Royal Free London
NHS Foundation Trust

Osseointegration for reconstruction

Information for patients

This leaflet provides information about the use of a technique called osseointegration for reconstruction of specific parts of your body (e.g., after loss of an eye or an ear). If you would like further information about this type of treatment, and/or if you have any queries about your eligibility for this treatment, please ask your nurse or doctor.

What is the difference between prosthetic and autologous reconstruction?

When part of the body is missing or malformed (e.g., congenital) or has been lost due to injury or disease, it is sometimes possible to reconstruct the missing parts. Whenever possible, plastic surgeons try to use the patient's own tissues for the reconstruction. Using your own tissues is called an 'autologous' reconstruction.

If the missing parts are too large (e.g., a whole leg or arm) or too complex (e.g., a missing eye), then one alternative is to replace the part with artificial (i.e., prosthetic) materials. Almost any part of the body can be replaced with an artificial alternative, although the ability of the prosthesis to mimic the function and appearance of the missing part can vary enormously.

How is a prosthesis attached to the body?

There are many different ways in which a prosthesis can be attached to the body including:

- Glues – for smaller prosthetics such as parts of the face, ears, noses, and eyes
- Spectacles – for parts of the face, eyes, and noses
- Sockets and straps – for limbs
- Bone-anchors (also known as osseointegrated implants) – for all types of prosthetics

Each of these techniques for securing a prosthesis has different advantages and disadvantages.

What is osseointegration?

Osseointegration is a description for the way in which certain materials are accepted by the bone as part of itself rather than as a foreign body. Once an implant is osseointegrated, it will not easily loosen and can then be used as a permanent anchor-point to which a prosthesis can then be fixed.

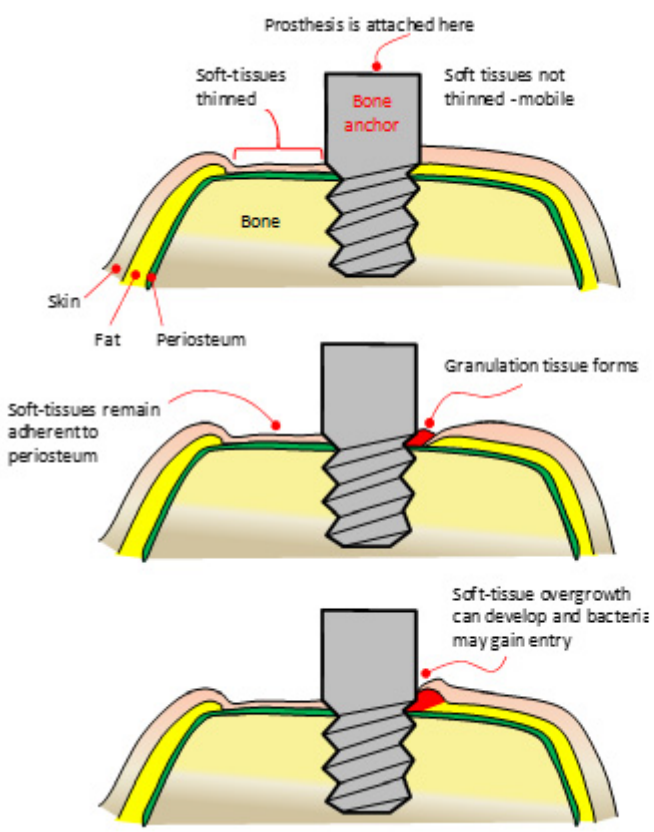
Only titanium or titanium-containing alloys can become integrated into the bone in this way. Once it is fixed securely in the bone, the implant is then referred to as an osseointegrated bone-anchor.

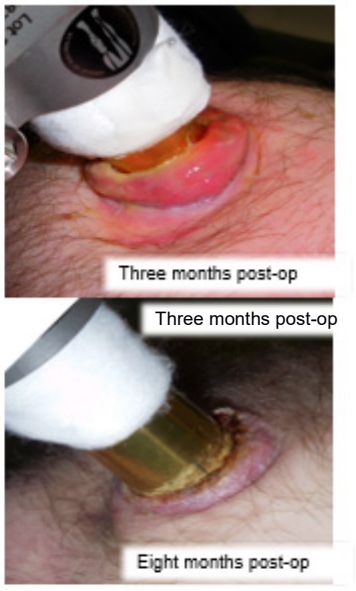
How can an osseointegrated bone-anchor be used to secure a prosthesis?

For osseointegration to work, part of the implant is secured in the bone whilst the other part of the implant protrudes through the overlying skin. This is so that a prosthesis can be secured to it.

Once the implant has been placed in the bone, it is necessary to wait for the bone to grow into the surface of the implant. This ensures that the implant will be fully secure before a load is applied (e.g., a prosthesis). The amount of time you need to wait for this to happen depends on many factors (e.g., type of anchor, site of anchor, intended use, bone-density). Your surgeon will be able to advise you on the specific type of anchor that will be used in your case and the loading characteristics.

The way in which the surgeon treats the part of the anchor that comes through the skin is an essential part of the treatment. Your skin normally acts as a barrier to prevent bacteria and infections from the outside environment gaining access to the inside of your body. When there is a break in the skin or an open wound, there is always a potential risk for infection.





Caption: The line diagrams show how the soft-tissues around a bone-anchor must be treated in order to ensure the longevity of the implant. Granulation tissue may form around the skin-implant interface after surgery. The granulations are fleshy areas of tissue which

gradually disappear as the skin stabilises around the implant. They are painless and are caused by the skin trying to heal around the metal implant as it comes through the skin. They do not occur in every case. The images show a patient at three months and eight months after surgery showing how the granulations settle spontaneously.

Research has been carried out (and continues) into the best method for reducing the risks of infection when using a bone-anchored implant. The goal is to create a tight seal between the implant and the skin which reduces the risk of infection.

There are several different ways in which to achieve this. Your doctor will explain which technique is the most appropriate for you, for the part of your body and the type of implant that is to be used.

Which body parts can be reconstructed using a bone-anchored implant?

Bone-anchored implants can be used for attaching a prostheses to nearly every part of the human body. It is important for you to know that **the NHS will not fund the use of osseointegrated bone-anchored implants for all parts of the body**.

There is more information about this below. Examples of some of the situations where an osseointegrated bone-anchor has been used for reconstruction are given below (Figure 2) together with the methods used for attaching a prosthesis to the bone-anchors (Figure 3).

Caption: Left transhumeral amputation with ITAP bone-anchor inserted in 2007

Caption: Left transfemoral amputation with OPL bone-anchor inserted in 2018

Caption: Missing right ear, reconstructed with silicone ear attached using Southern bone-anchors inserted in 2019.

Caption: Close-up view of the abutments that can be used to attach a prosthesis to the craniofacial skeleton. Some patients prefer magnets (left), other patients prefer a retention bar (right).

Larger prosthetics

For larger prosthetics (e.g., limbs), different systems must be used which are mechanically robust, and prevent rotation or other instability. No matter how rigid the method of fixation, the connecting systems for these larger prosthetics must also incorporate a fail-safe mechanism that allows the prosthesis to release if a patient applies an abnormal load to the limb, which might result in fracture of the bone in which the implant is embedded.

Caption: Examples of different types of connectors used to attach a prosthesis to a bone-anchor in a limb. Each connector incorporates a fail-safe mechanism.

What disadvantages are there with bone-anchored implants?

Patients sometimes need to have more than one surgical procedure to insert a bone-anchor after their initial surgery to remove the diseased part (e.g., after amputation of a limb). Many patients will have already had multiple surgical procedures and may be reluctant to have even more surgery to insert a bone-anchor, despite its advantages.

There is also a constant risk of infection in the skin around the implant and in the bone. In most cases, patients only experience minor skin infections which can be easily treated with oral antibiotics or topical antiseptic creams (such as Savlon). However, in rare cases, the infections can become more persistent and severe.

If this happens it may be necessary to remove the bone-anchor altogether to allow the infection to clear. Patients must also put up with a change in the long-term appearance of the treated part and accept the presence of a piece of metal permanently protruding from the skin. Some patients find it very difficult to adjust to this change in their appearance, but most accept it as a necessary outcome of achieving their reconstructive goals.

What has been the experience with bone-anchored implants so far?

Every year in the UK, thousands of patients are treated with bone-anchored implants which are fitted by their dentists to secure prosthetic teeth. Similarly, many patients have bone-anchored implants inserted to improve their ability to hear (bone-anchored hearing aids – BAHA) and/or to secure prosthetic ears and eyes. The outcomes in these groups of patients have been excellent over many years[1-4].

There has been much less experience with the use of osseointegrated bone-anchored implants after major amputations of upper and lower limbs. Worldwide, the total number of limbs (both upper and lower) that have had a bone-anchor inserted is still fewer than 2,000.

However, in the UK, the results are constantly improving, and at the Royal Free London we are now increasingly confident that we can achieve consistently good outcomes for most of our patients[5-6]. We are also actively contributing to research in this area[7-10] and are constantly monitoring our own outcomes to ensure we provide the best care to patients in the future.

Can I get NHS funding for surgery to insert an osseointegrated bone-anchor into the hand (wrist to fingertip) or head and neck region (especially eyes, noses, and ears)?

We routinely insert bone-anchors to allow missing fingers, eyes, noses, and ears to be replaced with a prosthesis. However, although the surgery to insert the bone-anchor is fully funded at the Royal Free London, the NHS is not always able to fund the cost of the prosthesis that must be attached to the bone-anchor to complete the reconstruction.

Unfortunately, in many cases, patients will have to bear the cost of the prosthetic finger, eye, or ear themselves. These costs can vary enormously so it is still worth visiting us to explore your options. Moreover, these prostheses do wear out with time so patients who are self-funding will have to consider how they will cover these ongoing maintenance costs themselves in the years to come.

Can I get NHS funding for surgery to insert an osseointegrated bone-anchor after major limb loss (e.g. missing arm or leg)?

Osseointegration surgery as a treatment after major limb loss is only available on a private basis (i.e., self-funded or compensation cases) at the Royal Free London. The treatment is very expensive. Moreover, the NHS will not provide rehabilitation support after insertion of a privately funded bone-anchor.

Therefore, the specific rehabilitation you will need after this type of surgery will also need to be paid for independently. In some cases, you may be able to use an NHS-provided prosthetic limb, attached to a privately funded bone-anchor. However, this is not always the case. **You are strongly advised to check with your NHS rehabilitation team whether**

they will allow this before any surgery is performed. Otherwise, you may end up having to pay for the prosthetic limb as well.

If you do decide to have privately funded surgery to insert an osseointegrated bone-anchor, you must remember that you will also be financially responsible for all the components attached to the bone-anchor, once it is in place. The components wear out with time and will then need to be replaced. They are also expensive.

Finally, we have treated patients who have obtained some financial support for their surgery from charitable institutions. The Royal Free London does not endorse any charity or grant-giving institution for this purpose, and it is the responsibility of the individual patient to explore all the funding possibilities themselves.

What happens if something goes wrong?

If something happens with a bone-anchor inserted as an NHS patient, then the NHS will continue to provide support to remedy any issues that may arise in relation to the bone-anchor. However, this advice does not apply for any bone-anchor which is inserted on a private basis.

If a privately funded bone-anchor must be removed because of infection or if it breaks, then replacement of the bone-anchor will have to be paid for by the patient or their private funder. Importantly though, if an emergency occurs in relation to a privately funded bone-anchor (e.g. a fracture of the bone in a fall or accident), and the patient is normally entitled to NHS care, then the NHS will still fund any emergency treatment.

How can I find out whether I am suitable for this procedure?

If you are interested and/or have a problem affecting your head and neck region or your hands and would like to be considered for this type of surgery, please ask your GP to send a referral letter to:

Mr Norbert Kang FRCS (Plast)
Department of Plastic Surgery
Royal Free Hospital
Pond Street
Hampstead
London NW3 2QG
Email: norbertkang@nhs.net

An NHS outpatient appointment will then be made for you.

If you are considering osseointegration after amputation of an arm or a leg and/or if you are not a UK citizen and wish to make an enquiry about osseointegration surgery, then you will most likely need to be self-funding (private) for your entire treatment. More information about the treatments offered to amputees and others on a private basis is available at: www.royalfreeprivatepatients.com/treatments/relimb

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More information

For more information about the osseointegration service at the Royal Free London, please visit our website: www.royalfree.nhs.uk/services/services-a-z/plastic-surgery/prosthetic-limbs-and-body-parts/osseointegration

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If you have any feedback on this leaflet, please email: rf.communications@nhs.net

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Trust Service: Plastic surgery
Leaflet reference: RFL937
Version number: 2
Approval date: October 2024
Review date: March 2026
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