

OSSEOINTEGRATION ON UPPER LIMB AMPUTEE. PROSTHETIC TREATMENT.

Stewe Jönsson¹, CPO Kerstin Caine-Winterberger² OT; Rickard Brånemark² MD, PhD
1 TeamOlmed, Upper limb prosthetic dept., Kungsbäck Hospital, Sweden
2 COO Sahlgrenska Univ.Hospital Gothenburg Sweden

BACKGROUND

Osseointegration has been used for prosthetic fixation since nineteen sixties. It is for example used in the dental and maxillofacial science^(1,2). In 1990 started the osseointegration (OI) programme for upper extremity in Sweden. The treatment involves two surgical procedures and results in bone anchorage attachment of prosthesis^(1,2). On upper limb has this method been used for transhumeral- (TH), trans-radial (TR), thumb- and partial hand amputation^(2,3). The method is also used for lower limb amputee⁽⁴⁻¹²⁾.

Several papers and presentations in this topic have been presented at conferences and journals over the years. The aim of this presentation is to show some of the differences of an OI prosthesis compared to socket prosthesis. Procedures, constructions/fabrication, and function parameters will be lift up and how does OI effect on the Prosthetists role.

METHODS

Treatment

All patients have to pass a team assessment to find out if they are a candidate for OI. If all parts are finding OI a good solution for the patient, starts the OI treatment. The treatment involves two surgical procedures (S1,S2). At S1 is a titanium fixture inserted. Thereafter starts a healing period of normally six months^(2,4,7,11). Over this period can the patient with some limitations use the ordinary socket prosthesis⁽³⁾. But specific socket modification is most often necessary. At S2 surgery, the implanted fixture is re-exposed and the abutment is connected to the fixture. The wound is closed with the abutment penetrating the skin^(2,4,7,11). A platform for prosthetic suspension/fixation is created. The prosthetic procedure starts some weeks after S2. Initially with a lightweight prosthesis or a special training prosthesis, where the load/weight can be increased over the time⁽³⁾. This part of the treatment is depending of amputation level and type of final prosthetic. Parallel to the prosthetic treatment, implement the Occupational Therapist training and rehabilitation according to the protocol⁽³⁾. Follow-ups are carried out frequently.

Components and constructions

Together with osseointegration comes some new prosthetic components and terminology⁽³⁾. The "Attachment device" is built in to the prosthesis. Achieves a quick connector and locking function of the prosthesis

and keep the prosthesis fixated to the implant. It is easy to don and doff the prosthesis. For TH and TR amputation levels is the "Puck" one part of the attachment device. The puck makes it also possible to handle individual abutment configurations on TR level, where abutment is used in both radius and ulnae. TH amputation level requires components to protect the implant from overload in rotation/torsion. For this is a "Rotation safety device" used. This component is also used for prepositioning of the forearm. Some prosthetic elbow joints on the market already include a reliable rotation/torsion function. In case of myoelectric control is "Electrode holder" used to keep the emg-electrodes in right site against the muscle position. "Alignment component" is used to optimize the prosthetic alignment. If needed can "Temperature insulator" and "Shock absorber" to avoid unwanted shock peaks or forces, be built in to the prosthesis. Some cases of TH levels need a "Soft tissue support" to stabilise the residual limbs distal tissues. A "Distal cap" can be used for protection when the prosthesis is not worn. Except from those components could selected prosthetic components on the market be used to build the prostheses. The patients can be fitted with prostheses of various types, i.e. cosmetic, body-powered, myoelectric including multifunctional and hybrids. A harness is never used for suspension but is needed for cable operated prosthesis, therefore has the TR level prostheses a built in "Wire/cable guide".

The Prosthetist role

How does this treatment affect the prosthetist role? One of the Prosthetists main goals is normally to create a good prosthetic suspension via a socket and sometimes in combination with harness. This construction shall hopefully include good function and comfort. In case of osseointegration is the suspension/fixation already ensured. The bone-anchored prosthesis always fits. It is attached correctly and is firmly held in place by the titanium implant. This eliminates all socket and harness related problems such as heat, sweating, chafing or discomfort. Change of the residual limb volume is not an issue and the Prosthetist can spend more focus on the prosthetic function and component technology⁽³⁾.

Involved in the osseointegration treatment, the Prosthetist has to be trained and learned to:

- Know how the osseointegration principal works.
- Observe the patients OI status. Take an active role in information flow in to the team and to be a part of a team.

- Supply the patient with an adequate prosthetic construction that guarantees the patients a safety situation. Never experimental construction that can risk the implant.
- Give the patient correct and relevant information regarding both prosthetic use and times when not wearing prosthesis.
- Follow the prosthetic and rehabilitation protocol, including checkups.
- In some cases, be a part of an assessment-team.
- And, listen to the patient, "listen to the bone" (PI Brånemark)

Direct bone-anchored prostheses always fit and have long durability. The need for prosthetic replacement is not frequent and worn-out sockets are no longer an issue. This reduces the prosthetic cost over a long time period. Ordinary prosthetic component services are of course not reduced.

With a fixed reference points can, alignments, prosthetic length and electrode site placement be stored. By saving those data, can prosthetic duplicate be produced and compared to socket prosthesis without a need of impressions and checkout-sockets. The patient can have a finished prosthesis delivered directly.

RESULTS/OUTCOME

Prosthetic

Different prosthetic types have been made and used in combination with OI. Attachment devices and special components have made it possible to provide patients with cosmetic, body-powered, myoelectric including multifunctional and hybrid prosthesis. Without any stump volume depending socket will the direct bone anchored prosthesis last for a very long time ⁽³⁾.

Patient

Approximately 40 patients have operated on upper limb. Different amputation levels have been treated, TH, TR, partial hand and thumb. OI has been successful for both short and long residual limb on TH and TR level. Causes of amputation have been trauma, congenital deformities, and tumour ⁽³⁾.

Function/experience

The prosthetic situation is improved because of the stable fixation. There is no need of harnessing in aim of suspension and the patients achieve full freedom of movement in the proximal joint. Problems with excessive irritation and sweating from the harness or socket do not exist. Without socket is higher degree of comfort achieved. The patients report improved functionality ⁽³⁾. Clinical follow ups of prosthetic users, show improved quality of life compared to the situation before osseointegration. Patients experience improved sensory feedback because of the phenomenon of Osseoperception

⁽¹³⁻¹⁶⁾. New prosthetic technology includes different platforms, where osseointegration is one important part.

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