

Developments in the trans-tibial prosthetic socket fitting process: a review of past and present research

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Background: A revolution in trans-tibial prosthetic design began at the end of World War II with the development of new materials and a dramatic improvement in the understanding of biomechanics. Early research was based mainly on the improvement of existing prosthetic design practice. Today, research has been focused on providing a better understanding of stump/socket interface biomechanics and improving socket fit by attempting to quantify the normal/direct stresses at the interface.

Objectives: The purpose of this review paper is to question whether research and prosthetic education/training to date has significantly improved our understanding of what makes a good socket. Although there is no doubt that advances in socket fitting techniques have been made what is not clear is the actual extent to which these advances have improved the quality of sockets fitted.

Criteria for selecting studies for this review:

Types of studies: NA

Types of participants: TTA

Types of interventions: Education in prosthetics, Computer-Aided Design/Manufacture, Interface stress investigations (Finite element models, Correlation of FEA and stress investigations), Socket and liner advances.

Types of outcome measures: Sensors inserted between skin and socket/liner and sensors positioned within the socket wall

Search strategy for identification of studies:

Conclusion: It can be concluded that a new technique is needed to overcome some of the problems identified and thus aid prosthetic fitting techniques. It can also be concluded that there are no pressure/interface interaction measurement or FEA techniques which offer any significant advances in designing and fitting optimal sockets. There is no proof that CAD/CAM systems result in more comfortable sockets, but they can aid in reproducing a socket that the patient has found to be comfortable in the past. In current clinical practice stump/socket interface interactions can be considered in the prosthetic design process by examination of the skin colour on the clear check socket, but not in a quantitative manner (Sanders, 1995). Interpreting the comfort of prosthetic fit requires the prosthetist to have substantial clinical experience and can easily be misjudged. A new tool that could quantify the interface interactions would potentially be of great value, as it would reduce the chance of the prosthetist making an error at the fitting stage and could be used to validate FEA models for investigations into understanding the stump/socket biomechanics. The main problem that needs to be addressed is the quantification/visualisation of the stump/socket interface interactions and formulation of a relationship between the quantified values and the comfort of the prosthesis.