



THE ETPP TOOLKIT FOR PRACTITIONERS

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End The Pain Project's ToolKit is a resource based up on recent break-throughs in Phantom Limb Pain therapy, a compilation of instructions, articles, internet links and a mirror box construction tutorial.

Successful outcomes requires commitment and active cooperation between your client and yourself. If your clients commit to a short-term procedure for approximately two 15-minute sessions a day for five weeks, they will join a growing number of other amputees reaping the reward of lifetime reduction or elimination of phantom limb pain.

Expectations differ among practitioners as to outcomes from Mirror Therapy. It is important to understand that Mirror Therapy is an experience to be explored, not a treatment to be applied to a clinical disorder. A common assumption is that the amputee is not going to be actively involved in the process. The actual goal is active participation by the client so that the process becomes a cooperative endeavor.

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HOW MIRROR THERAPY WORKS

Phantom limb pain occurs when the brain sends warning signals we call 'pain' through neurons to a limb that's no longer there. The mismatch between what the brain believes is there and what exists in consensus reality lies behind the pain.

A mirror reflection of the intact limb tricks the brain into "seeing" the amputated limb as an intact limb and the brain reprograms itself through this feedback so that the neurons stop misfiring. The brain regards this virtual reality stimulus of the mirror image as being real.

A brain may send signals that the phantom hand is painfully clenching. No signals can be sent back to the brain as with an intact arm. The brain continues to send out more messages, reinforcing the clenching pattern and its pain until the brain can be tricked, using a mirror image of the intact hand in motion. The loop is broken with the visual feedback and sensory-motor congruence is reestablished. The amputee feels this movement in the phantom hand and is able to unclench, leading to pain elimination.

Dedication to a four to five-week course of mirror therapy can result in the phantom pain being considerably reduced or even eliminated. Brain maps are remodeled and a new neural pathway created that overrides the sense of phantom limb pain. Pain can vanish forever even if sustained for many years prior to application of mirror therapy.

According to V. Ramachandran, upper limb amputees who experience phantom limb pain can also obtain relief in a surprisingly simple way, by watching someone else rub their hands together, using the same time schedule as for mirror therapy.

The procedure seems to fool the brain that it is the missing hand that is being massaged. Mirror neurons fire when a person performs an intentional action, such as waving, as well as when someone else is observed executing the same action. These neurons create a "virtual reality" simulation of the action in our minds, ordinarily useful to help us predict the intentions of others.

BRAIN MAPS & PLASTICITY

The brain contains a body schema utilizing diverse maps of the body surface.

The most important and accessible maps of the body are in an area called S1: The Somatosensory Cortex. As Matthias Weinberger, PT explains: it is these maps that other parts of the brain use to run a virtual reality program. They are the basic building block of our sensory perceptions or pre-perceptions.

If your brain wants to know how it would feel if you were to lift the arm straight up, It doesn't send an actual motor command to do this, it runs an internal virtual reality simulation of you lifting the arm. It can even anticipate the sensory feedback it would get from the receptors in your joints and muscles. These anticipatory sensory events are called "pre-sensations".

The brain relies so much on these pre-sensations that it often acts on them instead on what really is happening. "Online" sensory feedback is only checked occasionally. This is an important concept in treating chronic pain.

The brain can do every movement possible without actually having to do anything in real life. This saves huge amounts of energy and time and saving time is a key function of our brains.

Maps are hardwired early childhood experiences that refine the maps. These maps are plastic, changing constantly within certain genetic boundaries.

If one part of a body is often used, the part of the map that corresponds grows. Think violinists. One of their hand maps is huge. If they stop playing the maps shrink again. This has been shown for other forms of practiced movements too. This is a physical correlate of the motor skill learning process. Even meditation, is able to change your brain. Specific areas show remarkable differences between trained and untrained persons. Virtual reality simulation inside our brains is much more than a simple simulation. It actually is what the

brain sees as being the real thing, a weakness that we can exploit in treating chronic pain. The maps of the body are what the brain uses to run the virtual reality simulation.

Genetically every human body map has two hands and two feet, even if through some defect you are born with only one hand. The map still says there are two, and that is what the VR simulation represents. This is why people with one limb missing from birth still are able to feel a second "phantom" limb.

The brain doesn't care about reality since it regards the virtual reality simulation as being reality.

If those maps that form the basis for the VR program are plastic, what about them running amok? What happens when something goes wrong and those maps change in a maladaptive way? That's what happens in phantom limb pain, CRPS, chronic pain syndromes, anorexia, body image disorders, etc.

Let's have a look at phantom limb pain: here the real limb is amputated, but the map stays. Though it shrinks and adjacent map areas take over, there is always a representation of the limb present. The VR program is built on that. Watch someone who lost his arm slip. He still reaches out with his missing limb to steady himself.

Why? The VR program was built to enable us to react as fast as possible. If we didn't have something like it we could never regain balance. So it uses the basic blueprint, two arms and two legs when it comes to balance.

Maladaptive plasticity is most probably driven by these factors:

1) Lasting acute pain: pain demands attention and causes fear. Both are strong chemical reactions, probably accelerating learning in the map area, at a cost of course.

2) Reducing of computational demand: the brain adapts and learns the pain to free up resources in the periphery. Hence, "learned pain."

3) Favorable genetic disposition to develop chronic pain.

Regardless of what happens behind the scene, either a shrinking of the map or it's expansion, pain is the result.

The most notable difference is that in conditions where no input exists, the pain is often caused by clenching or spasms, whereas there is only pain and nothing else when the affected part is still there.

Some phantom limbs have pain from the stump or neuromas which appear to be phantom limb pains, but which will not respond to mirror therapy.

The stump or neuroma pain might create a contracture, but this type of contracture will not respond to mirror therapy. It is an overlap and a continuation of the stump or neuroma, which have to be treated with different interventions.

Does the phantom limb hurts the way it looks? If visual and kinetic representation are the same, it is usually phantom pain. Incongruity suggests stump pain and neuromas, etc.

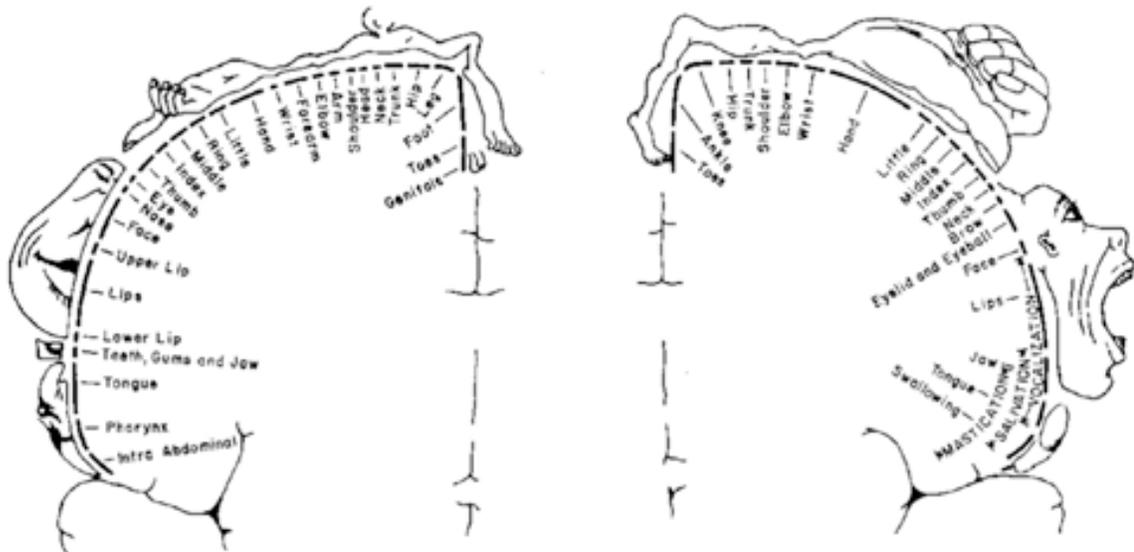
Why does pain occur? Well, the brain does an excellent job with the VR program. But there are times when it has to adjust the output that is produced by that program; this is especially true when we encounter new and unfamiliar situations.

Imagine having lived in the desert all your life and then encountering snow and ice for the first time. Your brain can't anticipate what's going to happen when you step onto that white surface. Having no experience with the new conditions, it constructs a motor command anyway and as feedback, checks the incoming sensory information on a regular basis.

What causes the maladaptive process in the first place? The best guess is that initial pain, a limb that hurts before amputation, is the single most important factor. The brain learns pain. Thats why

amputations performed on anesthetized limbs show much better outcomes than traumatic amputations.

There are three types of pain: a) remembered b) experiencing c) experienced or anticipated. Two-thirds of the pain can be eliminated by dealing with historical pain and anticipated pain.



Sensory (left) and Motor (right) Homunculi - Penfield and Boldrey, 1937.

Assessing the Phantom Limb

1. Is there remapping? It determines whether to use the mirror or not. as remapping indicates probable success with mirror therapy. There is much less success when remapping is not present. The hand/arm remaps to the face/neck and the foot/leg remaps to the genitals. In addition, remapping is sensory specific, i.e., wet, cold.

2. What does the phantom limb look like, the visual representation? You might want to ask, “How would your hand look if you draw the mental image?” This is different from how it feels, which is a kinetic representation. If visual and kinetic representation are the same, it is usually phantom pain. Does it hurt the way it looks? Incongruity suggests stump pain and neuromas

3. Responses:

a. Normal - looks like a mirror image of the intact hand. No representation of trauma on the phantom limb means nothing to heal.

b. Traumatized types:

1. Fixed point in time

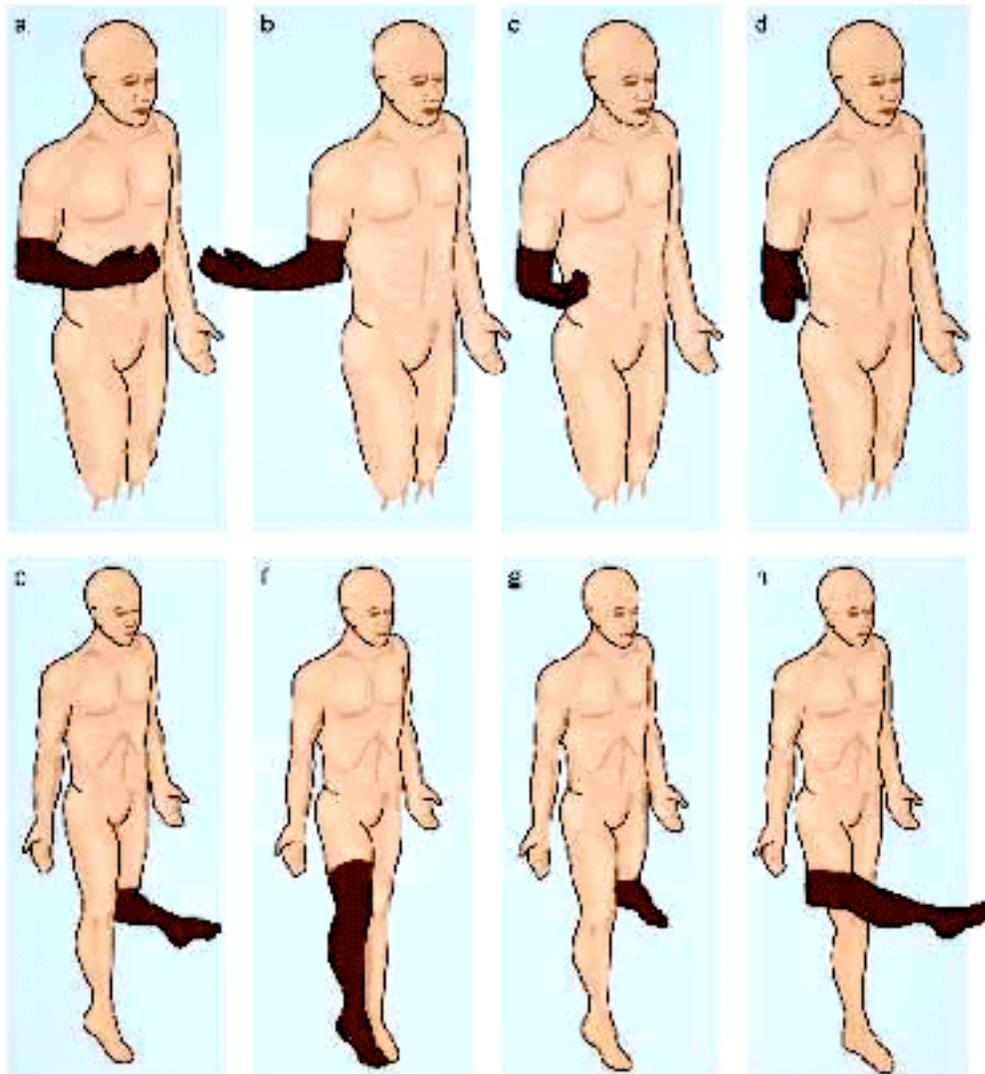
This is a snapshot of the limb at the point of massive trauma and is a worst case scenario. It could be a traumatized limb after the event or pre-amputation, such as a diabetic foot.

2. Fluid time

If the traumatized image is 'seen' in context of a hospital bed, the brain can heal over time.

3. Contracted

The pain felt in the phantom limb may come more from the contracture than from the trauma.



CONTRACTURES

Andrew T. Austin researched and addressed the issue of contractures, phantom limbs sensed as being in distorted positions and the necessity for positioning limbs so that they can move along with reflected images of intact limbs.

Can a phantom limb be moved by the amputee? Yes, but phantom limb movements are usually limited and cause pain. A phantom limb is capable of moving by itself, usually causing pain.

Most of the time a phantom limb is in an anatomical position, but in a contracture, the phantom arm may curl around towards the body with the tendons and ligaments stiffly pulled tight and up. It is

uncomfortable and painful. The problem originates in the head not the limb.

This distinction is important, because when we lose an upper limb, especially from the shoulder, there is no arm there. But, the brain might imagine that the phantom arm is contracted in an odd position. This makes it impossible for the amputee to insert the phantom arm into the mirror box or on the other side of the mirror.

The amputee sees the reflection only as a reflection because the sensory side of the brain says that the arm is folded under the elbow or behind the back, etc. If the contracture is not addressed, it may be a reason for a lack of success with mirror therapy.

Correcting Distorted Phantom Limbs for Successful Mirror Therapy

<http://www.youtube.com/watch?v=eK2M5GOvpOY>

Remapping a phantom arm:

SOLUTION #1:

1. The first question a practitioner might ask the amputee is “What position is the phantom arm in?”
2. If the phantom arm is in a contracted position, the practitioner has the amputee reproduce and continue to hold the exact same position of the phantom arm with the intact arm.
3. The practitioner begins by gently manipulating the fingers and hand of the intact arm. No abrupt pulling of the whole arm.
4. The practitioner asks the amputee to report back what is happening in the phantom arm as it is manipulated. Andrew T. Austin suggests that the phantom arm keep pace with the intact arm as the contraction is released. This releasing process usually takes about 45 minutes.
5. When the phantom limb is sensed as being in front of the amputee, mirror therapy can begin.

SOLUTION #2:

1. Wet q-tips and freeze them.
2. When the amputee’s cheek, side of neck or upper shoulder is touched with a frozen q-tip, it often is felt in the hand. The sensation in the phantom hand is often dismissed by the amputee when felt while washing or shaving the face because it is hard to describe or they think they might not be believed.

3. With the q-tip, map out where on the face, neck or shoulder, each corresponding part of the phantom hand is, based on feedback of sensation from the amputee. It is not an exact map but a leaking of sensory data.
4. A contracted, tight phantom hand can be unfurled by massaging each corresponding part of the face, neck or shoulder. The massage sends sensory messages to the phantom hand.
5. The rate of success using mirror therapy is close to 100% for a remapped phantom hand once the hand is eased and in the correct position is very high.

Remapping a phantom leg:

There is a significantly lower rate of success (10%) for a remapped phantom leg because legs are connected in the brain to the genitals. One reason for the lower rate of success is that people don't like to talk about sensations in their phantom leg when aroused.

However, it is possible for some practitioners to share the amputee's sense of where a contracted phantom limb is located. With feedback from the amputee and heightened sensory awareness on the part of the practitioner, the phantom limb can be brought to a position where the stump and connected phantom limb can be comfortably placed behind the mirror.

Assessments Prior To Mirror Therapy

1. Does the client have PTSD, a high impact, highly emotionally charged trauma? A PTSD element may not be obvious, but could be there without a high impact dramatic scenario. It could be spread over time, i.e., loss of circulation due to diabetes. Or it could be a rapid onset scenario leading to amputation and after-operation shock.

2. Other identifiers to consider

a. Sensations of Pain and Intensity

Ask client “where, when, type of pain and intensity”.

b. Dysmorphic Distress

Does the client have a change in body image? Amputee may be perceived differently because of this body change, though he/she may maintain a consistent internal sense of self. A practitioner’s pity, based on perceived dysmorphia, may set up barriers in the relationship.

c. Social Adaptation

How are other people adapting to the change in body identity? Is the client still a fully functioning human being? Carry the same self-worth? Beliefs may have to be addressed.

d. Depression/Anxiety

There may be secondary problems such as being housebound because the outside feels unsafe. There may be anxiety about the validity of experiencing a phantom limb and phantom limb pain

e. Prior Conditions

1. pre-existent psychological problems - esteem, confidence, neurosis.
2. pre-existent psychiatric problems - depression, psychosis.
3. pre-existent psycho-social problems - abusive relations, employment

Phases of a Session

From The Practitioner's Perspective

a. Assessment

b. Treatment of PTSD and related problems which can reduce level of the pain in itself.

c. Expectation Management

Expectations differ as to the outcome from a mirror treatment. A common level of expectation is that the amputee is not going to be actively involved. The goal is their active participation in the process.

d. Instruction as to thinking about the exercise, positioning for maximum illusion, starting the process.

e. Introduction to Mirror Therapy with minimal intervention after this point.

From The Client's Perspective

a. Expectation & Participation

There is a potential of mirror therapy being life changing or being one of the greatest disappointments in life, particularly if the pain has been present for years. These are reasons for taking time in the assessment phase to determine correct procedure.

b. Focus

A time of adjustments on part of the client who is watching the mirror. If the focus is not there, remove the mirror and return to the expectation management and instructions phase. It is necessary to get a correct mind set of exploration.

c. Reaction

This is often a verbal reaction to the mirror image when seen as the 'other' limb. There is often surprise or a semi shock which leads quickly to:

d. Emotional Reunion with Limb Image

This can be very dramatic. Crying may look like distress but is relief. The client may talk to the reunited limb. The client is not to be interrupted, no matter how long the phase takes. The client must go completely through the emotional state to reach relief and release.

e. Fascination Exploration loop

In the fascination stage, It may look like nothing is happening, but it is experiential and totally absorbing to the client. The client's whole being is engaged. This leads to exploration, where small adjustments are made and then possibly looping back to fascination, then to exploration and so on.

f. Fatigue

The client may report that they feel like they have been working out at a gym. They may feel totally drained. There seems to be a correlation between the level of fatigue and the depth of the emotional reunion with the mirror image limb. The client usually reports that he/she slept well that night.

MIRROR INSTRUCTIONS



- Remove all jewelry from the intact hand, i.e., rings, watches prior to using the mirror. This is to 'trick' the brain into believing that the mirror image is the intact other hand.
- To begin, have the client place the stump behind the mirror or within the mirror box and the intact hand in front of the mirror.
- Instruct the client to keep their eyes trained on the mirror image of the intact hand at all times.
- If the client experiences the phantom hand as a clenched fist, start the exercise with the client clenching the fist of the intact hand and releasing the clench very slowly.
- Guide the client into imagining and sensing that the phantom arm/hand is moving in exactly the same way as the mirror image at the same time.
- Other exercises might be squeezing and relaxing a sponge or a small rubber ball, raising and lowering fingers with palm flat on table, bringing the intact hand up and down on the table, repeating the movement every few seconds with eyes glued on the mirror.



- The same principles work to reduce or eliminate phantom limb pain affecting an amputated foot/leg. Contraction and release of the toes of the intact foot are continually watched in a long mirror placed between the legs. Have the client simultaneously imagine and sense these movements in the phantom foot/leg or rotate the intact foot from the ankle in both directions.
- Offer the client a arm/hand or leg/foot handout as a guide for home practice.
- For lasting results, Mirror Therapy should be practiced at least five times a week in two fifteen-minute sessions for five consecutive weeks.

MIRROR BOX CONSTRUCTION INSTRUCTIONS



You can make your own mirror box. All that is necessary is a box to hide the affected limb and a mirror.

For safety reasons, its best to obtain a good quality Acrylic mirror, not glass. It should measure at least 10 x 12 inches. It is important that the mirror not buckle, otherwise a distorted image will occur, similar to the convex and concave effects of a fun house mirror.

For a missing leg, a framed wall mirror measuring 48x24 inches is suggested instead of a box.

How to build a simple and inexpensive mirror box using a cardboard box, a mirror tile and scotch tape:

<http://www.youtube.com/watch?v=gHFOkVakRkw>

Complete folding mirror boxes/table-top tent

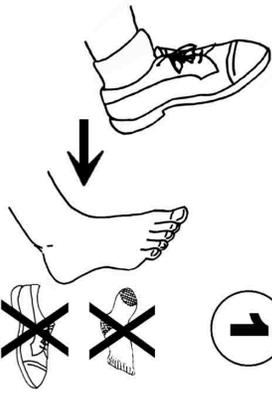
<http://reflexpainmanagement.com>

<http://endthepainproject.org>

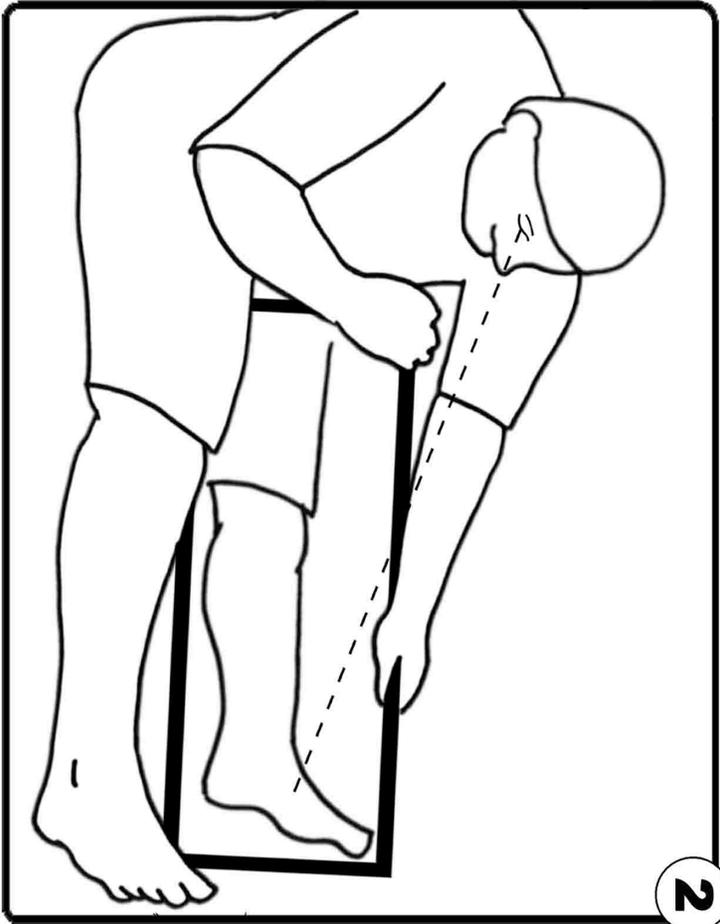


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 Dedicated to Global Reduction of Phantom Limb Suffering for Amputees
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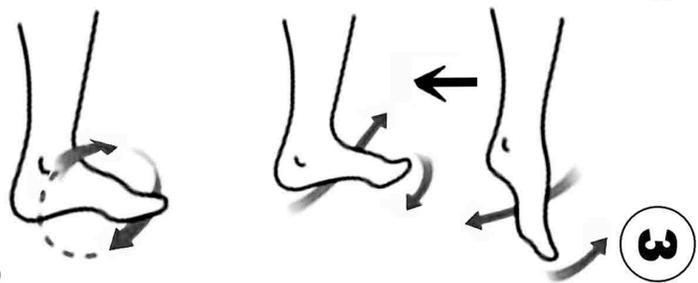
How to Stop Pain in your Missing Leg and Foot



1



2



3

15 minutes x2
15 _____ **x2**

1 month
1 _____

4	5	6	7	8	1	2	3
11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26
27	28	29	30	31			
26	27	28	29	30			

INTERNET LINKS

Links to Phantom Limb Pain Articles

- *The Itch* by Dr. Atul Gawande
http://www.newyorker.com/reporting/2008/06/30/080630fa_fact_gawande
- Walter Reed Hospital Mirror Box Trials
content.nejm.org/cgi/content/full/357/21/2206
- Virtual Massage
www.newscientist.com/article/dn13493-virtual-massagecan-relieve-amputees-phantom-limb-pain.html

Links to Phantom Pain/Mirror Therapy Videos

- www.youtube.com/watch?v=sq6u4XVrr58
- www.23npeople.com/brain/phantom_limb_pain_treatment.html
- www.youtube.com/watch?v=YL_6OMPwnQ
- www.Youtu.be/pYTSdwWg914
- www.youtube.com/user/coexistence100
- <http://www.neurotopian.blogspot.com/search/label/English>

Link to Progressive Relaxation Hypnotherapy Video

- www.youtube.com/watch?v=mD1I8ccMsi0

Link to Farabloc electromagnetic shielding fabric

- www.farabloc.com/

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- We value your feedback. What pain-relieving techniques work for you? How do you encounter obstacles? Please share your experiences on our blog to encourage others to use these simple but effective techniques: <http://endthepainprojectupdate.blogspot.com>

Please feel free to contact us at: info@endthepainproject.org