ORIGINAL ARTICLE

To Compare the Effect of Pre and Post Weight Bearing Anxiety, Depression in Conventional and Modular Prosthesis on Unilateral Transtibial Amputees

R. Raja[1], Ravindranath Rai[2], Sridharamurthy[3], B. Madhouraj[4], R. Balaji[5]*

[1]Kempegowda Institute of Physiotherapy, K. R. Road, V. V. Puram, Bangalore -560004 (Karnataka) India, [2] Department of Orthopaedics, K. S. Hegde Medical Academy, Deralakatte, Mangalore – 575018 (Karnataka) India, [3] Department of Orthopaedics, Kempegowda Institute of Medical Sciences, Orthopaedic Surgeon, K. R. Road, V. V. Puram, Bangalore -560004(Karnataka) India, [4] President of Indian Association of Prosthetist and Orthotist, R.R. Remedies, 32-A, II Agraharam, Salem – 636001(Tamil Nadu) India, [5] Junior Rehabilitation Officier, District Differently Abled Welfare Office, Tirupur District. (Tamil Nadu) India

Abstract:

Aims and Objectives: To compare the effect of anxiety and depression on unilateral trans tibial amputees those who are using conventional and modular patellar tendon bearing (PTB) prosthesis with stump exercises. *Material and Methods:* A sample of 40 persons with below knee amputation who were trained to wear prosthesis were studied with an experimental comparative study design. Patients who were admitted at Kempegowda Institute of Medical Sciences and Research Centre, Bangalore, K. S. Hegde Medical Academy and Research Centre Mangalore, (N=150) who underwent unilateral transtibial, transfemoral and other amputations between August 2009 - December 2011. To find out peri and postoperative prosthetic fitting, anxiety and depression level of transtibial amputees who wear conventional and modular PTB prosthesis. 3 years of experimental comparative study reveals that the outcome measures of peri and post-operative anxiety and depression level while using conventional PTB prosthesis with stump exercises and modular PTB prosthesis with stump exercises on unilateral transtibial amputees. *Results:* The unilateral transtibial amputees who were trained with modular prosthesis along with stump exercises group patients anxiety and depression levels are reduced as compared to the unilateral transtibial amputees who were trained with conventional PTB prosthesis along with stump exercises. There is no significant difference seen in both the groups while giving stump exercises alone. *Conclusion:* The unilateral transtibial amputees who were trained with modular prosthesis along with stump exercises group, patient's anxiety and depression levels are reduced drastically.

Keywords: Amputation, Psychometrics, HADS scale, PTB prosthesis.

Introduction:

Amputation is a triple insult that results in loss of function, body image, and sensation [1]. Amputation should be regarded as a treatment and not necessarily a tragedy. Following amputation the patient becomes physically, socially and psychologically impaired [2] Amputation of the lower limb can result in a permanent impairment and disability, by reduced capacity for productive activities among people of all age group [3]. The amputees experience the following four themes: 'lost in the dark woods', 'emotional collapse', 'difficulty in passing through the shadow' and 'ignition a gleam of hope'[4]. The loss of a body part can cause physical, psychological and social disturbance, the majority of previous studies in this area focused on the impact of amputation or the effectiveness of rehabilitation programme [4]. A general rule applicable to both upper and lower extremities, is that the more distal the level of amputation, better are the results with regard to overall function and efficiency of walking [5, 6, 7]. Further patients who have a lower extremity amputation that can be maintained at a transtibial level will have more efficient gait and better

function compared to those who have a transfemoral amputation. Therefore if an adequate soft tissue envelope permits, it is important to maintain as much skeletal length as practicable to optimize outcomes [8]. Amputation of a limb affects almost all aspects of an individual's life. Psychological state of the individual is one among them which is equally important in understanding the total wellbeing of the patient. According to Kolb [9], an alteration in an individual's body image sets up a series of emotional, perceptual and psychological reactions [10, 11]. In the below knee amputees the clinical anxiety and depression are the major complications that should be addressed quickly. The term depression frequently is misused to describe normal mood fluctuations. Clinical depression is used here to denote a seriously disabling autonomous condition capable of significantly increasing morbidity and even mortality. Rates of clinical depression in an outpatient setting were found in 23% - 35% of patients having undergone an amputation [12]. In an intense emotional response like grief, disbelief, numbness and anger are expected for a period of acceptance where sadness and despondency prevails following traumatic amputation which becomes part of the psychological adjustment. The mid and long term follow up has shown that more than half of the traumatic amputees develop a formal psychological disorder [13, 14]. Rehabilitation immediately after the below knee amputation is provided in a variety of ways by the physical therapists that could be considered as a continuum of an intensive inpatient rehabilitation service as a specialised unit using prosthetic devices. A study was therefore planned to compare the results of use of conventional and modular Patellar and Tendon Bearing (PTB) prosthesis with stump exercises

Material and Methods:

The study was a hospital based prospective peri and post treatment study. Sample for the study comprised of 40 adult (male and female) amputees out of 150 aged between 40 years to 44 years who underwent unilateral below knee amputation in between Sept 2009 to Sept 2012 selected under a simple random sampling method. The study was conducted at Kempegowda Institute of Medical Sciences Bangalore and Kshema Hospital Mangalore. The study period was from the post-operative day to the post prosthetic limb fitting day. The study samples were selected based on inclusion and exclusion criteria. The 40 adult amputee patients were divided into two groups having 20 subjects in each group, group A patients were given conventional patellar tendon bearing (PTB) prosthesis with stump exercises and group B patients were given modular PTB prosthesis with stump exercises respectively.

All 40 patients underwent physical therapy during hospitalisation. Daily 30 minutes of physical therapy for 12 weeks, counselling, the use of prosthesis and weight bearing status with surgical procedure were explained to the patient. Patients who had amputation were not permitted to bear weight until the surgical wound was well healed and non tender. Patients who had amputations, consultation with a prosthetist were initiated early during the initial hospital stay. Prosthetic fitting was performed after the six weeks of clinical follow up if the wound was well healed and non tender. Physical therapy was continued for prosthetic training with 3 visits per week for 4 weeks [15]. The data of pre-treatment and post treatment anxiety and depression were measured with the help of HADS SCALE questionnaire on both conventional and modular PTB prosthesis. [16]

One of the primary goals of the rehabilitation programme for people with a lower extremity amputation is to assist them in returning to and maintaining normal living activities with prosthetic devices which helps to reduce their anxiety and depression level.

Inclusion Criteria: Gender of subjects: male/ female, etiology of amputation (trauma/ cancer/PVD/DM), level of amputation (unilateral transtibial amputees),

all subjects immediately after amputation, ideal stump, patients who don't have phantom limb pain and other associated problems, patients who don't have cardio respiratory and renal problems, patients who report feeling of insecurity, self-consciousness, restlessness and depression as well as insomnia, post traumatic anxiety and depression were included in this study.

Exclusion Criteria: Level of amputation other than unilateral transtibial amputees, patients without ideal stump, patients with cardio respiratory and renal problems, patients with major associated psychological problems, patients who didn't want to participate in the study after being explained about the nature and purpose of the study, patients with past history of psychiatric disorders, patients with associated physical disabilities other than amputation.

The patients having psychiatric morbidity during the period of the study were treated. Psychiatrist carried out physical examination and mental status examination of the amputee patients. Central ethical committee clearance by NITTE University was obtained prior to peri and post treatment sessions. Informed consent was taken from each and every patient. The data of pre and post treatment anxiety and depression were recorded with the help of HADS SCALE while using conventional and modular prosthesis in unilateral transtibial amputees.

Conventional prosthesis also known as exoskeletal limb, the outer visible skin is the main structural element and such limbs are hollow attached with socket and joint. In this the weight bearing of the stump takes place at the boundary of the socket mainly 60% of the weight borne to patellar tendon and 40% of the weight borne to supracondylar region of the socket.

In the last decade the design, material and prescription of the prosthesis have changed dramatically leading to modular prosthesis.

Modular prosthesis also known as endoskeletal limb prothesis, this type of prosthesis is now most widely used for lower extremity amputee. It has a central structural tube to which the socket and joints are attached, and this is usually covered with shaped foam to match the contour of the contralateral limb as closely as possible. The advantage of this prosthesis is that it allows end weight bearing.

The HADS was developed as a self-reporting questionnaire to detect adverse anxiety and depression states. Amputee patients were asked to choose one response from the given four responses. The questions related to anxiety were marked as 'A' and to depression as 'D'. It has 14 items, 7 related to the anxiety and 7 to the depression. Scoring was done from 0-3 for each item and the total score ranged from 0-56. The normal values given were used to assess the level of anxiety and depression.

Anxiety and Depression were measured using Hospital Anxiety and Depression Scale and analysis of HADS and was presented on Mean SD (Min-Max) and results on categorical measurements were presented in number (%). Significance was assessed at 5 % level of significance. Explanatory questions for Anxiety (A) and Depression (D) were given below

Statistical Methods:

Descriptive statistical analysis was carried out in the present study. Chi square test was used to analyze the characteristics of the samples. Student't' test (two tailed, independent) was used to compare the means of Group A and Group B.

Self Reporting Questionnaire Based on HADS

A. I feel tense or "wound up" :		**D. I still enjoy the things I used to enjoy:**	
Most of time	3	Definitely as much	0
A lot of time	2	Not quite so much	1
From time to time, occasionally	1	Only a little	2
Not at all	0	Hardly at all	3
A. I get a sort of frightened feeling as if something awful is about to happen:		**D. I can laugh and see the funny side of things:**	
Very definitely and quite badly	3	As much as I always could	0
Yes, but not too badly	2	Not quite so much now	1
A little, but it doesn't worry me	1	Definitely not so much now	2
Not at all	0	Not at all	3
A. Worrying thoughts go through my mind:		**D. I feel cheerful:**	
A great deal of the time	3	Not at all	3
A lot of the time	2	Not often	2
From time to time, but not too often	1	Sometimes	1
Only occasionally	0	Most of the time	0
A. I can sit at ease and feel relaxed:		**D. I feel as if I am slowed down:**	
Definitely	0	Nearly all the time	3
Usually	1	Very often	2
Not often	2	Sometimes	1
Not at all	3	Not at all	0
A. I get a sort of frightened feeling like 'butterflies' in the stomach:		**D. I have lost interest in my appearance:**	
Not at all	0	Definitely	3
Occasionally	1	I don't take as much care as I should	2
Quite Often	2	I may not take quite as much care	1
Very Often	3	I take just as much care as ever	0
A. I feel restless as I have to be on the move:		**D. I look forward with enjoyment to things:**	
Very much indeed	3	As much as I ever did	0
Quite a lot	2	Rather less than I used to	1
Not very much	1	Definitely less than I used to	2
Not at all	0	Hardly at all	3
A. I get sudden feelings of panic		**D. I can enjoy a good book or radio or TV program:**	
Very often indeed	3	Often	0
Quite often	2	Sometimes	1
Not very often	1	Not often	2
Not at all	0	Very seldom	3

Results:

There were total of 40 amputees included in the study:
20 in the study group and 20 in the control group.

Table 1. Age Distribution of the Subject Studied

Age in years	Conventional Prosthesis	Modern Prosthesis
Mean ± SD	43.80 ± 7.12	42.75 ± 6.86

There was no significant difference in the mean age of these two groups.

Table 2. Gender Distribution of the Subjects Studied

Gender	Conventional		Ultramodern		Total	
	No.	%	No.	%	No.	%
Male	15	75.0	16	80.0	31	77.5
Female	5	25.0	4	20.0	09	22.5
Total	20	100.0	20	100.00	40	100.00

Majority of subjects (77.5%) were males

Table 3: Comparison Anxiety & Depression HADS Score within the groups

	Conventional mean ± SD	Ultramodern mean ± SD
Pre-intervention	40.25 ± 1.29 (38-42)	39.90 ± 1.25 (38 to 42)
Post-intervention	15.70 ± 3.19 (11-23)	12.05 ± 1.31 (10-14)
Significance	p = 0.000**	p = 0.000**
Percentage of change of improvement in imbalance		
Pre to post intervention	-1.56%	-2.311%

The above table shows that, analysis using Freidman's ANOVA mean values of HADS score there are statistically significant is different within the Group A and Group B.

Figure 1: Comparison of Anxiety and Depression within the Group A and B

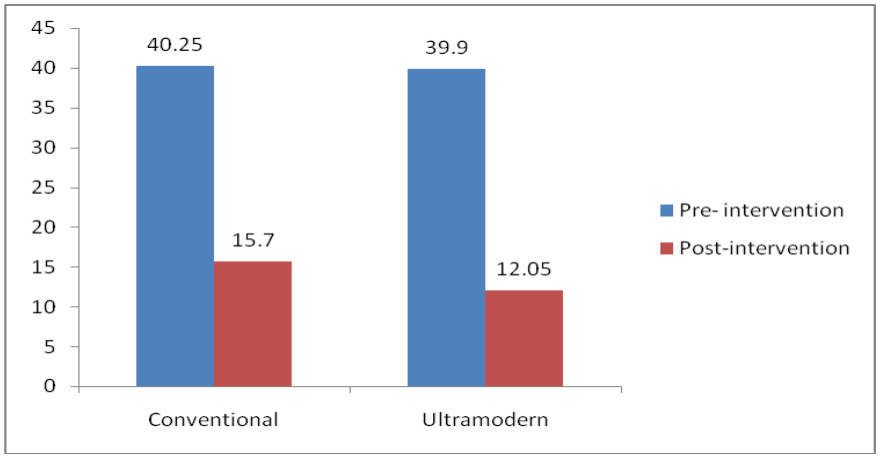
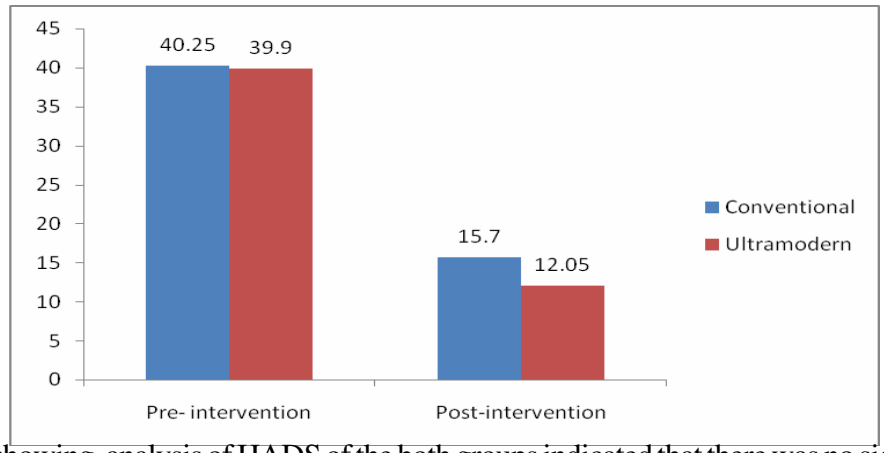


Table 4: Comparison of Anxiety and Depression HADS Score between the groups

	Conventional Mean ± SD	Ultramodern Mean ± SD	95% CI		Significance
			Lower	Upper	
Pre-intervention	40.25±1.29	39.90±1.25	0.465	1.165	t = 0.870; p = 0.390
Post-intervention	15.70±3.19	12.05±1.31	2.085	5.215	t = 4.721; p = <0.000**

The above table shows, analysis of HADS of the both groups using independent test showed that there was statistically significant change in means when compared to pre and post- intervention.

Figure 2: Comparison of Anxiety & Depression between the Conventional & Ultramodern Prosthesis



The above graph showing, analysis of HADS of the both groups indicated that there was no significant difference in pre intervention scores among two groups but statistically significant difference in the means of post- intervention scores.

In this study it is evident that, after a traumatic lower–extremity amputation, admission to a specialized inpatient rehabilitation programme with conventional below knee prosthesis with stump exercises improves functional and vocational outcomes and reduces anxiety and depression of the amputees, whereas the specialized inpatient rehabilitation programme with modular below knee prosthesis with stump exercises significantly improves functional and vocational outcomes and drastically reduces anxiety and depression of the amputees.

Discussion:

Prosthetic devices have been used for centuries to aid amputees in maintaining their quality of life and assist in their activities of daily living. The earliest written report of the use of prosthesis is in the Rig-Veda period between 3500-1800 BC (Lim, 1997). Since that time the field of prosthetics has continued to evolve. In the last few decades rapid advancements, not seen in other historical periods, have occurred. In each decade prosthetic professionals have displayed a unique ability to look to other fields and see how growth in these fields may be applied to prosthetics. This has allowed for the creation of prosthetic devices, which continue to meet or exceed the expectation of prosthetics users. The focus of this literature review is to identify the major advances and innovations of the 1990's which has seen prosthetic profession build on proven principles, quantify their achievement and improve upon their earlier advances.

Early post-operative phase of rehabilitation:

Post-operative rehabilitation should begin as soon as medically feasible, preferably on the day of surgery or at least by the first post-operative day. The goals of the rehabilitation programme include: intensive stump exercises which reduce the stump oedema and promote the healing, prevent contractures and the complications of bed rest, increase the stump muscle strengths. This assists with the adjustment of loss of body part, and maximising the functional independence [17]. The initial programme includes getting out of bed a minimum of three times a day with an emphasis on supine to sit and sit to stand transfer. Exercises are aimed at strengthening the intact lower limb and the remaining muscle groups for transtibial amputees like quadriceps, hamstring, hip abductors, hip adductors, hip flexors and hip extensors of the residual limb. Balance and co-ordination activities are essential to facilitate gait training. Ambulation training programmes vary depending upon the type of post-operative dressing. For patients with a standard dressing, edema control will begin with an elastic wrap over the gauze dressing with careful attention to the figure of eight technique with angular turns, anchoring around a proximal joint, greater pressure distally, and smooth wrinkle free application. Patients should be instructed in the wrapping technique early in the postoperative period and advised to avoid pushing or sliding the residual limb against bed or chair to prevent skin breakdown. Stump shrinkers are very useful after transtibial amputations. Contractures will be avoided with a combination of proper positioning, stump exercises, and prone lying at least 10 minutes twice a day. Pillows under the residual limb should be avoided to prevent the formation of a hip and knee contracture [18].

Transtibial amputees with an adequate fit of the prosthesis socket are more likely to function better in daily life than those with fitting problems of their prosthetic sockets [19, 20]. To determine the right range of movement after fitting the first prosthesis, it's necessary to know when the stump volume has stabilised. Fluctuations in stump volume may hinder an adequate prosthetic fit. Therefore, accurate measurement of the stump volume is important in prosthetic care.

Ambulation training with a temporary prosthesis begins in the parallel bars with a trial of standing and weight shifting to minimal weight initially to avoid pressure across incision line, for further progression standard prosthetic fitting can be done when the wound has healed and the sutures or staples have been re-

moved usually after 3 weeks of surgery. The hospital discharge is feasible when the patient is independent in short distance ambulation with the prosthesis and an assistive device [21].

The Hospital Anxiety and Depression Scale (HADS) has been used in several languages to assess anxiety and depression, in general post- surgical cases like trans tibial amputees. The (HADS) has been developed by Zigmond and Snaith in 1983. Its purpose is to provide the clinicians with an acceptable, reliable, valid, easy practical tool for identifying and quantifying depression and anxiety [16].

HADS has been translated and widely used in more than 25 languages since its original development. Hermann, in an extended review, has reported that the HADS has demonstrated reliability and validity when used to assess medical and post-surgical condition [22].

The study in the domain of psychological aspects like anxiety and depression of amputees has largely addressed the specific concerns of the adjustment after amputation. In the present study attempt has been made to analyse the changes in personality parameters of amputees with the help of conventional and modular PTB prosthesis along with stump exercises. A correct prosthetic prescription can be derived from adapting the functional benefits of prosthesis to the functional needs of the prosthetic user [23]. According to the World Health Organisation (WHO) the ability to change body position and the ability to walk are key components of mobility which reduces the anxiety and depression, Langer et al 1994 [24] has characterised depression in amputees as being constituted by indecisiveness, thoughts of death, or ideas of self-harm. Geurts et al 1992 [25]; Viton et al 2000 [26] have concluded that the ultimate goal of the rehabilitation of people with lower limb amputation is to regain functional walking ability. In the present study the authors have found that the advancements and light weight of ultramodern PTB prosthesis improves the functional walking ability which drastically reduces the anxiety and depression level in amputees.

Further, decreased self-esteem, distorted body image and increased dependency are few of the many reasons for the development of psychological maladaptation like anxiety and depression. Findings by Parkes are that in first year 25% amputees suffer from depression [27], feeling of insecurity, self-consciousness and restlessness. Hence increasing self-sufficiency by psychological intervention helps in ameliorating the distress [28]. In the present study the authors have found that the modular PTB prosthesis with stump exercises have shown more increase in the self-sufficiency as compared to the conventional PTB prosthesis with stump exercises. But both conventional and modular PTB prosthesis with stump exercises improves the walking ability of the patients which in turn reduces their anxiety and depression.

Amputation means a psychological reaction of loss, the loss is so much so that it is compared with the grief experience by an individual when he loses his near and dear ones; these reactions are manifested in different forms at different stages following amputation. In this study, the pre and post treatment data of peri and post-operative amputee's anxiety and depression have been measured with HADS scale and it is compared with conventional and modular Prosthesis along with stump exercises. The duration between amputation and the limb fitting is equally important in determining their reactions. Further Engsberg et al. 1992 [29] have found that the prosthetic socket prosthetic alignment, type of the foot and end weight bearing improves the walking ability. Using modular prosthesis drastically reduces the anxiety and depression than conventional prosthesis in amputees.

The consequences of the disability in the present study might have added to the anxiety [30]. The duration of anxiety and depression after amputation of three months is noted in all cases, therefore amelioration of anxiety and depression are primarily not based alone on duration after amputation and their inability of

walking. Active interventions like conventional and modular PTB prosthesis with stump exercises have militated positive effect after amputation. This conclusion is further strengthened by the observation that there has also been a statistically significant reduction in the scores on the HADS scale of anxiety and depression. Further the study carried out by Seidel et al [30] on patients of amputation of lower extremity have found 27% of them to be having depression and 25% having increased anxiety scores indicate a good acceptance of the prosthesis as an important predictive factor for the development of anxiety and depression. This is further confirmed by the finding of the present study where a significantly decreased score of depression and anxiety while using modular PTB prosthesis with stump exercises is seen.

It is evident from the study that modular prosthesis is desired compared to conventional prosthesis. Modular prosthesis is made up of light weight composite material, chiefly using carbon fibre, accurate socket design made by Computer Assisted Design (CAD) and Computer Assisted Manufacturing (CAM) of prosthesis which allows end weight bearing, easy correction of the prosthesis and its light weight which powers the prosthesis as better than conventional prosthesis.

Comprehensive management inclusive of psychological aspects, intensive stump exercises and the conventional on modular PTB prosthesis with GAIT restores patient's confidence in handling day to day life.

Conclusion:

It is suggested that the psychological evaluation and intervention should form a part of the overall management of amputees. The study has emphasised the role of psychiatrist, clinical psychologist, physiotherapist and prosthetics and orthotics as a part of the team in managing the cases. Further attempts may be made to evaluate patients with long term follow up,

Findings of the present study indicate important area of personality changes (anxiety and depression) due to type of PTB prosthesis and its advantages, stump exercises induces early ambulation in transtibial amputees. Comparing with conventional PTB prosthesis the anxiety and depression level are drastically reduced in post treatment while using modular PTB prosthesis; it is due to prosthetic advancements such as light weight, better design and better material of the prosthesis.

Refrences:

1. Racy JC. Psychological aspects of amputation. In Moore WAS. Malone JM (Eds). Lower Extremity Amputation. Philadelphia. WB Saunders Company 1989: 330-340.
2. Nigel H, Harris FE, Stinchfield MD. Post graduate textbook of Clinical Orthopedics, 1983. 2nd ed. Chapter No 8: The congenital amputee: 213-219.
3. Barabora E. Bates, Jibby E Kurichi, Clifford R Marshall, Dean Rekar, Greg Maislin, Margaret G Stineman. Does the Presence of a specialised rehabilitation unit in a Veterans affairs facility impact referral for rehabilitative care after a lower-extremity amputation? *Arch Phys Med Rehabil* 2007; 88(10):1249-1255.
4. Fen Liu, Rhonda M Williams, Hsueh-Erh Liu, Nai-Hui Chien. The lived experience of persons with lower extremity amputation. *J Clin Nurs* 2010; 19(15-16):2152-2161.
5. Pickard-Gabriel CJ, Ledford CL, Gajewski DA, Granville RR, Anderson RC. Traumatic transfemoral amputation with concomitant ipsilateral proximal fracture. A report of two cases. *J Bone Joint Surg Am* 2007; 89(12):2764-2768.
6. Hemdon JH, Tolo VT, Lanoue AM, Deffer PA. Management of fractured femora in acute amputees. Results of early ambulation in a case-brace and pylon. *J Bone Joint Surg Am* 1973; 55(8):1600-1613.
7. Pohjolainen T, Alaranta H, Karkkainen M. Prosthetic use and functional and social outcome following major lower limb amputation. *Prosthet Orthot Int* 1990; 14(2):75-79.
8. Dougherty PJ. Transtibial amputees from the Vietnam War. Twenty-eight year follow-up. *J Bone Surg Am* 2001; 83-A (3):383-389.

9. Kolb LC. Disturbances in body image: In Arielis, Reiser MF, Eds: American Handbook of Psychiatry, New York, Basic Books 1975; 4: 810-837.
10. Newell R. Body-image disturbance: cognitive behavioural formulation and intervention. *J Adv Nurs* 1991; 16(12):1400-1405.
11. Kashani JH, Frank RG, Kashani SR, Wonderlich SA, Reid JC. Depression among amputees. *J Clin Psychol* 1983; 44:256-258
12. Ebrahimzadeh MH, Hariri S. Long term clinical outcomes of unilateral transtibial amputations. *Mil Med* 2009; 174:593-597.
13. Melcer T, Walker GJ, Galarneau M, Belnap B, Konoske P. Midterm health and personnel outcomes of recent combat amputees. *Mil Med* 2010; 175(3):147-154.
14. Nielsen CC. A survey of amputees: Functional level and life satisfaction, information needs, and the prosthetist's role. *J Prosthet Orthot* 1989; 3:125-129.
15. May BJ. Setting Goals. Long Term Care in Amputations and Prosthetic: A Case Study Approach Philadelphia. FA Davis Company1996: 77-92.
16. Herrmann C. International experiences with the Hospital Anxiety and Depression Scale—a review of validation data and clinical results. *J Psychosom Res* 1997, 42:17-41.
17. Waters RL, Perry J, Antonelli D, Hislop H. Energy cost of walking of amputees: the influence of level of amputation. *J Bone Joint Surg Am* 1976; 58(1):42-46.
18. Burgess EM. Romano RL. Zeul JH: The management of lower extremity amputation. http://weber.u.washigton.edu:80/-dboone/mlea/title.html.1996.
19. Schoppen T, Boonstra A, Groothoff JW, de Vries J, Göeken LN, Eisma WH. Physical, mental, and social predictors of functional outcome in unilateral lower-limb amputees. *Arch Phys Med Rehabil* 2003; 84(6):803-811.
20. Malek F, Somerson JS, Mitchel S, Williams RP. Does limb-salvage surgery offer patients better quality of life and functional capacity than amputation? *Clin Orthop Relat Res* 2012; 470(7):2000-2006.
21. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta psychiatr Scand* 1983, 67(6):361-370.
22. Hofstad C, Linde H, Limbeek J, Postema K. Prescription of prosthetic ankle-foot mechanisms after lower limb amputation. *Cochrane Database Syst Rev* 2004;(1):CD003978
23. Parkes CM. The Psychological reaction to loss of a limb. The first year after amputation. Modern perspectives in Psychiatric Aspects of Surgery, New York, Brenner / Mazel 1976: 515-53.
24. Langer KG. Depression in disabling illness: severity and patterns of self-reported symptoms in three groups. *J Geriatr Psychiatry Neurol* 1994; 7(2):121-128.
25. Geurts AC, Mulder TW, Nienhuis B, Rijken RA. Postural reorganization following lower limb amputation. Possible motor and sensory determinants of recovery. *Scand J Rehabil Med* 1992; 24(2):83-90.
26. Viton JM, Mouchnino L, Mille ML, Cincera M, Delarque A, Pedotti A, Bardot A, Massion J. Equilibrium and movement control strategies in trans-tibial amputees. *Prosthet Orthot Int* 2000; 24(2):108-116.
27. Frank RG, Kashani JH, Kashani SR, Wonderlich SA, Umlauf RL, Ashkanazi GS. Psychological response to amputation as a function of age and time amputation. *Br J Psychiatry* 1984; 144:493-497.
28. Shukla GD, Sahu SC, Tripathi RP, Gupta DK. A Psychiatric study of amputees. *Br J Psychiatry* 1982; 141:50-53.
29. Engsberg JR, Tedford KG, Harder JA. Center of mass location and segment angular orientation of below-knee-amputee and able-bodied children during walking. *Arch Phys Med Rehabil* 1992;73(12):1163-1168.
30. Seidel E, Lange C, Wetz HH, Heuft G. Anxiety and depression after loss of a lower limb. *Orthopade* 2006; 35(11):1152, 1154-1156 and 1158.

***Author for Correspondence:** R. Raja, Associate Professor, Kempegowda Institute of Physiotherapy, K. R. Road, V. V. Puram, Bangalore -560004. Cell: 09448542011*
Email : vijiraja1972@rediffmail.com,