C. A. R. E. - Centre for Advanced Reconstruction of Extremities

TREATMENT WITH BONE-ANCHORED PROSTHESES FOR INDIVIDUALS WITH UPPER-LIMB AMPUTATION

Sahlgrenska University Hospital/ Mölndal Hospital
**BACKGROUND**

Treatment with direct bone-anchored prosthesis means that the prosthesis is attached without a socket. The method is based on the principle of osseointegration and has been used for the treatment of amputation since 1990.

Osseointegration means, the formation of a direct interface between an implant and bone, and provides a solid anchorage.

The direct connection of the prosthesis to the bone is made possible by inserting a titanium screw into the skeleton that will integrate with the living bone.

![Diagram of amputee prosthesis](image1)

Osseointegration treatment can be used for a) transhumeral-, b) transradial- and c) thumb and finger amputees.
ADVANTAGES

Many upper-limb amputees experience problems with conventional socket prostheses. Socket prostheses often restrict mobility and do not always fulfil the demands relating to stability, comfort and functionality.

These may be reasons for using the prosthesis less often or even lead to its abandonment. Many individuals experience problems with heat and sweat in the socket or develop blisters, pressure sores or eczema.

A socket prosthesis also frequently restricts the mobility of the adjacent joint, e.g. the elbow joint after transradial (below elbow) and the shoulder joint after transhumeral (above elbow) amputation. To ensure a good anchorage over elbow level, a shoulder harness is often used. The harness goes over the opposite shoulder, which can be both uncomfortable and sweaty, as well as limiting the range of motion in a healthy arm.

FOR WHOM

- Transhumeral, transradial, thumb or finger amputation
- Adequate skeleton condition in the residual limb
- Problems to be experienced with the conventional socket

This treatment is not suitable:

- For children
- If the amputation is due to vascular disease or diabetes
- During pregnancy
- For smokers
IF YOU ARE TRANSHUMERAL AMPUTEE

The treatment involves two surgeries with approximately three month interval.

At the first operation, S1, a specially designed titanium screw called fixture is inserted into the residual bone. The skin is closed, and the bone is then allowed to heal around the fixture for three months with no load. As soon as the surgical wound has healed, it is usually possible to use a standard socket prosthesis during this period.

At the second procedure, S2, an extension called abutment is attached to the end of the fixture. The first operation generally requires five to seven days in hospital, while the second involves a stay of about 5 days.

The overall length of the treatment, including operations, rehabilitation and prosthesis provision, is estimated at around 9 months for patients with normal bone quality.

Transhumeral amputee using the training prosthesis.
Transhumeral amputee using his definitive prosthesis.
IF YOU ARE TRANSRADIAL AMPUTEE

The treatment involves two surgeries with approximately three month interval.

At the first operation, S1, the specially designed titanium screws called *fixtures* are inserted into residual bones. The skin is closed, and the bone is then allowed to heal into around the fixtures for three months with no load. As soon as the surgical wound has healed, it is usually possible to use a standard socket prosthesis during this period.

At the second procedure, S2, extensions called *abutments* are attached to the ends of the fixtures. The first operation generally requires five to seven days in hospital, while the second involves a stay of about 5 days.

The overall length of the treatment, including operations, rehabilitation and prosthesis provision, is estimated at around 9 months for patients with normal bone quality.

![Transradial amputee treated with the osseointegrated prosthesis.](image)

a) with prosthesis   b) without prosthesis.
Transradial amputees using their osseointegrated prosthesis.
IF YOU ARE THUMB/ FINGER AMPUTEE

A thumb amputation significantly impairs hand function. Taking a large grip and a pinch grip can be difficult, with limited functionality as a result. To provide a conventional thumb prosthesis which gives both good function and cosmetics is challenging. An opposition-prosthesis/ orthosis or a surgical procedure, such as a toe-to-thumb transplantation or an extension of the thumb bone, can sometimes be a solution. None of these options overcomes the appearance of a lost thumb or provides maximum grip.

An example of osseointegrated thumb prosthesis. a) with the prosthesis showing the attachment b) patient without the prosthesis
The treatment involves two surgeries with approximately three month interval. Under certain conditions, such as good bone quality, thumb and finger amputation treatment can be performed in one operation rather than two.

At the first operation, S1, a specially designed titanium screw called fixture is inserted into the residual bone. The skin is closed, and the bone is then allowed to heal around the fixture for four to five months with no load. As soon as the surgical wound has healed during this period, it is usually possible to use a standard socket prosthesis.

At the second procedure, S2, an extension called abutment is attached to the end of the fixture. The first operation generally requires two days in hospital, and the second involves a stay of about two days.

The overall length of the treatment, including operations, rehabilitation and prosthesis provision, is estimated at around 6 months for patients with normal bone quality.
Patient using an osseointegrated thumb prosthesis during daily activities.
TREATMENT PROCEDURE
An overview of the treatment process. Individual variations may occur.

### Operation Seans 1
- 3–5 days hospitalisation
- Socket prosthesis can be used again after 6 weeks
- Gentle motions and strengthening exercise is allowed
- End bearing in the socket should be avoided!

### Operation Seans 2
- 3 months after Seans 1
- 5 days hospitalisation
- Possible extra visit to check healing process

### 3 weeks after surgery Seans 2
- Follow-up with medical team
- Transhumeral- weight-training with short training prosthesis
- Transradial- No short training prosthesis. Cosmetic or lightweight myoelectric prosthesis suggested
- Thumb- No short training prosthesis. Final prosthesis received

### 12 weeks after Seans 2
- Follow-up with medical team
- Rehabilitation starts using long prosthesis
- Transhumeral- full length prosthesis. Start with cosmetic type or light myoelectric. Standardised prosthetic training
- Transradial- switch to myoelectric hand or multifunctional prosthesis. Final prosthesis received
- Thumb- check-up visit

### 6 months after Seans 2
- X-ray
- Follow-up with medical team
- Transhumeral- Final prosthesis received

### 1 year after Seans 2
- X-ray
- Follow-up with medical team

### 2 years after Seans 2
- X-ray
- Follow-up with medical team

### Continued follow-ups
- 3, 5, 7, 10, 15, 20 and 25 years after Seans 2, including X-ray examination
SKIN PENETRATION AREA

The abutment protrudes from the skin penetration area and serves as an attachment for the prosthesis.

In the same way that it is important to brush your teeth in the morning and evening, the skin penetration area must be cleaned twice a day.

THE PROSTHESIS

The components are more or less the same as they would be with a socket prosthesis, but some of them may be less suitable.

At the attachment of the prosthesis, there is special connection elements that constitute the bracket between the extending abutment and the external prosthesis.

The prosthesis is pushed into place and locked there with a locking arm or allen key. It is quick and easy to attach/detach the prosthesis.
**COMPLICATIONS**

As with all surgical treatment, there is a risk of complications that can alter the treatment or compromise the results.

Superficial infections at the skin penetration area are not uncommon. They can normally be treated with careful cleaning, although antibiotics may be required. More serious complications, such as the loosening of fixtures due to insufficient osseointegration or deep infection, fracture of the abutment, fixture or bone fracture, can occur.

**WHERE TREATMENT TAKES PLACE**

All surgeries are performed at Centre for Advanced Reconstruction of Extremities (C.A.R.E.) Sahlgrenska University Hospital/Mölndal.

Once the treatment is completed, continued medical check-ups are made at C.A.R.E.

Instructions on movement and load training are given by the occupational therapist in conjunction with surgery and during visits to C.A.R.E. Most of the training is done at home with regular check-ups at the Rehabilitation Centre for Upper Limb Prosthetics.

Prosthesis provision take place at the Department of Prosthetics and Orthotics in co-operation with the patient’s local health service. Common prosthetic service procedures can often be performed locally, but the continued service of the prosthesis is sometimes necessary at the Department of Prosthetics and Orthotics in Gothenburg.
Before a decision can be taken if the treatment is suitable for you, you will be invited to our outpatient clinic at C.A.R.E. Sahlgrenska University Hospital/Mölndal for a team assessment. At the team assessment you will meet the whole team, be provided with information about the treatment and we will try to arrange a meeting with an already treated patient.

What is needed for team assessment?

In order to investigate whether treatment with bone anchored prosthesis is suitable, you need to complete a questionnaire. For further information, please contact us at careinfo@vgregion.se

All applications and financial matters relating to foreign nationals are administered by Sahlgrenska International Care. For a cost estimation, please contact Sahlgrenska I.C. at info@sahlgrenskaic.com
**Coordinator C.A.R.E.**

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Reception and ward 233
Elevator T1, 5th floor

X-ray is located at the main entrance behind the escalator