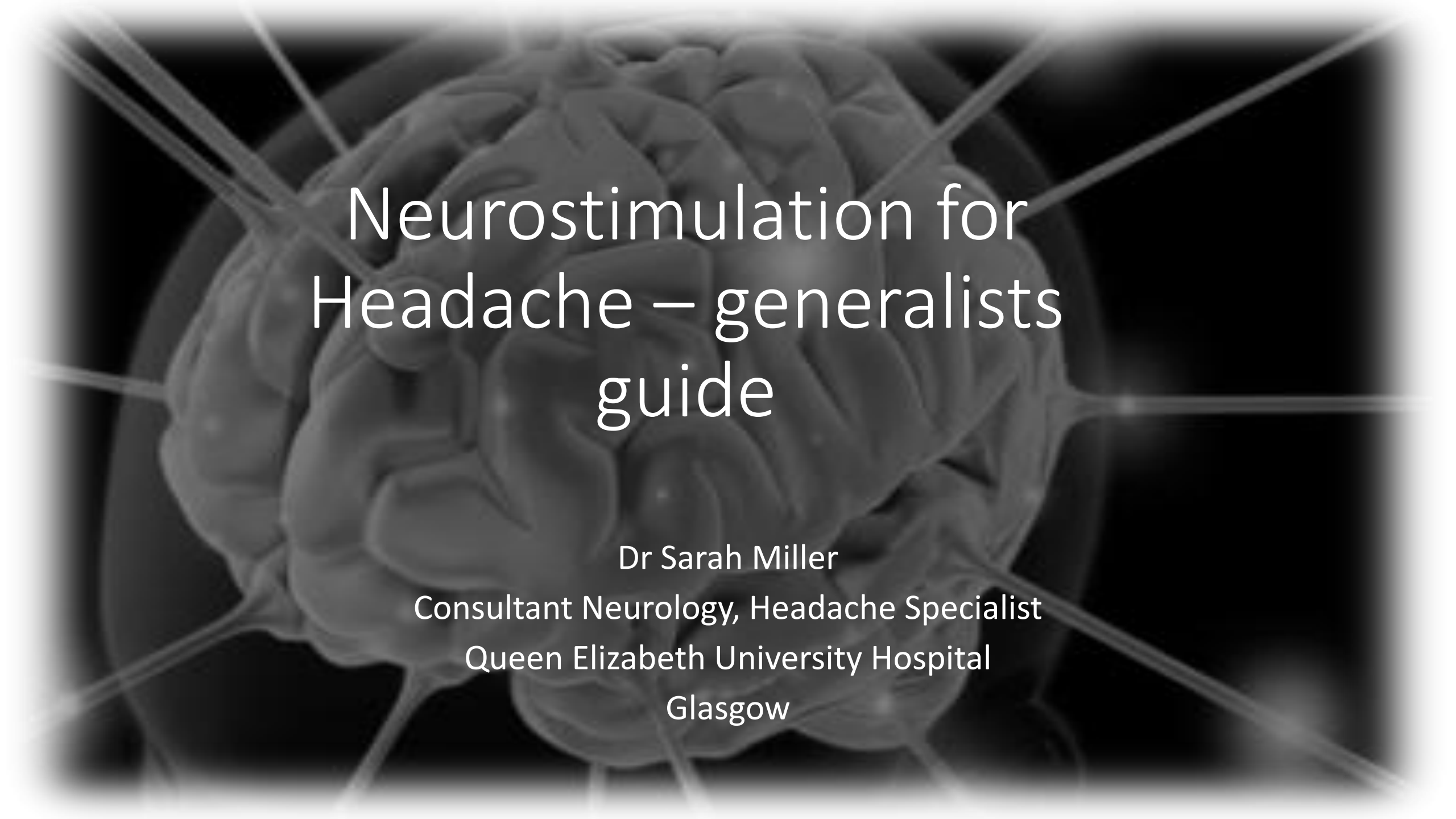




Neurostimulation for Headache – generalists guide

Dr Sarah Miller
Consultant Neurology, Headache Specialist
Queen Elizabeth University Hospital
Glasgow

Disclosure Statement

Sarah Miller

I have received funding from the following companies for educational grants, providing educational sessions, and received travel grants to attend conferences:

Eli Lilly

Novartis

Teva

Pfizer

What we should know by the end....

- History
- How does neuromodulation work?
- Why bother with alternative treatments for a headache?
- What neuromodulation is available?
 - Non-invasive
 - Invasive
- When to think about surgery / Who should benefit



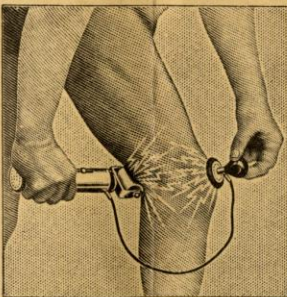


Electreat REG. TRADE MARK Mechanical Heart Relieves Pain

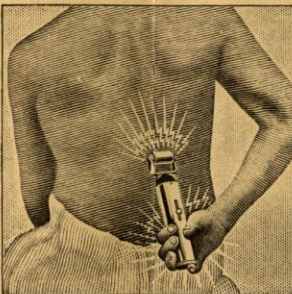
Needed In Every Home

Simplified Electrical Treatments In Your Own Home
Our demonstrators are now working in your city. If you or any of your friends suffer Headache, Rheumatism, Neuralgia, Pains of any kind, or any of the ailments named on opposite side in our testimonials, telephone us at once and our Demonstrator will call at your home and show how quickly Electreat will give you relief.

No Charges. Free Trial Demonstration



Rheumatism, Stiff Joints,
Breaking Up Chronic
Conditions

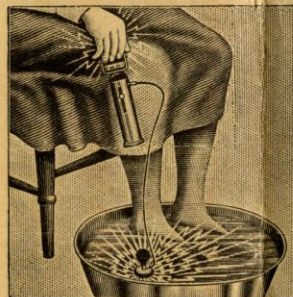


Breaks Up Congestion
Lumbago and Backache

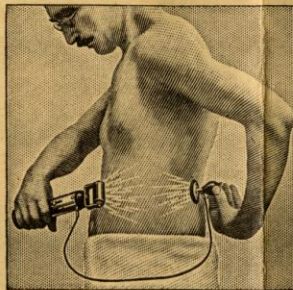


Muscle Building, Lung
Development. Improves
Circulation

5. Roller (+)



Electric Bath, Poor Circulation,
Tired Feet, Improving
Dry Chapped Skin



Regulating Internal Organs
Stomach, Indigestion,
Bowels, Constipation

6. Sponge and Roller



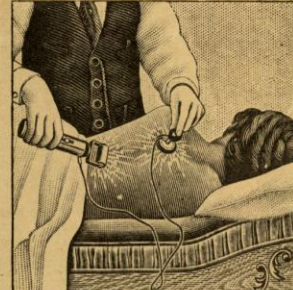
Headache, Earache, Tooth-
ache, Neuralgia, Neuritis,
Soreness

2. Sponge (+) Relieves Pain



Falling Hair, Dandruff,
Itchy Scalp, Brain Stimula-
tion, Restfulness

11. Scalp Brush



Tonic, Up Current, Debility,
Nervousness, Liver,
Kidneys, Spine

7. Spinal Treatment



Tonsilitis, Catarrh, Asthma,
Goitre, Voice, Throat

3. Sponge (-) Roller (+)



Enlivens the Hair, Enriches
the Color, Stimulates
Luxuriant Growth

12. Beautifying Hair



The Touch That Soothes—
Electricity and Personal
Magnetism

8. Electric Hand Massage



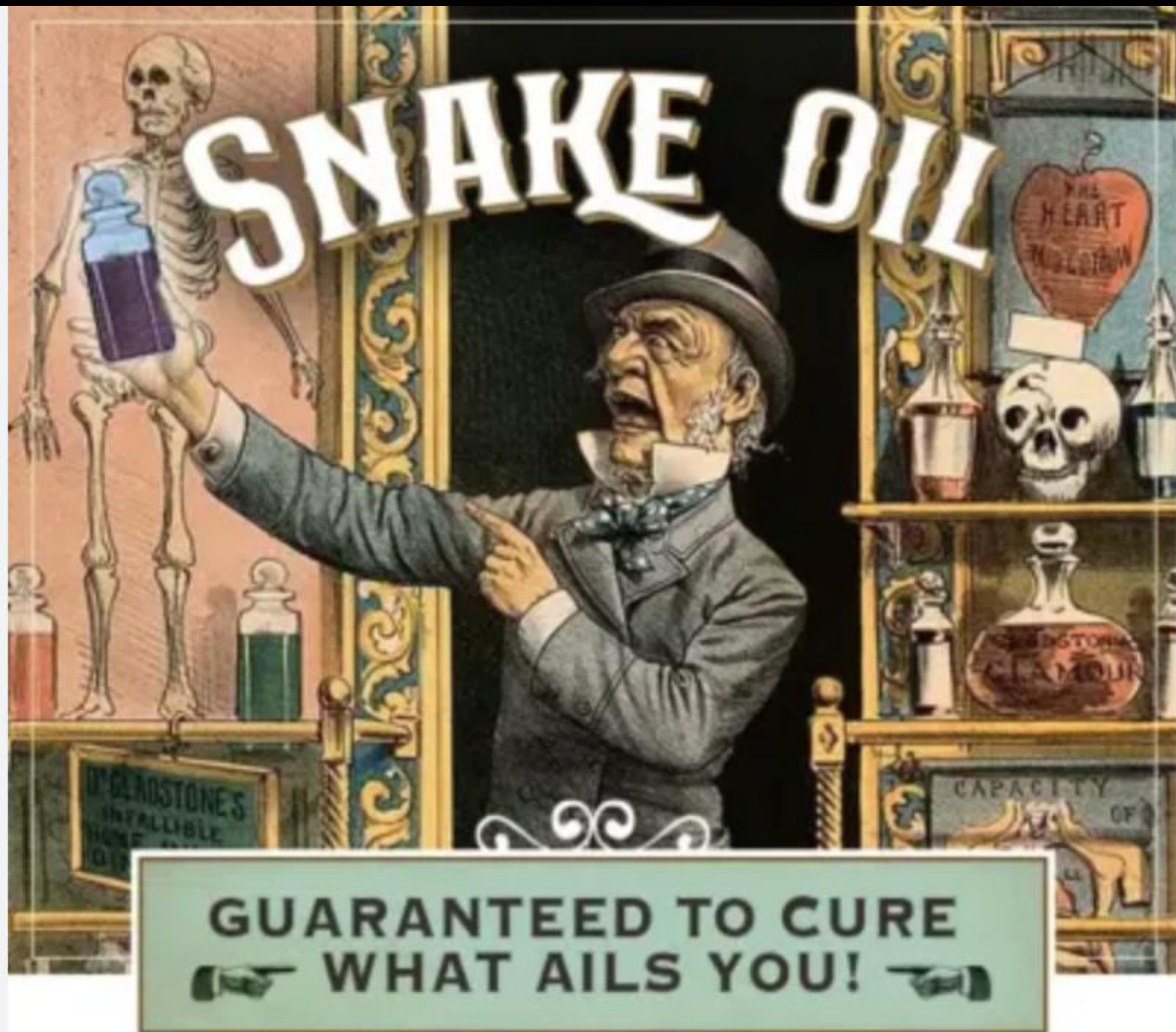
Pleurisy, Chest Pains, Re-
ducing, Making Lithesome

4. Roller (+)

SHOOTING ELECTRICITY IN, FORCES THE PAIN OUT

**ELECTREAT MECHANICAL HEART GIVES NEW
LIFE TO YOUR VEINS AND RELIEVES YOUR PAINS**

MRS. MARION PARKER
For Free Demonstration Write or Phone
Grace Apts. 817 So. Boulder, Apt. 3
TULSA, OKLA.
PHONE 3-5502



**GUARANTEED TO CURE
WHAT AILS YOU!**

Principles of neurostimulation

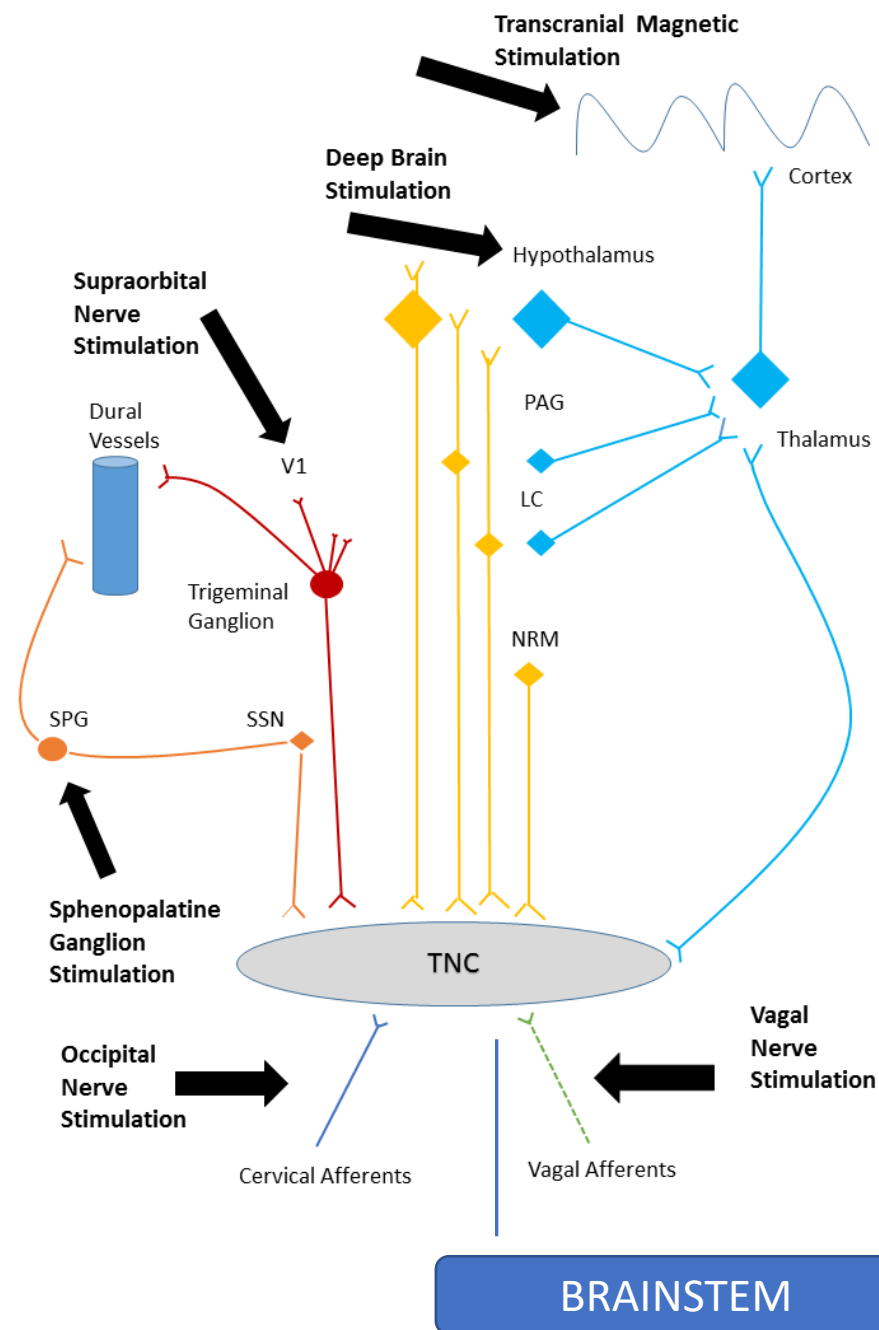
- Using electricity to change the functioning of a part of the nervous system
 - Aim to wind down an overactive pain system
- Options depend on phenotype headache and patient medical history
- Highly disabled, tried all available medical options

Non-Invasive vs Invasive

NON-INVASIVE	INVASIVE
Transcutaneous Nerve Stimulation (Cefaly / HeadaTerm2 Revilion eCOTNS)	Occipital Nerve Stimulation
Single Pulse Transcranial Magnetic Stimulation – sTMS (eNeura)	Deep Brain Stimulation
Vagal Nerve Stimulation (GammaCore)	(Sphenopalatine Ganglion Stimulation)
Remote Electrical Neuromodulation REN (Nerivio)	

Acute v Preventative

	ACUTE	PREVENTATIVE
Migraine	REN Cefaly, HedaTerm2 sTMS gammaCore Revilion	REN, Cefaly sTMS ONS (Chronic migraine)
Cluster	Gammacore	ONS DBS



Points to consider

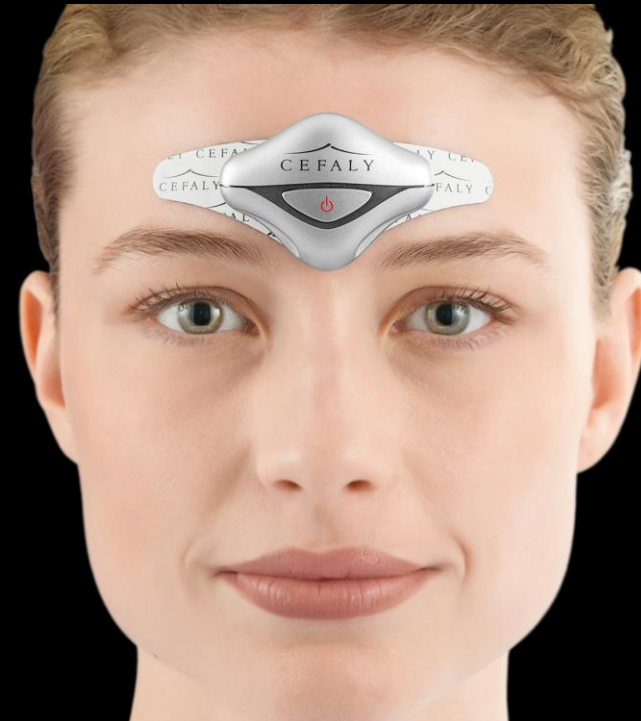
- Limited Availability on NHS
- Cost
- Adjust stimulation on basis of clinical response – individual “dose”
- Delay to clinical preventative response – months
- Not cure, pain returns when stimulation stopped – weeks/months
- Regular use
- Invasive - Small number highly specialised, highly skilled MDT units – cuts down complication rates
- Likely target population that will benefit most

Who could benefit?

- Anyone and everyone
 - Contraindications to acute meds / preventatives
 - Co-morbidities
 - Pregnancy
 - Paediatric / elderly population
 - Refractory
-
- (People able pay and avoid need NHS input)

Non-Invasive Neuromodulation: Transcutaneous supra-orbital nerve stimulation (tSNS)

- Cefaly device
- Cost: £380 for new device
 - 60 day return
 -
- No NHS availability
 - NICE 2022 “limited” or “inadequate” quality or quantity of data
- FDA Approved acute and preventative migraine





Prev – RCT negative for primary endpoint reduction MMD but significant difference 50% responder rate

Acute – RCT significant difference pain on VAS at 60min vs sham (59% vs 30% reduction)

Acute – 60min program start attack

Prev – 20min program daily



- Headaterm 2 Device
- £190 for new device - rechargeable
- NO NHS availability
- No NICE decision
- FDA approved Acute and preventative Treatment migraine
- Acute – 20min program start attack
- Preventative – 20min program daily
- RCT for acute treatment showed reduction VAS score
- Approved for preventative treatment with no studies

Non-Invasive Neuromodulation: Transcutaneous Vagal Nerve Stimulation (tVNS)

- Gamma Core device
 - Costs £200-300 per month—to complete 3 month trial period
- NHS availability
 - NICE 2016
 - Acute and Preventative treatment cluster headache
 - Trust by trust / IFR
 - Other TACs



FDA approved for acute and preventative treatment migraine + Acute and preventative treatment cluster headache

Acute migraine: Negative primary endpoint pain freedom at 2hr (superior at 30min and 60min)

Prev migraine: 2x RCT with negative primary endpoints (reduction migraine days)

Acute Cluster: 2x positive RCT for reduction pain relief and pain freedom 15min

Prev CCH: Higher 50% responder rate v sham (40 v 8%)



ACUTE: 2min stimulations PRN

PREV: 2 x 2min stimulations daily

Non-Invasive Neuromodulation: Single Pulse Transmagnetic Stimulation (sTMS)

- ENeura

Only available through clinics - £400 month

NHS availability

- Acute and preventative migraine
- Trust by trust
- IFR

FDA approved acute and preventative migraine



Acute: RCT higher percentage pain free 2hr (39 v 22%)

Prev: statistical placebo group had lower reduction migraine days (-2.75 v -0.63)



Acute – 4 pulses at onset

Prev – 4 pulses twice day

Remote Electrical Neuromodulation (REN)

- Nerivio Device
- £250 - 18 treatments
- No NHS availability
- FDA approved acute and preventative migraine



Acute: RCT 2017 – higher percentage VAS reduction compared sham (46% v 26% reduction)

RCT 2019 – 67% reduction VAS v 38%, pain freedom in 37% v 18%

Prev: RCT 2023 significant change mean migraine days both episodic and acute migraine (-3.2 EM, -4.7 CM)



Acute – 45min program at onset

Prev – 45min program alt days

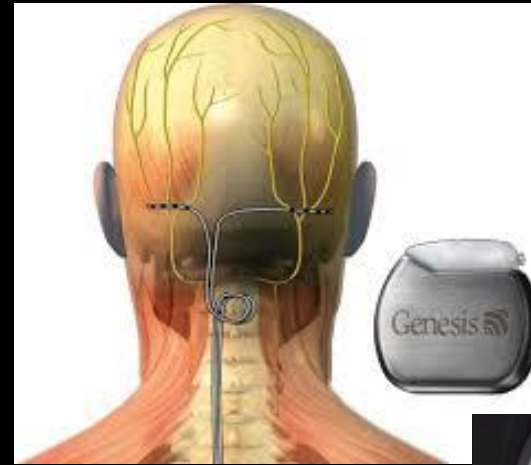
Concurrent Occipital and Trigeminal Neurostimulation



- Relivion Device
- Not available in UK - 2000USD
“currently discounted to 700USD”
- Acute: RCT significant difference reduction VAS scores 1-24hr
 - (1hr 53% v 10%)
 - 4hr 71% v 34%)
- Acute – 60min setting at onset

Occipital Nerve Stimulation

- Non-destructive surgical procedure
- Electrodes placed subcutaneously and connected to battery pack in chest/abdomen
- Patient limited control of stimulation
- Trial stimulation – not proven to be selective
- Aim continuous stimulation in occipital region
 - Paraesthesia vs None



ONS Migraine Data

- Controlled trials mixed
 - ONSTIM study: 61 patients compared adjustable stimulation, pre-set stimulation and medical management. Positive response 39% active treated and 0% in medical treated
 - PRSIM study: 125 subjects, no difference active to sham treatment
 - St Jude Medial Study: 157 patients active vs sham stimulation, significant difference reduction headache days (27% v 15%) and numbers reaching clinically relevant reduction pain scores (38% v 19%)
- Pooled analysis in 2015 of above found mean reduction 3 migraine days per month compared to sham
 - For comparison, topiramate reduced migraine days 44% in pooled analysis

ONS Cluster Data

- ICON Trial 2021
 - RCT double blind 150 medically intractable CCH
 - Used 100% stimulation as active v 30% stimulation as “sham”
 - Negative primary endpoint (reduction in weekly mean attack frequency)
 - Active group: 17.53 → 9.50 weekly mean attacks
 - Sham group 15.00 → 6.75
 - Difference -2.42 (95%CI -5.17-3.33)
 - Issue of using biologically active sham setting!
- Open label data positive with average 60-70% reduction attack frequency and series reporting number patients painfree on treatment

Long Term ONS

Monternegro et al (2023)

- 7 long term studies CCH (>24m)
 - All used variable endpoints most 50% reduction mean attack freq
 - Average 65% responders in these studies
 - 2 studies showed up 25% loss efficacy over time
 - Other studies showed ongoing response up 71m
- 5 long term CM (>24m)
 - Variable primary outcomes
 - All showed reduction pain but loss efficacy over time seemed more than for CCH

Occipital nerve stimulation

- Suitable for
 - Highly refractory and disabling chronic migraine, chronic cluster headache, SUNCT/SUNA
- Not suitable
 - Patients predictably need MRI post-implant
 - Safety with pacemakers/DBS is debated – case histories of safe dual-use exist
- Specialist units only – MDT approach
- Preventative treatment - NO role in acute treatment

ONS and NHS England – Clinical Commissioning Policy 2015

- Over the age of 18yrs

CHRONIC MIGRAINE

- Diagnosis of migraine as per ICHD-III beta confirmed by headache specialist
- Refractory CM which failed respond to least 4 classes of preventatives:
 - B-blockers, Anti-convulsant (topiramate/valproate), TCA, Pizotifen, Candesartan
- Failed respond acupuncture
- Failed respond Botox (and now add CGRP)
- No medication overuse

ONS and NHS England – Clinical Commissioning Policy 2015

CHRONIC CLUSTER

- Diagnosis of cluster headache as per ICHD-III beta confirmed by headache specialist
- Documented evidence failed all classes of oral preventatives in common use
 - Verapamil, Lithium, Methysergide (not available UK), Topiramate, Valproate, Gabapentin, Melatonin

ONS and NHS England – Clinical Commissioning Policy 2015

- Exclusion Criteria

- Medication overuse in chronic migraine
- Unable or unwilling to engage in self-management strategies supported by MDT and where patient expectations are not appropriate

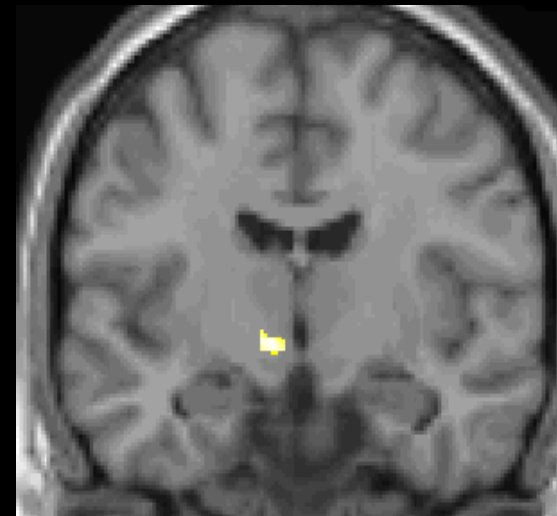
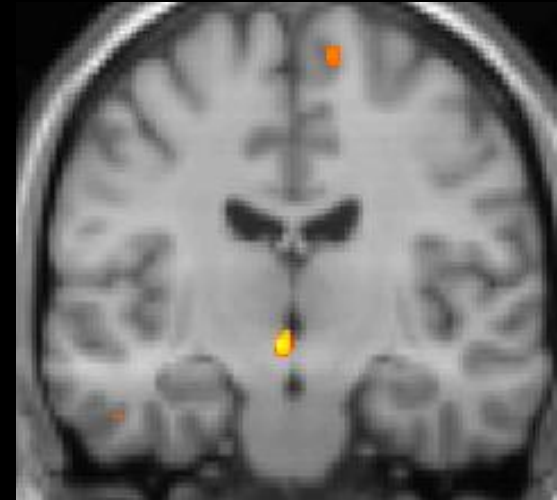
- Pathway

- MDT approach
- MDT team should consist of:
 - Suitably experienced headache specialist
 - Neurosurgeon or appropriately trained interventional pain specialist (must experienced ONS and implanting least 10 year)
 - Psychologist with experience pain management
 - Headache nurse specialist or neuromodulation nurse specialist
- Patient must completed pain management course
- Prior referral ONS team must have been reviewed by headache specialist +/- pain specialist and psychologist
- ONS must only be conducted in specialist experienced tertiary centers willing to gather and evaluate patient information, publish results and use appropriate outcome measures



Deep Brain Stimulation (DBS)

- Ipsilateral posterior hypothalamic region activation on PET in cluster and SUNCT/SUNA attacks
 - NOT in migraine
- Posterior hypothalamic region links to trigeminovascular system and thalamus
- First case DBS for CCH in 2001



DBS for CCH Trials

- Uwishema et al 2025 systemic review published studies DBS for CCH
 - Identified only single RCT 2009 – negative and reported only death as consequence DBS for CCH
 - 15 studies total
 - Response rates 50-60% - medically intractable patients
 - Sustained long term but variable response
 - Improved QoL measures long term
 - Safety and tolerability data favourable

Long Term Outcomes DBS for CCH

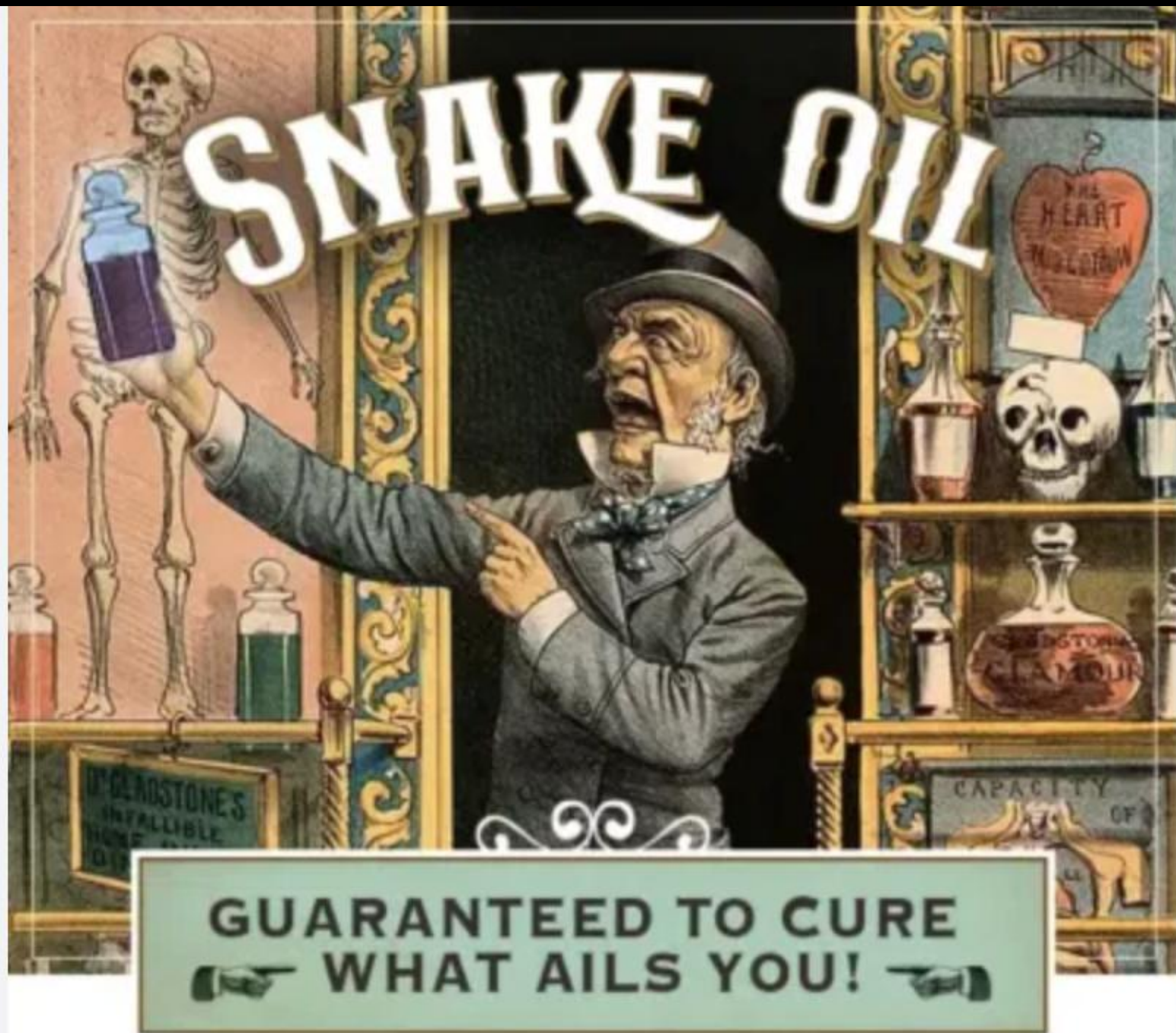
- Pant et al 2023 – 10 year follow up DBS for CCH
 - 82% decrease attack frequency maintained over 10yrs
- Akram et al 2023 – mean follow up 6.1yrs, 67% responders at last follow up (>50% reduction mean attack frequency)

Deep Brain Stimulation (DBS)

- Suitable for
 - Highly refractory and disabling chronic cluster headache, SUNCT/SUNA, failed ONS/SPG if available
- Not suitable
 - Patients predictably need MRI post-implant, PPM, major abnormality in brain anatomy
- Specialist units only – MDT approach
- Preventative treatment - NO role in acute treatment

Summary

- Cohort primary headache patients may benefit from neurostimulation
 - For invasive: chronic and medically refractory
 - For non-invasive: patient choice, side effects drugs, acute treatment options,
- Non-Invasive – very limited on NHS
- Invasive – available small number centres UK
- NOT curative but can offer treatment hope to difficult or refractory patients
- All need better quality sham controlled data



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WHAT AILS YOU!**

Any questions?

