

Functional Neurologic Disorders

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Who are we?

re+active therapy & wellness:

- Team of 35+: PTs, OTs, Psychology team, Wellness team
- Two outpatient clinic locations in Los Angeles currently
- Work mostly in transdisciplinary teams in complex neurologic or chronic conditions like:
 - FND
 - PD & Atypical PD+
 - EDS/HSD, MCAS
 - Dystonias
 - Concussion & PPCS
 - Other neuro: TBI, post-stroke, MS



Disclosures

- Chelsea is the director of our FND integrated program at re+active
- Published author in Practical Neurology on FND
- Teach continuing education courses for allied health professionals about FND for re+active

Learning Objectives

- 1. Be able to understand FND and how understanding the pathophysiology helps to guide treatment approaches.
- 2. Understanding the evidence is there for FND treatment.
- 3. Understand how to apply evidence to support the basic assessment and treatment for individuals with FND.

Meet our Case for Discussion: DW



- 35 year old Wife & Mom from AZ
- FND sx: Functional seizures, R UE tremors & weakness, difficulty walking (functional gait disorder), R UE variable sensory changes (sensory loss, sensitivity, pain, skin color changes), brain fog
- Unable to work currently in corporate job due to brain fog
- On disability
- Dx with "conversion disorder" 2013
- Seizures greatly affect function \rightarrow intermittent speech loss/difficulty
- Uses wheelchair on bad days, occasionally a walker or cane for mobility

Goals: improve functional mobility/independence, understand seizure triggers in order to reduce or prevent them, be able to participate in her roles as wife & mom, return to meaningful work

Comorbidities: Migraine, Insomnia

Had been to speech therapy with no change

Functional Neurological Disorder (FND) is the second most common neurologic diagnosis in neurology clinics

Fobian, Elliot 2019

FND

The term functional neurological disorder conveys a condition in which the primary pathophysiological processes are alterations in functioning of brain networks rather than abnormalities of brain structures. (Hallet, 2022)

FMD= involuntary but learned movement patterns (Glilmour, 2022)

Functional movement disorder (FMD) Complex Regional Pain Syndrome (CRPS)

Functional

Seizures

Persistent Perceptual Postural Dizziness (PPPD)

Functional Cognitive Disorders

> Persistent Post Concussion Symptoms (PPCS)

Etiology

Largely Unknown (like many other diagnoses) but considered to have biopsychosocial components

Once thought as "hysteria" or "conversion disorder" or "psychogenic movement disorder" It is now understood as NOT an entirely psychological disorder (or a diagnosis of exclusion)

- Predisposing risk factors
 - Autism
 - Hypermobility
 - Neurological disorders
 - Sensory processing or interoceptive difficulties
 - Adverse childhood events
 or psychological trauma

- Precipitating events
 - Physical injuries
 - Illness
 - Acute autonomic event
 - Acute psychological event
- Perpetuating factors
 - Psychosocial: beliefs, fear, environment
 - Ongoing medical conditions
 - Attention and hypervigilance

The case for overlapping mechanisms

	FND	PPPD	PPCS	Chronic pain
Onset Mechanism and Triggers	Physical injury, psychological stressor Immune/endocrine	Vestibular insult/injury Medical event psychological stressor Immune/endocrine	Physical injury: concussion Psychosocial Immune/endocrine	Physical injury Psychosocial Immune/endocrine
Description from patient	"My body doesn't belong to me"	"My head feels disconnected" "I'm floating"	"I feel disconnected from my body"	"my limb doesn't feel like it's part of my body"
Sensory Mechanism	Loss of sensation or pain Hypersensation	Hypersensitive to vestibular or visual Neck pain	Hypersensitive to touch, vision, vestibular HA and pain	Loss of sensation or hypersensation Pain
Autonomic Mechanism	Orthostatic and exercise intolerance Low HRV	Low HRV	Orthostatic and exercise intolerance Low HRV	Orthostatic and exercise intolerance Autonomic skin changes Low HRV

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Gould et al, 2021, Farrell et al 2021, Kozlowska et al 2015

Why might this happen?The Predictive Brain

"Functional neurological disorder is arguably what might be expected to happen when predictive processing in the brain goes awry." (Hallett et al. 2022, p. 547)

- Planning and preparation create feedforward signals that are compared to actual feedback
- In FND: seems to be an overweighting of the feedforward signal (prediction, expectation and attention); possibly slowed or less accurate sensory processing from body



Figure 2: Neural mechanisms of functional neurological disorder

Impaired motor programming and/or impaired sensory feedback Overweighted predictions: Planning and preparation create feedforward signals that are compared to actual feedback

Inaccurate feedback

inaccurate prediction

FND is not faking

Figure 3: Brain scans have helped provide evidence of functional changes in the brains of patients with functional neurological symptoms (functional paralysis right) which are distinct from feigning (feigned paralysis left)^{5,6}



Functional paralysis



Primary motor cortex

Connections: Primary motor cortex-->pre-cuneus and vmPFC

ALTERED SENSE OF AGENCY

ABNORMAL EMOTIONAL PROCESSING



Figure 1 Neurobiological models proposing the pathophysiology of functional neurological disease. Created using BioRender.com (by S.S.)

Sasikumar & Strafella, 2021

pathophysiological disease

Positive diagnostic signs

Functional limb weakness



Hoover's sign: Hip extension weakness that improves with contralateral hip flexion against resistance



Hip Abductor Sign: Abduction weakness that improves with contralateral hip abduction against resistance

Functional movement disorders

Functional dystonia typically presents with a fixed position, usually a clenched fist or inverted ankle





contraction of platysma or orbicularis oculi



Left wrist tremor stops or entrains when copying

examiner's movements with right hand

Functional or dissociative seizures

Should be diagnosed on the basis of finding characteristic features in the subjective account and observed description of the attacks, such as:



Ask patient if they would be willing to have their attacks video recorded by a family member

Functional visual signs



A tubular visual field defect at 50 cm which is the same width as at 150cm



Visual field spiralling caused by progressive constriction of vision during the test



Stone et al 2020

Validated Motor Signs

Test	Sensitivity and Specificity
Distractibility: engage in motor or cognitive dual task	Specificity = 100% Sensitivity = 58% In 19 people with FND vs. 64 people with tardive dyskinesia Bazabal-Carvallo 2017
Variability: observe for changes and periods of unexplained improvement/ or no symptoms	Specificity = 100% Sensitivity = 84% In 19 people with FND vs. 64 people with tardive dyskinesia Bazabal-Carvallo 2017
Hoover sign: weakness of hip extension that resolved during resisted contralateral hip flexion	Sensitivity: 63-100% Specificity: 86-100% Ziv et al 1998, Sonoo 2004, Tinazzi et al 2008, Stone et al 2010, McWhirter etal 2011, Daum et al 2015
Monoplegic leg dragging gait: weak leg dragged like a piece of wood, no circumduction	Specificity: 100% Sensitivity: 9% Daum 2015, Stone 2010

Aybek, 2023 BMJ

Hoover Sign





Seizure Differential Diagnosis

Table 1 | Clinical features that help separate functional seizures in functional neurological disorder (FND) from epilepsy (based on Avbersek et al 2010¹⁸). Syncope usually lasts less than 30 seconds and with eyes open. Clinical features usually need to be assessed in combination. A smartphone video taken by a friend or family member with consent may help

	Common in FN	ID and rare	e in epilepsy or		
Clinical feature		syncope		Common in epilepsy and rare in FND	May be present in either
Eyes Closed during event		Yes		_	_
Resistance to eyelid opening		Yes		—	—
Duration longer than 2 minutes		Yes		—	_
Hyperventilation during episode		Yes		—	-
Crying after the event		Yes		—	—
Guttural Cry at onset				Yes	—
Stertorous (snoring) breathing after the event		_		Yes	_
Synchronous EEG evidence of epilepsy		_		Yes (although interictal EEG often normal)	-
Report of tongue biting		_		_	Yes
Urinary incontinence		_			Yes

EEG = electroencephalogram.

Smart phone videos:

Can home videos made on smartphones complement video-EEG in diagnosing psychogenic nonepileptic seizures?

Bhargavi Ramanujam, Deepa Dash, Manjari Tripathi*

All India Institute of Medical Sciences, New Delhi, India

FND and other diagnoses: the overlap

Often overlap with a neurologic disorders

- 18% of people with tremor have functional symptoms (Baizabal-Carvalo et al 2023)
- 12% of people with epilepsy have functional seizures (Kutlubaev, 2018)
- 7-66% of people with PD have functional symptoms (Hallet, 2018)
- 7.5%-13% of patients with MS also have functional symptoms (Aybek and Chan 2022, Walz et al 2021)
- Autism
 - 17% of kids with functional seizures have autism (McWilliams et al., 2019)
 - 8% of adults with FND have autism (Gonzalez-Hererro et al., 2023)
 - 86.7% of participants with autism reported at least one FND symptom

Common Comorbid Conditions with FND

Health conditions that might contribute or perpetuate symptoms

- Migraine
- Autism
- Ehlers Danlos Syndrome and other hypermobility (and craniocervical instability)
- Postural Orthostatic Tachycardia Syndrome (POTS)
- Mast Cell Activation Syndrome (MCAS)

Treatment Evidence & Applications

Consensus guidelines in FMD: PT, OT, SLP

- Build trust before challenging/pushing the patient
- Create an expectation of improvement
- Limited hands-on treatment
- Goal-directed rehabilitation with focus on function
- Minimize reinforcement of maladaptive movement patterns
- Retrain movement patterns with motor learning approach
- MYTH: discourage use of equipment or device
 - EQUIPMENT IS NOT CONTRAINDICATED IN FND

(Nielsen et al 2015) -PT (Nicolson et al 2020)- OT (Baker et al 2021) - SLP

• Outpatient Physical Therapy

- Physio4FMD trial (Nielsen et al 2024)
 - 9 visits, 12 month follow up
 - Improved self reported motor and mental health
 - Not improved on SF 36 physical function scale
- Mass General Retrospective (Maggio et al, 2019)
 - 1x/week 6-12 sessions
 - > # of sessions = > improvement
- Interdisciplinary pain program for FND (Jimenez et al 2019)
 - 3-4 wks, 5 days per wk PT, OT, MD, psychology/psychiatry
 - Decreased disability, improved mobility
- **5 week multidisciplinary treatment** (Petrochilos, 2020)
 - Neuropsychiatry, CBT, PT, OT
 - 80% rated themselves better

The evidence Key components Education **Retraining movement** with external focus Setting up for automatic movement Multidisciplinary typically better

Psychology Evidence

Key components Illness beliefs Unhelpful behaviors Identification of triggers Emotional awareness Stress management Agency and control Response Plan Address underlying MH symptoms

- Shared Individual Formulation Therapy SIFT (Gutkin et al 2021)
 - 4 sessions psychoeducation and psychodynamic treatment: collaboration
 - $\circ~$ Improved SF-12 and decreased shut down
- **ReACT Retraining and Control therapy** (Fobian et al 2020)
 - 32 kids with functional seizures; 8 weekly sessions targeting control and symptom expectation
 - $\circ~$ 100% seizure free at the end, 82% maintained after 60 days
- ACT (acceptance and commitment therapy) (Graham, 2017)
 - $\circ~$ Case series, 8 people, 6-10 sessions
 - Improved QOL
- Interdisciplinary pain program for FND (Jimenez et al 2019)
 - \circ 3-4 wks, 5 days per wk PT, OT, MD, psychology/psychiatry
 - $\circ~$ Decreased disability, improved mobility
- Systematic reviews
 - Psychodynamic therapy and CBT have promising results in FND (but small, uncontrolled studies are a limitation) (Gutkin et al 2020)
 - CODES trial (Goldstein 2020) adults with PNES--CBT did not affect # of seizures at 12 months, but length of seizures and CGIC/PGIC
 - Recent review of CBT & standard med tx (Moro et al., 2024), CBT superior to standard medical care in reducing seizures & anxiety, and increasing QOL

Positive diagnosis with education= Treatment

"A positive diagnosis and clear non-judgemental explanation, backed up by reliable information sources associated with prompt onward referral to a neurologist can greatly reduce distress and ultimately improve outcomes."

Cock & Edwards, 2018

Education tools





Richardson & Mike Studer in 2020: update re-active

Pie Chart Method For Treatment



Diagnosis specific considerations

Symptom	Screens to Perform	Treatment Strategies
Functional Dystonia	Attention driven Sensory testing	 Body region dependent: use of visual tracking (cervical and facial symptoms) Increasing proprioceptive input to affected body region: weighted objects, ankle weights, weighted neck wrap
Functional Tremor	Entrainment test Attention driven Whack-a-mole sign Sensory testing	 Maximizing external focus: stepping over lines while walking, throwing a ball, playing a game Cognitive Dual Task: conversation, music, mental tasks, math⁵ Changing environment to elicit automatic movements: running, crawling, bear crawling, walking backwards, skipping, jumping⁵ Increasing proprioceptive input to affected body region: weighted objects, ankle weights, weighted neck wrap
Functional Weakness	Hoover test Hip abductor sign Sensory testing	 Changing environment to elicit automatic movements: running, crawling, bear crawling, walking backwards, skipping, jumping⁵ Increasing proprioceptive input to affected body region: weighted objects, ankle weights, weighted neck wrap
Gait Disturbances	Hoover test Attention driven Sensory testing	 Maximizing external focus: stepping over lines while walking, throwing a ball, playing a game Cognitive Dual Task: conversation, music, mental tasks, math⁵ Changing environment to elicit automatic movements: running, crawling, bear crawling, walking backwards, skipping, jumping⁵ Increasing proprioceptive input to affected body region: weighted objects, ankle weights, weighted neck wrap
Autonomic Dysfunction	Active stand test ¹³ Tilt table test HRV monitoring	 Education on slow and regular exercise and activity progression, referral to physical therapy or cardiology if appropriate.¹³ Externally focused breathing (eg, blowing bubbles) Grounding to the environment.¹⁵ Example: list 5 things they see, 4 things they hear, 3 things they feel, 2 things they smell, 1 thing they taste. Education on compression wear. Example: abdominal binder, compression socks Education on water intake, salt intake if appropriate Education on counter maneuvers to help stabilize heart rate while standing: crossing legs, feet together, feet elevated in sitting

Cicio et al 2024

Prognostic Factors in FND

Poor prognosis

- Diagnostic delay
- Without treatment: 39% of patients with FND are worse at one year neurology follow up visits
- Illness beliefs & perceptions (Sharpe et al, 2009)
 - Strong predictors= expectation of non-recovery, not acknowledging any psychological factors influencing symptoms
- Pain severity correlates with functional impairment and prognosis
- Comorbid Personality disorders and/or traits such as perfectionism and OCD

Better prognosis

- Clear diagnosis with positive clinical signs
- Patient understanding and agreement with diagnosis
- Early diagnosis and treatment (psychology, PT, OT, ST)
- Pediatric cases (in some studies up to 90% remission with treatment)
- Shorter duration of symptoms
- Variable vs. fixed deficits (especially with dystonia)

DW's Presentation:	Assessment:	Treatment:
Right UE Functional Weakness and Tremors	Variability, Distractibility Entrainment test Demonstrates automatic movements (like a Hoover sign)	External focus of attention→ Goal driven movement Visualizing normal movement for improving motor control
Functional Gait Impairment	Variability, Distractibility Improved voluntary motor control visualizing normal movement Drop weakness	External focus of attention→ Goal driven movement Visualizing normal movement for improving motor control
Functional/Dissociative Seizures	Clinical observation: >5 min in length Eyes closed Low HRV prior Unable to talk, platysma	Parasympathetic Regulation strategies: grounding, breathing, recognizing signs of dysregulation, seizure plan
Right UE sensory changes, color changes	Variable sensory changes Higher order sensory testing Neural tension screening	Sensory processing: Localization of touch, touch discrimination, mirror therapy, sensory graded exposure, nerve mobility

Higher order sensory testing:

Eval: impaired 2 pt R palm, Impaired graphesthesia , sensitive to vibration, Laterality 50% R hand, 70% L







70% accurate BIL in 2 sec

Motor Control Assessments (that turn into treatment):



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Motor control & Sensory Treatment









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More treatment examples: Motor control, sensory & ANS regulation









Create a functional seizure plan



Functional Seizure Response Plan

- You (bystander or care partner) can help me by:
 - Helping me safely to the ground
 - Grabbing my tool bag of self-management techniques My tool bag is stored
- Helping me use my regulation tools like
- Change the environment by:
- Modifying lights:
 - Modifying sounds:
 - Other:
- Saying calming phrases like:
 - "You're safe. You're going through a functional seizure."
 - "You aren't alone, I'm here to help."
 - "I'm here when you're ready, or need me to assist you in something."
- Interact with me by:
 - Giving me privacy and space
 Checking in every ____ minutes or so
 Remaining calm
- Additionally:

After a functional seizure, I will be using these strategies, as able:

I have been diagnosed with functional seizures by a medical professional, and that these episodes are not medical emergencies. I am safe, and will get better when responded appropriately.

Signed: _____ Date: ____ Date: _____ Date: ______ Date: _______ Date: ______ Date: ______ Date: __



Functional Seizure Response Plan

The purpose of this response plan is to help you and those around you safely and effectively handle functional seizures. The tools that work for you will be unique, so use this response plan to communicate your own unique triggers and strategies!

Functional seizures are categorically different from epileptic seizures and require a different medical management approach. What generally may work for epileptic seizures can be ineffective or harmful for people with functional seizures. Some guidelines include:

DO NOT

- Call 911, unless requested by me The chaotic nature of many paramedic calls may worsen functional seizures. No medical intervention is needed for functional seizures, other than strategies outlined below. Symptoms will resolve naturally on their own.
- 2. Remove me from work or school after the seizure, unless requested by me.
- 3. Behave frantically.

Functional seizure plan created by and for: _____

For me, my functional neurological disorder (FND) events looks like:

My early warning signs are:

During functional seizures, I will be using these strategies, as able:

DW's outcomes

Her wins! (from her DC summary)

🎉 🎉 Your Goals Achieved/Wins: 🎉 🎉

- 1. Take back/gain control of my situation and body
- 2. Confidence and Hope
- 3. Run on the treadmill and strength training
- 4. Improved Speech
- 5. Beating Mike in a Race!!!!!!!!

PGIC: 7/7 = A great deal better and a considerable improvement that has made all the difference

PSFS: 10/30 initial-->23/30 final (walking and cooking goals)

PSS: 26→12!

Summary

- FND is real (not malingering!) and has clinical signs and symptoms that lead to a clear positive diagnosis (rather than a diagnosis of exclusion)
- FND diagnostic education = treatment!
- Evidence for treatment exists & typically multidisciplinary approaches have the best outcomes
 - However treatment is better than no treatment!
 - Can use clinical screens to decide which referral to prioritize (Cicio et al)
- FND commonly co-occurs with: Migraine, Autism, EDS/HSD, MCAS, Autonomic conditions like POTS. Screen for these!
- FND is not purely psychological \rightarrow it is multifactorial
- There is hope for people with FND!

Resources for you!

- Youtube resources for regulation techniques to try & share with clients: <u>https://www.youtube.com/playlist?list=PL4QohjtCEzJ7ZHdTfbTsTbLvF5PQADjzy</u>
- Our recently published article: <u>https://practicalneurology.com/articles/2024-sept-oct/clinic-based-assessment-and-treatment-strategies-for-functional-neurologi</u> <u>c-disorders</u>
- A primer for initial encounter: https://www.amjmed.com/article/S0002-9343(15)00352-6/pdf
- Provider recommendations/referrals & great resources/education: <u>https://fndhope.org/</u>
- Great resource to learn about FND: <u>https://neurosymptoms.org/en/</u>

Our contact: <u>https://www.reactivept.com/referral</u>

Our FND membership: <u>https://reactive.mykajabi.com/FNDmembership</u>

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