 ± 0.53	2.30 ± 2.00	2.90 ± 1.79	0.001*
Euro-QoL-VAS	69.11 ± 11.34	74.80 ± 11.51	79.10 ± 9.93	67.7 ± 12.89	0.03*

EFA, expiratory flow acceleration; FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 s; PEF, peak expiratory flow; CPEF, cough peak expiratory flow; VAS, visual analogue scale; EuroQoL, Euro Quality of Life.
* Significant difference $p < 0.05$ (95% confidence interval).

LSVT®

Fig. 1. Physiological changes after LSVT LOUD.



Miles et al, 2017

LSVT®

20 pz con MP in fase iniziale e con disfagia lieve

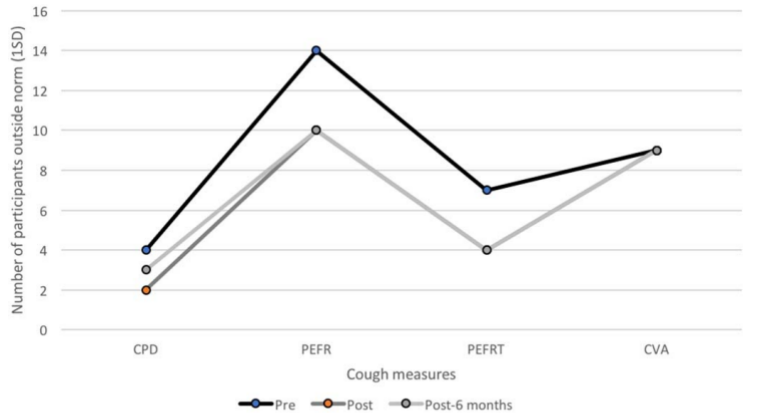


Fig. 2. Involuntary cough measures outside normative data (1SD) pre-, post- and 6-months post-LSVT LOUD, excluding the three participants lost to follow-up at six-months [42].

Table 5
Videofluoroscopic measures pre-, post- and 6-months post-LSVT LOUD.

Measure		Mean, SD			Statistic	p value
		Pre-LSVT LOUD	1 week post-LSVT LOUD	6 months post-LSVT LOUD		
Single sip (20 ml)						
Timing (seconds)	TPT	0.76, 0.09	0.82, 0.13	0.79, 0.11	F 1.07	p = 0.37
	AEdur	0.72, 0.07	0.61, 0.35	0.72, 0.08	F 1.19	p = 0.08
	PESdur	0.44, 0.14	0.48, 0.06*	0.58, 0.07*	F 4.11	**p < 0.05**
	Hdur	0.33, 0.13	0.37, 0.12	0.36, 0.12	F 0.17	p = 0.84
	AEcl	0.14, 0.08	0.10, 0.05	0.15, 0.05	F 1.89	p = 0.20
	20 ml fluid esophageal transit time	14.20, 20.34	6.57, 2.79	8.26, 2.28	F 0.656	p = 0.46
Displacement	PESmax (cm)	0.54, 0.20	0.68, 0.15*	0.73, 0.17*	F 3.87	**p < 0.05**
	Hmax(cm)	1.70, 0.55	1.57, 0.61	1.83, 0.37	F 0.34	p = 0.72
	HL (cm)	0.92, 0.39	0.77, 0.50	0.62, 0.48	F 0.52	p = 0.61
	PCR (cm^2)	0.04, 0.04	0.06, 0.07	0.06, 0.05	F 1.05	p = 0.38
Anatomical measure	PAhold (cm^2)	12.30, 2.75	10.94, 2.06*	8.57, 2.27*	F 5.01	**p < 0.05**
Paste (5 ml)						
Residue (cm^2)		0.16, 0.26	*0.09, 0.18	0.09, 0.22*	F 4.9	**p < 0.05**
Continuous straw drinking (100 ml)						
Duration (seconds)		12.42, 5.34	10.47, 3.48	10.80, 2.82	F 2.46	p = 0.14
No. of swallows		7.08, 2.93	7.31, 2.02	7.03, 2.82	F 0.12	p = 0.89
No. of breaths		5.08, 4.01	4.62, 3.73	4.40, 2.22	F 0.09	p = 0.92

Bold = statistically significant $p < 0.05$.
* Statistically different from baseline pre-LSVT LOUD.

Miles et al, 2017

LSVT®

Swallowing and voice effects of Lee Silverman Voice Treatment (LSVT®): a pilot study

A El Sharkawi, L Ramig, J A Logemann, B R Pauloski, A W Rademaker, C H Smith, A Pawlas, S Baum, C Werner

J Neurol Neurosurg Psychiatry 2002;**72**:31–36

Table 2 Swallowing motility disorders before and after LSVT®; numbers refer to number of subjects who demonstrated the disorder on swallows of each bolus volume

	Bolus volume													
	1 ml		3 ml		5 ml		10 ml		Cup drinking		Paste		Cookie	
Motility disorder	Pre Tx	Post Tx	Pre Tx	Post Tx	Pre Tx	Post Tx	Pre Tx	Post Tx	Pre Tx	Post Tx	Pre Tx	Post Tx	Pre Tx	Post Tx
Reduced tongue coordination	4	0	4	1	1	0	1	2	2	1	5	2	5	4
Reduced vertical tongue movement	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Reduced AP tongue movement	5	2	5	1	3	2	3	2	5	0	6	6	8	8
Reduced tongue stabilization	1	0	1	0	2	0	2	0	2	0	0	0	0	0
Reduced tongue lateralization	0	0	0	0	0	0	0	0	0	0	1	0	5	0
Reduced tongue strength	8	3	8	5	8	4	8	6	8	4	8	7	8	6
Rocking-like movement	0	0	1	0	1	0	1	1	1	0	1	0	2	0
Delayed pharyngeal swallow	2	0	2	0	0	0	0	0	0	0	4	1	6	4
Reduced tongue base retraction	6	3	7	3	6	4	8	4	8	4	8	4	7	6
Slowed/delayed vestibule closure	0	3	0	1	1	2	2	2	2	2	1	1	1	1
Bilateral pharyngeal weakness	0	0	1	0	2	0	4	2	3	2	3	2	3	2
Dipper swallow	1	0	1	1	1	0	1	1	0	0	1	0	1	1
Difficulty clearing pharyngeal residue	0	0	0	0	0	0	0	0	0	0	2	1	1	1
Functional swallow	4	7	4	7	6	5	5	7	5	6	2	8	1	2

8 pz con PD

LSVT ®

6 pz con IPD e 7 pz con MSA
16 sedute di LSVT

Dysphagia (2022) 37:198–206
https://doi.org/10.1007/s00455-021-10265-9

ORIGINAL ARTICLE

Swallowing Outcomes Following Voice Therapy in Multiple System Atrophy with Dysphagia: Comparison of Treatment Efficacy with Parkinson's Disease

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Table 1 Comparison of speech and swallowing function in IPD and MSA-C groups before and after LSVT

Variables	IPD			MSA-C			Time		Group		Time*Group	
	Pretest	Posttest	Follow-up	Pretest	Posttest	Follow-up	*F*	*p*	*F*	*p*	*F*	*p*
Speech												
MPT	13.01 ± 5.85	20.89 ± 9.05**	18.88 ± 7.86*	7.09 ± 3.31	10.36 ± 2.50*	10.32 ± 1.96**	15.622	.000***	8.632	.013*	2.380	.116
Voice intensity	75.68 ± 4.80	78.70 ± 2.35	78.93 ± 2.84	72.36 ± 6.73	78.24 ± 1.59*	76.42 ± 3.77*	7.515	.003*	1.360	.268	0.726	.495
Swallowing												
NIH-SSS	1.83 ± 1.83	0.67 ± 0.51	0.83 ± 0.75	1.71 ± 0.95	1.29 ± 0.48	1.14 ± 1.06	3.568	.046*	0.430	.526	0.586	.565
VDS												
Oral phase	5.58 ± 12.95	0.75 ± 1.25	1.75 ± 1.75	4.28 ± 6.89	0.64 ± 1.18	5.42 ± 7.21	1.500	.245	0.106	.751	0.540	.590
Pharyngeal phase	25.58 ± 14.76	8.08 ± 4.34*	9.50 ± 6.45*	24.78 ± 12.08	14.57 ± 7.66*	17.50 ± 8.18	12.900	.000***	1.235	.290	1.285	.297
Total score	31.16 ± 26.48	8.83 ± 4.79	11.25 ± 8.09	29.07 ± 16.32	15.21 ± 7.66*	22.92 ± 14.03	7.703	.003**	0.781	.396	1.067	.361

Data are presented as mean ± SD

LSVT Lee Silverman Voice Treatment, *IPD* Idiopathic Parkinson's disease, *MSA-C* Multiple system atrophy-Cerebellar type, *MPT* Maximum phonation time, *NIH-SSS* National Institutes of Health-swallowing safety scale, *VDS* Videofluoroscopic Dysphagia Scale

*P < 0.05, **P < 0.01, ***P < 0.001

*significant results were returned for pretest and posttest, Pretest Follow-up

MSA migliorano la continenza orale posteriore
IPD migliorano l'elevazione laringea

Skill-based Training

Acquisizione di abilità attraverso la ripetizione funzionale e il perfezionamento di schemi di movimento attraverso una riorganizzazione corticale dei network motori

Dysphagia (2023) 38:756–767
https://doi.org/10.1007/s00455-022-10516-3

REVIEW

Expanding Rehabilitation Options for Dysphagia: Skill-Based Swallowing Training

Maggie-Lee Huckabee[1] · Ruth Flynn[1] · Madeline Mills[1]

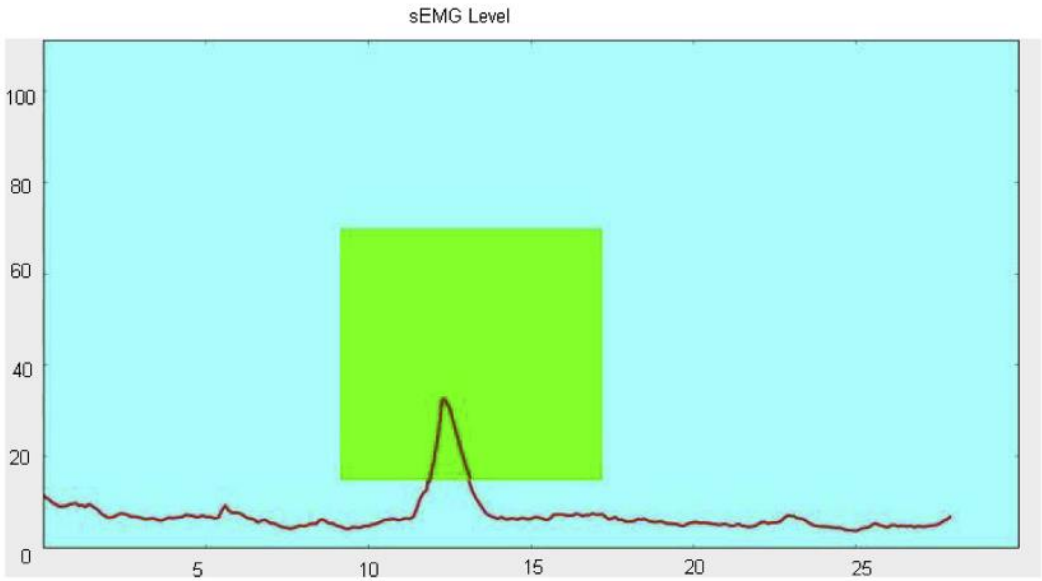
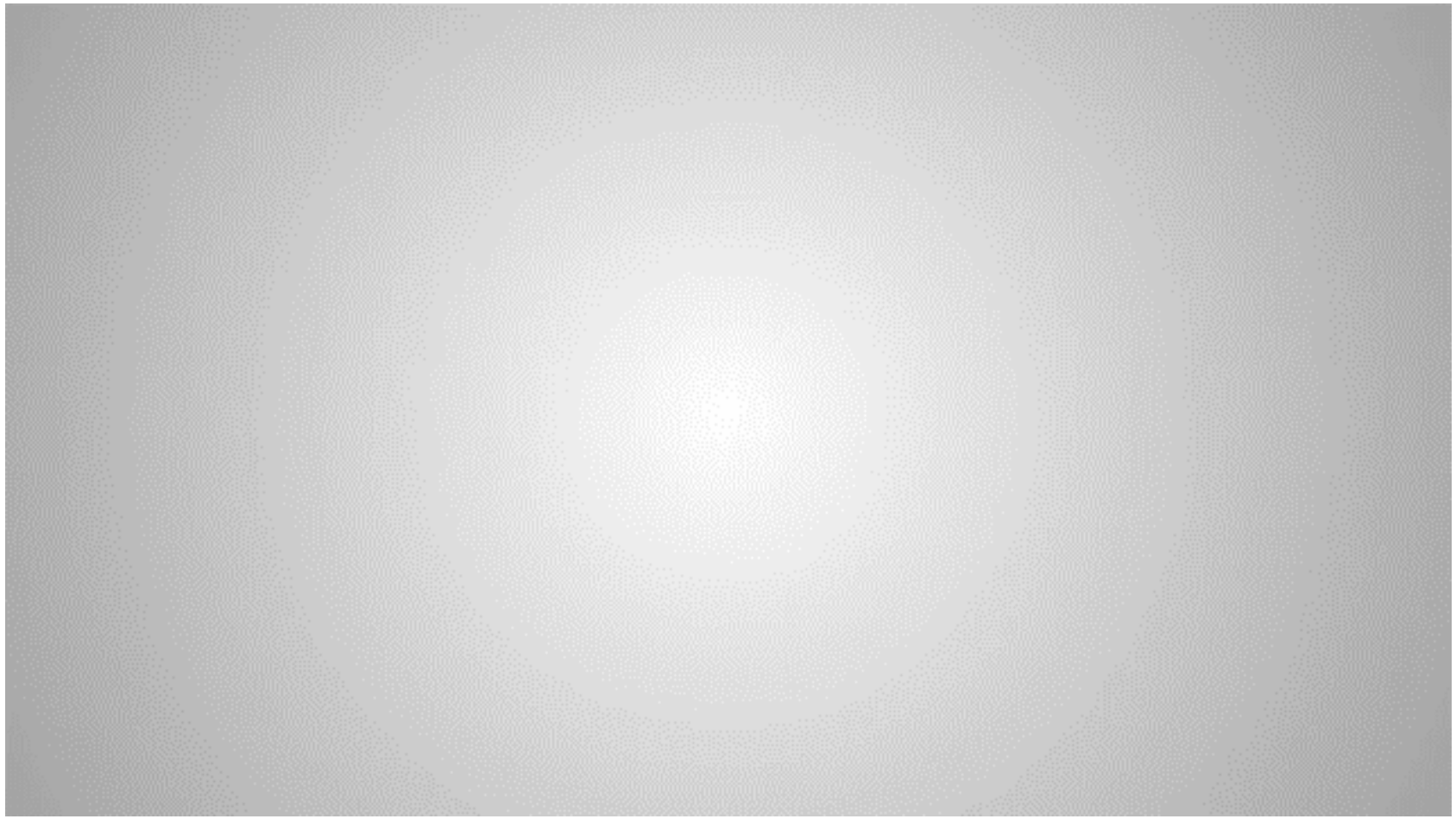


Fig 2 Skill training display (swallowing target) in the BiSSkiT software.

Visual cues



SKILL-BASED TRAINING

› Arch Phys Med Rehabil. 2021 Feb;102(2):314-322. doi: 10.1016/j.apmr.2020.06.033. Epub 2020 Aug 27.

Interventions Involving Biofeedback to Improve Swallowing in People With Parkinson Disease and Dysphagia: A Systematic Review

Irene Battel [1], Irene Calvo [2], Margaret Walshe [3]

Skill-based Training

https://www.youtube.com/watch?v=ijzbrybZUJ8

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

Ruvini P. Athukorala, MSc,[a,b] Richard D. Jones, PhD,[a,b,c] Oshrat Sella, PhD,[a,b] Maggie-Lee Huckabee, PhD[a,b]

N=10 pazienti con PD

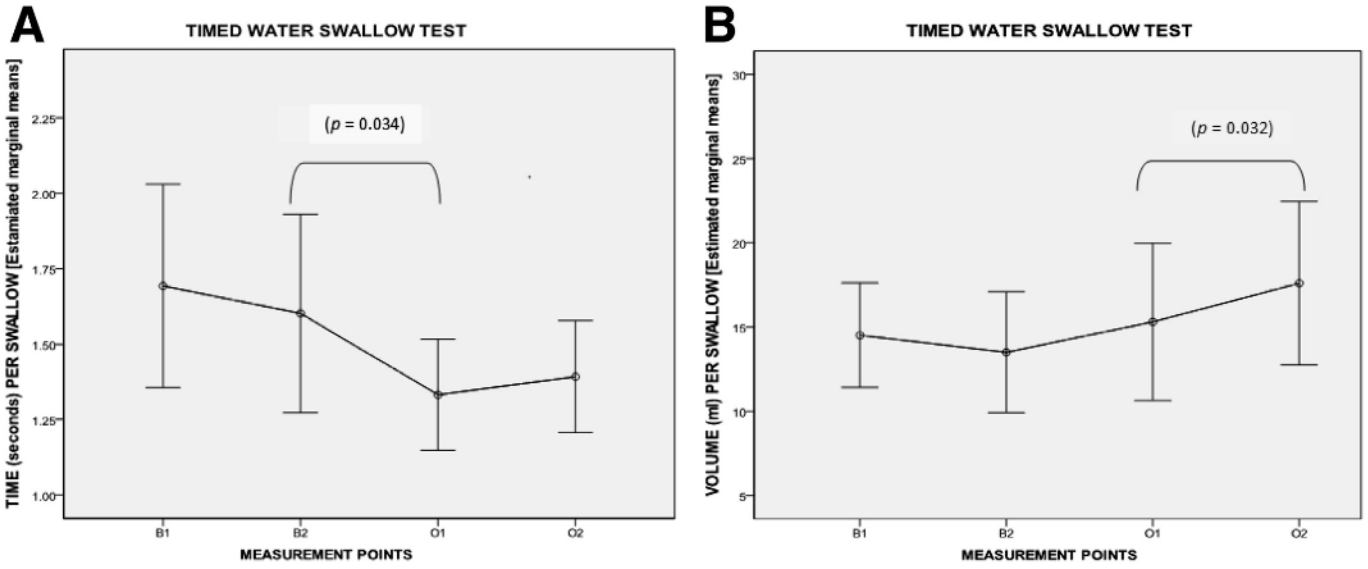
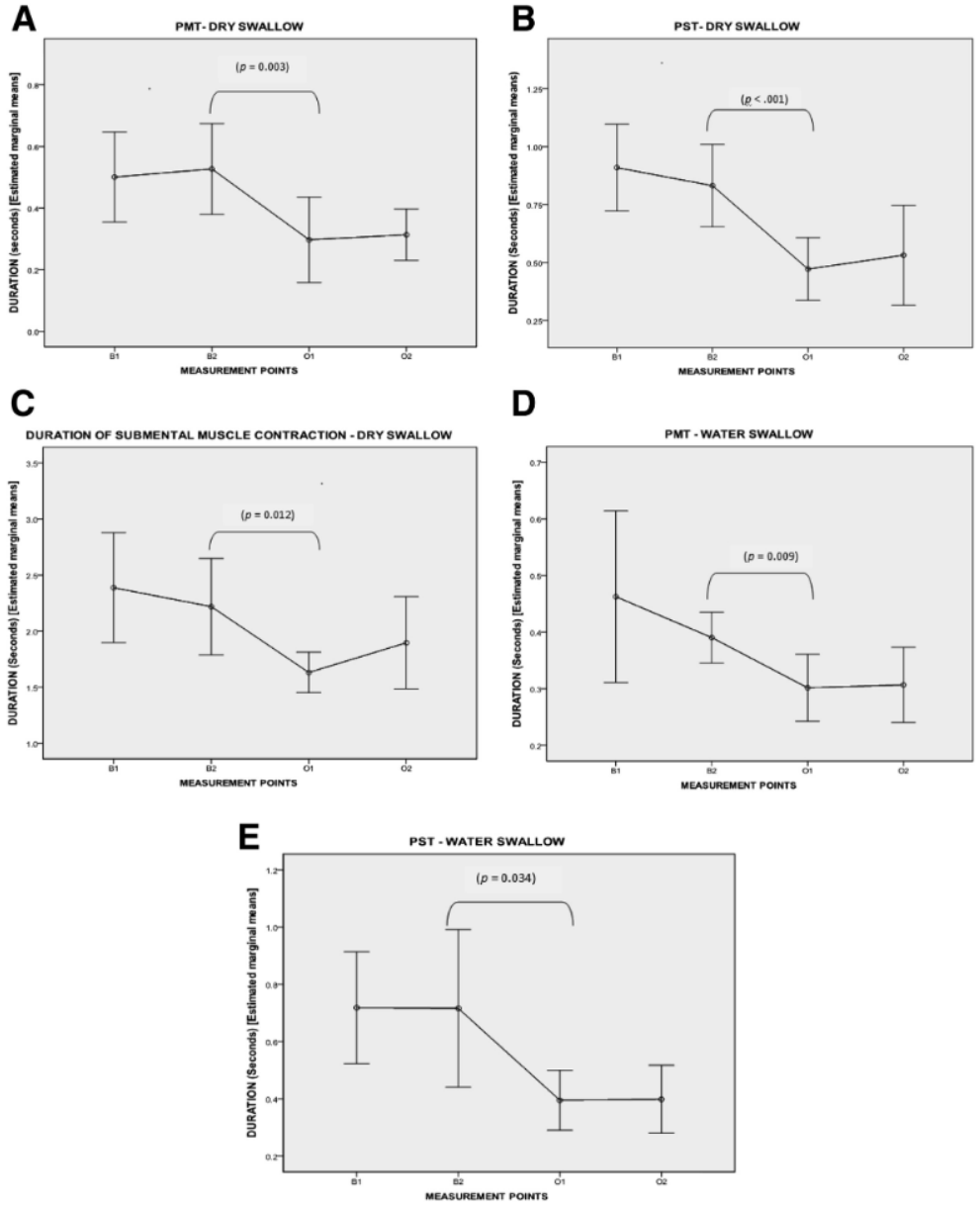


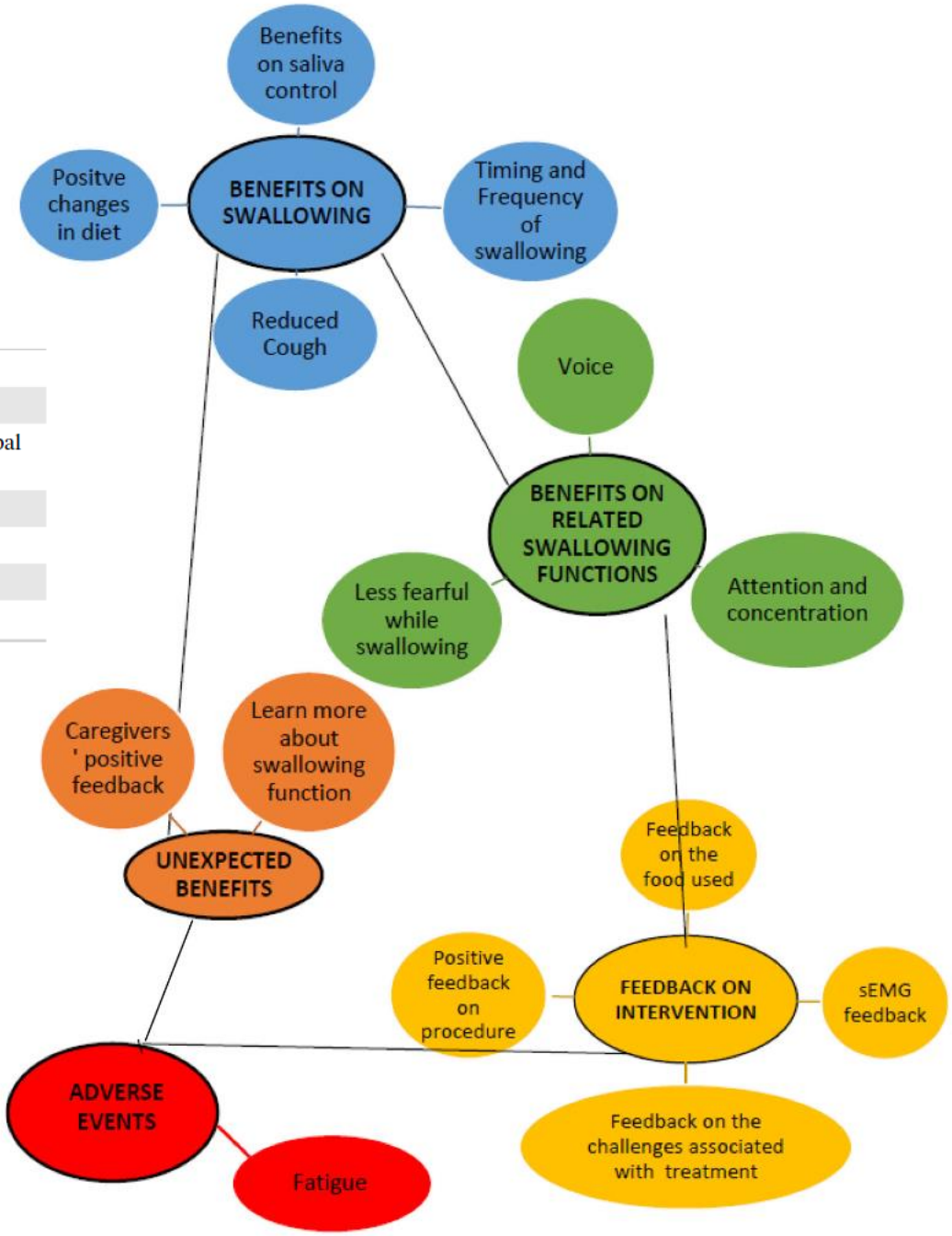
Fig 3 (A) Means and confidence intervals for time per swallow; and (B) means and confidence intervals for volume per swallow.



Skill-based Training

TABLE 2 sEMG swallowing tasks accordingly to neuroplasticity principles

	Description of swallowing treatment tasks
Use it or lose it	The intervention incorporated swallowing tasks as the goal was to improve swallowing
Use it and improve it	The swallowing tasks were planned in an incremental order of difficulty week by week. sEMG and verbal feedback were set to increase efficiency and accuracy of the participant's swallowing function
Experience specific	Exercises were tailored according to each participant's swallowing skills
Repetition matters	Repetition and consistent practice of swallowing exercises were incorporated into the programme
Intensity matters	The treatment was intense, 1 h a day, 5 days a week, for 4 weeks
Salience	The treatment incorporated food trials and a visual game using sEMG



Battel & Walshe, 2022

Skill-based training: coordinazione respirazione-deglutizione

Verbal cueing

- modifica la coordinazione respirazione-deglutizione
- è ottimale se fornito poco prima del picco di inspirazione

Fig. 2 Depiction of the four points during tidal breathing when verbal cues were given, relative to tidal breathing range [i.e., the difference between end-inspiratory level (EIL) and end-expiratory level (EEL): *HE* high tidal exhalation, *LE* low tidal exhalation, *LI* low tidal inhalation, *LI* high tidal inhalation

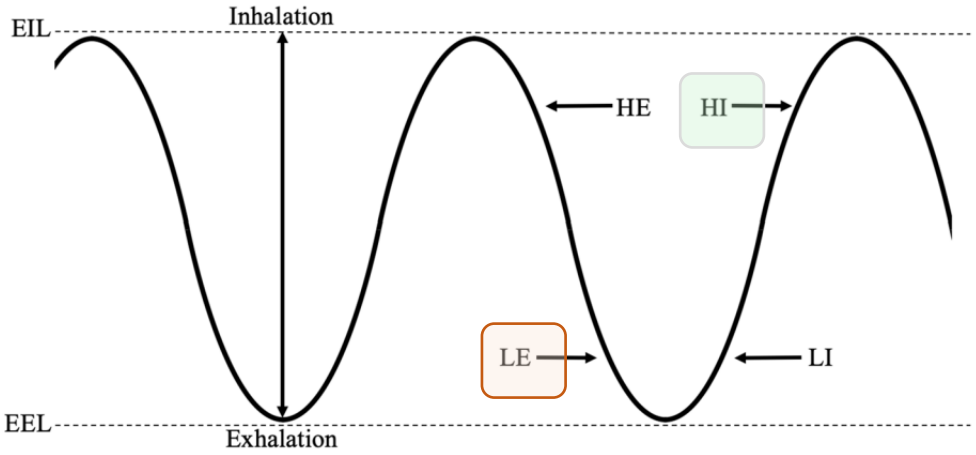
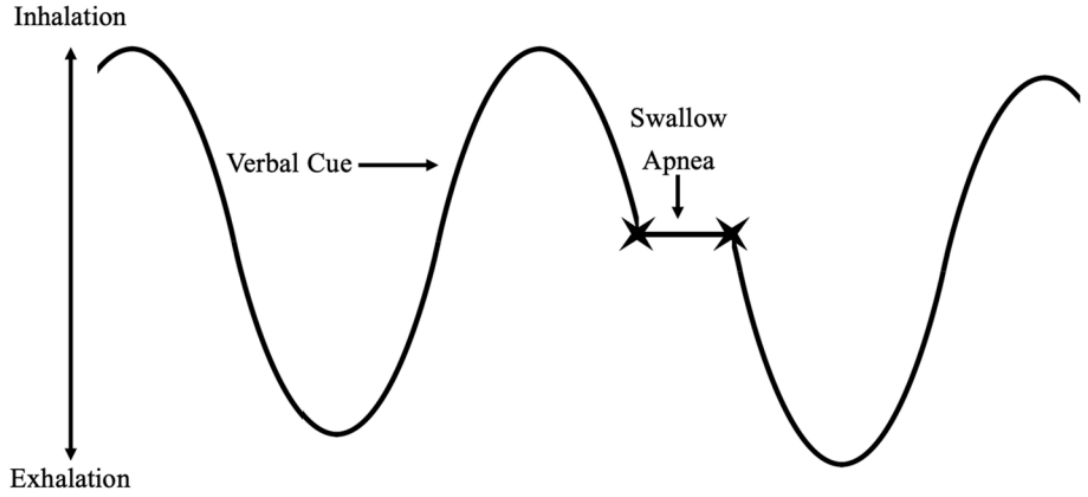


Fig. 4 Example of the latency between a verbal cue and the onset of swallow apnea



Curtis & Troche, 2020

FEES come biofeedback

- ✓Aumentare consapevolezza e conoscenza della deglutizione
- ✓Migliorare propriocezione
- ✓Migliorare l'efficacia degli esercizi (es. riduzione dei ristagni)

Parkinsonism and Related Disorders 19 (2013) 207–211

Contents lists available at SciVerse ScienceDirect

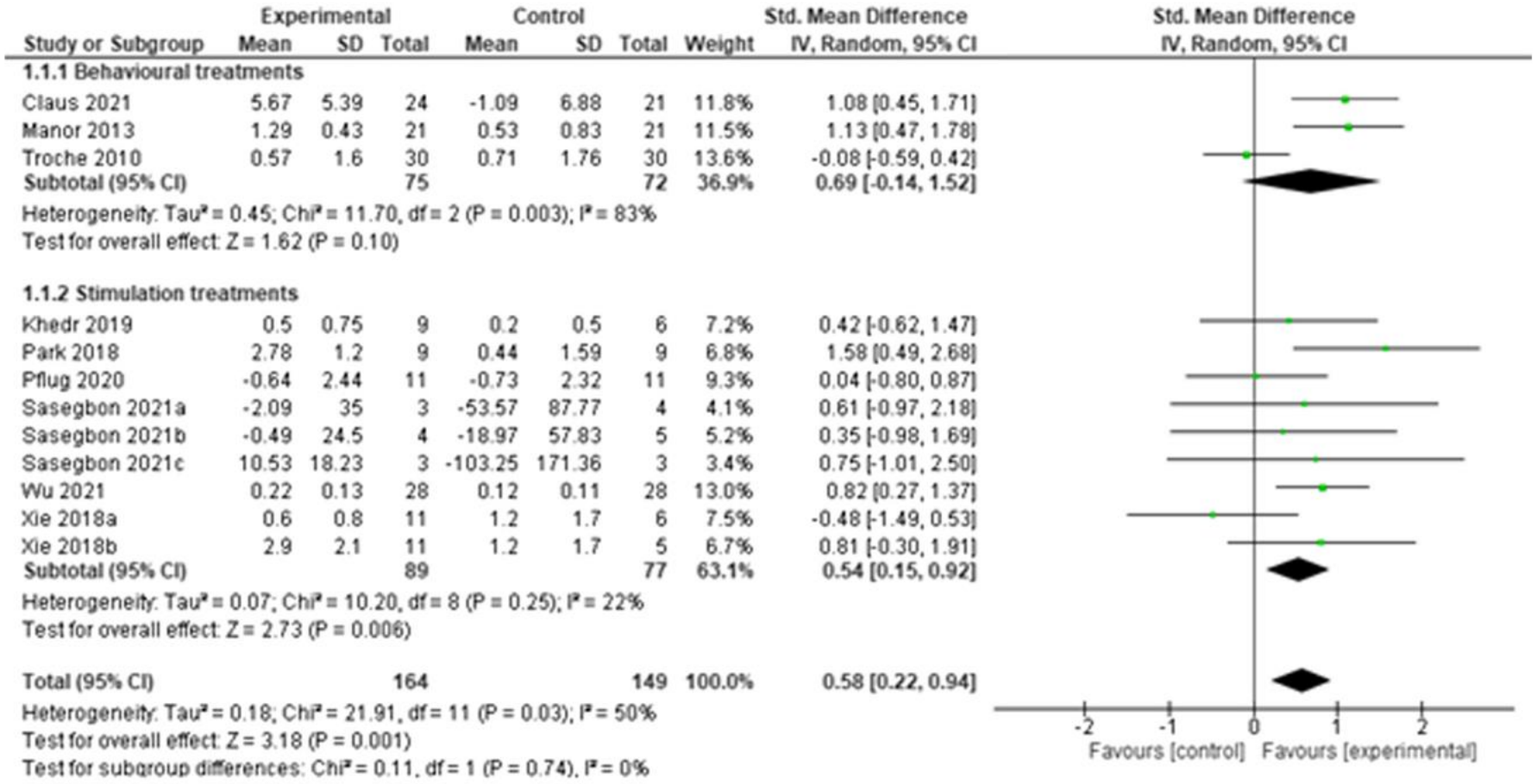
Parkinsonism and Related Disorders

journal homepage: www.elsevier.com/locate/parkreldis

Video-assisted swallowing therapy for patients with Parkinson's disease

Yael Manor [a,b,d,*], Rajshree Mootanah [c], Debora Freud [a,b], Nir Giladi [a,e], Jacob T. Cohen [b,e]

Neurostimolazione: quale ruolo?



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.1.1 Behavioural treatments								
Claus 2021	5.67	5.39	24	-1.09	6.88	21	11.8%	1.08 [0.45, 1.71]
Manor 2013	1.29	0.43	21	0.53	0.83	21	11.5%	1.13 [0.47, 1.78]
Troche 2010	0.57	1.6	30	0.71	1.76	30	13.6%	-0.08 [-0.59, 0.42]
Subtotal (95% CI)			75			72	36.9%	**0.69 [-0.14, 1.52]**
Heterogeneity: Tau² = 0.45; Chi² = 11.70, df = 2 (P = 0.003); I² = 83%								
Test for overall effect: Z = 1.62 (P = 0.10)								
1.1.2 Stimulation treatments								
Khedr 2019	0.5	0.75	9	0.2	0.5	6	7.2%	0.42 [-0.62, 1.47]
Park 2018	2.78	1.2	9	0.44	1.59	9	6.8%	1.58 [0.49, 2.68]
Pflug 2020	-0.64	2.44	11	-0.73	2.32	11	9.3%	0.04 [-0.80, 0.87]
Sasegbon 2021a	-2.09	35	3	-53.57	87.77	4	4.1%	0.61 [-0.97, 2.18]
Sasegbon 2021b	-0.49	24.5	4	-18.97	57.83	5	5.2%	0.35 [-0.98, 1.69]
Sasegbon 2021c	10.53	18.23	3	-103.25	171.36	3	3.4%	0.75 [-1.01, 2.50]
Wu 2021	0.22	0.13	28	0.12	0.11	28	13.0%	0.82 [0.27, 1.37]
Xie 2018a	0.6	0.8	11	1.2	1.7	6	7.5%	-0.48 [-1.49, 0.53]
Xie 2018b	2.9	2.1	11	1.2	1.7	5	6.7%	0.81 [-0.30, 1.91]
Subtotal (95% CI)			89			77	63.1%	**0.54 [0.15, 0.92]**
Heterogeneity: Tau² = 0.07; Chi² = 10.20, df = 8 (P = 0.25); I² = 22%								
Test for overall effect: Z = 2.73 (P = 0.006)								
Total (95% CI)			164			149	100.0%	**0.58 [0.22, 0.94]**
Heterogeneity: Tau² = 0.18; Chi² = 21.91, df = 11 (P = 0.03); I² = 50%								
Test for overall effect: Z = 3.18 (P = 0.001)								
Test for subgroup differences: Chi² = 0.11, df = 1 (P = 0.74), I² = 0%								

Cheng et al, 2022

Neurostimolazione

B3) Neuromodulation

Statements are based on core literature consisting of Class I-II-III-IV level studies [57,98–101] *and expert opinion:*

B3i. *There are no data available on the effects of tDCS in patients with PD and dysphagia.*

B3ii. *rTMS may be associated to a beneficial effect on swallowing function in patients with PD, but its use is limited to research settings for the identification of standard protocols of stimulation.*

B3iii. *The use of TES is not recommended for the treatment of dysphagia in patients with PD.*

- Non differenze significative rispetto a solo trattamento standard
- Possibili effetti detrimentali se elettrodi posizionati solo in posizione sottoioidea

Baijens et al, 2012, 2015; Park et al, 2018

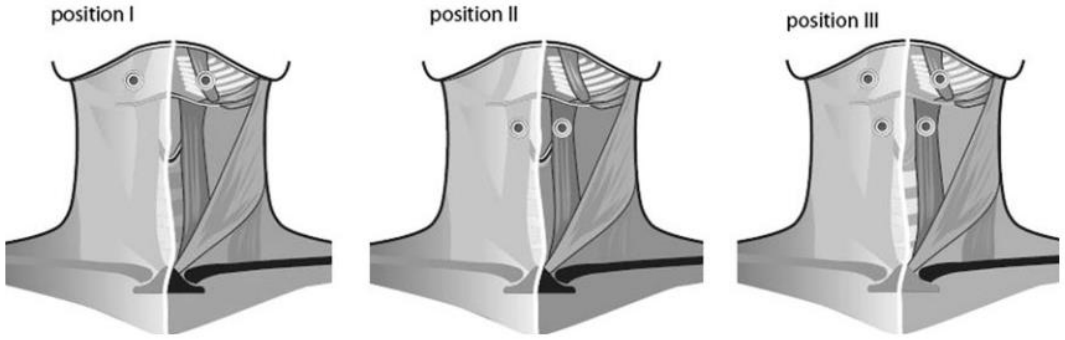


Fig. 1 Schematic illustration of the electrode positions. Position = two electrodes horizontally above the hyoid bone (submental egion); position II = two electrodes horizontally below the hyoid bone; position III = combination of positions I and II, with four electrodes connected on each side of the midline of the neck

RF2019

UO1 PI Prof Cosentino, Istituto Neurologico Mondino, Pavia
UO2 Dott. Bocci, ASST Santi Paolo e Carlo
UO3 Dott.ssa Pizzorni, Unimi

Popolazione

72 pazienti con PD e disfagia > 6 mesi (DOSS 2-5)

Valutazione basale T0 *

tDCS biemisferica **20 min**
(18 pz Real, 18 pz Sham)

x2 settimane

+ Logopedia (45 min)

Follow-up:
- **T1: alla fine del trattamento**
- **T2: a 3 mesi dall'inizio del trattamento**

x6 settimane

Valutazione basale T0 *

x6 settimane

NMES-plus 45 min
(18 pz Real, 18 pz Sham)

+ Logopedia (45 min)

Follow-up:
- **T1: alla fine del trattamento**
- **T2: a 3 mesi dall'inizio del trattamento**

*
- *Val. logopedica (MASA+ASHA+FOIS+ TOMASS+TWST)*
- *FEES (DOSS, PAS, FOIS) + EKSS senza ago (Mondino)*
- *SWAL-QOL e SWAL-CARE*
- *PEM lingua (San Paolo)*

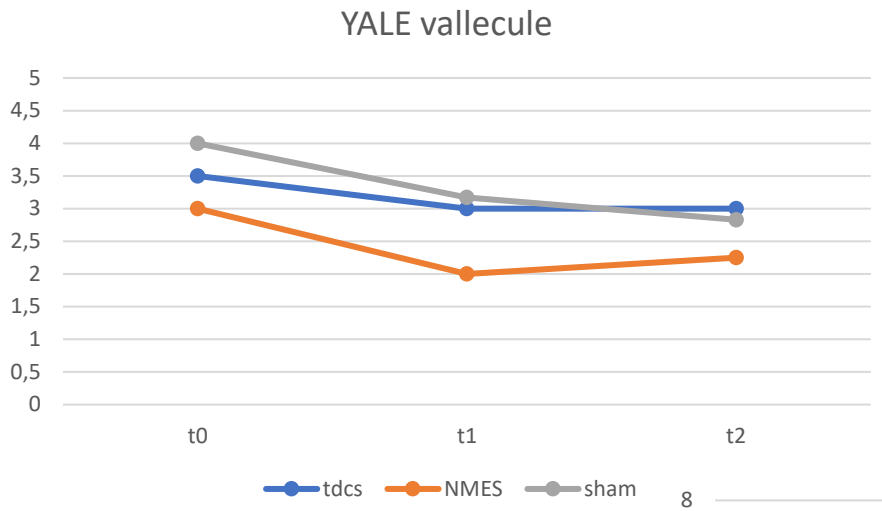
*

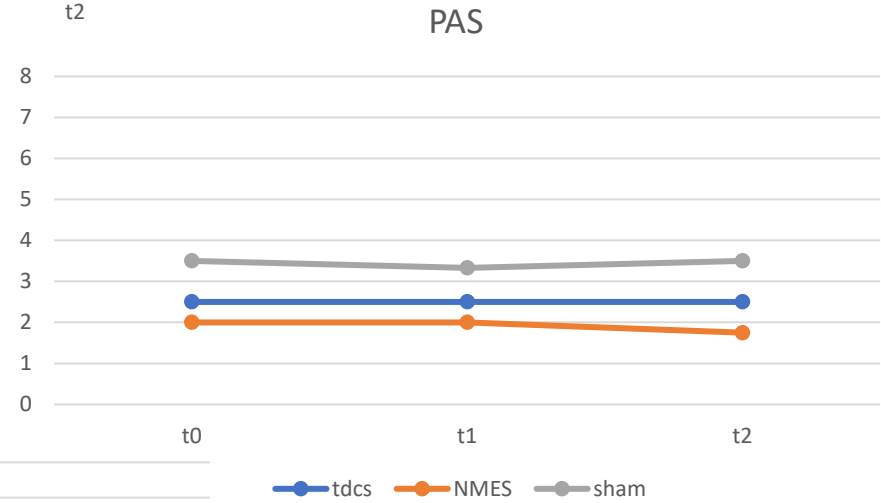
RF2019 Risultati preliminari

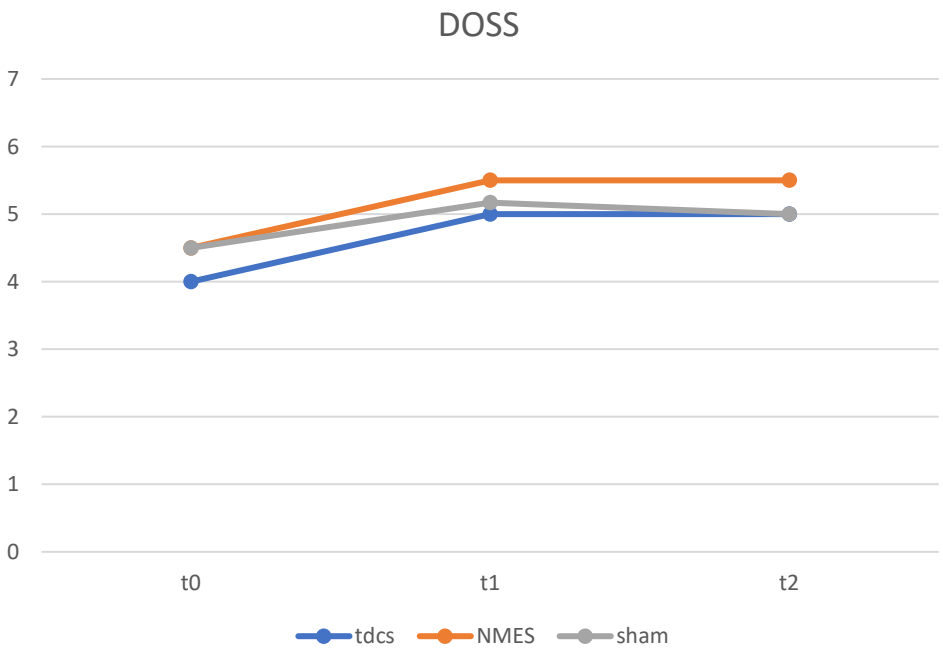
27 pazienti

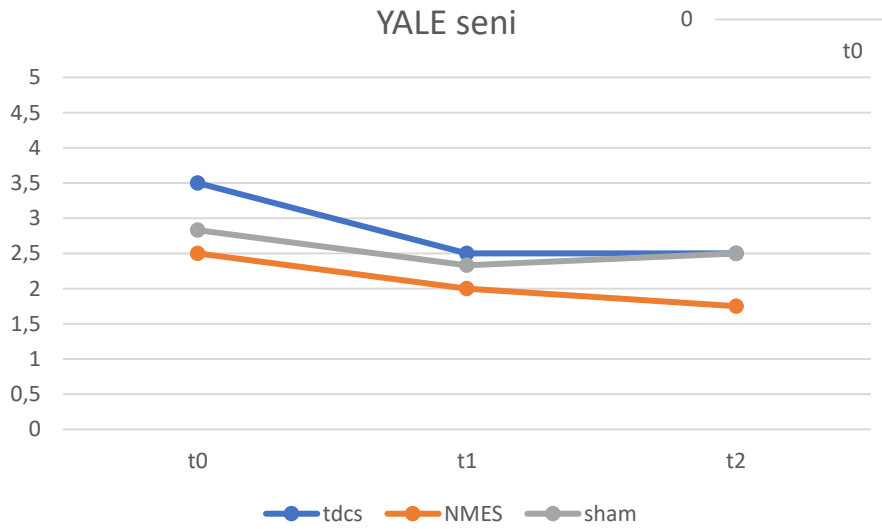
H&Y 2,4 ±1,2

- 11 tdcs
- 6 NMES
- 10 sham

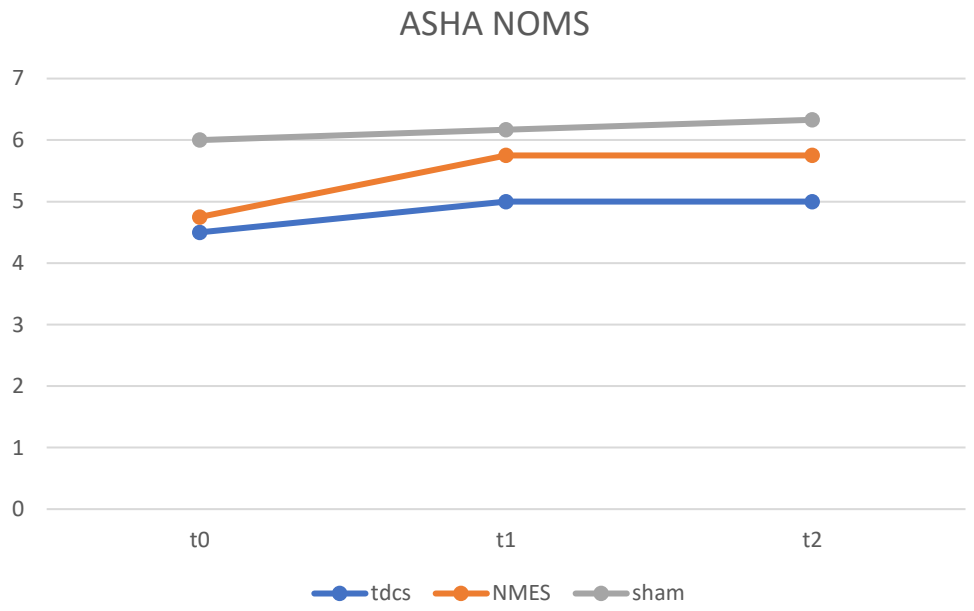


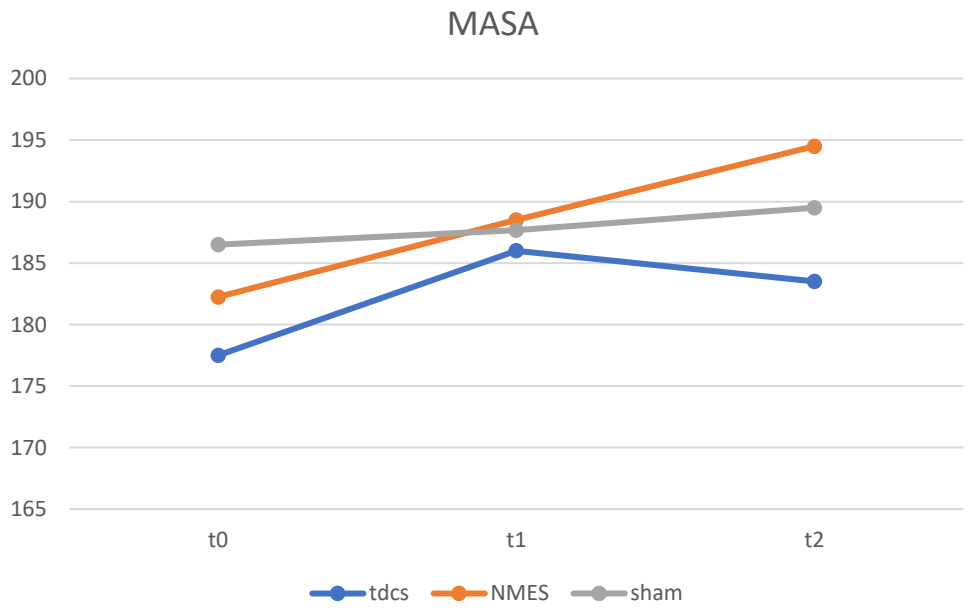


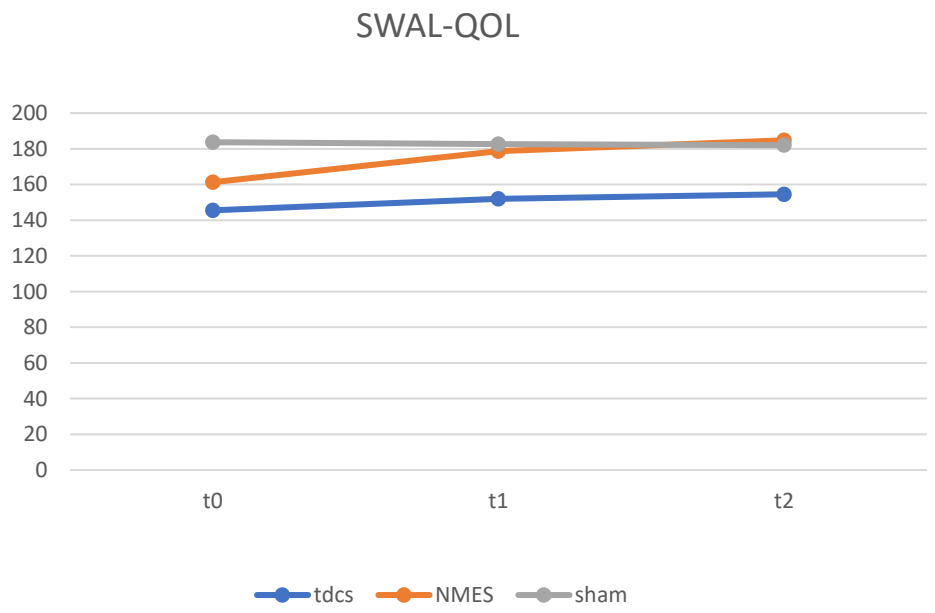


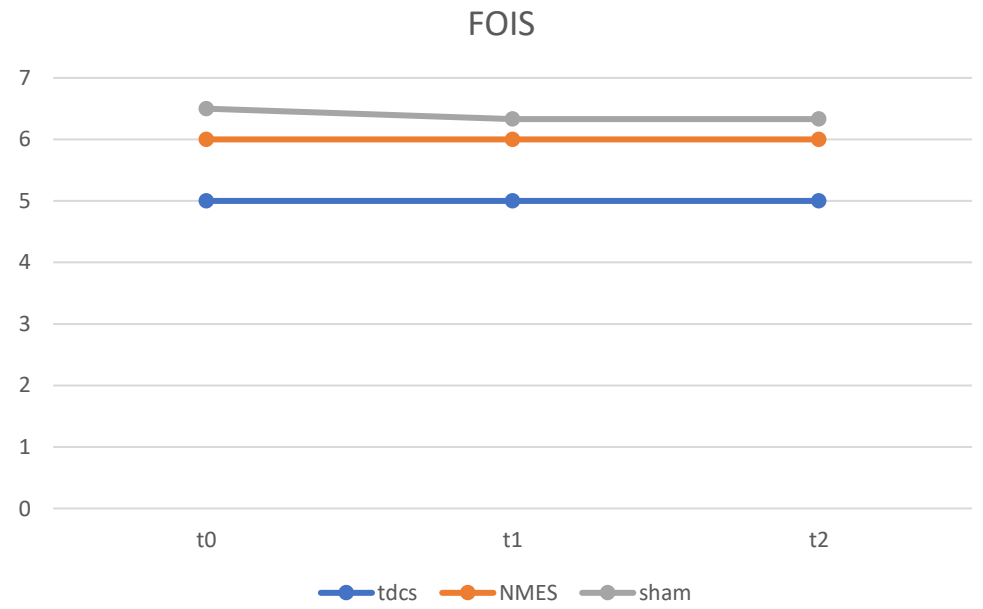


RF2019 Risultati preliminari









RF2019 Risultati preliminari

OUTCOME INESPLORATI:

- Frequenza deglutitoria
- Propriocezione orale
- Deglutizioni multiple

Tossina botulinica al m. cricofaringeo

B4) Medical treatments

Statements are based on core literature consisting of Class IV level studies [102,103,105] *and expert opinion:*

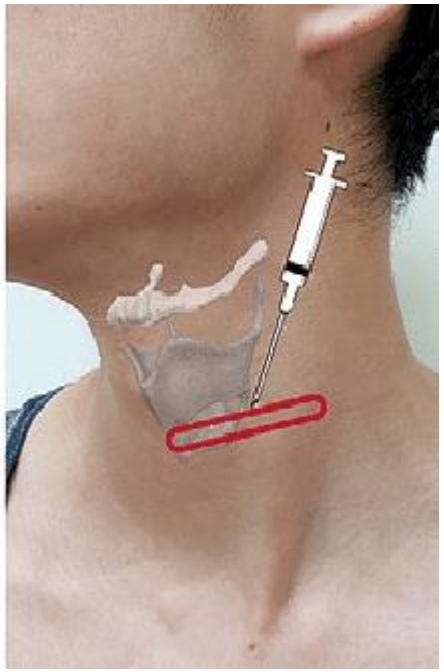
B4i. *BT injection may be an option to treat patients with well-documented UES impairment, in the absence of other significantly impaired swallowing mechanisms or where the UES impairment can be considered as the main pathophysiological mechanism of dysphagia based on instrumental findings.*

B4ii. *BT injection should be electromyography-guided and performed by experienced clinicians to avoid adverse effects.*

1. Ci sono altri meccanismi responsabili della ridotta apertura dello UES su cui posso agire?
2. L'ipertono dello UES è documentato tramite EMG?
3. La protezione delle vie aeree inferiori è sufficientemente adeguata vs. rischio di aspirazione di materiale gastrico?

15% di eventi avversi non seri e transitory -> consigliata inoculazione monolaterale (peggioramento della disfagia o disfonia da 1 a 3 settimane) (Alfonsi et al., 2017)

Necessità di ripetere la procedura in molti casi



Nutrizione enterale

Valutazione individualizzata caso per caso in equipe multidisciplinare considerando

- Situazione clinica
- Stato cognitivo
- Stato nutritionale
- Impatto atteso sulla qualità di vita
- Preferenze del paziente e dei caregiver

ESPEN guidelines on artificial enteral nutrition, Löser et al, 2005

Nutrizione enterale

D) When should percutaneous endoscopic gastrostomy indicated for the nutrition of patients with PD and dysphagia?
Statements are based on expert opinion:

Di. *PEG should be placed in case of inadequate oral intake expected to be longer than 4 weeks resulting in involuntary body weight loss (≥5% in 1 month or ≥ 10% in 3 months) and/or significant risk of prandial aspiration exceeding the risk of aspiration of reflux.*
Dii. *In case of potentially reversible swallowing impairment (short-term exacerbation or expectations of positive treatment response), nasogastric tube feeding should be considered.*
Diii. *PEG feeding should be carefully considered on an individual basis taking into account patient and family choice, caregiving context, health ethics, prognosis and* QOL.
Div. *In case of dementia, PEG insertion is not indicated.*
Dv. *In case of continuous intra-jejunal levodopa infusion, oral nutrition may be continued in patients with sufficiently safe and efficient swallowing.*
Dvi. *Oral hygiene interventions and oral intake (if safe based on clinical/instrumental assessment) should be continued even after PEG placement.*