Use of a Subischial Vacuum Assisted Dynamic Socket with Adjustable Volume Control: A Case Study

Introduction

A variety of subischial socket designs have been introduced over the years with mixed success. Socket design can significantly influence a patient’s comfort and functionality. Traditional transfemoral sockets are rigid in design. This lends to increased structural integrity but does not allow the socket to dynamically adjust to the limb’s changing dimensions (Sanders, 2009).

Subischial sockets have two major advantages over ischial containment sockets. The lower subischial trim lines increases comfort due to a lower brim height. Secondly, the lowered brim does not impinge on the pelvis, allowing increased range of motion at the hip joint.

The purpose for this case study was to create a novel dynamic subischial socket that uses vacuum technology and also adjusts to fluctuating limb volume. Noted advantages of vacuum systems include reduced pistoning of the residual limb within the socket and limb volume maintenance (Board, 2001), (Goswami, 2003).

Method

The subject was a 63-year-old male who stands 5’9” and weighs 180 pounds (Figure 1). Over 20 years ago the subject suffered a traumatic left transfemoral amputation. The previous socket used by the subject was an ischial containment suction design.

Fabrication of the new subischial socket was started with a fiberglass impression taken over a gel cushion liner. A four percent global reduction was taken off the positive model. Next, a flexible inner socket was blister formed over the positive model. The flexible inner socket was laminated over with a standard vacuum layup and an adjustable cable dial (Figure 2). Circumferential measurements were taken at the proximal edge of the socket and every 50 mm distally. Measurements were taken with the socket in a neutral position and fully closed.
Results

<table>
<thead>
<tr>
<th>Level of measurement</th>
<th>Neutral</th>
<th>Fully closed</th>
<th>Change in Circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal Brim</td>
<td>528 mm</td>
<td>392 mm</td>
<td>26%</td>
</tr>
<tr>
<td>50mm Distal</td>
<td>505 mm</td>
<td>405 mm</td>
<td>20%</td>
</tr>
<tr>
<td>100mm Distal</td>
<td>472 mm</td>
<td>415 mm</td>
<td>12%</td>
</tr>
<tr>
<td>150mm Distal</td>
<td>450 mm</td>
<td>433 mm</td>
<td>4%</td>
</tr>
</tbody>
</table>

Discussion and Conclusion

The results show a wide range of volume adjustability. This suggests that the socket can accommodate a large change in limb volume. As a result, the need for sock or pad management may be eliminated or greatly reduced. This versatility could also potentially save time and cost by reducing the number of socket refabrications. Most importantly, the socket size can be adjusted to ensure proper fit and function.

References