

Enhancing Rehabilitation and Quality of Life after Limb Amputation: Strategies, Challenges, and Solutions

Shaurya Mohapatra

Lecturer (Prosthetics & Orthotics), Department of Prosthetics and Orthotics, Chakradhara institute of Rehabilitation Sciences (CIRS), Bilpada, Near Gudiapokhari Chhak, Bhubaneswar, Odisha, Pin code 752104

Abstract: Amputation is a ruinous operation which only removes the whole/part of the limb, but does not cures the patient. As the consequence of it that one more disabled has been added in the society. In the developing world, trauma is the leading cause of amputation caused by inadequately treated fractures, motor vehicle accident and other motorized machinery. Referring to the present statistics of limb loss, the main leading causes are vascular disease (54%) including diabetes, PVD (Peripheral vascular disease). ICD (Intermittent claudication) etc, trauma (45%) and cancer (less than 2%). To overcome the postoperative complications, immediate rehabilitative intervention is essential. Several devices called walking aids were developing for this purpose that is for early ambulation, more reliable life, more independence, security, functionality approach and many more associated benefits. The goals are achieved by different physiotherapy modalities, mirror therapy, prosthetics interventions etc. Physical therapy for transfers and assisted ambulation are initiated. Assisted ambulation is at the discretion of the surgeon and therapist, depending on the patient's rehabilitation potential. Precautionary instructions regarding falling are provided to the patient to avoid the potential of injuring and opening the postoperative wound. A consultation should be obtained for psychosocial and emotional issues.

Keywords: Amputation, Mirror therapy, IPOP

1. Introduction

Lower-extremity amputation is one of the oldest known surgically performed procedures, dating back to prehistoric times. Neolithic humans are known to have survived traumatic, ritualistic, and punitive rather than therapeutic amputations. Cave-wall hand imprints have been found that demonstrate the loss of digits. Unearthed mummies have been found buried with cosmetic replacements for amputated extremities. Ever since the field of rehabilitation has emerged there has been a constant effort towards making the disable to able to do their activities daily living to increase the living style of an amputee. There are many professionals and researcher who play a vital role in field of innovation of new components and other technology. It is important to remember that earlier the onset of rehabilitation, the greater the success will be. To overcome the postoperative complications, immediate rehabilitative intervention is essential. Several devices called walking aids, were developing for this purpose that is for early ambulation, more reliable life, more independence, security, functionality approach and many more associated benefits. These goals are achieved by different physiotherapy modalities, mirror therapy, prosthetics interventions etc. Physical therapy for transfers and assisted ambulation are initiated. Assisted ambulation is at the discretion of the surgeon and therapist, depending on the patient's rehabilitation potential. Precautionary instructions regarding

falling are provided to the patient to avoid the potential of injuring and opening the postoperative wound. A consultation should be obtained for psychosocial and emotional issues. Support groups for people who have undergone amputations and discussion with someone who has undergone amputation are of assistance. The aim of this project is to develop a single universal supporting frame for both transtibial and transfemoral amputee to aid in early ambulation in post operative rehabilitation.

2. Materials & Methods

The concept of this design is based on the combined principles of pneumatic post amputation mobility aid (ppam) (Ortho Europe, UK), immediate postoperative prosthesis (ipop), and temporary prosthesis. Though the above designs have been effectively intervening the post-operative rehabilitation process but this design has an universal approach. In spite of the customized design, it provides wide use for varied lower limb amputation especially both trans tibial and transfemoral variety. This concept upgrades the existing designs with an adjustable frame design which can be given to a multiple no of amputee with required modifications. The pneumatic suspension system correctly encompasses the stump fulfilling the total contact principle. It has been emerged for the early and universal intervention for lower limb amputees.

SL. NO	Parts	Material	Benefits
1.	AK & BK Sections	16mm polypropylene	Gives a proper rigid structure
2.	Suspension system	Pneumatic pillow	Gives total contact pneumatic suspension Prevents rotation of the stump
3.	Adjustment provision	5mm hexagonal headed screw & nuts	Length adjustments with the help of proper slot.
		Elastic webbing with Velcro strap	Volume adjustments

Volume 12 Issue 9, September 2023

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY



Installation of Housing



Nut Attachment



5MM Screw



Modified 5MM Nuts



Pneumatic Pillow



Nylon Webbing



Inflator Pump



Foam



Frame for Transtibial Amputee



Frame for Transfemoral Amputee



3. Result

This entire project scenario includes both pros and cons. The overall design is a compact which provides better functioning and patient satisfaction. Although different types of pneumatic aids for early recovery of walking are currently in use and demonstrated their effective role, the device here presented overcomes some limitations of the available aids owing to its greater adjustability for patients. The Positive effects are Psychological boost, improves circulation and wound healing, Decreases pain, Reduces swelling, Decreases phantom limb sensation, Elevates reconditioning, Aids in edema reduction, Improves balance, Improves postural reactions, Provides total stump contact, Prevents post operative flexion contractures, Can be reused for other amputees, Cost effective, Less maintenance is required.

4. Discussion

This feasibility study showed that temporary application of an adjustable supporting frame for pneumatic bag as part of the rehabilitation programme for patients after lower-limb amputation was beneficial without contraindication and adverse effects even when we applied it a few days after amputation. Fitting of a pneumatic weight bearing temporary prosthesis had a tremendous benefit to the patient. There was a significant decrease in the perception of pain sensation which could be attributed to psychological factors and physical factors. Since psychological factors also play an important role in the individual's perception of pain, the psychological benefit provided by early ambulation would also affect the patient's gradation of pain scores

As per the author Hercegovics-Perri's design, it depends upon the type of fixator to be used after the surgery, the prosthesis can only fit the trans-tibial amputee and it involves the typical trans tibial suspension. In contrast, our design contains the adjustability facility both in length and volume which can be easily accommodating a trans-femoral amputation, in addition to this a total contact suspension principle is incorporated via the pneumatic air pillow.

Thomas L. BS made the design for Trans-tibial amputees which consists of several features like removal of the prosthesis during the physical therapy, pylon adjustability facility etc, the different features our design includes is that it can be fitted to the Trans femoral amputee also, it is an universal frame and can be used as an asset in the rehabilitation centre for early fitment to the patient.

According to the author Tod. A instead of a proper suspension system a custom removable cosmetic cover is

acting as an anchoring system. Hence it is highly customized and may take a period of time for fabrication as per the patients anthropomorphic data. The present said design bears a pneumatic suspension system with it via the pneumatic pillow and contacts the entire stump. In case of a slender patient the said pillow overlaps and gives extra suspension whereas in an overweight patient the pillow can provide adequate anchorage as per the need.

This design concept can allow 4 " of adjustment facility while changing from a trans tibial to trans femoral amputee, it can be extended higher by proper data collection of the average femur and tibia length after amputation. The frame should all time being sterilized before giving to the patient.

5. Conclusion

The conclusive aspect of our small study are encouraging and indicate that the use of an universal ambulating frame may be safe and reliable technique to facilitate rapid ambulation post-amputation. In comparison to conventional methods, patients were ambulant with this universal walking frame earlier i. e 7 weeks and 12 weeks more quickly in trans tibial and trans femoral amputees respectively. There were definite physical and although we did not specifically test for it, apparent psychological benefits, to patients requiring amputations for road traffic accidents, musculoskeletal malignancy, diabetes or infection. In spite of this particular study more research studies need to be availed to determine the best physical therapy treatment approach in addition with the use of this well adjustable ambulating frame for the effective and rapid come back to the normal life.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

References

- [1] Villarruel, George CP; Hercegovics-Perri, Tomie; Setoguchi, Yoshio MD; Watts, Hugh G. MD, Temporary prosthetic fitting over tibial stump lengthening device, JPO Journal of Prosthetics and Orthotics: July 2003-Volume 15-Issue 3-p 113-117
- [2] 3.2 Walsh, Thomas L. BS, CPO, Custom removable immediate postoperative prosthesis, JPO Journal of Prosthetics and Orthotics: October 2003-Volume 15-Issue 4-p 158-161
- [3] Kuiken, Todd A. MD, PhD; Soltys, Nicole T. CP, Technical Note:-An Economical Cosmetic Covering For Preparatory Prostheses JPO Journal of Prosthetics and Orthotics: April 2007-Volume 19-Issue 2-p 37-39

- [4] Smith, Douglas G. MD; McFarland, Lynne V. PhD, MS; Sangeorzan, Bruce J. MD; Reiber, Gayle E. PhD, MPH; Czerniecki, Joseph M. MD, Postoperative Dressing and Management Strategies For Transtibial Amputations:-A Critical Review, JPO Journal of Prosthetics and Orthotics: July 2004-Volume 16-Issue 3-p S15-S25
- [5] Zati Alessandro MD; Cavazzuti, Lorenzo PT; Okita, Yusuke PT, PhD; Mariani, Elisabetta MD; Benedetti, Maria Grazia MD, An Original Supporting Frame for Early Mobilization after Lower-limb Amputation for musculoskeletal tumor, Journal of Prosthetics and Orthotics: January 2017-Volume 29-Issue 1-p 35-38
- [6] Shilpshree Palsule, Ona Desai, L. T. M. Medical College & Hospital, Mumbai, Early post operative rehabilitation with a pneumatic weight bearing temporary prothesi. The Indian Journal of Occupational Therapy: Vol. XXXVI: No. 1 (April-July '04)
- [7] Richard W. Rausch, A. A. Khalili: Air splint in pre-prosthetic rehabilitation of lower extremity amputated limbs. : Physical Therapy, 1985.