



A review of prosthesis socket thermal discomfort

Ghoseiri, K. and Safari, M.R.

Orthotics and Prosthetics Department, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

INTRODUCTION

Socket is the main component of the prosthesis that primarily provides structural coupling, control, and proper transfer of forces and motions at the interface by residual limb. Socket comfort impacts function of the amputee and the extent of prosthesis use. Amputees are dealing with thermal stresses in their daily activities. Unfortunately in this population all thermal transfer mechanisms including convection, radiation, evaporation and conduction are disturbed due to socket barrier, decreased body surface and vascular diseases in majority of them. Thermal environment inside prosthesis socket in addition to decrease quality of life, prosthesis use, comfort and satisfaction, could encounter amputee with risks of skin problems. The aim of this review is to provide an overview of thermal and perspiration discomfort inside lower limb and upper limb prostheses.

METHOD

The literature search was performed in two databases of PubMed and ISI Web of Science to find relevant articles. The time period chosen was the first date possible for each database until May 2013. The following key words used in combination for searches: amputation, amputee, residual limb, stump, socket, prosthesis, sweating, perspiration, hydration, temperature, heat, and thermal. The inclusion/exclusion criteria were according to Table 1.

Inclusion criteria	Exclusion criteria
English language	No abstract available
human as subject	Review articles
Study objective of thermal and/or perspiration discomfort inside prosthesis	Case reports, case studies, technical notes

Table 1. The inclusion/exclusion criteria

RESULTS

By consideration of the inclusion/exclusion criteria and hand search in references of the reviewed articles, finally 21 articles were selected for review. Table 2, shows a brief description of the articles.

First author, date	Prosthesis type	Thermal complaint: N (%)
Burger,1994	ULP	111(45.7%)
Cluitmans,1994	LLP	11(42%)
Datta,1996	LLP	40(77%)
Pereira,1996	ULP	10(33%)
Susak,1996	NR	16(100%)
Leow,1997	ULP	4(100%)
Hachisuka,1998	LLP	>6(20%)
Legro,1999	NR	NR
Vannah,1999	NR	51(20%)
Heim,2000	LLP	NR
Hachisuka,2001	LLP	39(47%)
Hagberg,2001	LLP	65(72%)

Davidson,2002	ULP	38(55%)
Peery,2005	LLP	NR
Charrow,2008	LLP, ULP	8(100%)
Almassi,2010	NR	223(66.5%)
Berke,2010	NR	317(66%)
Kern,2011	NR	9(100%)
Meulenbelt,2011	NR	11(25%)
Visscher,2011	LLP	NR
Ali,2012	LLP	NR

LLP: Lower limb prosthesis, ULP: Upper limb prosthesis, NR: Not reported

Table 2. Description of studies

DISCUSSION

This narrative review of the literature clearly shows the high incidence of reported heat and perspiration complaints from thermal environment of inside prosthesis socket. Although in reviewed articles, due to existing diversity in study purpose, design and participant no comparison could be done, but an evidence could be achieved to confirm the heat and perspiration discomfort exist from inside prosthesis socket without consideration of sex, age, amputation level, cause of amputation, time since amputation and daily prosthesis use.

CONCLUSION

Thermal comfort inside prosthesis socket could affect socket comfort. Although some efforts done previously and some has started to resolve the heat and perspiration problem of inside prosthesis socket, but these are in their infancy and far more researches in this field are required to achieve a safe and long lasting solution.

CLINICAL APPLICATIONS

Due to socket barrier for heat and perspiration, the environment of inside socket commonly is hot and moist. This situation causes thermal discomfort and prevents prosthesis use especially in summers and during long activities. Skin irritations, ulcers, infections and unpleasant odour are consequences of this thermal environment. Of course existence of this problem limits amputee's activities and causes discomfort and dissatisfaction from prosthesis.

REFERENCES

- Peery, J.T. J. Rehabil Res Dev.42,147-154,2005.
 Hagberg, K. Prosthet Orthot Int.25,186-194,2001.
 Huff, E. J. Prosthet Orthot.20,170-173,2008.
 Dudek, N.L. Arch Phys Med Rehabil.86,659-663,2005.

American Academy of Orthotists & Prosthetists
**40th Academy Annual Meeting &
 Scientific Symposium**
 February 26 - March 1, 2014