

# Relationship between socket pressure and EMG of two muscles in trans-femoral stumps during gait

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## Abstract

The biomechanical interaction between the leg stump and the prosthetic socket is critical in achieving close-to-normal ambulation. Although many investigations have been performed to understand the biomechanics of trans-tibial sockets, few studies have measured the socket interface pressure for transfemoral amputees. Furthermore, no report has examined how the residual muscle activities in the transfemoral stump affect the socket interface pressure characteristics during gait. In this study, an experimental method was developed to measure the trans-femoral socket interface pressures and EMG of muscles in the stumps of two trans-femoral amputees. Also, the measurement of three-dimensional prosthetic locomotion was synchronized to understand detailed socket biomechanics. Based on the experimental results, a significant correlation ( $P < 0.05$ ) was found between the measured temporal EMG amplitude and the interface pressure at the knee flexor (biceps femoris) and extensor (rectus femoris). Therefore, the residual muscle activity of a trans-femoral amputee's stump could be an important factor affecting socket-interface pressure changes during ambulation.

## Conclusion

Based on the test results, it was suggested that the residual muscle activities of the amputee's stump are important factors affecting socket interface pressure changes during locomotion. Therefore, it is important that the dynamic activities of residual muscles in the trans-femoral stump be considered in the design of a more comfortable and physiological prosthetic socket. Further study with a larger population is required for a complete understanding.

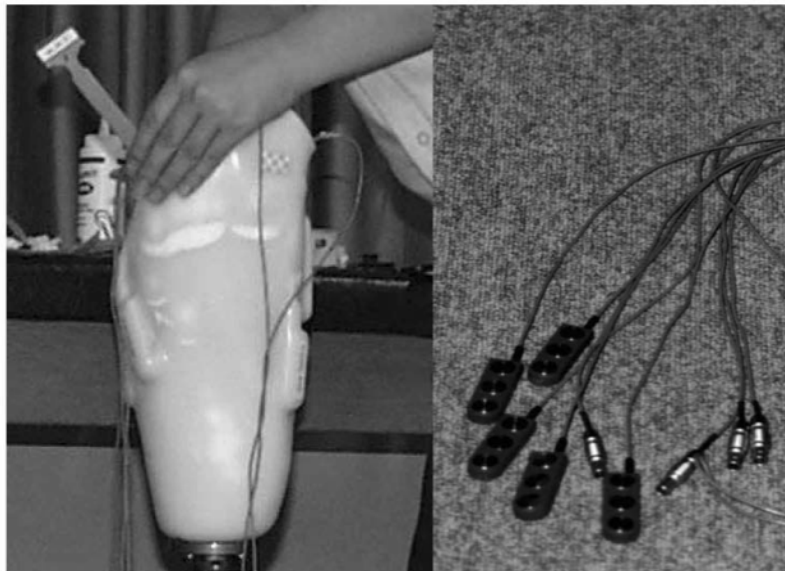


Figure 2. Specially fabricated trans-femoral socket for this study. The inner wall of the socket has slots for inserting MES electrodes. The locations of MES electrodes were determined based on individual stump muscles. The slots for the wires of the electrodes were also made for accurate socket-interface pressure measurement.

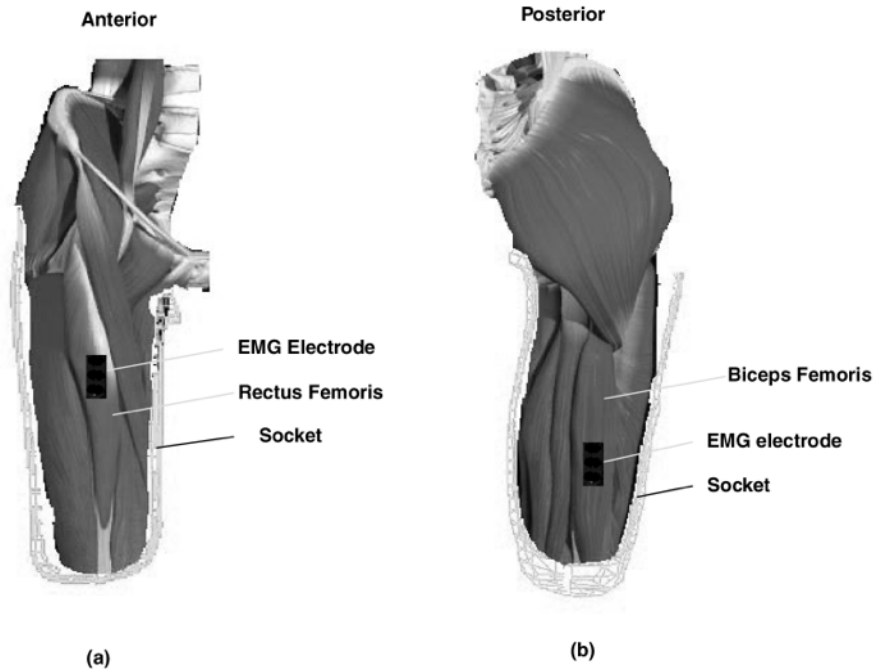


Figure 3. Electrode positions with respect to the stump. For the biceps femoris, the electrode was positioned at a point on a line between the ischial tuberosity and the amputated end (the fibular head for normal subjects). For the rectus femoris, the electrode was positioned at a point on a line between the anterior superior iliac spine and the amputated end (the patellar for normal subjects).

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