POSITIVE OUTCOMES FOLLOWING USE OF VACUUM ASSISTED SUSPENSION IN TRANS-FEMORAL AMPUTATION. A CASE SERIES

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INTRODUCTION
Individuals with transfemoral (TF) amputation may benefit from socket systems using active vacuum pumps (VAC) to create and maintain pressure at sub-atmospheric levels. Preliminary research suggests that VAC may provide a more secure suspension and improve stability, weight bearing, comfort, perception, and limb health for those with transtibial amputation. Few studies have investigated VAC when applied to the TF amputee. Currently, there are no studies examining the change in one’s daily life as a result of using a VAC socket system for the TF amputee.

METHOD
Subjects: Six with TF amputation participated. All have used current prosthesis for >12 months.
Apparatus: Balance and walking capacity; activity, participation, and quality of life questionnaires.
Procedures: At baseline, testing was performed with participants EXISTING socket and questionnaires completed regarding use of EXISTING socket. Participants were measured for a flexible inner socket with polypropylene rigid frame that achieved vacuum through use of the Otto Bock Harmony E2 pump with the Evolution Aura Sheath. Two weeks later participants were tested again with EXISTING socket. Following testing the VAC socket was fit, aligned on the participant’s prosthetic (knee and distal), users were instructed how to use the system, and then went home. Participants returned 2 and 4-weeks later for testing using the VAC socket. Following the 4-week test participants went back into their EXISTING socket and were asked which socket they preferred.
Data Analysis: Means for the 2 sessions with EXISTING and the 2 sessions with the VAC socket were calculated for each participant. Data is incomplete at various time points because of deviations from testing protocol due to individual socket modifications and participant health.

RESULTS
As seen in Table 1, a positive change was noted in all patient reported outcome measures while minimal change was noted in balance and walking abilities. 4 of the 6 participants utilized a brim that was SI. Subjective comments from participants addressed improved comfort with the VAC socket. All who have completed the protocol have opted to stay in an active vacuum socket system.

DISCUSSION/CONCLUSION
In this case series, positive changes were noted using the VAC socket compared to the EXISTING socket. While the 4-week acclimation period may have been too short to result in improvements in balance or walking abilities, large improvements in perception of activity, participation and quality of life were noted supporting the use of VAC for TF amputation. These results can potentially help lead to policy change regarding reimbursement for VAC socket systems.

CLINICAL APPLICATIONS
Use of VAC sockets for TF amputation should be considered due to positive outcomes associated with activity, participation and quality of life when compared to EXISTING sockets.

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Since amp (yrs)</th>
<th>Knee</th>
<th>RLL (cm)</th>
<th>Brim SI (cm)</th>
<th>Brim SI as % of RLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1  61</td>
<td>3 (Vasc)</td>
<td>C-Leg</td>
<td>31</td>
<td>3.0</td>
<td>90.4%</td>
</tr>
<tr>
<td>S2  80</td>
<td>2 (Vasc)</td>
<td>Til Knee</td>
<td>35</td>
<td>4.0</td>
<td>88.6%</td>
</tr>
<tr>
<td>S3  68</td>
<td>4 (Vasc)</td>
<td>C-Leg</td>
<td>26</td>
<td>3.0</td>
<td>88.5%</td>
</tr>
<tr>
<td>S4  26</td>
<td>2 (CA)</td>
<td>C-Leg</td>
<td>25</td>
<td>2.5</td>
<td>90.0%</td>
</tr>
<tr>
<td>S5  41</td>
<td>23 (Trauma)</td>
<td>C-Leg</td>
<td>33</td>
<td>0.0</td>
<td>--</td>
</tr>
<tr>
<td>S6  30</td>
<td>8 (Trauma)</td>
<td>C-Leg</td>
<td>22</td>
<td>0.0</td>
<td>--</td>
</tr>
</tbody>
</table>

For all EXISTING socket was ischial containment; 2 used suction, 4 used a laynard system. RLL: residual limb length = ischial tuberosity to distal end. SI: Subischium

TABLE 1

<table>
<thead>
<tr>
<th>Balance Sway Composite Score (Lower the better)</th>
<th>Overall Limits of Stability Score (Higher the better)</th>
<th>6-Minute Walk Test (feet)</th>
<th>Amputee Mobility Performance Score (Higher the better)</th>
<th>Activity Balance Confidence (Higher the better)</th>
<th>Patient Specific Functional Score (Higher the better)</th>
<th>Prosthetic Evaluation Questionnaire (Higher the better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXISTING 1.4</td>
<td>VAC 1.3</td>
<td>% change</td>
<td>EXISTING 664</td>
<td>VAC 37</td>
<td>% change</td>
<td>EXISTING 64.3</td>
</tr>
<tr>
<td>S2  1.8</td>
<td>1.1</td>
<td>0%</td>
<td>10.6</td>
<td>9.5</td>
<td>121%</td>
<td>60.0</td>
</tr>
<tr>
<td>S3  1.5</td>
<td>1.8</td>
<td>0%</td>
<td>90.5</td>
<td>90.5</td>
<td>27%</td>
<td>60.0</td>
</tr>
<tr>
<td>S4  1.2</td>
<td>1.2</td>
<td>0%</td>
<td>10.0</td>
<td>50.0</td>
<td>44%</td>
<td>1400</td>
</tr>
<tr>
<td>S5  1.5</td>
<td>1.4</td>
<td>7%</td>
<td>10.0</td>
<td>20.0</td>
<td>16%</td>
<td>908</td>
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