

A black and white photograph of a man in a white short-sleeved button-down shirt cooking in a kitchen. He is standing at a stove, stirring a pan with a white spatula. He has a prosthetic left arm. The kitchen features a large stainless steel range hood, a sink with a faucet, and various kitchen items like a coffee machine, a bowl of fruit, and a stack of plates. The overall scene is bright and clean.

ottobock.

Targeted Muscle Reinnervation

Innovative fitting solution in upper limb prosthetics

Quality for life

User Information

Targeted Muscle Reinnervation (TMR)

Selective nerve transfer for the intuitive control of arm prostheses

After a successful TMR fitting, including an appropriate training, the user is able to move the hand, the wrist, and the elbow simultaneously

Targeted muscle reinnervation (TMR) describes an established treatment method after amputation of the upper arm or shoulder disarticulation. Movements of arm prostheses are usually controlled with two muscle signals. This is very time-consuming.

After a TMR fitting, you can control your prosthesis with up to six different thoughts of natural movements. E.g. When thinking about „closing the hand“ or „making a fist“, the related muscle is activated and the corresponding signal closes the prosthetic hand. Several movements can be performed simultaneously, quickly and intuitively.

The surgery:

connecting to a new muscle

Controlling the prosthesis with the nerves of a lost arm, which are initially responsible for moving fingers, hand and elbow, requires a surgery. This surgical method is called Targeted Muscle Reinnervation, short TMR.

In this selective nerve transfer, the intact arm nerves are reconnected to the muscles of the residual stump, breast or back. During the healing process, the nerves grow back in the new muscles.

A complex motor training during the following rehabilitation enables you to selectively activate the new innervated muscles in an adequate way. The result is up to 6 independent muscle signals and an improved way of controlling the prosthesis.

Controlling the prosthesis

For optimally using your arm prosthesis in everyday life, an intense coordinative and neuromuscular training, first without, later with prosthesis is necessary. The therapy training has especially been developed for TMR user.

The TMR prosthesis can only be used, after the nerves completely grew in and the muscles can be adequately activated.

Your movement options as a TMR user

The active functions of your prosthesis are:

- open/close hand
- rotate wrist inwards/outwards
- bend/extend elbow

After a TMR fitting, all the functions mentioned above can be controlled simultaneously and you are able to perform movements faster and more intuitively.

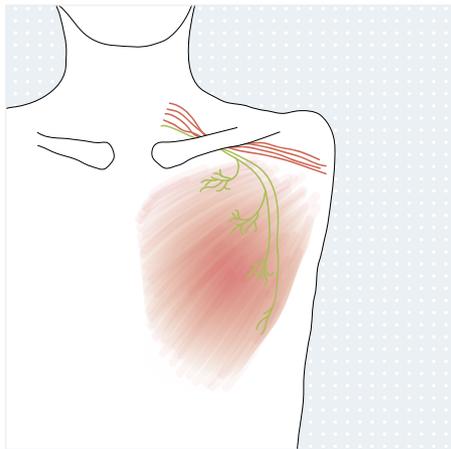
Depending on the amputation level, the following passive movements are possible:

- Move shoulder joint
- Bend/extend wrist



The selective transfer of remaining arm nerves to other muscles is called Targeted Muscle Reinnervation (TMR).

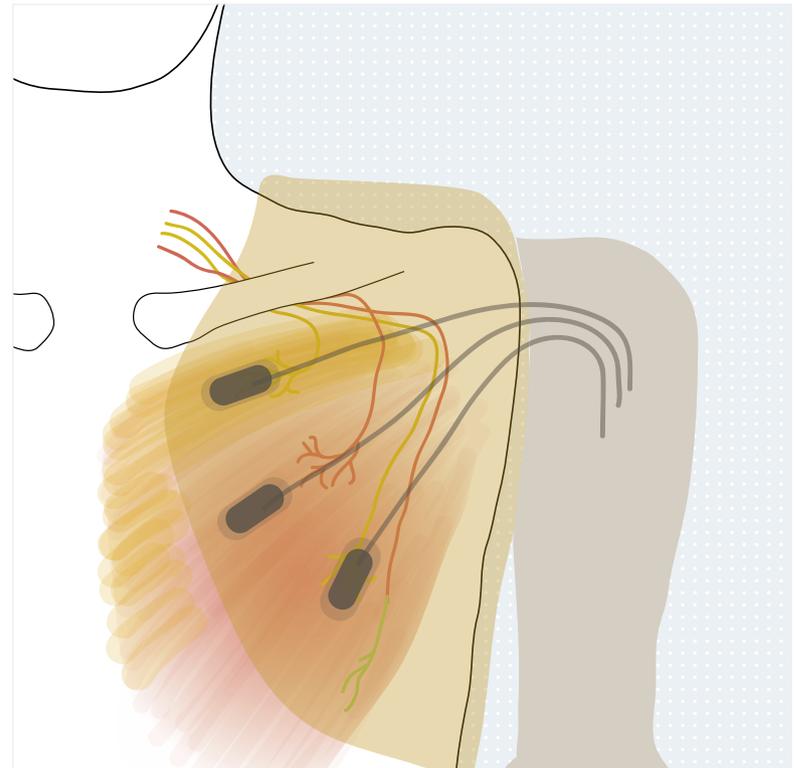
Anatomy before surgery



Nerve transfer after TMR surgery



Prosthetic control through EMG signals



Your advantages

TMR-prosthesis (DynamicArm Plus)

Control using up to 6 muscles (6 electrodes)

Up to six different thoughts control one movement of the prosthesis

Each of the 6 involved muscles controls one of the 6 prosthesis movements:

- Simultaneous control of several movements
- Faster execution of movement combinations
- Easy, intuitive prosthesis control

Natural and intuitive movement pattern

Neuroma pain is treated or prevented. Neuroma formation is counteracted by the transfer of the nerves.

Wearing a myoelectric prosthesis can reduce phantom pain.

A TMR operation can lead to a further reduction of phantom pain.

Conventional myoelectric prosthesis (Dynamic Arm)

Control using 2 muscles (2 electrodes)

The prosthesis is always controlled by two signals.

Two muscles control 6 possible prosthesis movements:

- Movements are executed one after another
- The user has to switch to the desired joint (e.g. by briefly tensing both muscles)
- Prosthesis movements are sequential, resulting in the delayed execution of complex movement sequences

Wearing a myoelectric prosthesis can reduce phantom pain.



TMR Treatment process

Please consider: the process described below is an example for a prosthetic fitting. Individual changes from this example are possible.

A successful fitting with a TMR prosthesis means a significant gain in quality of life. You are eligible for a TMR fitting if you:

- have an amputation of the upper arm or shoulder
- suffer from neuroma and/or phantom limb pain
- reported need for a TMR prosthesis
- fulfill the physical and mental requirements (assessed by a medical team)
- have the strong will to commit to the extended rehab process of (approx. 2 years)
- have the willingness to travel; TMR fittings are only possible in special centers.
- are experienced with myoelectrical prosthesis (no must)

1. Assessment

A clinical assessment, including functional tests, provides information on your physical and mental status.

2. Therapy

You will be prepared for TMR surgery.

3. Surgery

Selective transfer of the residual arm nerves to other target muscles.

4. Post-operatives Training

You receive a special rehabilitation program, which is adapted to your reinnervation process.

5. Signal Training

The specific intended movement and the optimum electrode position are defined for each reinnervated muscle.

6. Production

Fabrication of various trial versions as well as final TMR prosthesis according to rehab procedure.

7. Fitting

You are fitted with the final TMR prosthesis with up to six electrodes, embedded in the socket.

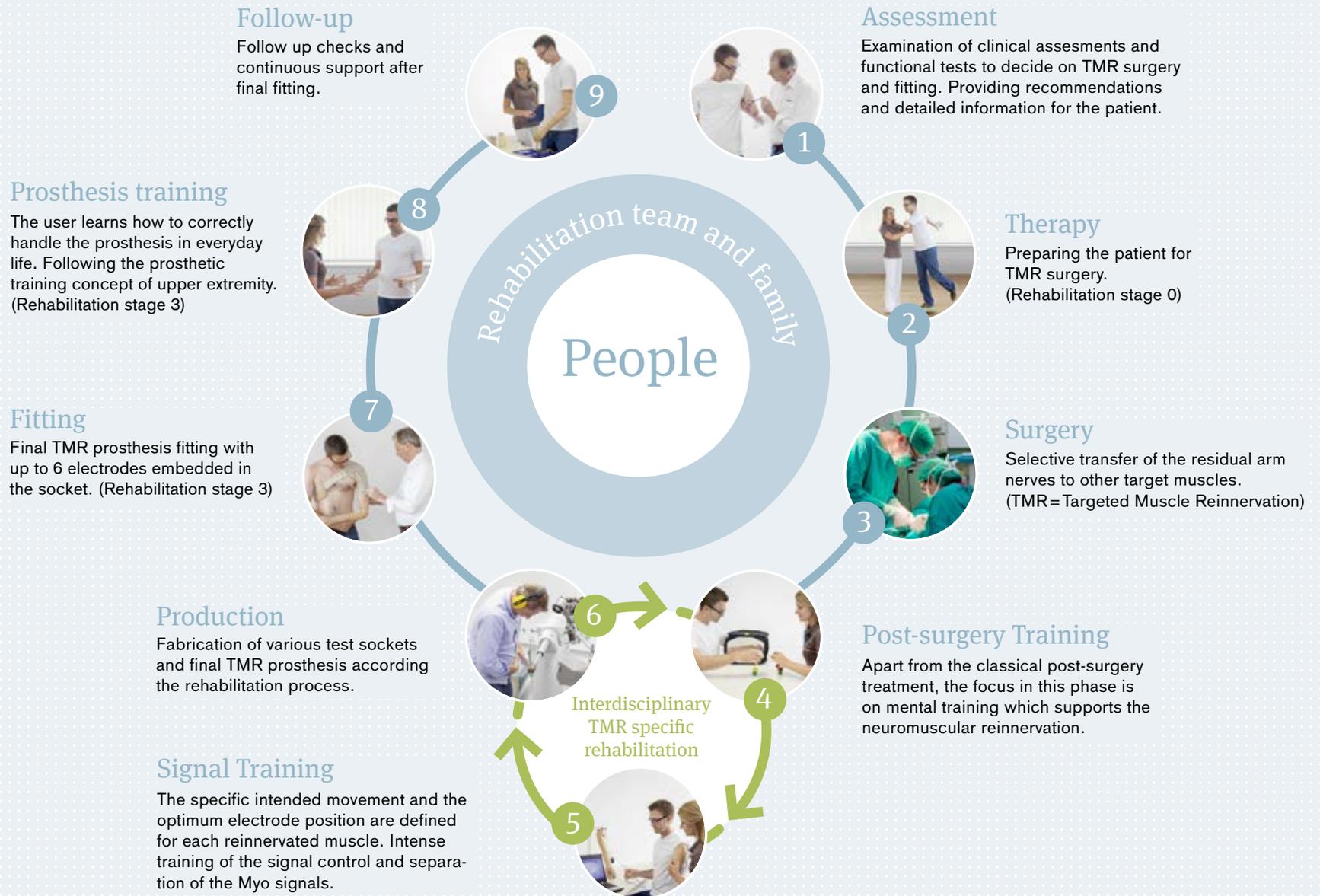
8. Prosthesis training

You will learn to properly handle the prosthesis in everyday life according to upper limb concept.

9. Follow-up

Follow up examinations and continuous support after the final fitting.

TMR Treatment Cycle



Contact and initial information

A TMR fitting is a complex process, which is exclusively performed and accompanied by selected specialists.
Please contact us under: tmr@ottobock.com

www.ottobock.com