Available online at http://www.journalcra.com

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

International Journal of Current Research
Vol.3, Issue, 3, pp.171-176, March, 2011

ISSN: 0975-833X

RESEARCH ARTICLE

IMPACT OF AMPUTATION - AN ERGONOMIC INTERVENTION

Visalakshi Rajeswari and Sarasvathi, V

Department of Resource Management, Avinashilingam Deemed University, Tamilnadu, India

ARTICLE INFO

Article History:

Received 18th January, 2011
Received in revised form
1st February, 2011
Accepted 5th March, 2011
Published online 13th March, 2011

Key words:

Rehabilitation,
Ergonomic intervention,
Prosthesis

ABSTRACT

Injuries are a major public health problem in India which also has a definitive causative pattern and mechanism. Every year, injuries contribute to a significant number of deaths, disabilities, amputations, disfigurement, pain, suffering and agony. Identifying issues and problems in the occupational health of women remains a challenge. Any accident/injury to the hand or leg which throws a prospect of decreased efficiency in the present occupation and hinder in other types of work must be considered serious. Injuries due to occupational accidents lead to serious consequences in terms of both clinical courses and economic losses. The causes of injuries can be road traffic injuries, occupational injuries, fire-related injuries, fall, domestic injuries, and violence. The impact of injuries on the general well being is reflected in terms of economic, social, psychological, physiological distresses in the victim .This in turn will reflect as the performance limitation in both the occupational and domestic settings. Absence of emergency and trauma care, inadequate care combined with various dangerous home remedies aggravate injuries and complications, especially in rural areas. Rehabilitation forms an integral part of overall trauma care. Low-cost walking-aid equipment as prosthesis with ergonomic perspective should be readily available for use in community centres. Ergonomic intervention to induce confidence in their life styles should also be attempted. Appropriate use of these techniques along with social support systems for employment, education and home care would be of help to many disabled persons and help to improve their quality of life. This paper presents the findings of a micro level study conducted on a sample of injured women in Coimbatore city.

INTRODUCTION

A study was conducted to find out the extent of injuries and rehabilitation efforts undertaken. The purpose of this retrospective study was to investigate the epidemiology and general characteristics of the amputees to assist in future planning of prosthetic services and to identify the possible ergonomic technique that could contribute towards attainment of improved quality of life. This study was carried out in a few famous hospitals of Coimbatore. It was selected randomly and the casualty cases of the hospital consisting of 19,685 patients were studied for the year 2010. The methodology adopted here are interview schedule and direct personal survey.

The study

Data recorded from an amputee intake form, maintained at the selected hospitals for all new admissions with the common characteristics dealing with age, sex, height, weight, education,

***Corresponding author:** drsramesh11@yahoo.in

marital and vocational status were obtained. In addition, the onset and date of amputation, cause and site of amputation, the length, shape and condition of the stump and range of joint motions were also found. Information on prosthetic prescription, duration of prosthetic fabrication, status of check-out and overall period of prosthetic rehabilitation were also deduced.

Number of amputees

The population under study comprised of 19,685 patients, out of which 15,035 were male and 4650 were female. The 15-45 year age-group had the highest population with 10,250 persons (52.07%). A total of 735 amputations had occurred in one year in the total population. Incidence density was calculated to be 4 amputations per hundred people-per year of observation. Amongst male (31.4%), maximum number of amputations occurred in the 20-30 year age group. Female (49.38%) met with the amputations in their 30-40 year age group. Only 10.4% cases were above 60-year age group.

Etiology

Majority of amputations were due to Trauma (55%) being the leading cause, followed by disease (32.45%) and congenital (12.55%) reasons. Trauma (86.87%) was the main cause of upper limb amputations. In the lower limb amputations both trauma (46.86%) and disease (40.58%) appeared to be almost equally responsible. Out of 36 multiple limb amputees' trauma was the cause for 59 per-cents. In congenital, lower limb amputees (76.3%) were most predominant. Specific causes of trauma were considered under "railway", "road" and "domestic/farm/ industrial" accidents; and "cut" injuries. Farm and industrial accidents were actual work related injuries, whereas domestic accidents were those sustained by individuals falling from trees and huts/houses, and injuries received during pursuit of their personal livelihood. Specific causes of disease were considered under "gangrene", "bone and joint infection", "leprosy", "tumor" and "vascular disease". Specific causes of amputation analyzed against five different age groups are: Among the trauma amputees (59.9. %) the most affected age groups were 20-30years of age. (30%) Patients of 30-40 age groups were amputated due to domestic/farm/industrial accident. Among 238 disease amputees 41-60 age groups (42.05%) were primarily involved, followed by 21-40 age groups (38.45%). Within the 41-60 age groups the specific causes of amputation, were, gangrene (52%), vascular disease (23%) and leprosy (14%).Congenital amputees usually came forward for assistance between 11-20 years of age (46%) and before 10 years of age (54%)surfaced

Levels of amputation

Among the 735 amputees there were (53.13%) lower limb, upper limb (46.87%) and 36 multiple limbs (4.89%) amputees. The levels of amputation are: below knee (30 %); followed by above-knee (24%), below-elbow (25%) and above elbow (21%) amputations. Among leg amputee partial foot amputation (8%) - (Chopart, Lisfranc, Ray) and ankle disarticulation – (7%) (Syme, Pyrogoff) were reported. With regard to the arm amputation of digits (10%) and metacarpal amputation (4%) reported

Impact of injuries

Economic impact: An injured person has to spend resources for care at different levels and can be enormous. The rehabilitation costs were huge in certain types of injuries such as road traffic injuries, burn injuries and work-related injuries. No insurance coverage is offered for rehabilitation Damage to goods had led to repair costs based on the extent of damage. Work absenteeism-an inevitable outcome-leads to loss of productivity and indirect losses to the employer. People after lower or upper limb amputation have problems relating to returning to work and working. Return to work rate is about 66% (43.5% after lower limb amputation and 53% for people after upper limb amputation).Almost 67 per-cents people after lower limb amputation retained the same occupation following amputation. After upper limb amputation (80%) have to change it. Post-amputation jobs generally more complex with a requirement for a higher level of general educational development and are being physically

less demanding jobs were spelt out as major problems

Social impact: Majority of the survivors experienced life-long psychosocial impact and had a poor quality of life, as society keeps overt as well as covert discrimination with them. They often experienced discrimination in some form: in the workplace, from general public and from their kinfolk and relatives. Majority of the patients completely changed their activities and only few were interested in the same activities as before. They had even changed their recreational pursuits

Psychological impact: Amputee patients, who had experienced longer hospital lengths of stay, were diagnosed depressed. This had suggested that scores on a depression scale could be positively correlated with longer hospital length of stay, which will be taken up in the later part of the study. Amputees reported more significantly problems with mobility, social isolation, lethargy, pain, sleep and emotional disturbance. Other impacts include depression, anxiety, crying spells, insomnia, and loss of appetite, suicidal ideas and psychotic behavior. In cases of trauma, the sudden and dramatic physical loss of limbs is unsettling in the extreme. It shatters the body image of the victim and reduces his self esteem to an alarmingly low level. Therefore the psychological effects of amputation are more dramatic and incapacitating to the victim's ego and to his social relationships. Thus the patient and his immediate family have a powerful motive for seeking early treatment.

III REHABILITATION

Rehabilitation forms an integral part of overall trauma care. Factors to be considered with various areas of amputation with are as given below

The Upper Limb: The functional capacity of the upper limb is determined by the shoulder complex, elbow, wrist, and hand developing multiple integrated spheres of action. Given the normal proportion of limb segments, this capacity is limited in relation to the surrounding space.

The Lower Limb: The three components of walking-progression, standing stability, and energy conservation-involve distinct functional patterns. There are two main progressional forces: The primary one is forward fall of the body weight. The second, which is generated by the contra lateral swinging limb, starts with the onset of single-limb support.

Standing Stability: Balance is challenged by two factors. The body is top-heavy, and walking continually alters segment alignment. During walking the body divides itself into two functional units-passenger and locomotor. The head, arms, and trunk are the *passenger* unit because they are carried rather than directly contributing to the act of walking. The *locomotor* unit consists of two limbs joined by the intervening pelvis.

Energy Conservation: The basic measure of efficiency is energy expenditure per task performed. For walking, this is oxygen used per meter traveled. Oxygen is consumed as the muscles contract. Thus efficiency is improved by reducing the amount of muscular effort required to walk. This normally is accomplished by two mechanisms: momentum is substituted for muscle action wherever possible, and displacement of the body from the line of progression is minimized.(Durbadal Biswas etal, 2010) .Five joints in each limb (hip, knee, ankle, subtalar, and metatasophalangeal), under the selective control of 28 major muscles, coordinate their actions to provide continual progression and weight-bearing stability with minimal displacement of the body's centre of gravity. To meet these demands each limb performs eight motion patterns that have been identified as the phases of gait.

Gait: A gait is considered as being composed of a sequence of kinematic characteristics of human (i.e. human motion) and most systems in existence recognize it by the similarity of the characteristics

1. Musculoskeletal Complications in Amputees:

Amputee management has the added dimension of complications related to the amputation-prosthesis interface. The complications of amputation surgery

can therefore be divided into pre prosthetic and post-prosthetic problems

Pre prosthetic Problems: (1) Delayed healing, (2) Skin Adherence to Bone of the Residual Limb.(3)Problems in Shaping of the Residual Limb.(4) Contractures.

Post prosthetic Complications: (1) Painful Residual Limb. (2) Adherence of Skin to Bone (3) Insensitive Skin, (4) Poor Fit (5) Degenerative Arthritis (6) Fracture (Sunder, 2010)

2. Prosthetic problems

A pilot survey of prosthetic problems for sample 500 patients was undertaken. Prosthesis was fitted for 405 patients and 95 amputee patients did not opt for the prosthesis due to financial constrain. Survey was undertaken for 100 female patients who had traumatic amputations over last year regarding the problems faced by them in the fitting of the prosthesis. 26 percents responded that they had significant problems using their prostheses for work both domestic and other work. Most problems were related to pain (45%) and attachment method (55%).

RESULTS

Activities of daily living

There is an extreme paucity of information in the literature relating to activities of daily living (ADL) among amputees.

Bathing

Of the total group, 80 percent could sit on the floor and bathe in the normal manner, 3 percent took a standing shower and 17 percent took; both latter groups or hand-rails to assist them. Of the bilateral amputees, 47 percent sat on the floor and 53 percent sat on a stool.

Getting in and out of chairs

Support was not required by 44 percent of patients but 48 percent needed arms on low chairs, while 8percent required arms on all types of chairs. Of the below-knee amputees, 87 percent did not require any support, while in above-knee about 67 percent amputees did need support.

Use of aids for ambulation

53 percent used no assistive devices, 41 percent used one cane and 6 percent used 2 canes or crutches and wheelchairs .Many more patients between 31 and 60 years used one or more assistive devices compared to those younger than 30 years. When both age and level of amputation are considered, 54 percent of below-knee fewer than 30 years and 20 percent of below knee above 30 years did not need assistive devices. In the above-knee group, 31 percent of those 30 years of age and under, and 7 percent of those above 30 years did not need assistive devices.

Daily distance walked

Ten per cent of the total patient population felt that they walked as much as non-amputees. Most of the patients (84%) walked outdoors daily for approximately 1-2 km, 2 percent walked only in the house, and 8.5 percent (among bilateral cases) did no walking at all.

Use of stairs

Patients were asked their ability to ascend and descend stairs. Only 47% of the group did not need help, while 8 percent (all bilateral) could not manage stairs at all. Those needing hand rails or other assistance totaled 70 percent. Of the total group, 16 percent descended stairs. step over step, while 81 percent preferred one step at a time.

Use of ramps

Most patients (92.8%) had no. trouble using ramps while 2 % needed help and 4.6% could not manage ramps at all with their prosthesis but could use them with a wheelchair.

Other effects of amputation

There are significant problems with current methods for attaching prostheses that need to be addressed. Factors affecting were put forth and

proved out as affecting their normal life were changes in Endurance (82%), walking downhill (78%), Recreation (75%),walking speed (65%), stability (42%),cosmesis (32%),and few reported that descending stairs was quite difficult (37%), Problems with fit (65%), appearance (54%), weight of the prosthesis (46%) were also reported.

Functional outcome was compared to level of amputation and age at time of amputation. Age had a definite effect on the functional outcome of the patient; as age increased, functional independence decreased. There was also a significant relationship between the level of amputation and functional outcome. The below-knee amputee was more independent than the above-knee and the bilateral amputee. There was a significant age and level of amputation interaction indicating that relative to the below-knee amputee, the above-knee amputee's functional independence decreased more rapidly with age. The functional decline of the bilateral amputee in comparison to the below-knee amputee was even more rapid.

Tackling the problem AS

The study set out to uncover the multidimensional impact of these limb-threatening injuries. It was observed that the majority of disabilities were due to amputations. The patients identified the following needs in their suggestions for improvement: (a) more cosmetic looking foot. (b) durable foot. (c) Complained of the heavy weight of prosthesis. (d) Manual on the maintenance of prostheses. (e) Ventilation holes and others water proofing of the artificial limb. (f) Complained of frequent breaking of locking joints .

Conclusions

Amputations of the lower limb were more frequent than those of the upper limb. In the lower limb, motorcar accidents were the main factors leading to amputation. 2.The ratio of males to females seeking treatment is very high, i.e. 8:1. 3.Right arm amputees are almost double in number to left. 4. The majority report late for treatment. 5. Lower limb prostheses are renewed more often than upper limb prostheses 6. The average life of prosthesis is about 5 years. 7. The average hospitalization or absence from work is about 8 weeks for manufacturing, fitting and prosthetic training. 8. Both poliomyelitis and accidents that produce the maximum number of disabled in India are preventable.

For these procedures to be effective, innovative community-based approaches should be employed as 80 percent of the population is rural inhabitants. In addition, research is needed to investigate the multiple deficits by an individual with partial absence requiring special attention when fitting a prosthetic system. Many of the amputees were neglected for as long as thirty-five years and, in many of the cases, revision of the stump was also required as bony projections, flabby musculature, contractures and sinuses were common. It was also observed that the conventional type of artificial limb did not suit the amputees from the villages. They needed an artificial limb which would permit them to walk bare-footed, allow them to squat and which would also permit them to sit in a cross-legged position. In addition these limbs should be ergonomic, economic, strong, simple, and easily repaired. So several improvements could be considered:

1. It can be made known through education and publicity that disabled can be rehabilitated and can once more be independent and earning members of society.

2. There should be more emphasis on the prevention of disabilities. Road safety campaigns could reduce car accidents and similar campaigns could be aimed at train accidents and industry accidents. Health education in diet and care of hands and/or feet; instructions in first-aid for minor injuries especially patients with diabetes mellitus should be undertaken

3. Encouragement of early management of the disabled should be undertaken as it would result in better rehabilitation as well **revolution in technology** as helping to prevent crippling complications.

4. Immediate fitting of temporary artificial limbs to these amputees in the villages, while they awaited their permanent artificial limb, would help tremendously in boosting their morale as well as

results in early gait training and improvement in muscle power.

Hence the future plans of the study are aimed at generating awareness among amputees on the benefit of the compatibility of the prosthesis and improving the existing prosthesis. Evaluating the outcome of the access to amputees and enlarge access to the same.

Acknowledgment

I would like to thank and extend my gratitude to my Guide Dr. Visalakshi Rajeswari, Dr.Rajsabapathy, Dr. Bakthavasalam, Mr.Mohanty for their encouragement and support given to conduct this investigatory study, which is a baseline study for my doctoral research on "An Ergonomic Perspective in the accessibility of prosthesis".

REFERENCES

Agarwal, A. K. and Goel, M. K. 1978. *Problems in the rehabilitation of the physically disabled in rural areas of India. Prosthetics and Orthotics International,* 2: 27-29.

Dr. Hitesh C. Sheth, 2005. Common Problems in Psychosocial Rehabilitation, International Journal of Psychosocial Rehabilitation, *10(1): 53- 60.*

Dr. Hla Pe, 1988. *A 15 year survey of Burmese amputees*. *Prosthetics and Orthotics International, 65-72*

Durbadal Biswas *et al.*,2010. *Energy Cost and Gait Efficiency of Below-Knee Amputee and Normal Subject with Similar Physical Parameters & Quality of Life: A Comparative Case Study,* Online Journal of Health and Allied SciencesPeer Reviewed, Open Access, Free Online Journal Published Quarterly : Mangalore, South India : ISSN 0972-5997**,**Volume 9, Issue 3; Jul-Sep 2010.

Sunder, S. 2010 *Text book of Rehabilitation,* Jaypee, 3 edition.

****