

THE USE OF SILICONE LINERS IN EARLY PROSTHETIC REHABILITATION.

A PILOT TRIAL.

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In March 2003 Orthotic Prosthetic Services Tasmania (OPST) – Launceston General Hospital introduced a pilot trial in early prosthetic rehabilitation using a silicone liner for its trans tibial amputees.

The trial was conducted along similar lines as the Ossur Smart program as practised at the Hassleholm – Kristianstad Orthopaedic Hospital, Sweden (Ossur hf., 1993). In all cases at the Launceston General Hospital (LGH) the cause for amputation was Peripheral Vascular Disease (PVD). Key members of the prosthetic team were recruited from the vascular surgical team, the surgical and rehabilitation wards, physiotherapy and prosthetic departments.

Amputations were carried out by the vascular team using the McKendrick procedure (long posterior flap), with a fibreglass rigid removal dressing, applied immediately post amputation in the recovery room. The silicone liner acclimatisation period was generally started between day six and day ten unless there was a complication with the wound. The acclimatisation process consisted of a four day period, where the liner was applied on the first day for an hour in the morning and again in the afternoon. Day two consisted of using the liner two hours in the morning and again in the afternoon and so on until a total of eight hours was reached on day four. A pool of interim silicone liners and ratchet locks were used. Liners were autoclaved before being re-used for other clients.

A plaster of paris (POP) pressure cast socket was then fabricated using the Ice-Cast Compact at 40mm Hg. A ratchet lock, pylon and foot were then attached to the socket and patients began gait training in the physiotherapy gym an hour after casting. Plastic bags were used to aid donning of the POP sockets. POP sockets were initially fabricated because of the large volume loss in the residuum once gait training commenced.

Gait training always started with a gradual weight shift transfer to the prosthetic side, to even weight bearing through both lower limbs before progressing to single steps, eventually progressing to walking with the aid of bi-lateral crutches. Physiotherapists were trained in the application and removal of the liners and conducted most of the patient education regarding donning/doffing, hygiene and teaching the patient to monitor the fit of prosthetic socket. Prosthetists were available to make alignment and socket adjustments.

8-10 days later, patients were cast for the manufacture of copolymer sockets and to be fitted within the next 3 working days with a re-sized silicone liner to suit. 8-12 weeks after use of the initial plastic socket, the patient was recast for fabrication of their primary silicone liner prosthesis.

Day 24

Posterior flap pulled down but wound edges appear healthy.

Copolymer socket fitted day 28. Wound continued to heal very rapidly. Prosthetic training continued with two elbow crutches, stairs, indoor/outdoor, uneven surfaces and on/off floor training. Patient was able to ambulate 80 metres at a time. Surgeons refashion flap on day 48, followed by two weeks of non-weight bearing. Gait training recommenced day 60. Patient discharged day 61 and wound healed uneventfully.

Patient DB.

Case 2

43-year-old female, (L) TTA on 11/04/03 due to an ischaemic (L) foot on background of vasculopathy and PVD.

Past Medical History - hypercholesterolemia, gross obesity, DVT (L) leg in 2000, cholecystectomy, gastric stapling and inactivity.

Surgeon's Comments:

Very troublesome TTA wound due to very oedematous failed fem-pop bypass because of lymphoedema. Also complicated by acute episode of vasculitis on day 51 and skin purpura secondary to Niacin treatment. Liner was used to control lymphoedema.





Day 113



Day 138



Day 138

Silicone liner acclimatisation began day 27 as the residual limb volume was too large to fit largest commercially available liner. Volume was initially reduced with an RRD. Gait training commenced on day 32 with POP shuttle lock socket. Copolymer socket fitted day 54

Notes:

Wound complicated as from onset of TTA, due to sloughy areas, blister formations, massive amount of exudate and MRSA infection. Pain was initially an issue but tolerance was gradually built up. Patient was discharged day 82 with independent gait, using two elbow crutches and used the prosthesis for five hours per day. Practised stairs with crutches, uneven ground, indoors/outdoors and wheelchair skills. Community nurse to follow up wound management. Since discharge, wound has continued to heal and prosthesis is worn eight hours per day. Last reviewed in prosthetic clinic on day 138.

Patient TF

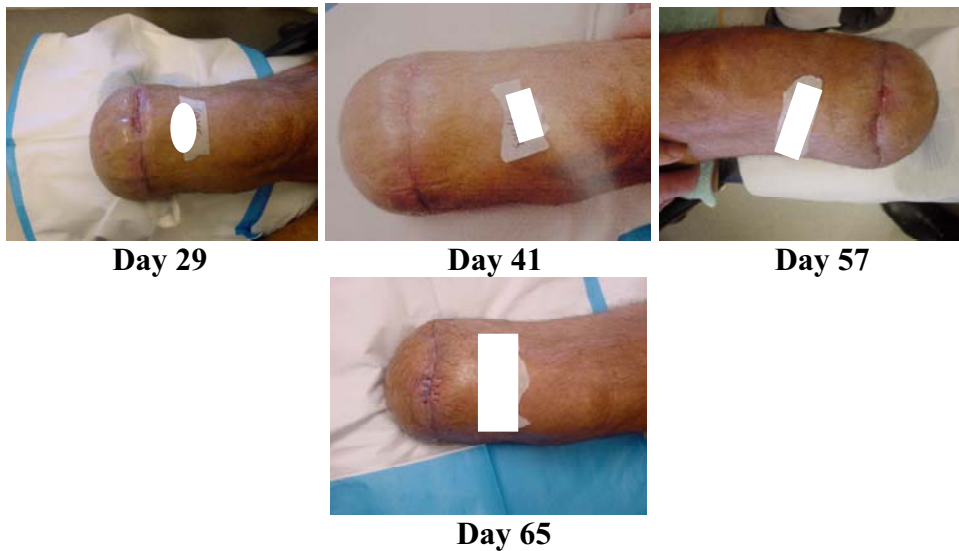
Case 3

73 Year old male, (R) TTA on 22/05/03 due to leg ischaemia, failed fem-pop bypass (infected vascular graft).

Past Medical History: Multiple vascular surgical interventions in (R) LL over the last 4 years, (R) hip replacement 2000, AF, obesity and hypercholesterolemia.

Surgeon's Comments:

Wound breakdown on day six requiring re-exploration. Query debridement or TKA/TFA. Posterior flap viable and therefore re-fashioned flap with tibia slightly shortened. Lingering oedema. Patient motivated and has good transfer skills without prosthesis. Liner applied later because of multiple residual limb problems.



Silicone liner acclimatisation began Day 41 and gait training commenced with POP socket Day 43. Copolymer socket fitted day 55.

Notes:

Pain was a big issue on early mobilisation and this was managed with strong pain medication. Delayed wound healing (2cm across) along anterior aspect of tibia. Surgical exploration of the area on day 63 reveals an abscess, which was drained, and the removal of a foreign body (tiny gauze remnant). Pain in residuum disappears subsequently and wound improves dramatically. Patient's gait is independent with elbows crutches, stairs, indoor/outdoors, ramps and uneven surfaces. Discharged day 84.

Patient LG

Case 4

77 year old female, (L) TTA on 25/3/03 due to a gangrenous 2nd toe with cellulitis of the (L) foot.

Past Medical History - PVD, IDDM (20 years), RA and hypertension.

Surgeon's Comments:

Well motivated with early independent transfers (without prothesis) and good wound healing. Silicone liner was trialed to provide early prosthetic mobilisation.



Silicone liner acclimatisation commenced day 8 and gait training commenced day 14 with a copolymer socket.

Notes: Minimal pain on early mobilisation with uneventful healing of the wound. Patient ambulated and managed indoor/outdoors, ramps, side and backward manoeuvring with 2WF, on/off floor training before discharge on day 52.

Patient CL

Case 5: 50 year old male, (R) TTA on 15/07/03 due to critical ischaemia of the (R) foot.

Past Medical History: Lower limb neuropathy and depression. Still smokes heavily.

Surgeon's Comments: Well-vascularised residuum, no local complications. Patient motivated and had good transfer skills without prothesis, therefore early mobilisation trialed with silicone liner.



Silicone liner acclimatisation began Day 8 and patient commenced gait training with POP socket day 13.

Notes: All sutures removed day 14 and steri-strips applied. Some surface slough noted along sutures line, which was easily removed. Nil signs of infection. Copolymer socket fitted day 23 and patient progressed to independent gait with two elbow crutches, indoor/outdoors, stairs, ramps, uneven ground and on/off floor training. Patient discharged day 35. Since discharge, patient displays poor compliance with monitoring socket fit, still smokes heavily and appears unmotivated.

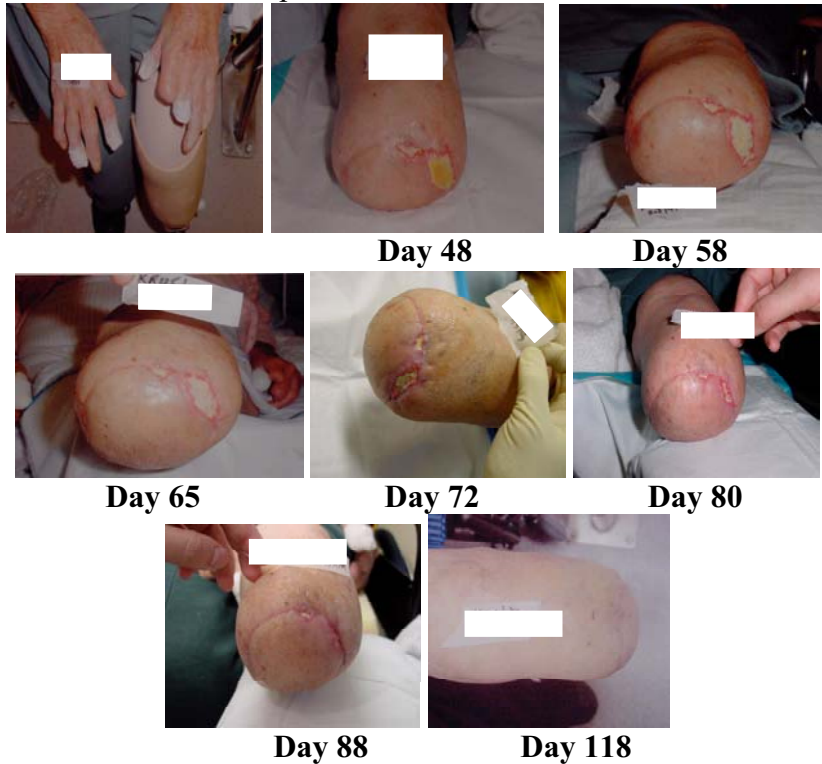
Patient BK

Case 6: 78 year old female, (L) TTA on 28/02/03 due to necrotic (L) foot on background of long standing scleroderma.

Past Medical History – Diabetes, Glaucoma, (R) total knee replacement, partial digit amputations of both hands and feet, anxiety.

Surgeon's Comments:

Delayed wound healing with large area of slough, eight weeks post amputation. Patient well motivated and largely independent with transfer without prosthesis. Liner applied to ambulate earlier than otherwise expected.



RRD insitu since amputation and silicone liner acclimatisation was started day 41. Gait training commenced day 44 with copolymer socket.

Notes:

Wound chart over the last several weeks showed no progress with healing. Patient was due to be discharged from the rehabilitation ward for the wound to heal before commencement of prosthetic rehabilitation. Since experience with early mobilisation using silicone liners had been positive with wound healing, it was decided to give patient a trial with the liner. On day 66 granulation tissue starts to appear. Day 72- sloughy areas diminishing and wound getting smaller. Prosthetic gait training continued with two wheel frame and stand-by assistance, due to patient anxiety. Manages ramps, indoor and flat surfaces. Patient was largely independent in donning/doffing the prosthesis. Discharged to nursing home (original abode) day 99. Wound healed uneventfully as an out-patient.

DISCUSSION

This initial experience with the use of silicone liners in early prosthetic rehabilitation has certainly caused this team to reconsider how new amputees are managed at the Launceston General Hospital. Since the time of Burgess in the 1960's, rehabilitation professionals have always known or suspected that early mobilisation with a prosthesis provides an environment for more rapid wound healing and prosthetic rehabilitation. Although Burgess had good success, other centres had difficulty reproducing his results.

The challenge in early prosthetic management is provision of early mobilisation without compromising the integrity of the wound in the early days after amputation surgery, particularly for dysvascular amputees.

The trials at the LGH indicate that early mobilisation with silicone liner prostheses promote rapid wound healing. Silicone liner prostheses allowed early mobilisation without comprising the integrity of the wound. An exception to this was shown in case 1, where skin integrity was already compromised since day 1 post amputation. In all cases the wound continued to heal and no revision to a higher level was required after early prosthetic mobilisation. No notable or significant pain was experienced in wounds that appeared healthy and clean as in cases 4, 5 and 6 on early prosthetic mobilisation. The results of this trial show that the use of silicone liners may offer a promising solution for complex amputation wounds such as those seen for patients in cases 1,2 and 3.

The use of silicone liners in patients who have delayed wound healing and who formerly would have been discharged prior to prosthetic fitting, has been positive as demonstrated by Case 6. It would have been highly probable that this patient would not have been a prosthetic candidate if prosthetic rehabilitation had been delayed, due to de-conditioning and anxiety.

As a result of the positive outcomes, several clients who had been discharged earlier for delayed wound healing were called back to have silicone liner prostheses fitted and commenced prosthetic gait training immediately. Rapid and uneventful wound healing also occurred in this group. No silicone liner acclimatisation period was initiated in these cases.

The use of large dressings to treat wounds with massive exudate did not exclude patients from early prosthetic mobilisation as demonstrated in cases 1,2 and 3 (Exu-Dry dressings were used). Early mobilisation had a positive impact in this group as well.

Retrospectively it is suggested that patients commence gait training with the POP socket on Day 12 with the acclimatisation period starting 4 days earlier. A dedicated and knowledgeable prosthetic rehabilitation team is necessary for the program to be successful.

A controlled study in the use of silicone liners in early prosthetic rehabilitation is currently being drafted.

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