Original Article

Skin problems of amputees using upper limb prosthesis

Saba Afzal, Maryam Altaf, Natasha Fatima, Bazal Bukhari, Maham Nasir, Sadia Khan

Department of Orthopedics Surgery and Traumatology, The University of Lahore, Pakistan

Objective: To evaluate burden of skin problem in prosthetic users.

Methodology: In this observational or cross-sectional surveywas performed at Department of Orthopedics Surgery and Traumatology, Myo Hospital, Lahore from March to September 2020. Data were collected by using Self-made questionnaire from already diagnosed upper limb prosthetic users. Cronbach's Alpha value was 0.63.

Results: Out of 66 patients, 44 (66.7%) had skin problems. Most predominant skin problems was irritation seen in 21 (31.82%) patients. Others were ulcers, inclusion cysts, blisters and other than these problems seen in 3 (4.55%), 5 (7.58%), 6 (9.09%) and 9 (13.64%) patients, respectively.

Conclusion: Skin problems are most frequent complications for upper limb prosthetic users that create hindrance in activity.

Keywords: Amputees, upper limb prosthesis, skin problems.

INTRODUCTION

Amputations of upper limb are cause of severe functional loss, lower the self-body image of patient and also impacts badly on psychological condition.[1] Absence of tactile feedback or force, reduces hand grasp abilities.[2] There are about 2 million individuals in US who are living with amputation.[3] To prevent epidermis from damage such as infection, irritation and breakdown, skinof stump must be cared accurately.[4,5]

Most common problems related to socket of prosthesis comprised sweating and heat in socket of prosthesis (72%) as well as skin irritation and sores from prosthetic socket (62%).[6] Poor perfusion is reason of skin diseases in amputees suffering with peripheral vascular disease and diabetes mellitus, whereas mechanical stress are reasons of skin problems in healthy and active amputees.[7] High pressures application on the skin in an irregular way, may cause pressure sensitive skin, ulcers, irritations and partial or total vascular occlusions.[8,9] Economic, social and mental rehabilitation can be threaten by mistreatment or negligence.[10] These skin problems can be easily corrected by modifying socket and suspension system.[11,12] The aim of this study was to identify frequency of skin problem and predominant type of skin problem among upper limb prosthetic users.

METHODOLOGY

This observational or cross-sectional surveywas conducted at Department of Orthopedics Surgery and Traumatology, Myo Hospital, Lahore from March to September 2020.Online calculator EPI tool was used to calculate sample size.

$$n = \frac{z^2_{1-\alpha/s} P(1-P)}{d^2}$$

We usedSelf-made questionnaire and included already diagnosed upper limb prosthetic users of either gender. Cronbach's Alpha value was 0.63.Convenient sampling technique used. Age and age at the time of amputation and gender, level of amputation, cause of amputation, status of employment, type and presence of skin problem were recorded.

Statistical Analysis: The statistical analysis was performed by SPSS 24. For categorical variable Chi square test was applied. $p < 0.05$ was considered statistically significant.

RESULTS

The study included 66 upper limb prosthetic users. Age was 26 to 71 years. Trans radial and trans humeral amputees were 45 (68.2%) and 21 (31.8%), respectively. Patients had congenital deformity 24 (36.3%), trauma 22 (33.3%), cancer 5 (7.6%) and burn 15 (22.7%). Employed and unemployed patients were 51 (77.2%) and 15 (22.7%), respectively.

Out of 66 patients, 44 (66.7%) were suffering from skin problems and 22 (33.3%) were without any skin problem. The most predominant skin problems was irritation as 21 (31.82%) patients were suffering from this. Other problems noted were cysts, blisters and other than these problems were 3 (4.55%), 5 (7.58%), 6 (9.09%) and 9 (13.64%), respectively (Table 1).

Table 1: Skin problem frequency.

Skin Problems	Frequency	(%)
Ulcers	3	4.5
Irritation	21	31.8
Inclusion Cysts	5	7.6
Blisters	6	9.1
Others	9	13.6
None	22	33.3
Total	66	100.0

DISCUSSION

In our study, 66.7% patients had skin problems, most common being irritation. A study on skin problem of lower limb found that78% Trans-Femoral amputees and 59% Trans-Tibial amputeeshad skin problems due to prosthetic socket.[13] Irritation was in 31.8% amputees in our study. Another study reported that amputees that with prosthetic devices had skin problems between 32% and 90.9%. These problems may be excessive sweating, irritation and wounds.[14]

Colgecen et al, reported skin problems in70% cases allergic reaction like contact dermatitis in (45.7%).[15] Braaksma et al, found skin problems in 18% out of 195 patients using prosthesis.[16] Darter et al, reported low of about 18% to as high as 75% skin problems while using prosthesis, mainly from sweating.[17] Excessive or overloading by application of prosthesis and excessive sweating on skin of stump causes skin problems.[18]

All of the above studiesfound that prosthetic users had skin problems, percentage and predominant type of problem may change in different studies. Variations in results are due to difference of population, sample size and geographical area.

Skin problems are most frequent complications for upper limb prosthetic users that create hindrance in activity. These can be due to poor hygiene, poor or loose fitting of prosthetic socket, inappropriate suspension system and relative motion between socket and stump. These can be minimized by good hygiene, properly fitted prosthetic socket and modification in suspension system**.**

CONCLUSION

We found that 66.7% patients with upper limb prosthesis were suffering from skin problems. Most predominant problem was irritation.

Author Contributions:
Conception and design: Saba Afzal.
Collection and assembly of data: Saba Afzal, Natasha Fatima.
Analysis and interpretation of data: Maryam Altaf, Sadia Khan.
Drafting of the article: Bazal Bukhari, Maham Nasir, Natasha Fatima.
Critical revision of article for important intellectual content: Maham Nasir, Bazal Bukhari.
Statistical expertise: Maryam Altaf, Sadia Khan.
Final approval and guarantor of the article: Saba Afzal.
Corresponding author email: Saba: saba.afzal1@uipt.uol.edu.pk
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REFERENCES

1. Atallah R, Leijendekkers RA, Hoogeboom TJ, Frölke JP. Complications of bone-anchored prostheses for individuals with an extremity amputation: A systematic review. PLoS One, 2018; 13: e0201821.
2. Resnik L, Huang HH, Winslow A, Crouch DL, Zhang F, Wolk N. Evaluation of EMG pattern recognition for upper limb prosthesis control: a case study in comparison with direct myoelectric control. J Neuroeng Rehabil. 2018; 15: 1-13.
3. Shue S, Wu-Fienberg Y, Chepla KJ. Psychiatric Disease after Isolated Traumatic Upper Extremity Amputation. J Hand Microsurg. 2021; 13: 75-80.
4. Pomares G, Coudane H, Dap F, Dautel G. Epidemiology of traumatic upper limb amputations. Orthop Traumatol Surg Res. 2018; 104: 273-6.
5. Sankaran S, Murugan PR, Johnson JC, Abdullah HJS, Raj CMN, Ashokan. Prevention of skin problems in patients using prosthetic limb: A review of current technologies and limitations. 2019 International Conference on Communication and Signal Processing (ICCSP); 2019: IEEE.
6. Du Plessis JH, Berteanu M. The importance of prosthetic devices in sport activities for Romanian amputees who compete in Paralympic competitions. Am J Sports Med. 2020; 16: 3197-204.
7. Lannan FM, Meyerle JH. The dermatologist's role in amputee skin care. Cutis. 2019; 103: 86-90.
8. Paternò L, Ibrahimi M, Gruppioni E, Menciassi A, Ricotti L. Sockets for limb prostheses: a review of existing technologies and open challenges. IEEE Trans Biomed. 2018; 65: 1996-2010.
9. Davies KC, McGrath M, Stenson A, Savage Z, Moser D, Zahedi S. Using perforated liners to combat the detrimental effects of excessive sweating in lower limb prosthesis users. J. 2020. https://doi.org/10.33137/cpoj.v3i2.34610
10. Dickinson A, Steer J, Worsley P. Finite element analysis of the amputated lower limb: a systematic review and recommendations. Med Eng Phys. 2017; 43: 1-18.
11. Zaid MB, O'Donnell RJ, Potter BK, Forsberg JA. Orthopaedic osseointegration: state of the art. J Am Acad Orthop Surg. 2019; 27: e977-e85.
12. Afzal S, Bukhari B, Waqas M, Munir A. Skin problems of amputee using lower limb prosthesis. Rawal Med J. 2019; 44: 61-3.

13. Chatterjee S, Majumder S, Roy Chowdhury A, Pal S. Problems with use of trans-tibial prosthesis. J Med Imaging Health Inform. 2016; 6: 269-84.
14. Quintero-Quiroz C, Pérez VZ. Materials for lower limb prosthetic and orthotic interfaces and sockets: Evolution and associated skin problems. Revista de la Facultad de Medicina. 2019; 67: 117-25.
15. Colgecen E, Korkmaz M, Ozyurt K, Mermerkaya U, Kader C. A clinical evaluation of skin disorders of lower limb amputation sites. Int J Dermatol. 2016; 55: 468-72.
16. Braaksma R, Dijkstra PU, Geertzen JH. Syme amputation: a systematic review. Foot Ankle Int. 2018; 39: 284-91.
17. Darter BJ, Hawley CE, Armstrong AJ, Avellone L, Wehman P. Factors influencing functional outcomes and return-to-work after amputation: a review of the literature. J Occup Rehabil. 2018; 28: 656-65.
18. McGrath M, McCarthy J, Gallego A, Kercher A, Zahedi S, Moser D. The influence of perforated prosthetic liners on residual limb wound healing: a case report. Can Prosthet Ortho J. 2019: 2.