Mirror Mirror On The Wall

HAVEN OF HOPE HOSPITAL
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LK M/80

HT DM PVD

L AKA in 12/2008, sent to rehab ward in 01/2009 for post amputation rehab, he had vague phantom limb sensation but no phantom limb pain.

Started pre-prosthetic phase training- UL strength, walking between parallel bars, hopping with a frame, walks with pylon between parallel bars.

Complained of phantom pain in 02/2009

pain score 6/10,

PT therapy: prosthetic phase started, walks with prosthetic limb between parallel bars. TENS to the residual stump

Commenced with Epilim 200mg BD

+ tramadol 50 mg tds,

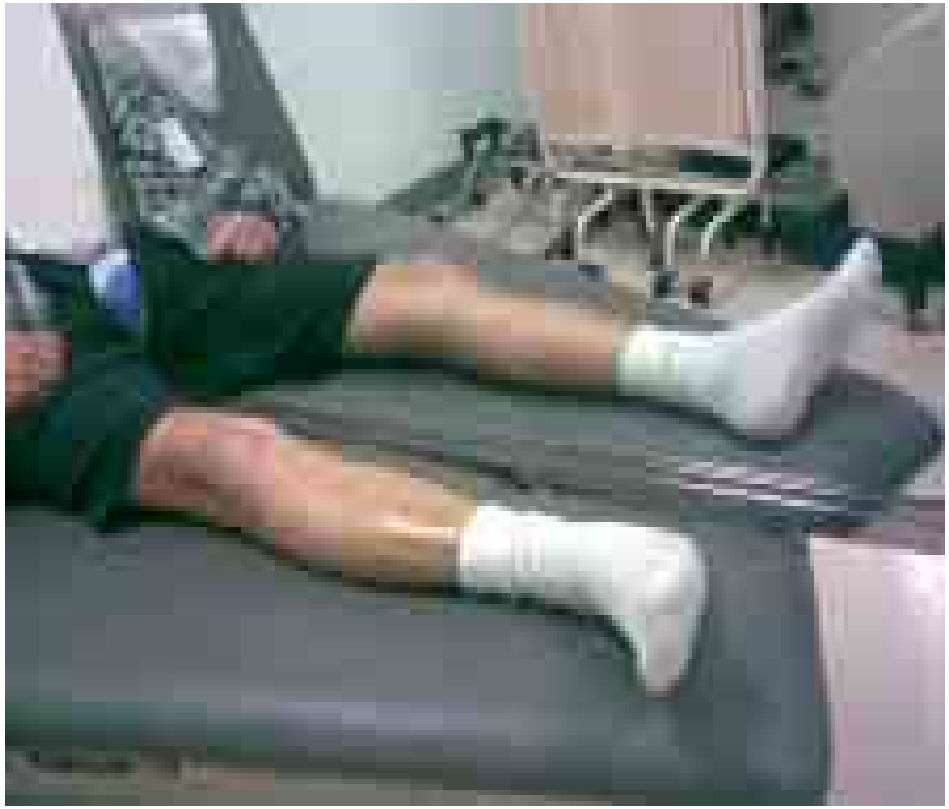
+ gabapentin 100mg om + noon + pm, also felt dizzy with tramadol,

Pain not adequately controlled, also has dizziness and GI upset with pharmacological therapy. Refused to continue tramadol.

- What other therapy could we offer?

started mirror therapy in early 03/2009,

Before MT, L AKA



♣Mirror therapy 30 minutes when he came to PT dept.
♣perform leg and ankle movements on the R unaffected limb, while look into the mirror attentively.

Case 3 after rehab

2 weeks after MT, pain score 2/10, did not need any analgesics.

Mirror therapy

- Use in phantom limb pain
- Use in CRPS1
- Use in hemiplegic limbs after stroke.

Impact of Phantom limb pain

- 1 it first described in 1872.
- 2. high prevalence 10-80%.
- 3. 64% rated at least bothersome in nature.
- 21% said it was severely bothersome
- 4. in the sample with PLP, 81% had > 2 years, 42% > 6 years after amputation.
- 5. low success rate of control, one review: 30% from various kinds of treatments.

Commonly used treatments for phantom-limb pain

Pharmacological
Conventional analgesics
Opioids*
β-blockers
Neuroleptics
Anticonvulsants
NMDA-receptor antagonists
Ketamine*
Memantine†
Antidepressants
Barbiturates
Muscle relaxants

Surgical
Stump revision
Neurectomy
Sympathectomy
Rhizotomy
Cordotomy
Tractotomy
Dorsal column stimulation
Deep brain stimulation

Anaesthetic
Nerve blocks
Epidural blockade
Sympathetic block
Local anaesthesia
Lidocaine*

Psychological
Electromyographic biofeedback
Temperature biofeedback
Cognitive-behavioural pain management
Sensory discrimination training*
Hypnosis

Other
Transcutaneous nerve stimulation (TENS)*
Acupuncture
Physiotherapy
Ultrasound
Manipulation
Prosthesis training

*At least one controlled study with a positive effect on phantom-limb pain has been done. †A controlled study with a negative effect on phantom-limb pain has been done.

Memantine NMDA receptor antagonist not effective, in a controlled study.

Pathophysiology of PLP

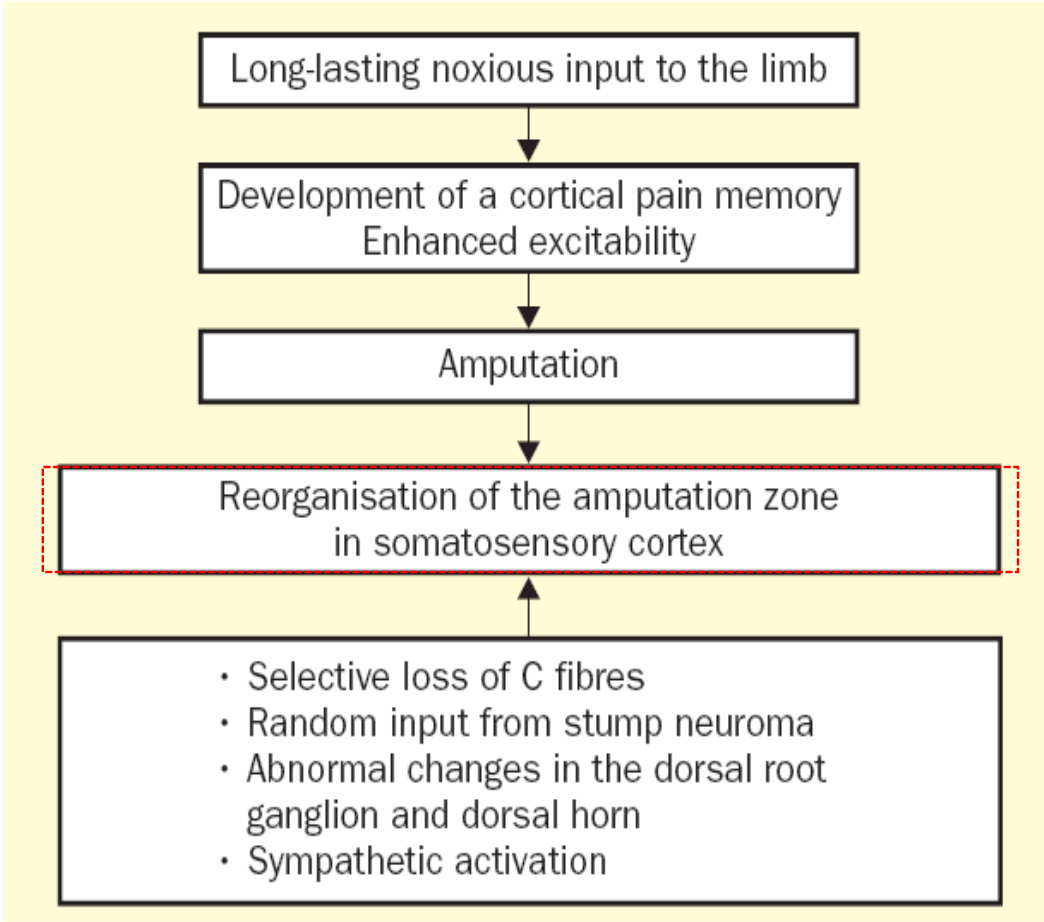
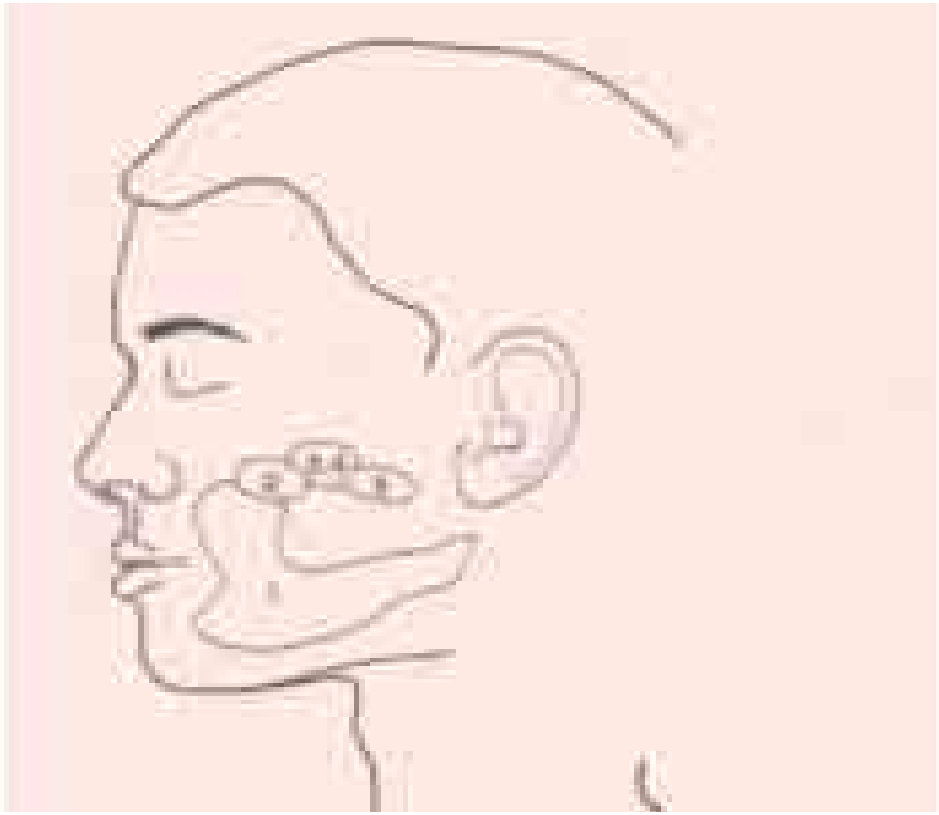


Figure 4. Schematic diagram incorporating the main factors thought to be relevant for the development of phantom-limb pain.

Pathophysiology of PLP

- Ramachandran 1996
-
- the area served originally represented the amputated limb is ‘invaded’ by neighboring parts of the body, termed “ **topographical remapping**”
- e.g. a shift of the mouth territory into the hand representation in the somatosensory cortex (SI cortex)

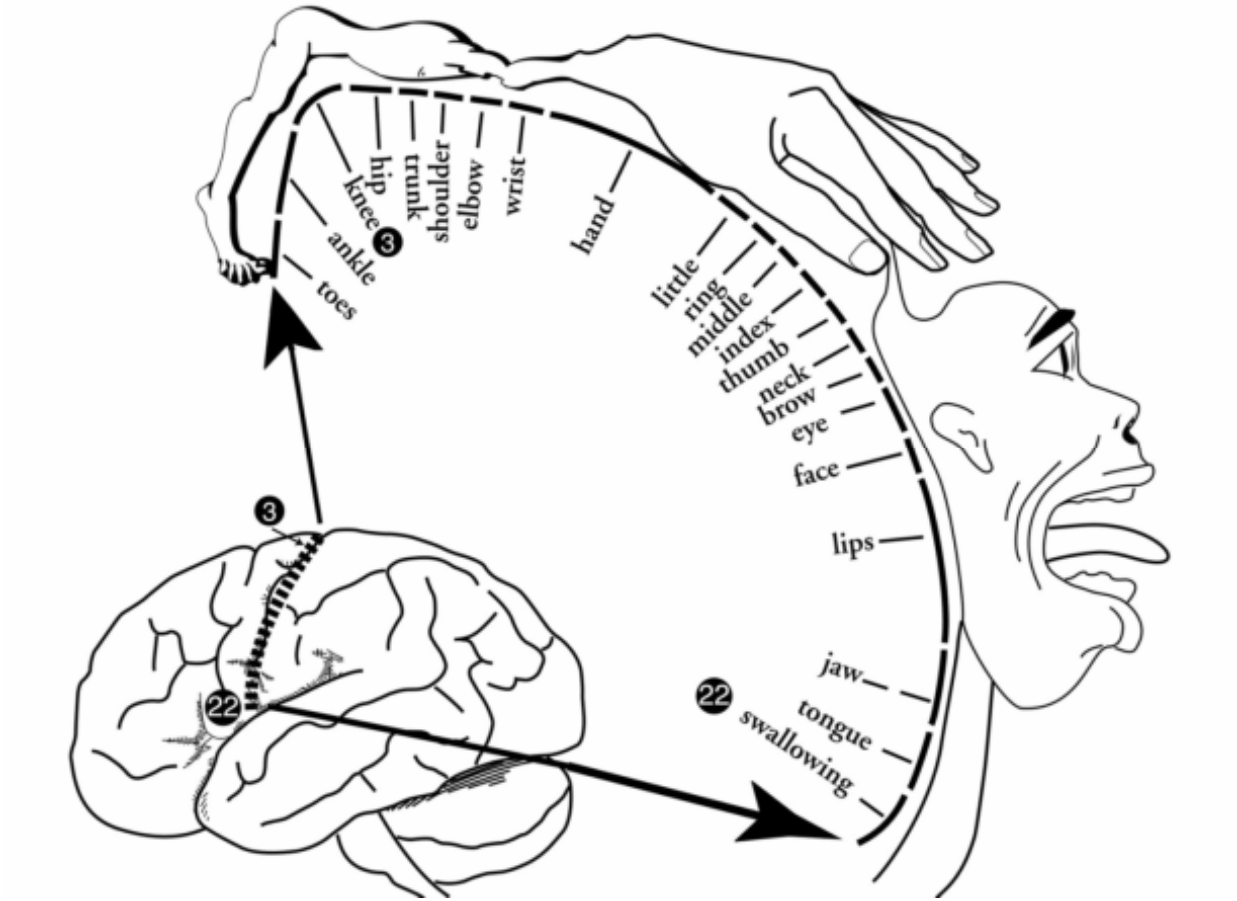
Pathophysiology of PLP



- After amputation of an arm, touching the face will often evoke precisely localised sensations in the phantom hand and fingers and arm.
- because the higher brain area continue to interpret the signals as arising from the missing hand.

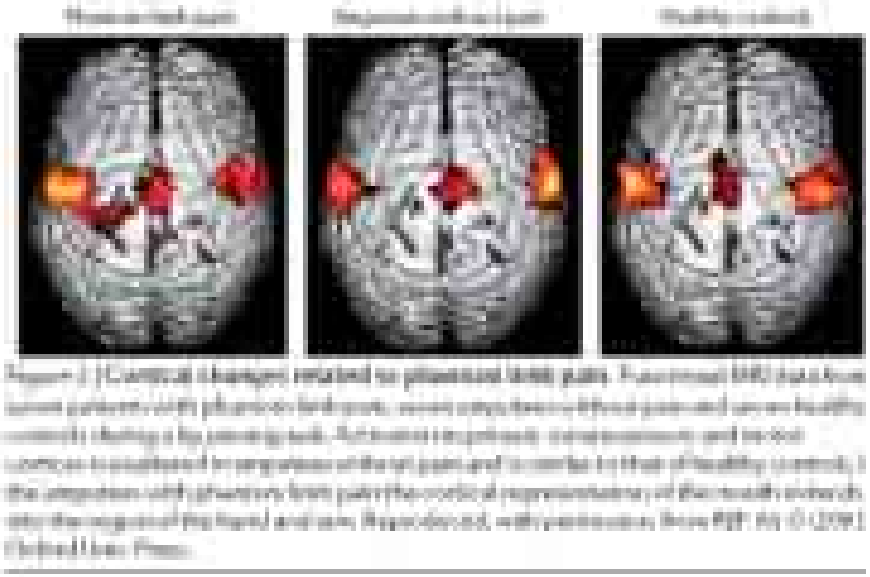
on the somatotopic map of the body surface that is present in the somatosensory cortex , hand and forearm lie between face and arm.

May explain the referred pain to arm or to phantom when face is touched.



The Penfield Homunculus, first described In 1937.

Evidence of cortical reorganisation>pain



1. The larger the shift of the mouth representation into the zone that formerly represented the arm, the more pronounced the phantom limb pain.

Evidence of reorganization>pain

- 2. surgical removal of SI cortex abolished phantom limb pain in some studies, stimulation of it evokes PLP.
- 3. In patients with PLP, intensive use of a myoelectric prosthesis reduced pain. This could be due reduced cortical reorganization. The extent of cortical reorganisation is positively correlated with severity of PLP.

Evidence that Reorganization causes pain

- 4. A two week regimen of daily discriminatory training of electrical stimuli to the stump Vs control of only medical treatment and psychological counseling: former produce significant improvement of PLP reversal of cortical reorganization .

- Resolution of symptoms is associated with normalization of cortical reorganization.

- Thus cortical reorganisation in PLP became a form of “maladaptive CNS plasticity”.

The mirror therapy

- 1. Mirror therapy provide a “congruent” visual feedback - *normally moving affected arm*
- 2. compensate for the lack of proprioceptive input,
- 3. reconcile motor output and sensory feedback,

- This may reverse the maladaptive cortical reorganization.

The conduct of Mirror therapy

- Mirror therapy :
- 1. the mirror is placed along the patient’s midline.
- 2. the unaffected limb move as directed,
- 3. Patient “sees” the affected limb inside the mirror.
- 4. the affected limb (inside the mirror) and unaffected are instructed to “move” together.

how to conduct

MT group view the affected limb by the reflection in the mirror

The control group: non reflective surface in place of a mirror

EMB MT in phantom limb pain

- Early incorporation of its use, since 1996
- Ramachandran: 4 of the 10 patients , without control, reported relief of PLP
-
- “unclench” a painfully clenched phantom hand and relieve the clenching spasm.

PLP-LL

- MacLachian et al 2004 : first case report of LL amputee,,
- relieves PLP significantly form pain of 5-9/10 to 0/10 after 3 weeks MT, and
- increase his phantom limb control from 0% to 20-30%. (this may be related to reversed cortical reorganization)

- Darnall B D 2009: Case report of home delivered mirror therapy for chronic (I year) LL phantom limb pain>> cured pain of initial intensity of NAS 4/10 after 1 month MT at a dose of 20 min/day. After 3 months, he was taking analgesic p.r.n. Pt continues to practice MT from time to time when PLP recurred.

PLP LL

- Chan Brenda L 2007: N=18, 6 patients in each group,
- LL amputee, 15 minutes/day for 4 week,
- gauge pain by VAS, cross over to MT after 4 weeks.
- * average pain reduction 24mm

	Mirror therapy MT	Covered mirror CT	Imagery I
% of pt reduced pain at 4 weeks *	100	17% some patients had increase in pain	33%
% of pts reduced pain after cross over to MT	N/A	9 from the CT/I group: 89% improved	

PLP LL

- E E Brodie 2007: N=80 LL amputees,
- 40 MT 40 control,
- a single session of MT
- does not attenuate pain, but improved PL awareness and movement.

- CRPS1 and mirror therapy

CRPS

- Peripheral sensitization
- Central sensitization
- Sympathetically maintained pain

- Cortical reorganisation also occurs- referred pain was present in CRPS patients

evidence

- 1. McCabe et al 2003: 5 of 16 CRPS1 patients reported referred sensations that is consistent with the Penfield homunculus.
- 2. Maihofner 2003: 12 CRPS1 patients, affected UL, the area subserving the affected hand was reduced as assessed by magnetoencephalography (MEG), it was shifted towards the lips representation.
- After treatment that reduced pain, the cortical map was largely reversed.

- 3. Maihofner et al 2006: 8 of 24 subjects mislocalised of digits when hand affected by CRPS1 was touched with non noxious stimuli-”blurring” of cortical representation.
-

CRPS1 and MT

- ***learned pain-***in chronic pain, a person continue to immobilise to avoid tissue injury and promote healing well after the inflammation subsided. The “move will evoke pain”
- mirror therapy: unlearn the” learnt pain”~ desensitize the central nervous system *because through the mirror, movement do not induce pain-*
- *>> reestablish the pain free relationship, a motor execution will monitored by sensory feedbacks. Again there will be rconciliation sensory feedback and motor execution.*

EBM-CRPS 1-evidence 1

- Anecdotal reports concluded that mirror therapy is associated with increase in pain in chronic CRPS but useful in acute CRPS.
- C S McCabe et al 2003:
- N=9:
- acute n=3 (<8 weeks),
- Subacute n= 2 (5 months to 1 years) and
- Chronic n=4 (> 1 year),
- continued on with standard treatment: PT OT drugs, acupuncture.
- baseline pain according to VAS,

- Method:
- A control phase of exercising the normal and painful arm in front of a nonreflective surface of mirror, 5 minutes,
- then reflective surface of mirror in midline position, exercise for 5 minutes in the same manner.
- Continued for 6 weeks as home therapy, max of 10 minutes /session , as frequently as they wished, in a quiet room.

- alleviated symptoms of acute cases CRPS 1 (but no significant effect on chronic cases in the study) in terms of pain and vasomotor changes.
- 2 patients in acute or subacute group returned to work, and 3 reported no pain on VAS at the end of 6 weeks.

- ♓ Neural pathways may have been more established in chronic cases and led to failure

EBM-CRPS 1-evidence 2

- G L Moseley 2004 :Graded MIP for chronic CRPS 1 (>6 months), after non complicated wrist fractures,
- N=13:
- 7 into MT group, 6 into controlled;
- controlled group cross over to MT at 12 weeks.
- Motor imagery program (MIP)
- 1. recognition of hand laterality, 2 weeks,
- 2. imagine hand movements, 2 weeks,
- 3. mirror movements, 2 weeks,
- Stop if there is increase in pain during MT

EBM-CRPS1-evidence 2

- *Results:*
- *1. the neuropathic pain score (NPS)* { effect size of treatment 20 points}; *circumference* of the affected hand; all improved in the MT, all $p<0.01$
- 2. 4 patients of MT group exclude themselves from the dx criteria of CRPS 1 at 12 weeks.
- 3. NNT to achieve >50% pain reduction was 3.
- 4. the originally controlled group: After cross over to treatment group at the end of 12 weeks:
- ♣ demonstrated similar improvements in NPS,
- ♣ 2 patients exclude themselves from the dx of CRPS 1 after they crossed over to MT.

- 1. The sequence in MIP might be important:
- Laterality training>> activate premotor cortex
- Imagery>> premotor and primary motor cortices
- 2. imagery *promotes sustained attention* to the affected limb.
- There may be element of neglect to the body part in pain as reflected
- ☜by longer laterality recognition time.
- ☜And many (70-80%) of CRPS 1 patients report neglect like symptoms (Galer and Jensen 1999):
- "*my limbs seems foreign to me*";
- "*I need to focus all of my attention on my painful limb to make it move the way I want it to*"
- The forced-attention element in MIP may serve to reverse a "learnt disuse" of the limb

EBM-CRPS1 evidence 3

- Moseley 2006
- N= 51, (chronicity not specified)
- 3 groups: CRPS1 n=37, post amputation with PLP n=9, brachial plexus avulsion injury n=5
- Underwent MIP (1 hour), or control

	Pain, by VAS decrease, at 6/52	VAS decrease at 6 months	Task performance NRS increase at 6/52	NRS increase at 6 months
MIP	23.4	32.1	2.2	3.7
control	10.5	11.6	0.6	1.5

Moseley 2006

	NNT to get a 50% in decrease in pain	NNT to get a 4 point increase in function by NRS	NNT for both criteria
Response at end of program at 6/52	3	4	4
Response at 6 months FU	2	2	3

The heterogeneity of patient group may have diluted the efficacy of MIP.

(NRS-numerical rating scale 0-impossible to perform a task, 10-no difficulty)

Moseley 2006

- Compare with drugs for neuralgic pain, NNT
- TCA 2.2 -5
- Antiepileptics 2.2-5
- Opiates 2.2-5
- SSRI 2.9-7

- Stroke rehabilitation and mirror therapy

The role of cortical reorganization in stroke

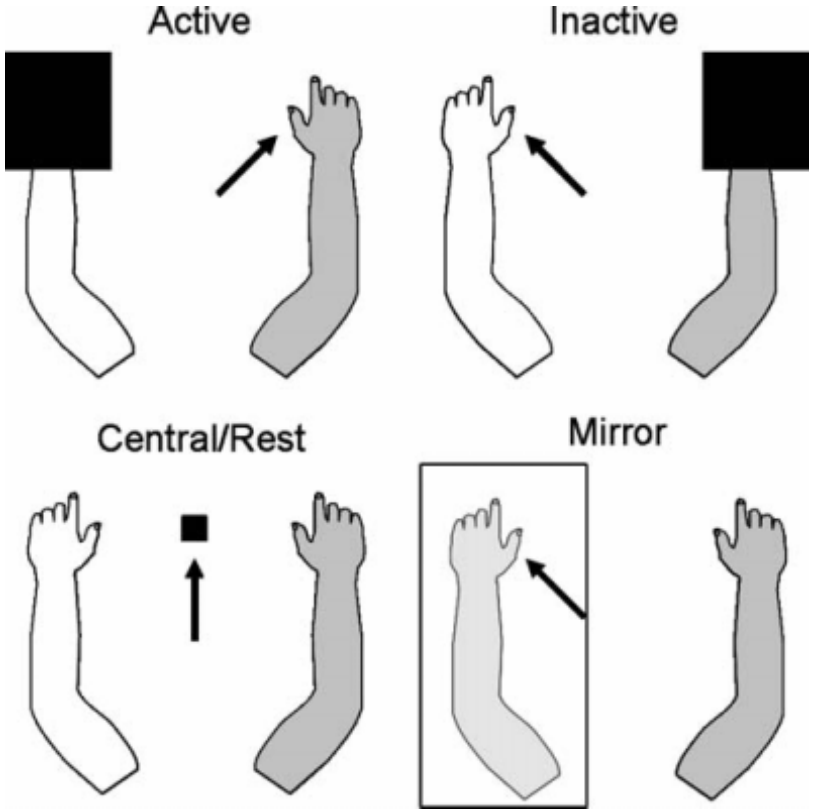
- Cortical reorganisation has been used to explain recovery of the damaged brain.
- Active movement training (AMT) such as constraint induced movement therapy (CIMT) prevents loss of the peri-infarct hand territory and can even force expansion into adjacent areas. CIMT overcome “ learned nonuse” results in cortical hand expansion and produces functional gains.
- **Mirror therapy**, by means of its repetition and frequency of treatment, need of attention enhance cortical reorganisation.

- the visual illusion that actions could be carried out by oneself normally— may prevent **learnt disuse** of the paretic limb.

- the mirror neuron system
- The mirror neurons (MN) are visuomotor neurons that are active during action observation, motor imagery and action execution. They are present in primates and possibly in human too.
- So that each time an individual sees an action done by another individual, neurons that represent that action are activated in the observer's premotor cortex.
- transforms visual information into knowledge.
- It is believed to be present bilaterally and in large portion of the parietal and premotor cortex.

Excitability of M1 ipsilateral to the moving hand was facilitated.

Fig. 1 Schematic illustration of the different viewing conditions when the right hand is the active hand (*gray*). MEPs were measured from the inactive (*white*) left hand. The *arrow* in each condition indicates where subjects were instructed to look



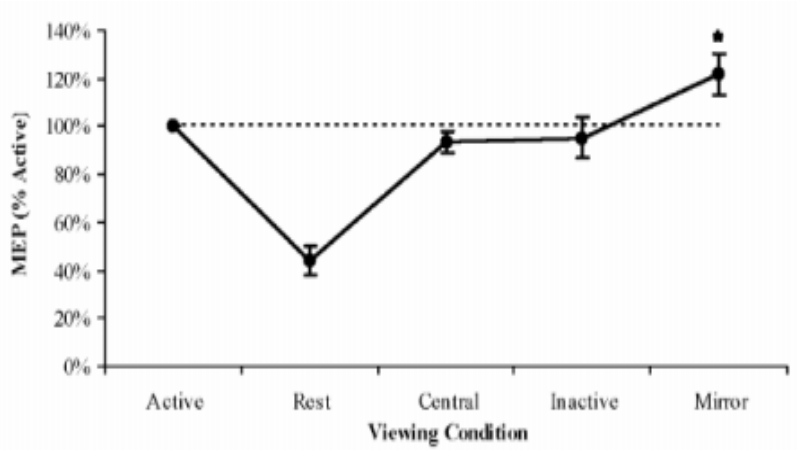


Fig. 2 Normalised MEP amplitude in each condition collapsed across the dominant and non-dominant hand. MEPs were significantly facilitated in all conditions relative to Rest ($P < 0.02$). MEPs in the Mirror condition were significantly facilitated compared with both the Inactive and Central conditions (*asterisks* denote $P < 0.05$)

Hemiplegic UL 1

- Lancet 1999: cross over study, N=9, chronic stroke,
- 4 weeks MT + 4 weeks CT, n=4; Vs
- 4 weeks CT + 4 weeks MT, n=5.
- Assessment by subjective comment form blinded neurologist or patient: change from baseline patient's movement ability in terms of ROM, speed and accuracy, using a scale form +3 to -3,
- More patients received MT showed +1 or +0.5 change, whereas control usually neutral change.

Hemiplegic UL 2

- Gunes Yavuzer and Serap Sutbeyaz 2008 Arch Phys Med Reh: mirror therapy improves UL motor performance in chronic stroke patient (within 12 months after stroke.)
- MT N=20,
- control N=20,
- 4 Weeks, standard Tx + 30 minutes MT: non paretic wrist finger flexion and extension, looks into mirror, + perform same movement in the paretic hand which was hidden from sight.

Mirror therapy

Contro. group

Table 3: Motor Recovery, Spasticity, and Hand-Related Functioning Scores of Patients at Baseline, Posttreatment, and Follow-Up (n=36)

Parameter	Group	Baseline	Posttreatment	Follow-Up	Δ (95% CI)	*P**
Brunnstrom stage (hand)						.001
	Mirror	2.6±0.8	3.5±1.3	4.0±1.4	1.5 (1.1–1.9)	
	Control	2.6±0.8	2.7±1.0	3.1±1.2	0.4 (0.1–0.8)	
Brunnstrom stage (UE)						.001
	Mirror	2.7±0.9	3.7±1.2	4.2±1.3	1.6 (1.3–1.9)	
	Control	2.7±0.8	2.8±0.9	3.0±1.1	0.3 (0.1–0.6)	
MAS score						.904
	Mirror	1.4±0.5	1.3±0.5	1.1±0.3	0.3 (0.0–0.6)	
	Control	1.7±0.6	1.6±0.6	1.4±0.5	0.3 (0.1–0.6)	
FIM self-care score						.001
	Mirror	23.7±7.0	28.9±10.0	32.0±9.5	8.3 (6.5–10.1)	
	Control	21.1±5.0	22.2±6.3	22.9±6.3	1.8 (0.3–3.2)	

NOTE. Values are mean ± SD.
Abbreviations: CI, confidence interval; Δ, mean change at follow-up from baseline.
*ANOVA for repeated measures.

Hemiplegia UL 5

- Christian Dohle Dec 2008 Neuroreh neural repair onlineFirst:
- N=48, subacute stroke <8 weeks
- 12 patients were lost from study:
-

	Transfer out to acute unit	Lack of cost approval by insurance	Medical worsening	Withdrawal of consent
CT	2	1	1	2
MT	1	4	0	1

- MT n=18
- CT n=18
- severe hemiparesis
- experimental group- mirror box: standard therapy + MT: 30 min per day, 5x a week for 6 weeks;
- control group- standard therapy + just view the unaffected arm, found:

Hemiplegic UL

- Result:
- 1. MT favours more improvement in finger motor function by FuglMeyer score, not significant (reach significance in subgroup of severe stroke),
- 2. light touch sensation improved, $p < 0.009$;
- 3.better performance in neglect tests (scoring method not validated), $p = 0.005$.
- Conclusion: MT improved only distal hand function and possibly improved neglect s/s.
- May be used for allowing patients of high severity: recovery of some distal function may allow patient to try CIMT.

Hemiplegic LL

- First RCT studied in 2007, Arch Phy and Med rehab
- Serap Sutbeyaz and Gunes Yavuzer
- 40 subjects: 20 control, 20 mirror therapy,
- subacute stroke after 3.7 months average,
- 30 min MT a day + standard therapy 2-5 hours/day, 5 days a week for 4 weeks.
- Improved Brunnstrom stages FIM score
- Asworth score or FAC (ambulatory measure) not improved. The complexity spasticity and gait may explain failure of response.

Table 2: Motor Recovery, Spasticity, Walking Ability, and Motor Functioning Scores of Patients at Pretreatment, Post-Treatment, and Follow-Up

Parameter	Group	Pretreatment	Post-Treatment	Follow-Up	Δ (95% CI)	*P*
Brunnstrom stages						.002
	Mirror	2.4±0.7	3.5±0.8	4.2±0.8	1.7 (1.2–2.1)	
	Control	2.5±1.0	3.0±0.7	3.4±0.8	0.8 (0.5–1.2)	
MAS						.102
	Mirror	2.6±0.5	2.3±0.5	1.8±0.7	0.8 (0.4–1.2)	
	Control	2.3±0.7	2.2±0.7	1.9±0.7	0.3 (0.1–0.7)	
FAC						.610
	Mirror	1.9±0.5	2.8±0.6	3.6±0.9	1.7 (1.2–2.1)	
	Control	2.0±0.7	2.9±0.7	3.5±0.9	1.5 (1.1–1.9)	
FIM motor						.001
	Mirror	48.3±5.5	65.9±4.8	69.9±5.9	21.4 (18.2–24.7)	
	Control	50.2±11.6	61.7±14.6	62.9±12.8	12.5 (9.6–14.8)	

NOTE. Values are mean ± SD. *P* values were obtained using analysis of variance for repeated measures.
Abbreviation: Δ, mean change at follow-up from baseline.

Conclusion

- 1. Ramachandran 2008: evidence for efficacy in mirror therapy in areas described came mostly from case reports.
- High quality RCT incorporates motor imagery indicated positive results, thus the role of MT in the overall effects not known.

Conclusion

- 2. Emerging evidence that the sensory and motor reorganization is not a hierarchy of organized autonomous modules, but a set of complex interacting networks that are in a state of dynamic equilibrium. The cortical motor system is well integrated with sensory cortical areas in the parietal lobe and cerebellum.
- An afferent sensory inflow is necessary to perform well coordinated movement.
- Means to improve sensory inputs could also be exploited in motor rehabilitation. Mirror therapy would well serves this purpose. >> further study

- 3. MT could be used in conjunction with other rehabilitation modality since it is easy to implement, less labor intensive than CIMT,
- can bring home and exercise as much as possible
- can practice in a pattern close to normal (normal hand moving thus normality perfect), and could be done intensively.

- 4. in pain conditions: due to low success rate of pain therapy, MT could be considered when conventional treatments failed.

- End of presentation

- Thank you for your attention

What patients say…

- “Very enjoyable” PLP
- Exclaimed with considerable surprise PLP
- Much to her surprise and amusement PLP
- This gives him a sense of enjoyment. PLP
- It is a blessing. CVA
- It looks like my bad arm is moving normally
- The mirror is the only one which exercises my brain and my nerves. CVA
- It looks like my bad arm is moving normally even though it was not. CVA
- The mirror reduces my pain every time I work with it. PLP

- I do not feel my hand at all. It feels as if it is would not belong to myself. … feel like plastic and strange. (CRPS1)
- It looks foreign to me, I have to use all my attention to move it. CRPS 1)

MT in hemiplegic arm- advantages

- 1. easy to implement, less labor intensive than CIMT
- 2. can bring home and exercise as much as possible
- 3. MT can incorporate bilateral arm training.
- 4. can practice in a pattern close to normal (normal hand moving thus normality perfect), and could be done intensively.

- So far no data on duration and timing of application after CVA, optimal time, dose of MT uncertain.
- for those with sensory loss, vision may compensate for absence of propioception sense, ? \\provide a way for patients with sensory loss who are among the most difficult to rehabilitate.

Hemiplegic UL-Pre-requisite ?

- Efficacy still a question
- Cognitively sound, able to understand verbal instruction, one study MMSE $\geq$ 24
- Trunkal strength and sitting balance (since pt need to sit in front of a desk)
- Still some minimal motor strength (C/W CIMT: wrist extension), Brunnstrom stages 1-4 recruited
- Sub-acute stroke (studies within 12 months), case study (6 years)
- Need to follow conventional rehab program, as most studies did ?
- To follow and then extend into home exercise program so as to prolong the duration of practice, how long?

Neuroscience –pain memory hypothesis

- The source of pain could be due to implicit pain memories- the pain memory hypothesis.
- Evidence: Pre-amputation pain is associated with PLP>>>it has been proposed that implicit pain memories established prior to amputation are powerful elicitor of the PLP. Because implicit pain memory may cause central changes related to nociceptive input that lead to subsequent altered processing to the SI system do not require changes in conscious processing of the pain experience. (patients with chronic LBP has increased representation zone in the SI cortex)

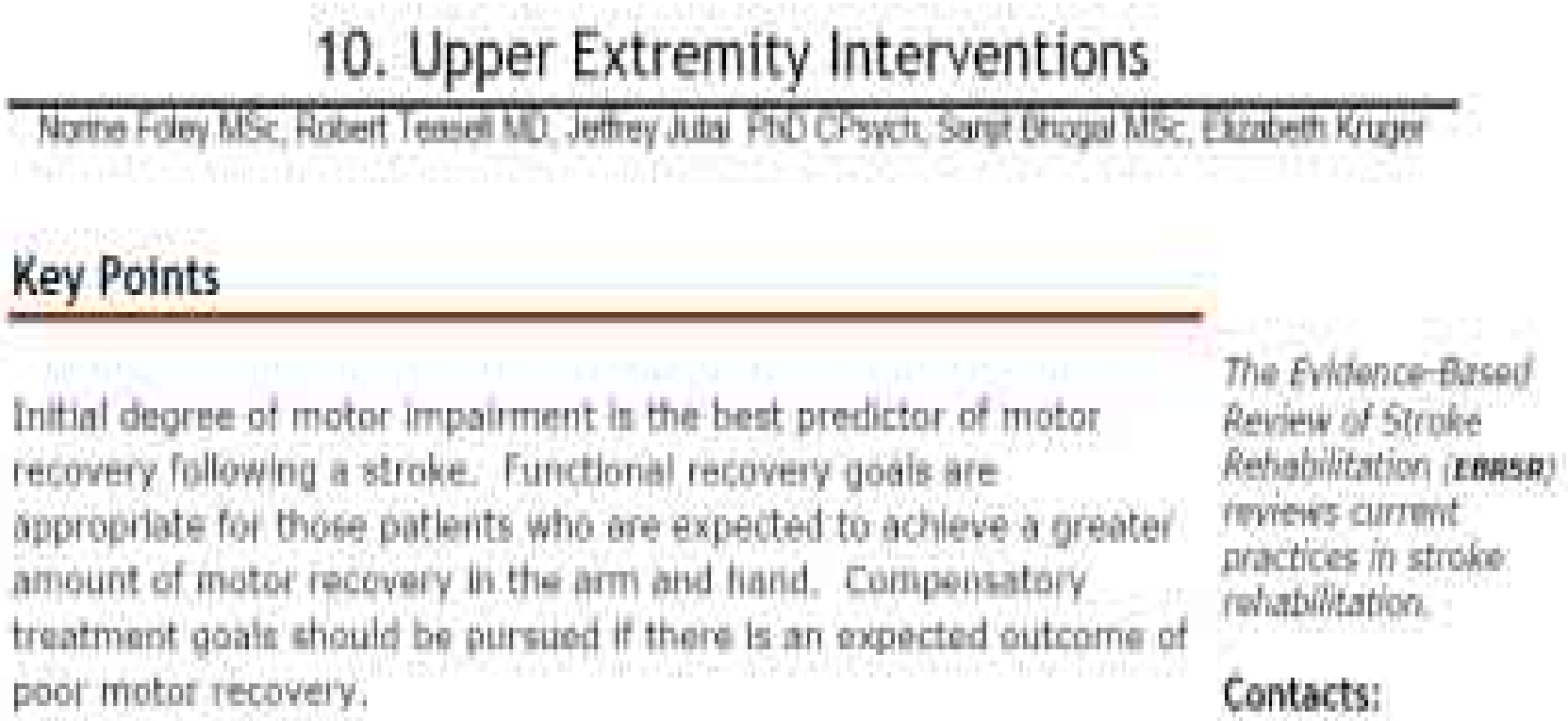
Neuroscience –pain memory hypothesis

- These long term changes at the central-cortical level may affect later processing of somatosensory input.
- And after deafferentation, an invasion of the amputation zone by the neighbouring inputs might preferentially activate neurons that code for pain.
- The cortical area that receives input the periphery seems to stay assigned to the original zone of input, activation in the cortical zone representing the amputated limb is referred to this limb and could be interpreted as PLS or PLP.

- This may explain pain in phantom limb and after limb surgery, or nerve injury, and usefulness of motor recoery after limb surgery.

Hemiplegic UL 4

- **Neurorehab and neural repair 2000**,
- *a case report* of chronic stroke (6 months), RUL power 4/5, profound pan-modal sensory loss including propioception, paresthesias, spasticity, incoordination,
- underwent MT with the affected “motor copy” the unaffected limb >> motor imagery>> CIMT like forced use in daily activity.
- Duration 3 months.
- Able to use the RUL in daily ADL without staring the limb, dystonia improved, ROM of shoulder, functional reach, time to complete simple task all improved.
- He himself served as a control.
- MT may have provided visual feedback . (again sensor-motor congruence reconciliation?!)



10. Upper Extremity Interventions

Norine Foley MSc, Robert Teasell MD, Jeffrey Jutai PhD CPsych, Sangt Bhogal MSc, Elizabeth Kruger

Key Points

Initial degree of motor impairment is the best predictor of motor recovery following a stroke. Functional recovery goals are appropriate for those patients who are expected to achieve a greater amount of motor recovery in the arm and hand. Compensatory treatment goals should be pursued if there is an expected outcome of poor motor recovery.

The Evidence-Based Review of Stroke Rehabilitation (EBRSR) reviews current practices in stroke rehabilitation.

Contacts:

- future directions of study:optimize RCT large scale; different modes of mirror therapy, time of delivery of MT, duration and frequency, combination with other modes of motor training which possibly is the trend in rehabilitation.

Table 1. Patient characteristics and the effect of the control and intervention phases on their pain at presentation; the frequency of mirror use on follow-up and final pain scores at 6 weeks with infra-red thermal temperature differences between affected and unaffected limbs

	At presentation						Follow-up								
							Frequency of mirror use (times per day) (duration of each treatment 10 min)						At 6 weeks		
			Control phase 1[a]		Control phase 2[a]	Intervention[a]	Week								
Subject, painful limb, age (yr), sex	Symptom duration	Mean temp difference painful – non-painful limb (°C)[b]	Pain VAS at rest	Pain VAS on movement	Pain VAS on movement	Pain VAS on movement	1	2	3	4	5	6	Pain VAS	Mean temp. diff. (°C)	Treatment duration (weeks)
1, LL, 39, F	6 weeks	1.1	8	8	8	2	8	3	3	3	2	0	0	0.2	6
2, LA, 38 F	3 weeks	2.0	7	8	8	3	4	4	3	3	2	0	0	0.4	6
3, LL, 34, F	8 weeks	2.7	6	8	8	2	9	4	3	0	0	0	0	0.8	4
4, RA, 35, F	9 months	1.9	8	9[c]	9[c]	9[c]	5	4	5	4	5	4	2[c]	0.3	6
5, RA, 48, M	1 yr	0.8	4	6	6	6	5	4	3	4	4	3	1	0.4	6
6, LL, 24, M	2 yr	1.4	7	8	8	8	5	5	5	0	0	0	8	1.3	Unresolved
7, LL 16, F	3 yr	n.d.[d]	4	5	5	5	4	4	0	0	0	0	5	n.d.	Unresolved
8, LL, 27, M	2 yr	2.1	7	8	8	8	4	4	0	0	0	0	8	2.8	Unresolved

LA, left arm; LL, left leg; RA, right arm; F, female; M, male; n.d., not done.
[a]Region of interest constant significant difference if > 0.4°C; [b]both limbs (no device); [c]painful limb hidden; [d]mirror visual feedback; [e]stillborn; [f]case 7 had widespread ulceration on her left leg, which made thermal imaging impossible.