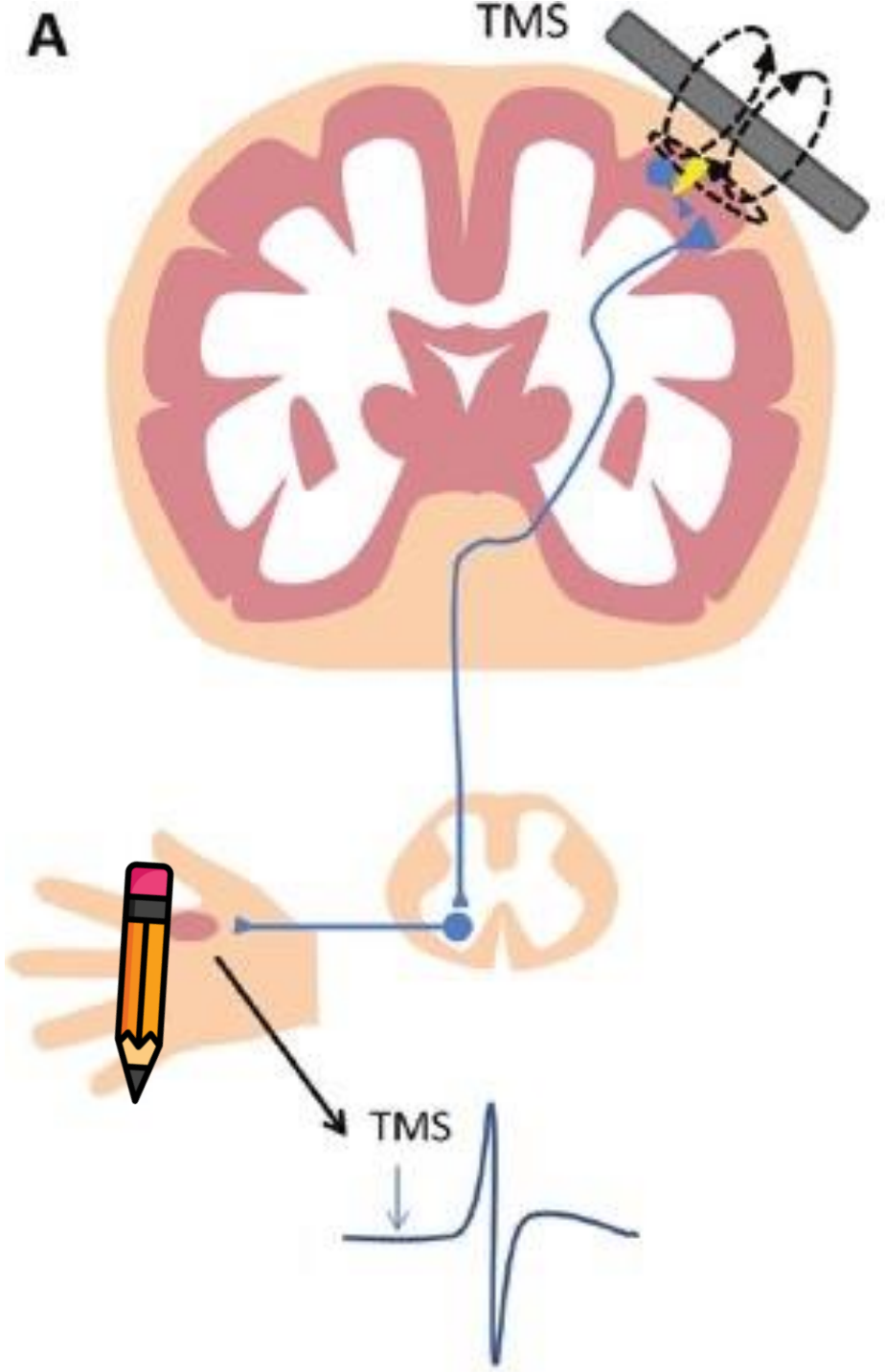
經顱磁刺激後，合併上肢訓練是否可以提升訓練成效！？

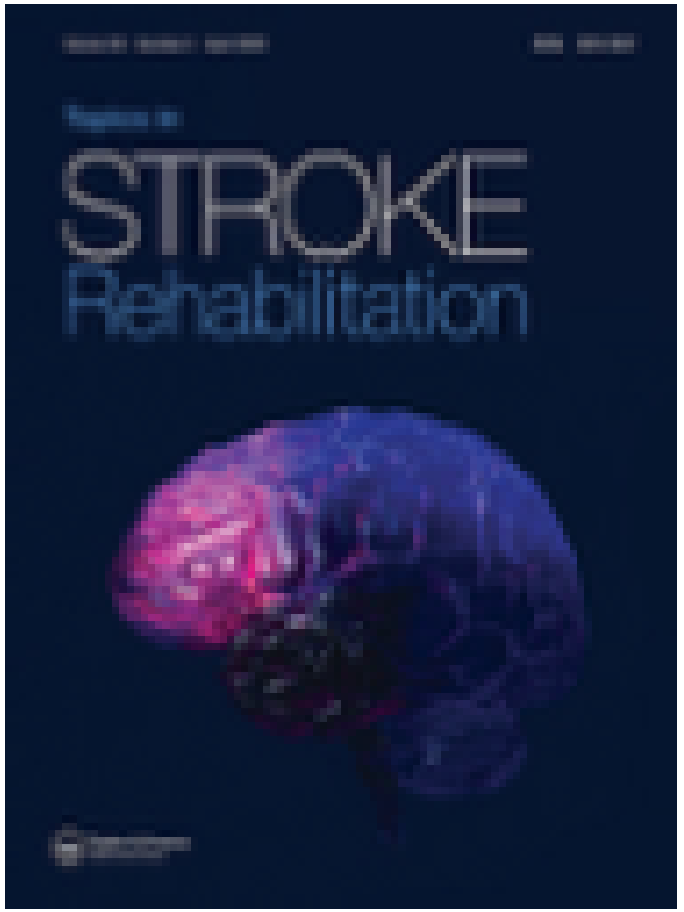
職能治療師 蔡翰霆

2024.11.20



Does noninvasive brain stimulation combined with other therapies improve upper extremity motor impairment, functional performance, and participation in activities of daily living after stroke? A systematic review and meta-analysis of randomized controlled trial

Ishtiaq Ahmed, Rustem Mustafaoglu, Nesrine Benkhalifa & Yakhoub Hassan Yakhoub



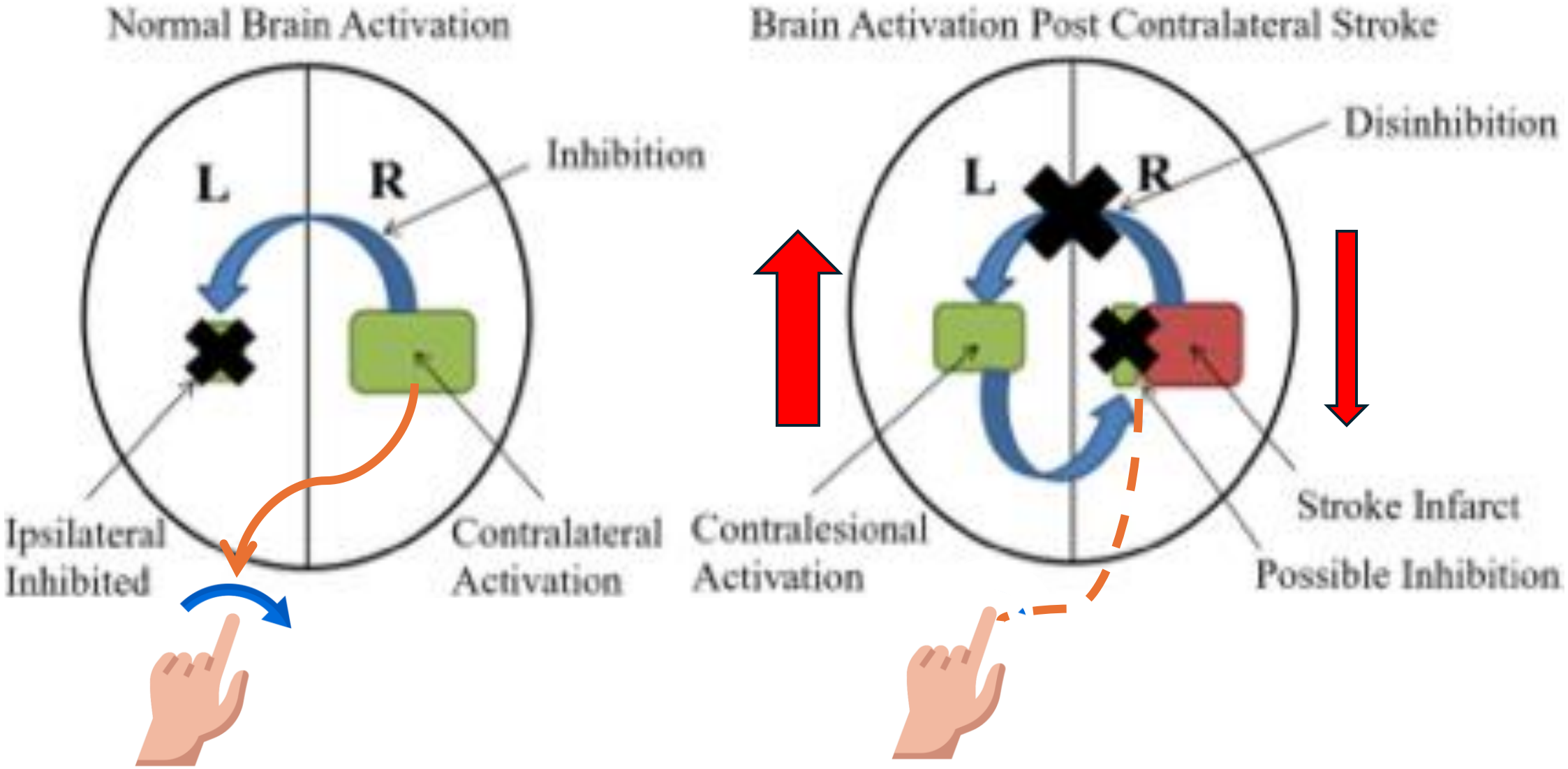
非侵入性腦刺激合併上肢訓練，
是否可以提升訓練成效！？

不可以　待驗證　可以

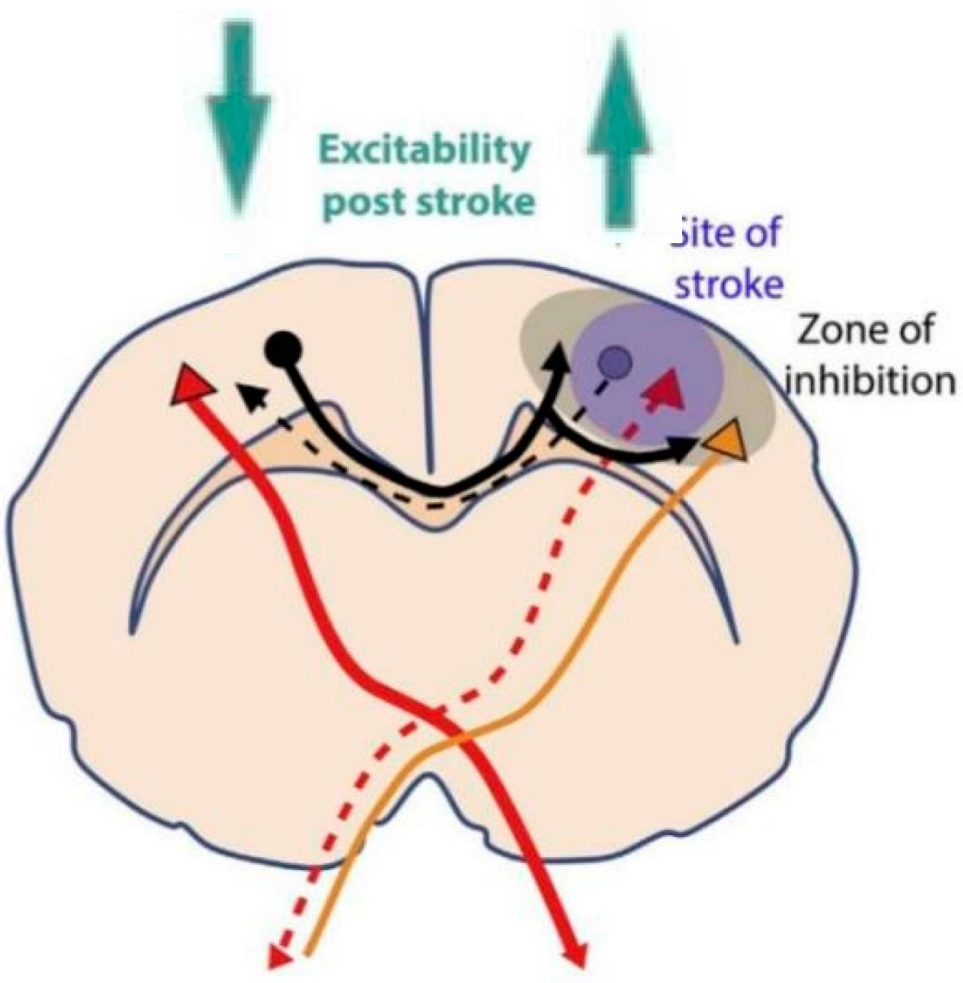
TOPICS IN STROKE REHABILITATION
2023, VOL. 30, NO. 3, 213–234

Hemisphere coordination

Non-lesioned hemisphere increases its activity



Neural Modulation with NIBS



Principle of neuroplasticity

↓

Changes in neuronal pathways

↓ ↓

Strengthening | Suppression

Aim of this study

1. To investigate the effect of NIBS with other therapies on upper limb motor impairment, functional performance, and participation in activities of daily living (ADLs)

2. To determine the most appropriate stimulation time and number of sessions for these applications

Search strategy

The standard guideline of Cochrane Collaboration

- The PRISMA Statement for randomized controlled trial
- English articles
- 2010.01.01 - 2020.12.30

Literature Search

- Web of Science (WOS)
- Medline (PubMed)
- Cochrane Central Register of Controlled Trials (Cochrane CENTRAL)
- Google Scholar

Search strategy

Eligibility criteria

"rTMS" or "tDCS" combined with other therapies

control group in which sham "rTMS" or "tDCS" combined with other therapies

Quality assessment

Cochrane Risk of Bias assessment tool

Outcome measures

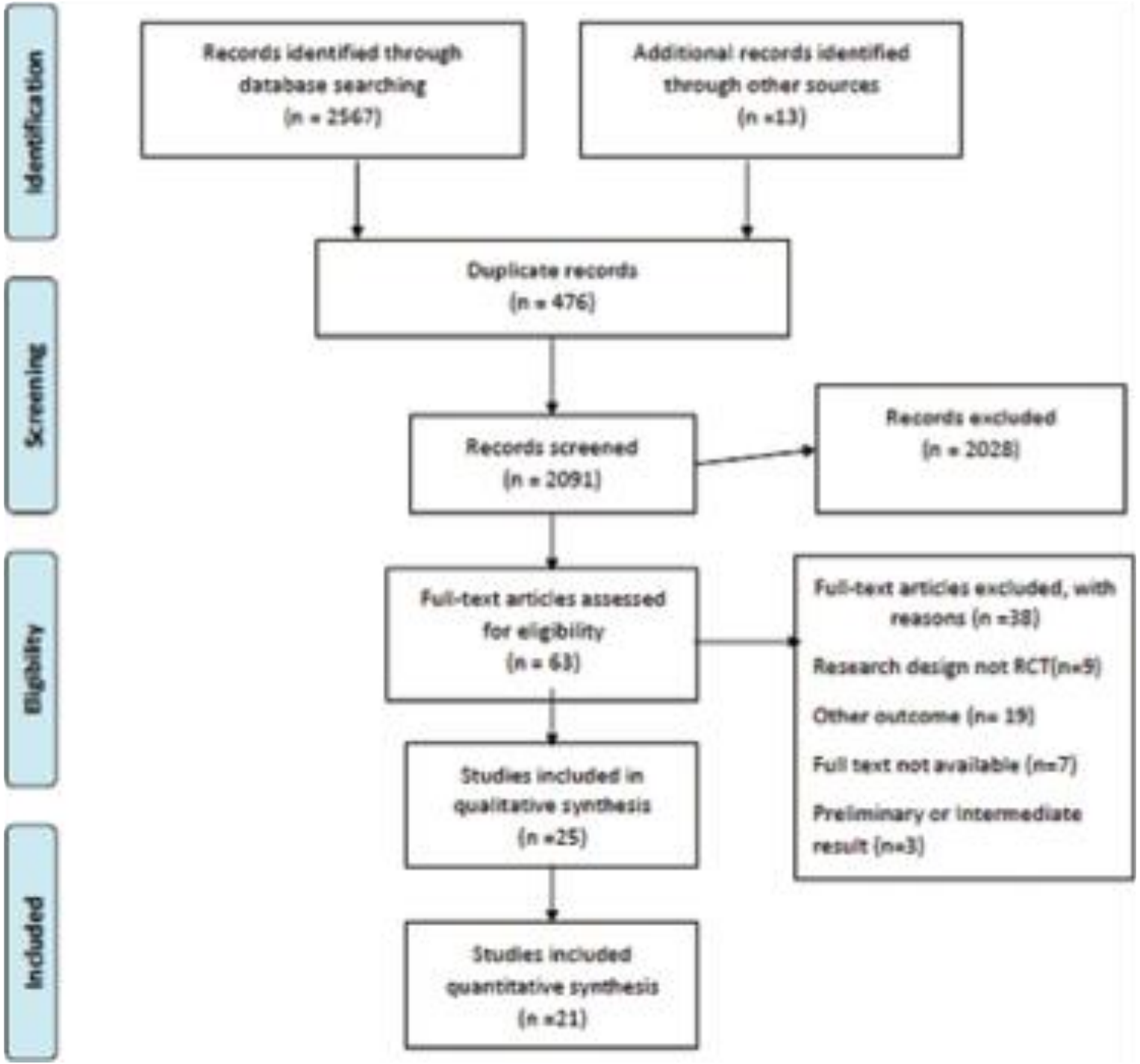
ICF framework

Motor impairment	Functional performance
Fugl- Meyer Assessment- Upper Extremity	Wolf Motor Function Test

Participation

Barthel Index

Flow diagram



Cochrane risk of bias

NIBS

tDCS:12 rTMS:13

Other therapy

Robot:4 VR:3 Conventional therapy:18

tDCS protocol

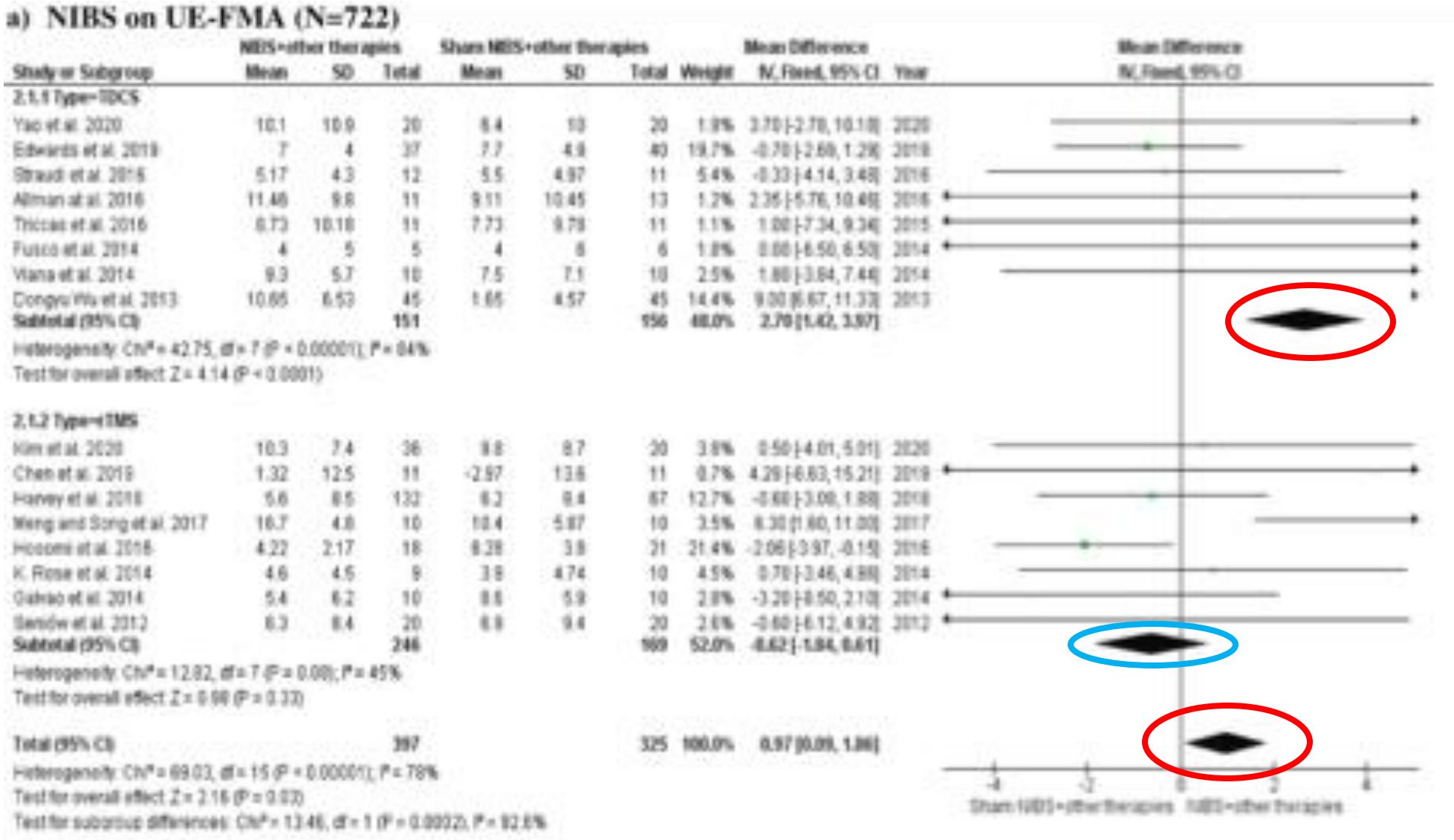
Anodal tDCS:8 Cathodal tDCS:4

rTMS protocol

High frequency:5 Low frequency 8

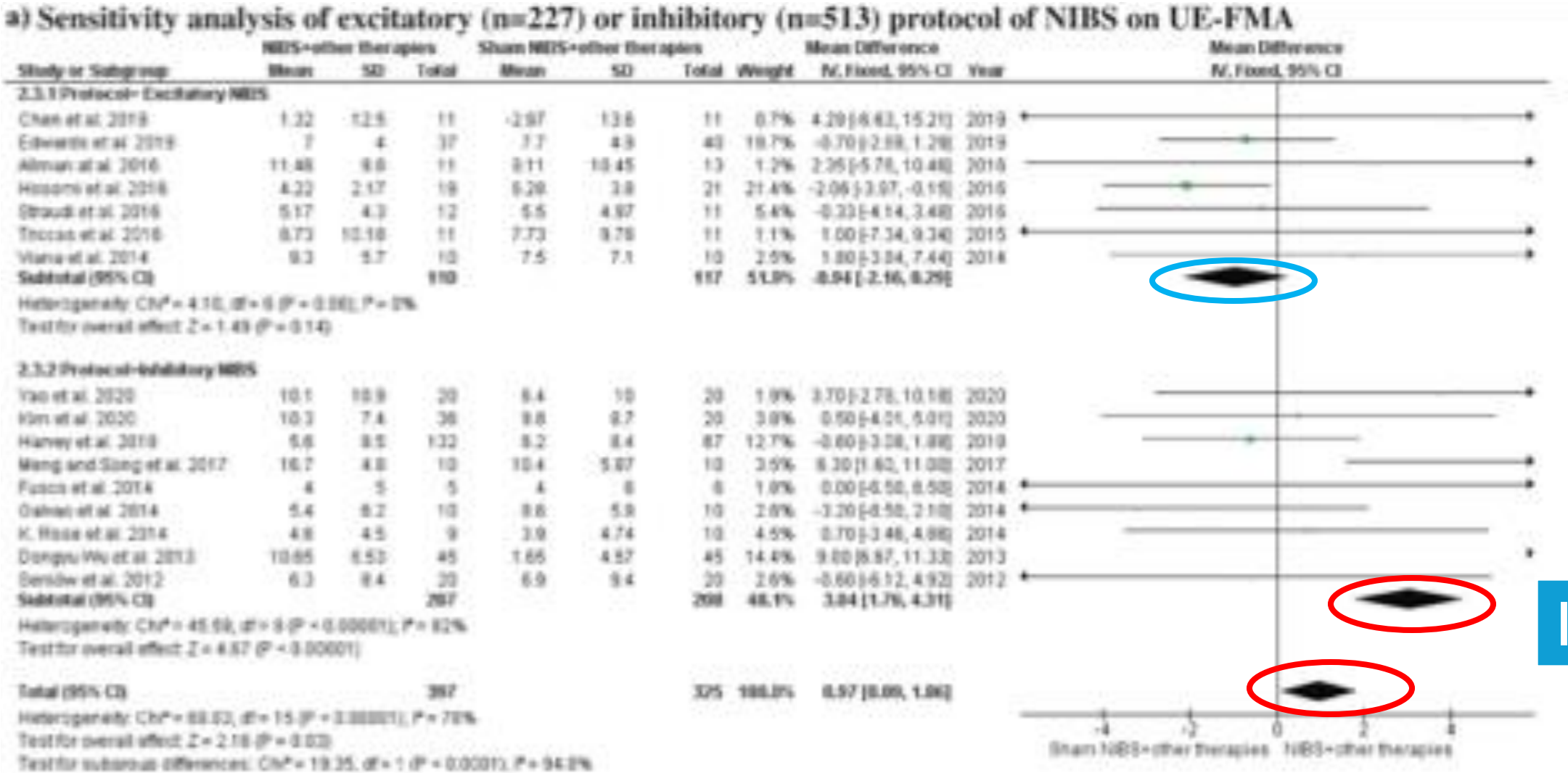
Mod-to-high quality

NIBS on UE-FMA



tDCS

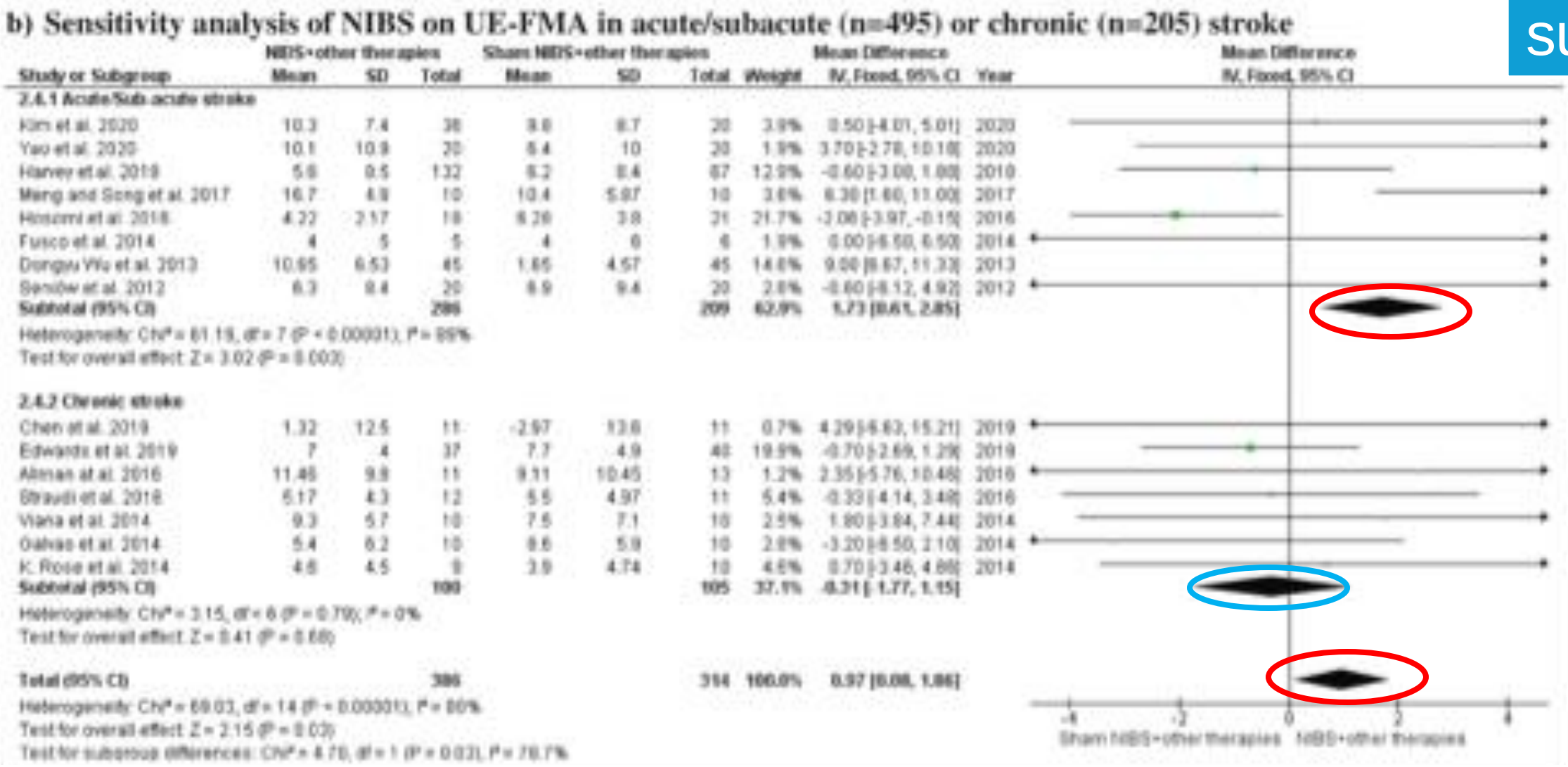
Protocol of NIBS on UE-FMA



Inhibitory

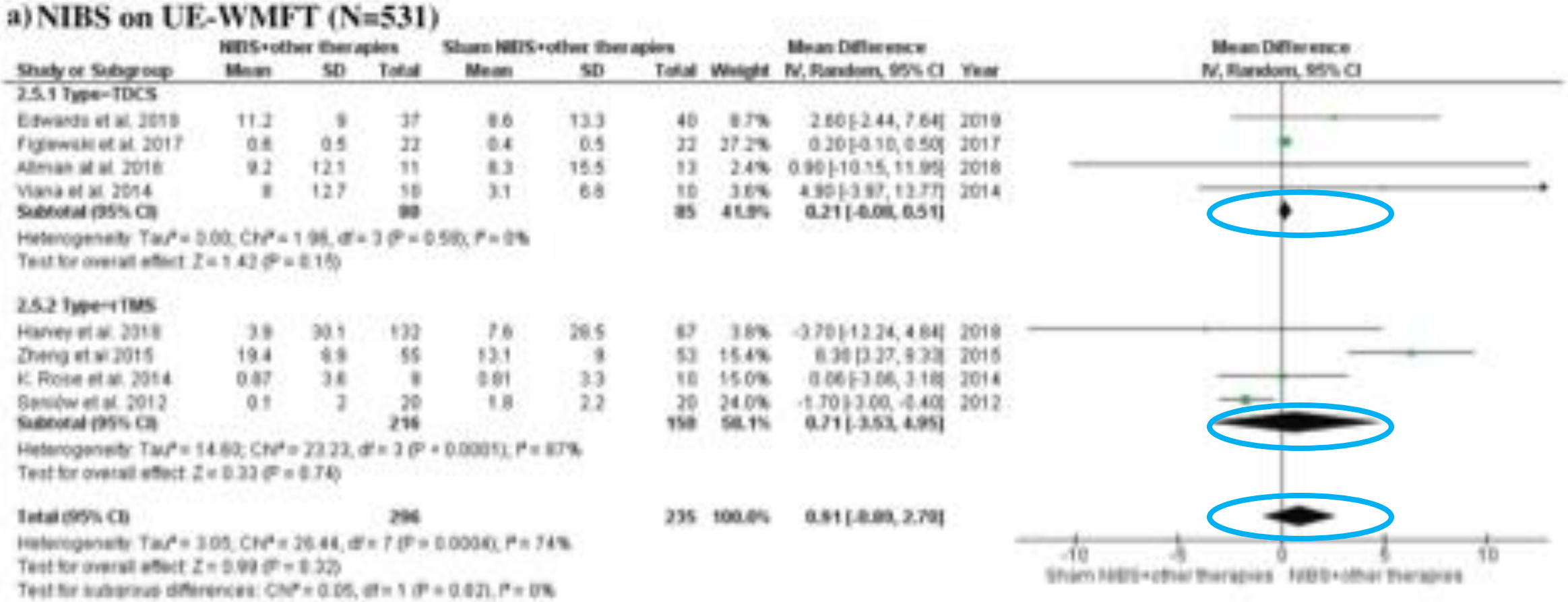
NIBS on UE-FMA: Acute vs. Chronic

acute
subacute



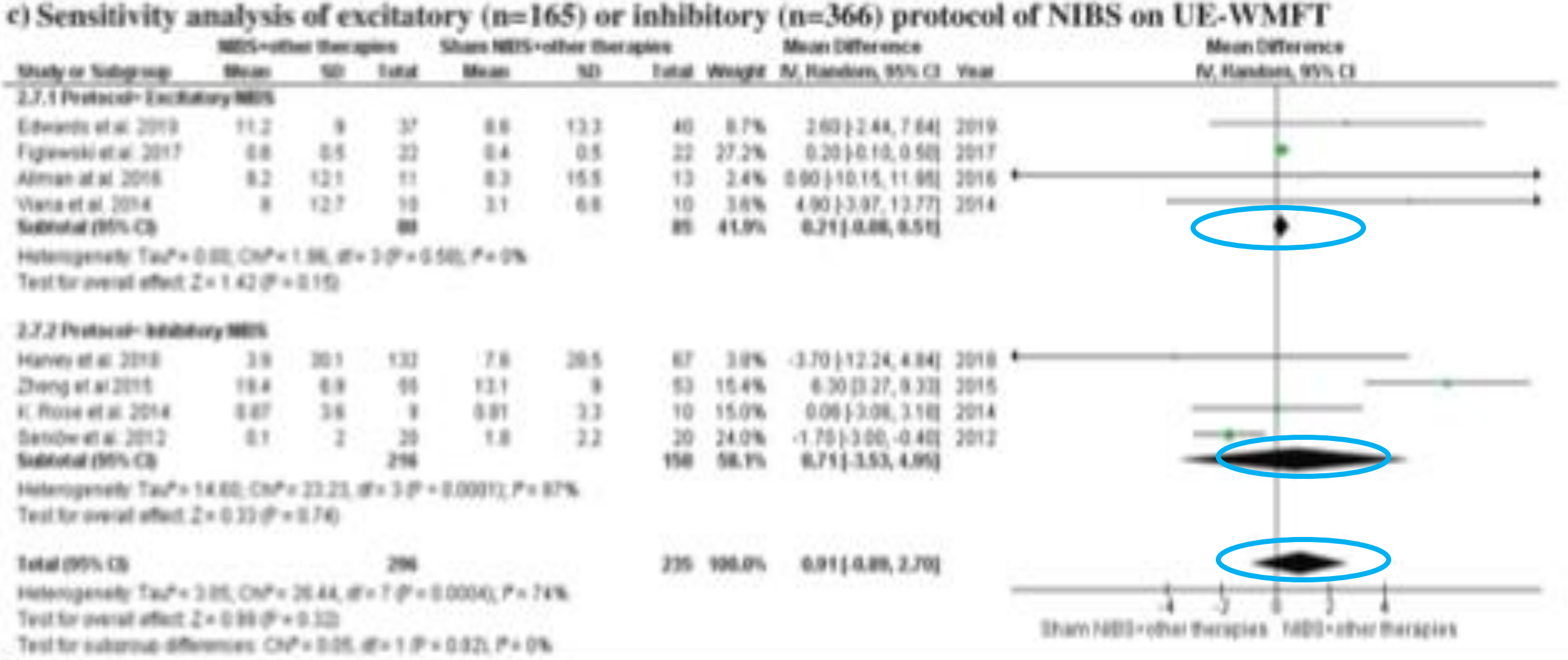
NIBS on WFMT

No significant difference



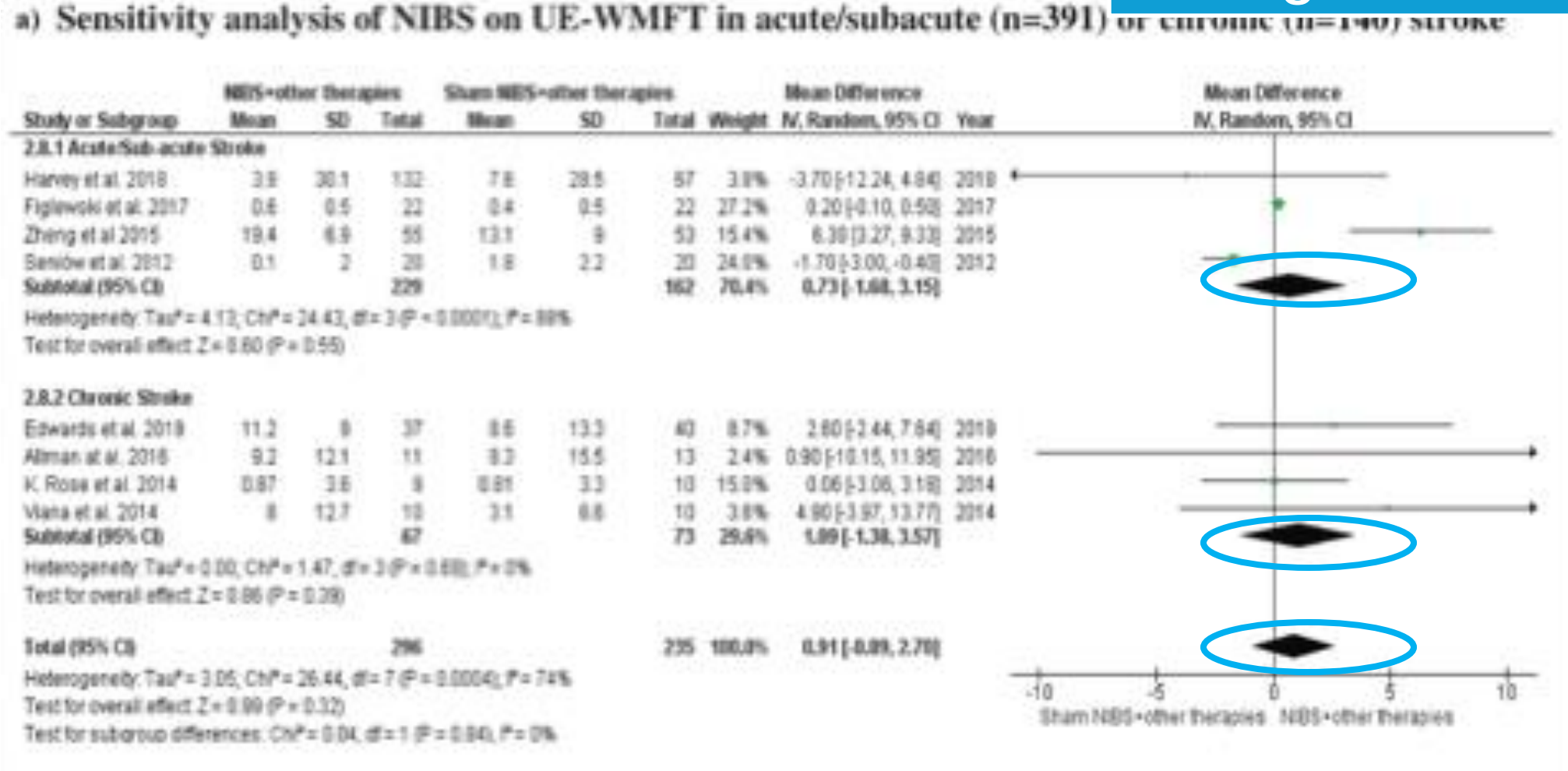
Protocol of NIBS on WFMT

No significant difference



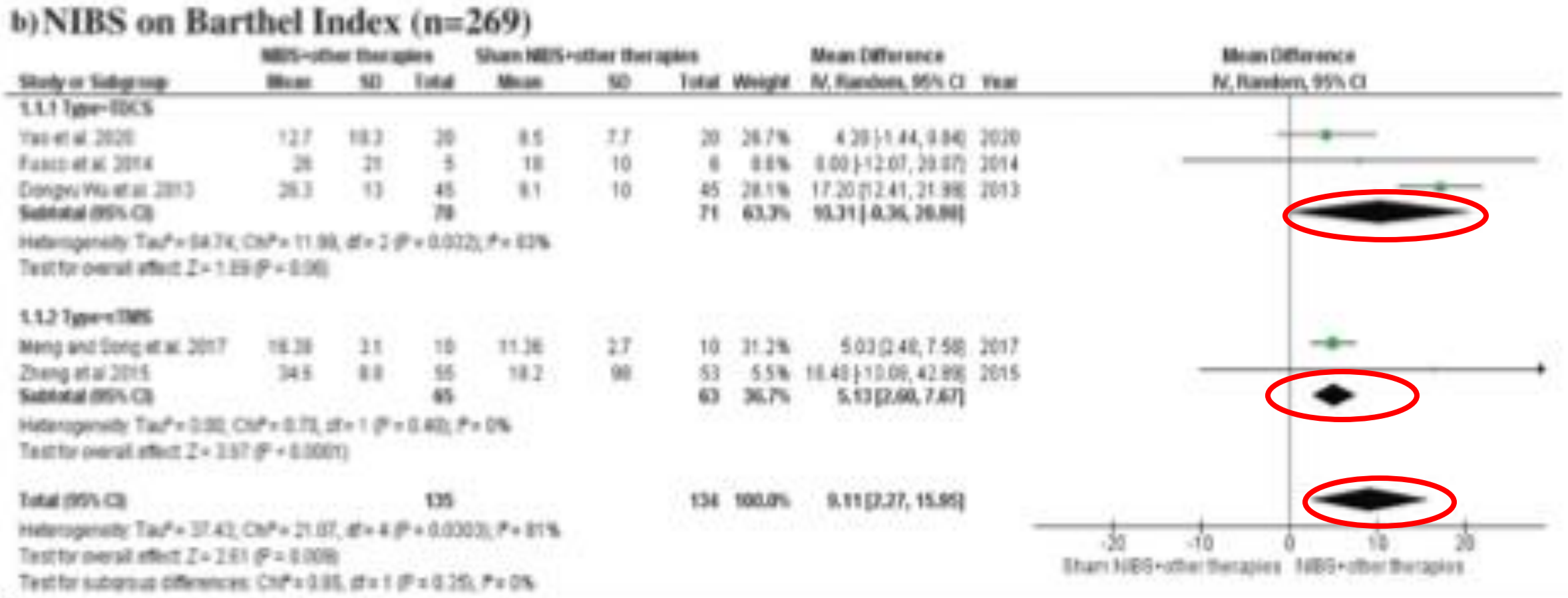
NIBS on WFMT: Acute vs. Chronic

No significant difference



NIBS on Barthel Index

Significant difference



Improvement in Stroke with NIBS+Other

Induce a more suitable environment for neural plasticity

Acute/sub-acute stroke

UE motor impairment and participation

Inhibitory NIBS

Improve the upper limb motor impairment

NIBS

Promote neural plasticity

Long-term potentiation/depression

Modulate cortical excitability

+

Combine with other therapies

Different NIBS on Motor Outcomes

tDCS with other therapies improves motor impairment

The acute/subacute phase of is a period of spontaneous recovery

Receive OT/PT or other treatment within 6 months

rTMS with other therapies was ineffective for motor impairment

6/7 studies: Inhibitory signals

3 studies: In acute/subacute

20 min of stimulation/session is more effective

Only 1 study = 20 sessions

Different NIBS on function Outcomes

tDCS and rTMS show no significant

4 studies: excitatory protocol
4 studies: inhibitory protocol

tDCS and rTMS with other therapies improved BI scores

Further studies are required to verify the effect of excitatory or inhibitory NIBS on functional performance.

Study limitation

Differ in terms of stimulation frequency, intensity, duration, and number of sessions per week.

Excitatory NIBS were analyzed together with inhibitory

The duration and intensities of other therapies combined with NIBS were also different from each other.

There is still a lack of consensus about the ideal intensity, frequency, and duration of NIBS in stroke rehabilitation.

1. Mod to high-quality studies suggested that NIBS combined with other therapies is effective in improving UE motor impairment and ADL in acute/sub-acute stage of stroke but unable to modify upper extremity motor impairment in chronic stroke.

2. Only inhibitory protocol is associated with improved motor impairment.
3. 20 min of stimulation/session for ≥20 sessions were found to be effective in improving UE motor impairment.

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2023;104: 1683–97

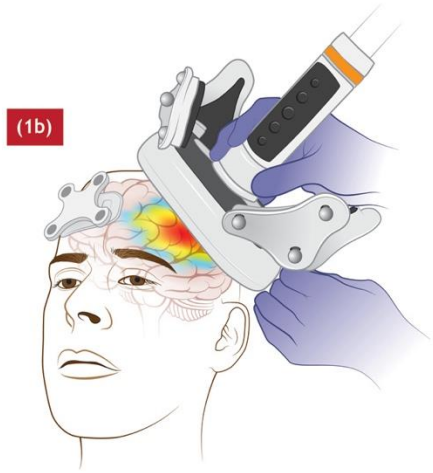
REVIEW ARTICLE (META-ANALYSIS)

Non-invasive Brain Stimulation Techniques for the Improvement of Upper Limb Motor Function and Performance in Activities of Daily Living After Stroke: A Systematic Review and Network Meta-analysis

Ishtiaq Ahmed, DPT, MSc,[a,f] Rustem Mustafaoglu, PhD,[b] Simone Rossi, PhD,[c] Fatih A. Cavdar, MSc,[f,g] Seth Kwame Agyenkwa, MSc,[f] Marco Y.C. Pang, PhD,[d] Sofia Straudi, PhD[e]

1.87 RCTs with 3750 participants were included.
2.NiBS except continuous TBS (cTBS) and cathodal tDCS were significantly more efficacious than sham stimulation for motor function (SMD range 0.421.20)
3.taVNS, anodal tDCS, and both low and high frequency rTMS were significantly more efficacious than sham stimulation for ADLs (SMD range 0.54-0.99)

Method

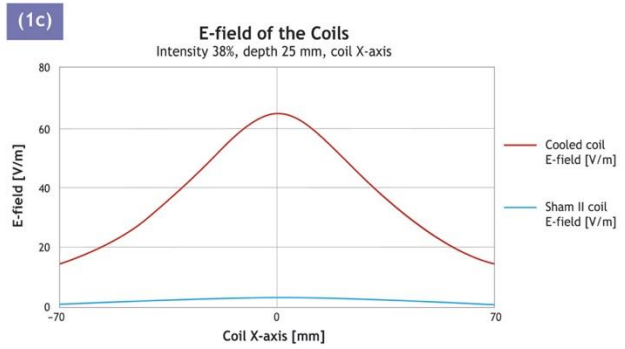


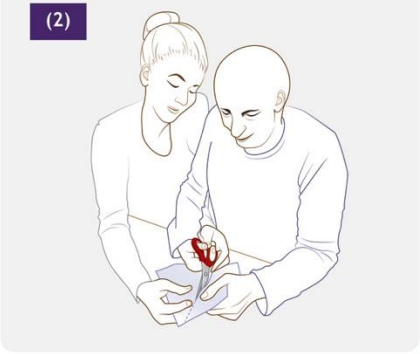
(1a) Sham-rTMS -or- (1b) Active-rTMS

(1c) Cortical electric field per coil type

(2) Task oriented rehabilitation

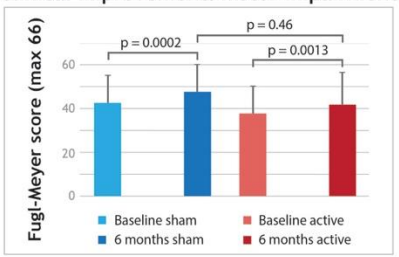
The treatment comprised 1Hz-rTMS (or sham), M1 ipsilateral to hemiparetic arm, preceding 60-minute task oriented rehabilitation therapy, 18 sessions over 6 weeks).



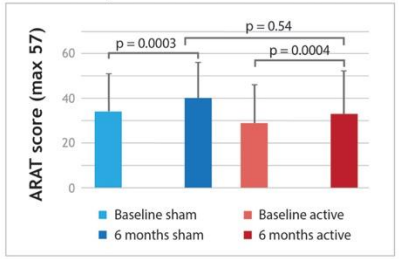


Results

A. Clinical improvement: Motor impairment



B. Clinical improvement: Motor function



Conclusions

- Intensive motor rehabilitation improved clinical impairment, function, and quality of life six months after treatment.
- 1Hz-rTMS of primary motor cortex ipsilateral to the hemiparetic hand delivered before therapy did not confer advantage.
- Low frequency rTMS treatment based on the interhemispheric competition model was not an effective treatment to improve clinical impairment, function or quality of life in a sample stroke population with mixed lesion location and extent.

(1) 20-minute pre-functional upper limb therapy (individualized from the Chedoke-McMaster hand score).
(2) 10-minute rest
(3) NBT delivered at rest targeting $M1_{CL}$ (≈15 minutes)
(4) 10-minute rest
(5) 60-minute structured session of goal-directed, task-oriented rehabilitation therapy (individualized from the Chedoke-McMaster hand score).

Dylan J. Edwards. Stroke. Electric Field Navigated 1-Hz rTMS for Poststroke Motor Recovery: The E-FIT Randomized Controlled Trial, Volume: 54, Issue: 9, Pages: 2254-2264, DOI: (10.1161/STROKEAHA.123.043164)

Conclusion

1. NIBS combined with other therapies may improve performance in various ICF domains for post-stroke patients.
2. However, the optimal dosage or combination of NIBS and other therapies has not yet been established and requires further research for validation.
3. Patient characteristics may also influence treatment outcomes, which warrants additional investigation in future studies.
4. In addition to the neuromodulatory benefits provided by NIBS, individualized and high-intensity training programs are essential for achieving better outcomes.

非侵入腦刺激合併上肢訓練，是否可以提升訓練成效！？

不可以　　待驗證　　可以

Thank you!!!