“Sensory re-education” after nerve repair

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What happens when a nerve is repaired?

After a nerve repair sensibility and muscle function in parts of the hand are lost, and intolerance to cold is common.

After the surgery when the nerve sheath is repaired new nerve axons grow into the skin and the muscles. Hypersensitivity to light touch is normal during this growth period but can be influenced by so-called desensitisation when the skin gradually gets used to normal touch again.

It takes a long time for the nerve to grow, approximately 1 mm per day. The result is a new sensibility that you have to learn to interpret. We say that the hand ”speaks a new language to the brain”.

The brain has a detailed map of the body where touch is registered and interpreted. Touch from the right hand is mainly processed in the left part of the brain, but both halves of the brain are active during perception of touch. All our senses cooperate when we touch something, and vision and hearing for example can help to strengthen touch.

A repaired nerve means that the brain programme for interpretation of touch input for a period of time is silent since there is no or very little sensibility in the hand (phase 1). During this period the handmap in the brain is also rapidly ”occupied” by adjacent areas and is changed. When the new axons have grown to the skin, and to the muscles, the map is again changed since the axons don’t grow in exactly the same paths as before the injury. The handmap becomes unstructured, and the sensibility during this time is not very useful. You need to use vision to understand what the hand is touching (phase 2).

This functional reorganisation of the brain is a natural process and depends on the brain´s capacity to adapt when the body sends new signals.
Why is it necessary to do sensory re-education exercises?

With structured training you can learn to understand the new "language" from the hand. With no training at all the result can be that the simplest touch feels strange. Control over the sensory input gives a better grip function and makes it easier to use the hand in daily activities.

The principles of sensory re-education after median nerve repair. (a) gives a schematic illustration of the “handmap” in an uninjured person touching a marble. After nerve transection and a regrowth of nerve fibres the map is altered due to misdirected nerve fibres and following functional reorganisation (b). By combining visual and sensory information together the brain learns to understand the “new language” from the hand (c+d).
Sensory re-education and sensory re-learning

You and your therapist compose a training programme to improve the functional sensibility based on how much the nerve has grown.

The exercises should be done for a few minutes several times per day. Make sure you are in a quiet and comfortable place where you can concentrate.

Training in phase 1

In phase 1 the hand is without sensibility and the handmap in the brain has disappeared. This phase lasts up to three months after an injury at wrist level and encompasses the period direct after surgery until some growing axons have reached the palm of the hand.

During this phase you have no protective sensibility and it is important to carefully watch the hand when you use it to prevent skin injuries.

The sensory re-learning in this early phase, in combination with training of the mobility of the hand, is aimed at activating and maintaining the hand map in the brain to make the sensory re-learning easier once the axons have regrown. This is done by giving the brain an illusion of sensibility in the hand.

The training:

When you see someone else touch things, think about how such touch normally feels.

By touching the areas in the hand that have no sensibility in combination with concentrated watching, the handmap in the brain is activated. This is repeated several times per day.

You can for example ask someone else to touch the fingers without sensibility and corresponding fingers on the other hand simultaneously while you watch carefully (picture 1).

You can also touch the fingers without sensibility yourself using the corresponding fingers of the other hand (picture 2).
Another way is to use a mirror (picture 3) positioned so you can see your uninjured hand in the mirror looking like the injured hand. In this way you create an illusion that means that the brain thinks there is activity in the injured hand.

You can also use other senses to substitute for sensibility in phase 1, for example hearing using a so called Sensor Glove with small microphones that pick up the friction-sounds during touch (picture 4).
Training in phase 2

In phase 2 the axons have reached the hand and the hand map in the brain has a changed pattern. This is approximately three months after a repair at wrist level and you have some sensibility in the palm. This means that it is time to start training with phase 2 exercises.

The training:

To localise touch touch your skin in one of the areas marked in the picture on the next page with a blunt object e.g. a pen. Press or move the object hard enough for you to perceive the touch. Compare to an area where you have normal sensibility. Concentrate on WHERE, WHAT and HOW you feel the touch. Is it in the area where you touch or somewhere else? Is it static or moving touch? Does it feel different from the area with normal sensibility?

Repeat the touch, first with your eyes open and then with your eyes closed until you feel you know the location and character of the touch.
Work on a few areas first until you are sure that you can localize the touch correctly. Then move to adjacent areas.

Get someone else to apply the stimulus to ensure that you really are able to identify where and what you feel.
When you have some protective sensibility in the fingertips it is time to start exercises to relearn to differentiate between different textures and shapes and to identify objects. Use the same principles as for the localisation exercises. Repeat the touch, first with your eyes open and then with your eyes closed until you feel you know what kind of stimulus it is.

One way to strengthen the effect of the sensory re-education is temporary cutaneous forearm anaesthesia with an anaesthetic cream. This area is hereby vacant in the body map in the brain for some hours and can during this time be used by the hand during sensory re-learning. This is done repeatedly with help of your therapist during a period in combination with intensive sensory re-education.

**Examples of how the training can be performed:**

1. Touch a hidden texture/shape/object and try to identify it.
2. Touch a copy of the texture/shape/object with the uninjured hand and the hidden object with the injured hand at the same time and compare the feeling.
3. Was it correct? If not or if it was too difficult - touch and watch at the same time.
4. Using a modified Rubik’s cube several different patterns can be created as you turn the elements of the cube.
5. Combine identical shapes/textures/objects.
6. Carry a few objects in your pocket and try to identify them – and think about their shape, texture, weight and which object you are touching.

Use all your senses to strengthen the feeling of touch. For example when you eat a fruit think not only about its taste, but also the smell, colour and how the structure feels.

“The tactile meal!”
It will help you re-educate the sensibility in your hand if you make it a rule to try to feel the structure and shape of everyday objects.

Concentrate on what you feel, and e.g. is it a soft or hard object, with sharp or blunt edges, what is its shape, size and texture?
During the rehabilitation regularly follow-ups are done to see how sensibility and hand function improve and to upgrade your sensory re-education programme.

The sensory and motor recovery after a nerve repair takes long time, and with active use of the hand and training, improvements can be seen several years after the injury.

If you have any questions your occupational therapist will be happy to assist.

GOOD LUCK

with your sensory re-education programme
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