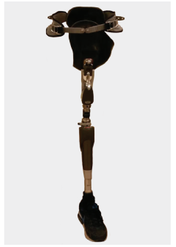
Key Points

1. The use of Iliac crest stabilizers, applies a force into 2 planes both horizontal and vertical, effectively pulling the patient down and into the socket, ensuring a very secure fit. The ratchet fit ensures that tension is not lost over time and is very easy to achieve the required tension in the straps. These factors eliminate the drop off issues seen in traditional socket design. This in turn leads to a much better gait, no vaulting and gives the user a level of 'natural control' that was previously impossible.
2. The cut back trim lines of the socket have reduced the profile of the socket significantly, promoting ventilation so sweating is less of an issue, and dramatically reducing the weight and bulk of the socket, which is paramount in such a high level amputation.
3. The more secure fit almost completely eliminates sliding / moving around in the socket as a result very few blisters / chafing occur, which with other sockets was a regular occurrence.
4. Removing the prosthesis can now be achieved in less than 1 second and donning in no more than 20 seconds. This is compared to several minutes for the traditional corset style fitting.
5. The ratchet straps can easily be undone and retightened through the clothes, so when seated for long periods, the patient can loosen off the prosthesis and then subsequently retighten the prosthesis through the clothing. This is a very discrete process and enables the patient to keep comfortable for longer wearing the limb.
6. In conjunction with the Otto Bock Helix 7e10 3D hip and C-leg, the bikini facilitates unparalleled levels of walking that have previously been simply unattainable.

Conclusion

- Strong, comfortable socket which supports the patient throughout the gait cycle
- The drop off issue at swing phase has been resolved
- The flexibility of the proximal edges allows a greater range of movement and is more forgiving when the patient is sitting down

The Bikini Socket



Final Socket

Contact Details

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Case Study
Bikini Style Socket - Hip Disarticulation

steeper
Creating life's turning points, together

This case study illustrates the innovative work carried out to improve bikini sockets for hip disarticulation patients. The result of the project is a lighter socket, more modern looking, easier to manufacture and fit than the traditional hip disarticulation sockets. The new socket design has improved the patient's comfort and fitting experience significantly.

The project was led by Lynzy Holding (Prosthetic Manager at Steeper). A special thanks to the team involved:

- Damian Harper (Patient)
- Terry Moore (Specialist Technician), Aintree Hospital, Liverpool
- Jay Martin (CP, LP, FAAOP), MARTINBIONICS USA

Introduction

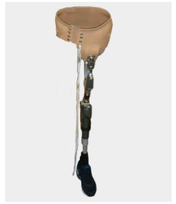
Silicone sockets have been developed at Aintree Hospital for a number of years, and they are now the first choice as they are fully flexible and very comfortable. The draw backs of a silicone socket are that it still requires a lace up section or velcro straps to fasten it and is still quite heavy. There have been recent studies to suggest that focusing more on the patients skeletal anatomy within the residuum rather than the soft tissues when creating a socket will achieve more optimal results and reduce the movement between the socket interface and the residuum.

Damian Harper, one of our established hip disarticulations patients asked Steeper Prosthetist Lynzy Holding and Terry (Specialist Technician), if they would look at a new style of socket and suspension he had seen on YouTube currently being used in the States. 'The Bikini Socket with iliac stabilisers' developed by Martinbionics, USA.

Damian currently wore a silicone socket in combination with the Helix hip and C leg and Trias foot. The team agreed to contact Jay Martin, and look at designing a socket for Damian.

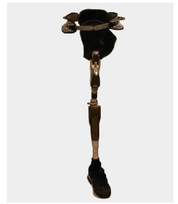
Traditional Socket

Silicone Socket



Silicone Socket

The Bikini Socket



Methodology

Damian's existing cast was used to capture the exact alignment of his current set up on the Ottobock C leg and Helix hip. The cast was rectified and the volume reduced dramatically. The laser alignment kit was used at fitting and delivery stages to achieve the optimum set up for Damian.

If a new cast is necessary then a 'total suspension' casting technique is used at Aintree for hip disarticulation to contain the soft tissue and achieve a better volume match within the socket. It requires two prosthetists. Elasticated bandage under the residuum held as tight as possible by one prosthetist then slabs of plaster bandage is applied by the other .

This still isn't as tight as desired but achieves a closer fit than using the traditional method with the blocks.

The rectification must drastically reduce the original size of the positive model to achieve the best outcome when using the bikini style suspension. Stability of the new hip disarticulation socket still relies primarily on the alignment, comfortable axial support and suspension.

Technical Benefits

The socket fabrication consists of a lightweight carbon frame which is sandwiched between layers of silicone, using lightweight adjustable compliant illiac crest stabilisers to add comfort for the user, these stabilisers replace the majority of the socket and contour over the illiac crests and suspends the prosthesis through compliant forces.

The costing for this prosthesis is as follows:

- Silicone Gel 2x 0. 900 kg bottles £67.00
- Carbon frame resin and materials £30.00
- PVA bags £10
- Attachment plate £35.00

The costing for conventional style prosthesis is as follows:

- Blocking leather £80.00
- P/E low density polymer £5.00
- Copolymer £5.00
- Attachment plate £35.00

The manufacturing time for the Bikini Socket is as follows:

- Carbon frame lamination incorporating the attachment plate 2 hours
- Making support plate ready 2 hours
- Curing time for the lamination 1 hour
- First 6 layers of silicone also allowing for cure time 3 hours
- Attaching the last 6 layers of silicone material and carbon frame and allowing for fully curing time 4 hours

The manufacturing time for the conventional style prosthesis is as follows:

- Soaking block leather 3 days
- Moulding and stitching leather 3 to 4 hours
- Making ready support plate 1 hour
- Drying time for leather 1.5 days
- Draping P/E 1 hour
- Draping copolymer 1 hour

Patient Experience

This is an account of Damian's experience

"I have been a HD amputee for 30 years now, from the age of 16. During this time I have tried out many, many different prosthetic sockets and components, generally each has been a miserable failure, these include leather block sockets which are very heavy, bulky, relative poorly fitting, uncomfortable, especially initially, and can become after some wear quite noisy.

I tried early plastic polymer sockets which whilst slightly lighter and less bulky, were extremely uncomfortable and unforgiving and became un-wearable very quickly due to the number of sores/blisters they caused.

I asked for a silicone socket to be made and found that to be very comfortable, lighter and much less bulky. So I moved onto this socket type in lieu of the leather block socket.

The silicone socket also has its drawbacks however, such as excessive sweating especially in summer, and for the socket to work effectively it must be fastened on very tightly using a corset style fitting. This puts excessive pressure on the abdomen and requires constant re-tightening during the day. It is also a very time consuming mechanism to tie up and undo. Also, as the socket only put tension in the horizontal plane, there is continued 'drop off' during the swing phase, causing significant gait problems and control issues, this is irrespective of how tight the socket is fastened. Due to the nature of the material, it also causes excessive sweating, especially in summer, which can make the socket very uncomfortable to wear, especially on long journeys.

The Bikini Socket eliminates nearly all of these issues. Over the course of a year we have been developing a new socket type based on the bikini socket design suggested by Jay Martin. This socket interface moves on the traditional bucket style quite significantly."