

NORWAY
LOW / HILLS / MOUNTAINS



Greetings from Norway and Oslo Metropolitan University

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Program for this talk

- Background information on Phantom Limb Pain (PLP)
 - A little history and some definitions
 - PLP intensity over time
 - Prevalence and incidence of PLP
 - Mechanisms of PLP
 - A short overview of the effect of different treatment strategies for PLP
- The design and protocol of our study
 - What data have we collected?
 - The fNIRS study on ULA
 - Incidence and Prevalence in Norway
 - Some experiences and patient stories



Phantom Limb Pain

Some French history... (from Keil, 1990)

- The first medical description of phantom limb pain was given by the French military surgeon Ambroise Paré (1510-1590):
- “Chose digne d'admiration et quasi incredible”: the “douleur ès parties mortes et amputées”
 - Translation: «Something worthy of admiration and almost unbelievable: the pain in dead and amputated parts»
- Paré also differentiated stump pain from phantom-limb sensations (“faux sentiments”)

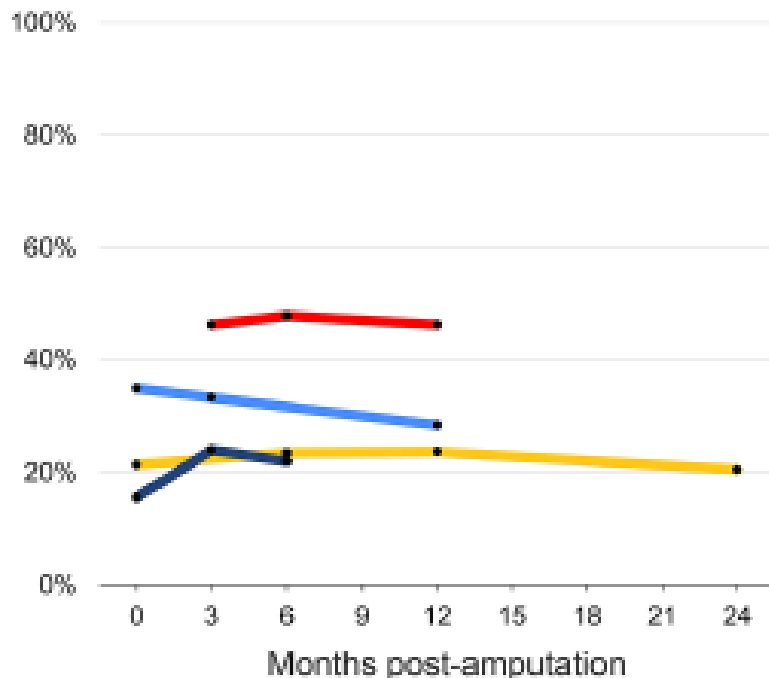


Pain intensity over time

PLP debuts early and is more or less constant over time

Phantom Limb Pain Intensity

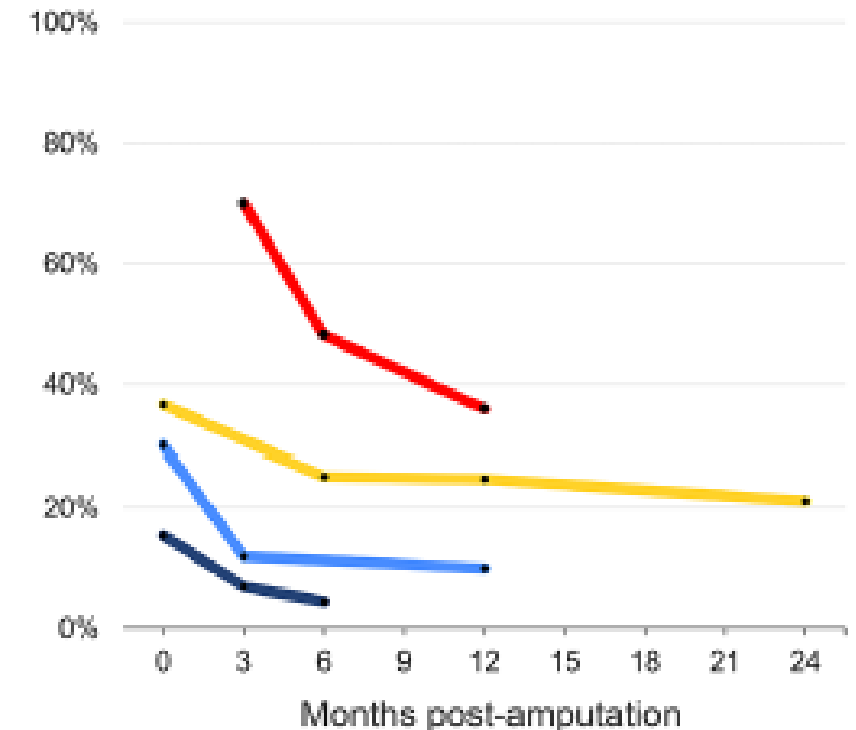
Average pain intensity score (% of maximum score)



Residual limb pain show a decrease within 3-6 months post-amputation

Residual Limb Pain Intensity

Average pain intensity score (% of maximum score)



Figures from Schone 2022

Phantom Limb Pain Prevalence and Incidence

Phantom Limb Pain Prevalence

Average prevalence (% of amputee sample experiencing phantom limb pain)

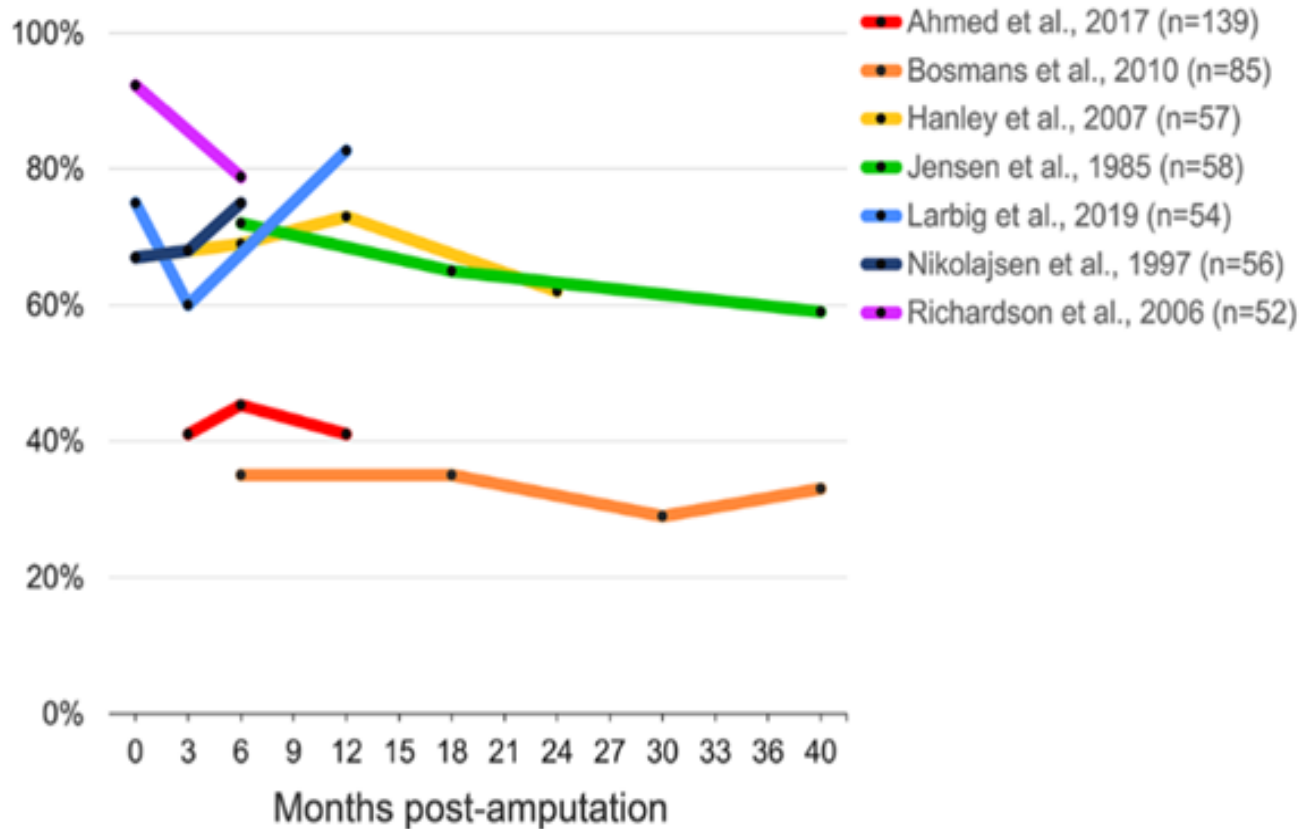


Figure from Schone et al. (2022)

Phantom Limb Pain incidence

Data is very limited and heterogenous.

Following amputation studies report incidence rates of:

- 2.2% (1 month, Agha 2017)
- 41% (3 months) (Ahmed, 2017)
- 67% (6 months, Jensen, 1983)
- 83% (12 months, Labrig, 2019)

Two older studies report incidence rates of about 70% one week after amputation (Jensen 1983, Nicolajsen 1997)

What about Norway ?

Despite the high prevalence and seriousness of the condition, PLP is an under-investigated and under-treated condition

Patient-reported Outcome Measures following Traumatic Lower Extremity Amputation: A Systematic Review and Meta-analysis

Tirrell et al. (2021)

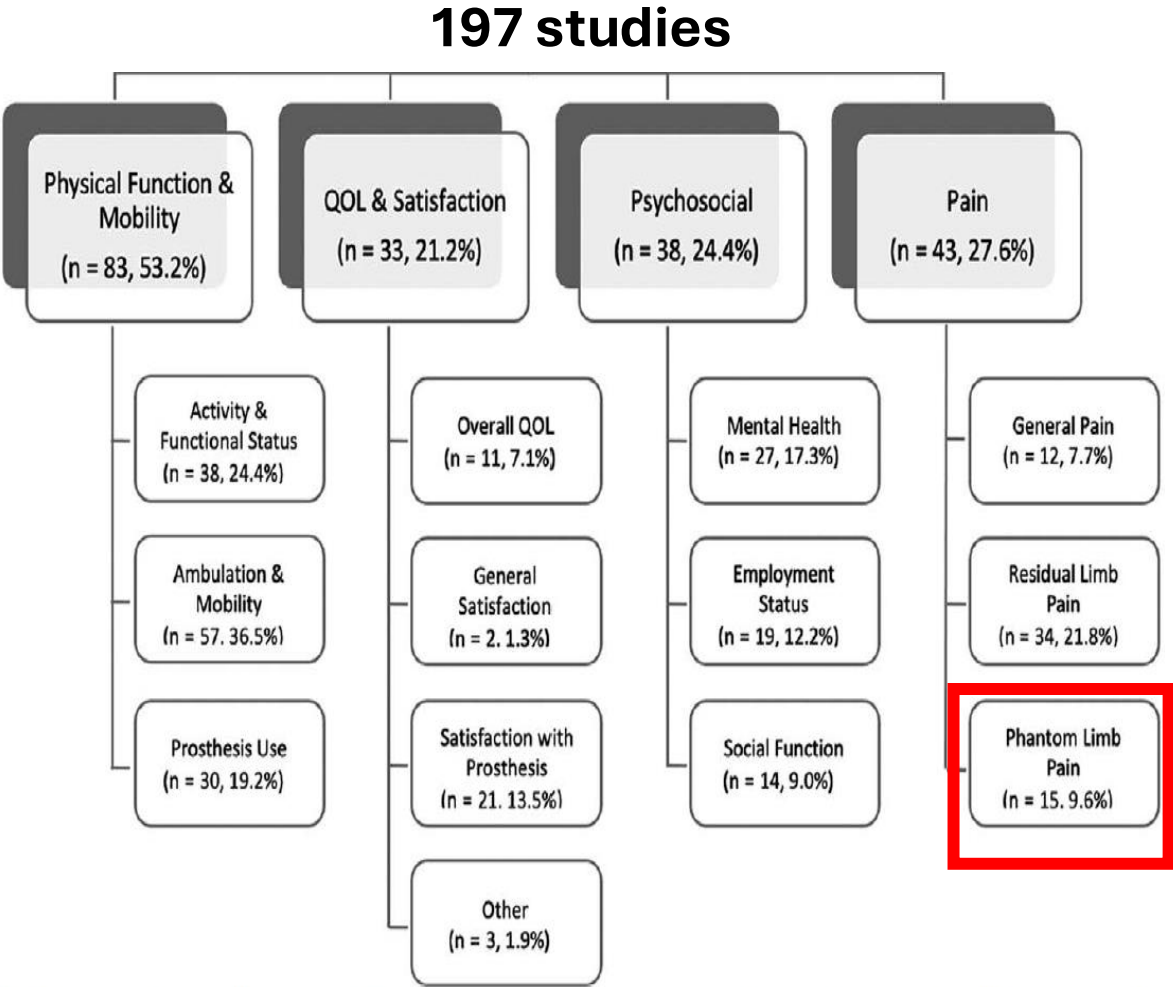
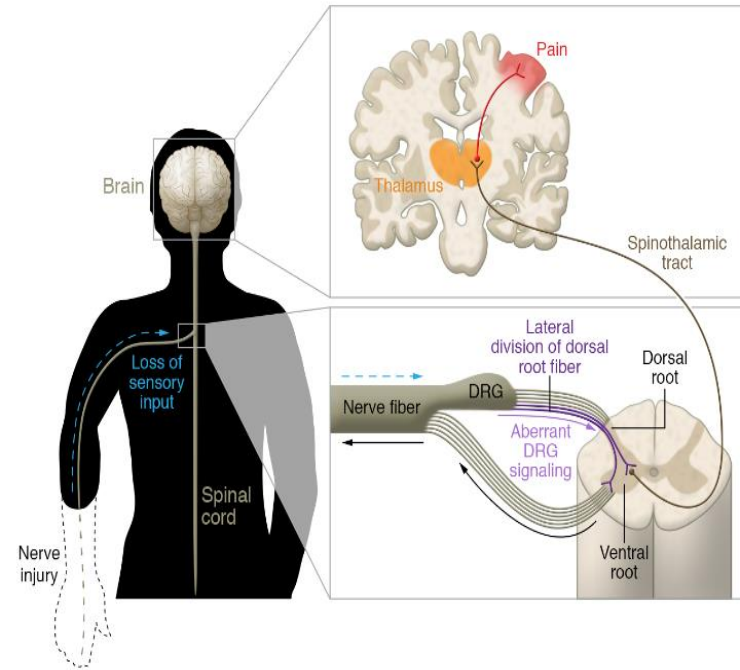
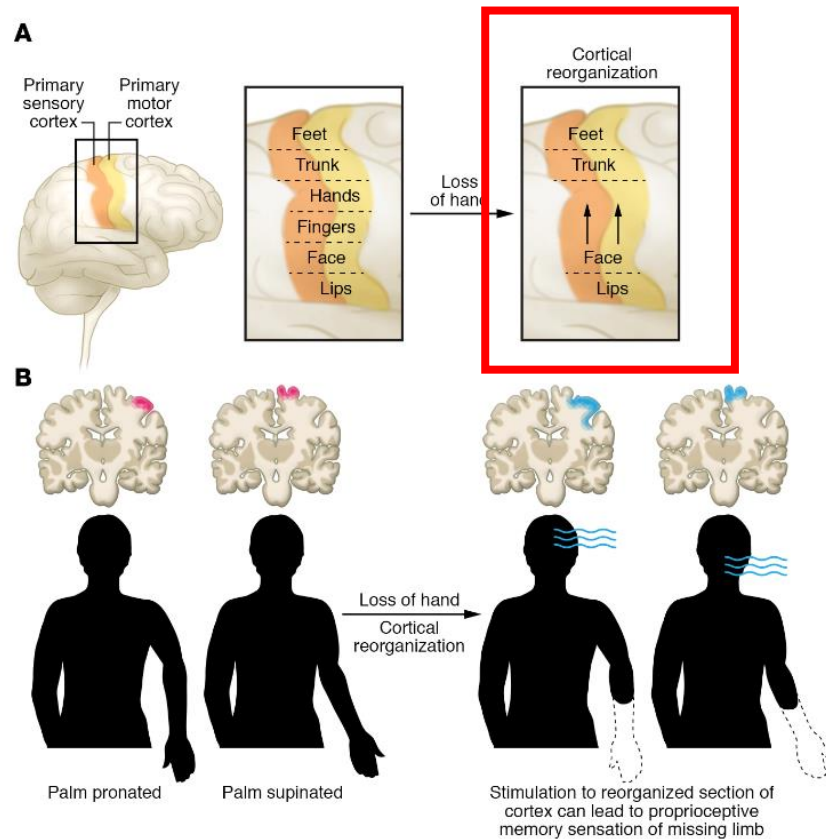


Fig. 2. Flowchart of studies that report PCO, divided into categories and subcategories of physical function and mobility, QOL and satisfaction, psychosocial, and pain.

The mechanisms of PLP is not completely understood

Both central (including spinal) and peripheral mechanisms are proposed, which is reflected in the large selection of possible treatment strategies



What are common treatment strategies for PLP?

More than 60 different methods for treatment of PLP have been identified (Sherman, 1980)



Neuromodulation

dTCS
TMS

Pharmaceuticals

A lot of different
drugs.....

8-10 are
commonly in use

Surgical procedures

Peripheral nerve
surgery
Residual limb revisions
Targeted muscle
reinnervation

Non-pharmaceutical methods

More than 25 different
methods

What are the effects of common non-pharmaceutical treatments for PLP?

- Graded motor Imagery (GMI)
- Mirror therapy (MT)
- VR/AR therapy



Intensive
Visual
Simulation

IVS4 from
Dessintey

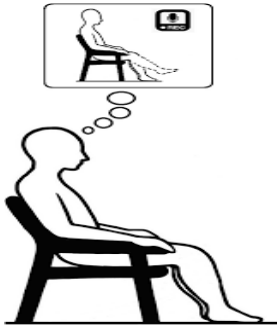
Review and Meta-analysis of Graded Motor Imagery

Limakatso et al. 2023

1st step in GDI: Laterality recognition

2nd step: Explicit Motor Imagery

3rd step: Mirror Therapy



**11 studies included
mostly males and people with LLA**

Anaforoğlu et al. 2019

Brodie et al. 2007

Chan et al., 2007

Finn et al., 2017

Limakatso et al., 2020

Moseley et al., 2006

Ol et al., 2018

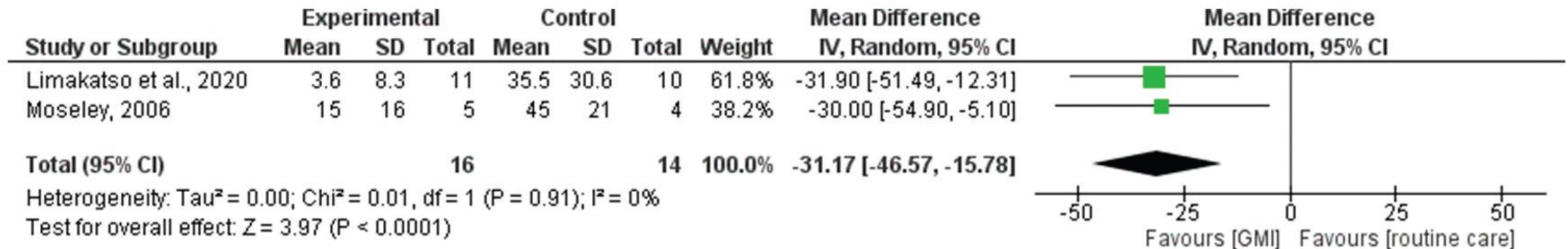
Ramadugu et al., 2017

Rothgangel et al.,

Tilak et al., 2016

Tung et al., 2014

GMI studies summary



- Only two studies compared 3-step GDI to routine care

The weighed mean difference of these two studies was: -21.3 [95% CI -31.6 to - 11.0]

- There is limited body of evidence and certainty of evidence is very low

Mirror therapy

Systematic review and meta analysis of RCTs on mirror therapy

(Wang 2021)



RCTs on PLP included in review

Brodie et al. 2007

Chan et al. 2007

Külünkoğlu et al. 2019

Mallik et al. 2020

Brodie et al. 2003

Ol et al. 2018

Tilak et al. 2016

Tung et al. 2014

Ramadugu et al. 2017

Rothgangel et al. 2018

Finn et al. 2017

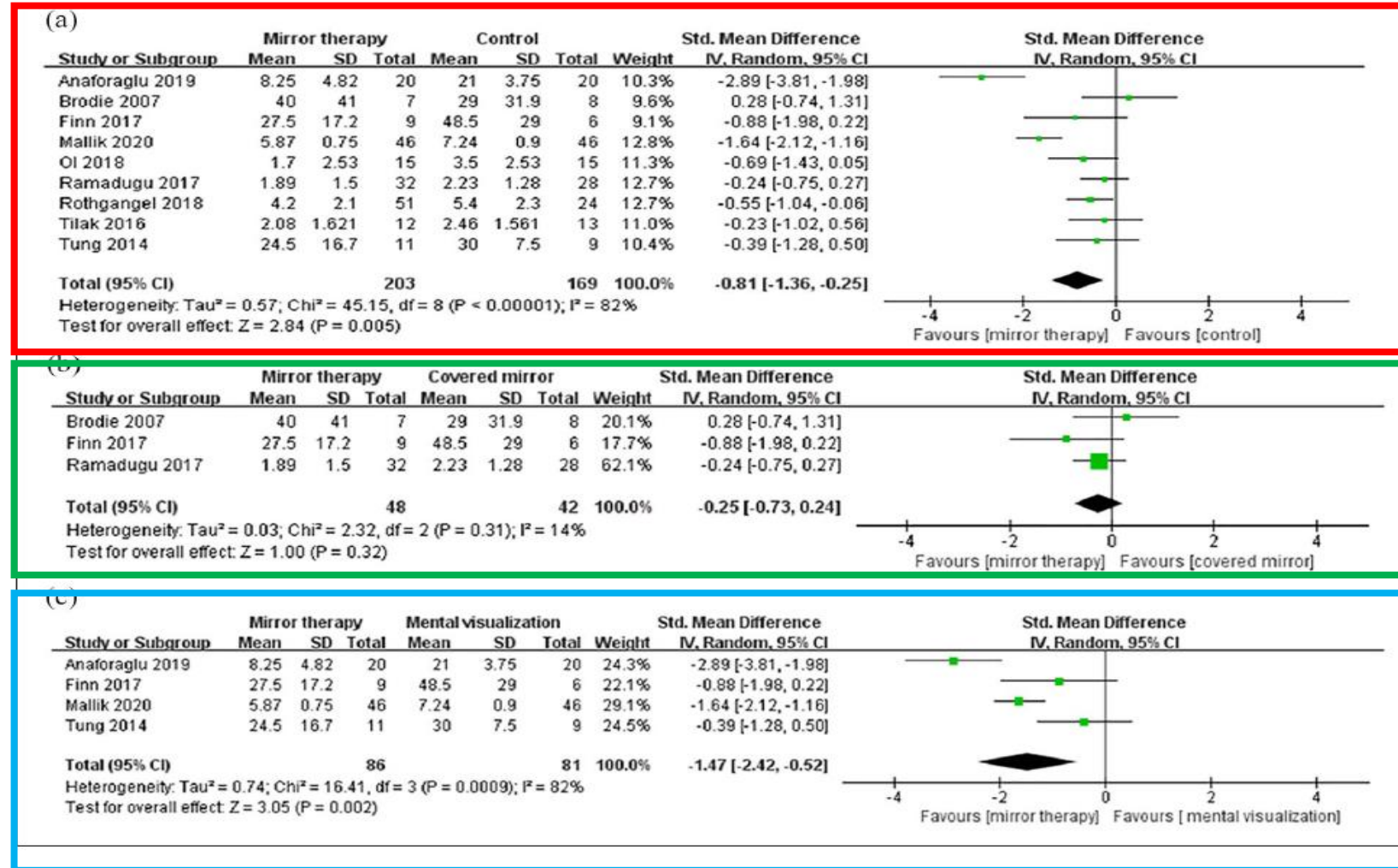
Mirror therapy summary

Mirror therapy reduced PLP with a large effect size: $m = -0.81$; 95% CI = -1.36 to -0.25 , $P = 0.005$ compared with other methods

MT vs. Control group →

MT vs. Covered mirror →

MT vs. Mental visualization →



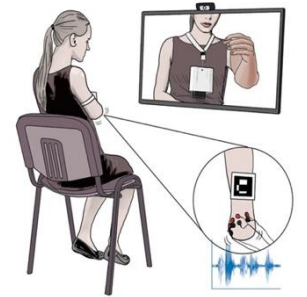
Three studies have reviewed the effect of VR/AR therapy on PLP

The different VR/AR methods differ in their degree of immersiveness

Eldaly et al. 2024. Systematic review, but no metaanalysis.
9 studies included, only one RCT.
Time period 2016-2021



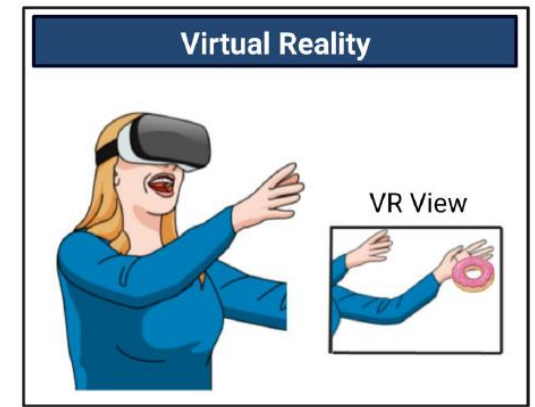
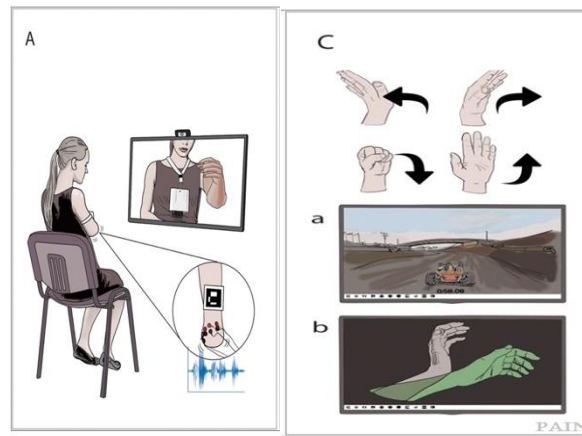
Vassantacharact et al. 2024. Systematic review, but no metaanalysis.
20 studies included, only one RCT (same study as above) .
Time period 2009-2020.



Hali et al. 2024. Systematic review, but no meta analysis.
15 studies included.
Time period 2009 - 2020



VR/AR summary



Eldarly et al. 2024

«We can not recommend using VR/AR for PLP.....No substantial evidence can be derieved from the studies»

Hali et al. 2024

11 of 14 studies reported acute PLP only pre and post **one treatment session**.
2 af 3 longer-term studies reported decreased PLP levels post-intervention

.....» the low quality of studies, heterogeneity in subject population and intervention type, and lack of data on long-term relief make it difficult to draw definitive conclusions”

Vassantacharact et al. 2024.

8 of 13 immersive VR/AR studies reported significant decreased levels of PLP
4 of 7 non-immersive studies reported significant decreased PLP after VR/AR treatment



The Oslo Study.....

