EFFICACY OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION STRENGTHENING TECHNIQUES VERSUS TRADITIONAL STRENGTHENING TRAINING TO IMPROVE AMBULATORY FUNCTION FOR UNILATERAL TRANSTIBIAL AMPUTEE

Razia Sultana

Bachelor of Science in Physiotherapy (B.Sc. PT)

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BHPI, CRP, Savar, Dhaka-1343

Bangladesh Health Professions Institute

Department of Physiotherapy

BHPI, CRP, Savar, Dhaka-1343

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We the undersigned certify that we have carefully read and recommended to the faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled

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Submitted by **Razia Sultana** for partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy (B.Sc. PT).

.....

Mohammad Anwar Hossain
Associate Professor, Physiotherapy, BHPI
Head of the Department of Physiotherapy
CRP, Savar, Dhaka
Supervisor

.....

Mohammad Habibur Rahman
Assistant Professor
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

E.Rahman
.....

Ehsanur Rahman
Assistant Professor
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

Shofiq
.....

Md. Shofiqul Islam
Assistant Professor
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

.....

Md. Obaidul Haque
Associate Professor & Head
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of information of the study. I would be bound to take written consent from the Department of Physiotherapy of Bangladesh Health Professions Institute (BHPI).

Signature: Razia Sultana **Date:** 04.10.2017

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Acronyms

BHPI	Bangladesh Health Profession Institute
BKA	Below Knee Amputation
BMRC	Bangladesh Medical Research Council
BS	Ballistic Stretching
CR	Contract Relax
CRAC	Contract-relax Antagonist-contract
CRP	Centre for the Rehabilitation of Paralysed
GTOs	Golgi Tendon Organs
HR	Hold Relax
ICF	International Classification of Functioning, Disability and Health
IRB	Institutional Review Board
LCI	Locomotor Capabilities Index
LLA	Lower Limb Amputation
MTU	Musculotendinous Unit
MVIC	Maximal Voluntary Isometric Contraction
PNF	Proprioceptive Neuromuscular Facilitation
ROM	Range of Motion
SS	Static Stretching
SPSS	Statistical Package for the Social Sciences
TF	Trans Femoral
TTA	Trans Tibial Amputation
TPT	Traditional Prosthetic Training
WHO	World Health Organization

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Abstract

Purpose: To identify the effectiveness of PNF strengthening training between traditional strengthening training for improving ambulatory function among the unilateral transtibial amputees. *Objectives:* To compare the PNF strengthing techniques and traditional strengthening training, find out the socio demography of the unilateral transtibial amputee and evaluate the effect of PNF Training for ambulatory function improvement in unilateral transtibial amputee patients. *Methodology*: The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. Four sessions of treatment was provided for every subject. This study was conducted by experimental study in which a total 10 participants were selected randomly included 5 control group and 5 experimental group. Data was collected by using socio demography and Locomotor Capabilities Index scale questionnaire to evaluate the improvement of ambulatory function. SPSS was used for data analysis which was displayed through table, pie chart, bar chart and parameter test- paired t-test and unpaired or unrelated t-test. *Results:* A significant improvement of ambulatory function were found in experimental group by using PNF strengthening training. So this treatment approach was considered as beneficial for unilateral transtibial amputee patient and physiotherapist can suggest this technique. *Conclusion*: The result of this study suggest PNF strengthening programmed with traditional strengthening program is effective for unilateral transtibial amputee patient. This would help to accelerate the improvement of ambulatory function.

Keywords: Functional abilities; Proprioceptive neuromuscular facilitation; Prosthesis; Transtibial amputation.

CHAPTER-I: INTRODUCTION

1.1 Background

The majority (53%) of amputation cases area unit classified as a transtibial (TT) or below-knee amputation (BKA), in which there is a loss of one or both legs below the level of the knee (Ziegler-Graham et al., 2008). Lower limb amputation (LLA) occurred approximately 91.7% because of traumatic injury, wherever men being at a considerably higher risk than female (Sahay et al., 2014). In recent study in Kolkata, 94.8% of the amputation population consisted of lower limb amputees, the foremost common age group affected by amputation being those in their 20s and 30s (Pooja & Sangeeta, 2013). The population of lower limb amputation ranges were 0.2 per 10,000 total population for first major amputation in Japan & were 115.7 per 10,000 population aged over 90 years in Sweden (Ephraim et al., 2003). A proportion of lower limb amputation individuals will successfully learn to use a prosthetic limb.

Depending on the sample studied and the definition of what constitutes "success", this proportion may be as low as 5% or as high as 100% (Brunelli et al., 2006). During the 10-year amount, LLA was performed on 62 females and 71 males with diabetes and on 79 females and 78 males without diabetes (Moxey et al., 2011). The incidence of initial unilateral amputation per 100,000 person-years was 192 for diabetic females, 197 for diabetic males, 22 for nondiabetic females, and 24 for nondiabetic males. The incidence increased from the age of 75 years (Jonasson et al., 2008). Of all amputations, 74% were transtibial.

The incidences of contralateral amputation and of re-amputation per 100 amputee years in diabetic female amputees were 15 and 16, respectively; in diabetic male amputees 18 and 21; in nondiabetic female amputees 14 and 18; and in nondiabetic male amputees 13 and 24 (Johannesson et al., 2009). Existing literature shows that diabetes is that the leading explanation for lower limb amputation and trauma accounts for the minority of those cases. The incidence of LLA is for seen by gender, age, marital status, and level of education, socio-economic standing and therefore the presence of diabetes. However, in some components of Africa wherever there is violence and wars, trauma is that the leading explanation for LLA (Godlwana et al., 2008).

Amputation can be performed as a disarticulation of a joint or as a transection through a long bone. The level of amputation is usually named by the joint or major bone through which the amputation has been made (Shurr & Michael, 2000). An amputation that involves the lower extremity can affect an individual's ability to stand and walk, requiring the use of prosthetics and, often, an assistive device for mobility. Amputation involving the upper extremity can affect other activities of daily living, such as feeding, grooming, dressing, and a host of activities that require manipulative skills. Because of the complex nature of skilled hand function, prosthetic substitution for upper limb amputation does not typically restore function to the same degree that lower extremity prosthetics do (Lusardi & Nielsen, 2007).

Between 25% and 45% of persons with amputation have had amputations of both lower extremities, most often at the TT level in either limbs or combination of TT amputation of one limb and TF amputation of the other (Meltzer et al., 2002). Because neuropathy and peripheral vascular disease occur in a symmetrical distribution, the risk of subsequent amputation of the contralateral lower extremity is high (Lusardi & Nielsen, 2007). Even with successful healing of the primary amputation site, amputation of part of the contralateral limb occur in 50% of patients within 2 to 5 years It is essential that patients with amputation go through a grieving process(Meltzer et al., 2002).

The two most common types of grief are anticipatory grief and normal uncomplicated grief. Anticipatory grief occurs before a loss and is associated with a diagnosis of a life-threatening illness, and a forthcoming amputation. The uncomplicated grief consists of five stages of grieving process; first one is denial stage which is usually experienced by people who go through traumatic amputations (Lusardi & Nielsen, 2007). The second stage is the anger. Often amputees blame God, the doctor, or others for their loss. In the third stage amputees may attempt to postpone the reality of amputation, this is called bargaining stage. The most complicated stage of grief is depression, which is normal and not clinical depression (Morris, 2003). Common symptoms of this stage include sleeping either too much or too little, negative feeling about the environment and the future, feeling of hopelessness, and talking about death. The last stage is the acceptance and hope; eventually amputees come to terms with their loss and start living again. Along with the loss of the

limb, amputees may also experience other complications, depending on their situation and the support from others. Example of these complications; loss of self-esteem, loss of self-confidence, fear of rejection from their mate, questions about the body image, and financial problem. One of the most common problems is losing the sense of independence and having to rely on others in the daily living activities (Morris, 2003).

Transtibial amputee patient has the problems of pain, edema, knee flexion contractures, wound healing, reconstruction surgeries, limited return to function, ambulatory function & a high rehabilitation cost. The main risks described within the early history of amputation surgery were hemorrhage, shock, and sepsis. Patients, his family & care givers should be remember of the realistic outcomes and expectations of amputation (Anjum et al., 2016). Persons United Nations agency have undergone amputations are usually viewed as incomplete people.

When the removal of a diseased limb and therefore the application of an appropriate prosthesis, the patient will resume being an energetic member of society and maintaining a freelance lifestyle. The patient should learn to walk with a prosthesis, apply and take away the prosthesis, look after the prosthesis, monitor the skin and therefore the presence of any pressure points, walk on tough surface, and use the commode at the night. The result is directly affected by level of amputation, stump length and therefore the age of patients (Anjum et al., 2016).The importance of excellent gait training cannot be immoderate. In reality, most new amputees need months of practice with their prosthesis. Walking with a prosthetic limb is that the primary goal of rehabilitation once a lower limb amputation.

By a physical therapy programmed, amputees will able to walk in a pattern of a normal gait approximately. The amputees want to perform additional vigorous indoor and outdoor activities and participate in sports. Gait training is the key of the ambulatory function and its main focus should be given to improve the symmetry, gait velocity, cadence, and step length of person with amputation. International Classification of Functioning, Disability and Health (ICF) is provided to measure the physical and functional performance in gait training (Hebert et al., 2009).

Traditional Prosthetic Training exercises to help maintain ROM and improve muscle strength in the lower limb and residual limb in preparation for using the prosthetic limb.

Abdominal and back exercises should also be considered to help trunk control and reduce back pain. Prosthetic limb exercises can help prevent occurrence of prosthetic gait deviations (Marek et al., 2005). Due to the loss of the limb the amputee will automatically shift their center of gravity over the foot of the non-prosthetic side. When associate degree amputation there will be an amount of time whenever the amputee is without a prosthesis. This is because of the timeframe of the assessments needed to make a decision if the availability of a limb is acceptable. During this period the amputee will become familiar with the shifted center which will increase the difficulty of reorientation of the center of gravity once they receive a prosthetic limb (Khamwong et al., 2010).

Prosthetic training should include orientation of center of gravity and improve weight bearing on the prosthetic side. There are a number of technique/exercises which can be employed to facilitate the rehabilitation of this, such as lateral weight shifting, forward and back weight shifting, high stepping, balance board, throwing and catching, obstacle stepping, football, braiding, single leg standing (Marek et al., 2005). Stretching is traditionally used as part of a warm-up to extend flexibility or painless range of motion (ROM). Increasing of ROM can promote performances, and reducing the risk of injury. Therefore trainers and other rehabilitation professionals also recommend that their patients stretch before performing strengthening exercises or strength assessment tests (Marek et al., 2005). Most of the studies are conducted to assess the results of stretching exercises on ROM (Khamwong et al., 2010). There are completely different techniques for increasing ambulatory function like a traditional and PNF stretching. The traditional technique incorporates a slow stretch of a selected muscle or muscle group, control at the purpose of discomfort for an amount of time ranging from 6 to 60 seconds (Feland et al., 2001). It is standard that Traditional Prosthetic Techniques enhance ROM. Within the literature, the increase in ROM, usually reportable when passive stretching, which can involve biomechanical, neurological and molecular effects, seem to be understood (Yuktasir & Kaya, 2009).

Proprioceptive neuromuscular facilitation (PNF) is an integrated approach for treating an individual as a whole person, rather than merely focusing on a body segment (Adler et al., 2007). The basic facilitation procedure provides a mean for therapists to help an amputee

efficient motor control in gait pattern that are necessary for proper ambulation. It is believed that PNF provides efficient treatment of multiple joints or muscles for functional movement patterns (Adler et al., 2007). Gailey and Clark suggested that the neuromuscular facilitation system may effectively achieve static standing, weight bearing steadiness, dynamic walking and weight shifting stability for amputees. A proposal that the difficulties arising from inadequate awareness of functional tasks because of the loss of the limb segment could be taught and restored more easily with proprioceptive feedback and furthermore reported that, in patients with transtibial amputation, prosthetic training based on proprioceptive feedback a lot of effectively improved weight bearing and gait as compared to a traditional programmed (Yigiter et al., 2002). However, these training methods have not been compared among patients with transtibial amputation (Sahay et al., 2014). Proprioceptive facilitation with appropriate biofeedback is also provided to improve the dynamic balance and overall mobility of patients but gait training part is missing with proper feedback (Lee et al., 2006).

Proprioceptive neuromuscular facilitation (PNF) may be a popular method of stretching that utilizes inhibition techniques, of these, contract-relax (CR), hold-relax (HR) and contract-relax antagonist-contract (CRAC) seem to be most typically used. The best period of isometric contractions employed in the PNF technique is 3 to 6 seconds. PNF techniques create use of proprioceptive stimulation for the strengthening (facilitation) or relaxation (inhibition) of particular muscle groups (Hindle et al., 2012).

One principle of PNF maintains that voluntary muscular contractions are performed together with muscle stretching to decrease the reflexive elements of muscular contraction, promote muscular relaxation, and later on increase joint ROM. Resistance to musculotendinous stretching involves each the mechanical elastic properties of muscle and connective tissue, in addition because the neurological reflexive and voluntary elements of muscular contractions (Khamwong et al., 2010). PNF stretch techniques are believed to reduce reflexive elements that stimulate muscular contraction and thereby modify joint range of motion to extend.

There was additionally a report using a single set of PNF stretching that demonstrated a significant increase in flexibility (Daneshmandi et al., 2011). Improving tissue flexibility

has additionally been mentioned as a way to reduce the risk of soft tissue injury and prevent muscle damage (Khamwong et al., 2010). Both mechanical and neural adaptation mechanisms are responsible for these changes throughout stretching. Studies suggest that self-produce and behavior therapy mechanisms occur throughout the PNF stretching technique application. Associate in isometric contraction of stretched muscle throughout applied PNF stretching technique triggers the self-produced inhibition mechanism, making a succeeding reduction in muscle tension through stimulation of Golgi tendon organs (Caplan et al., 2009). This mechanism lowers resistance to stretch, and is vital in improving ambulatory function. Additionally tension throughout the maximum isometric contraction of the stretched target muscle results in less resistance to length changes in the same muscle (Babault et al., 2010).

As an alternative, concentric contraction of an antagonist muscle causes reciprocal inhibition. Because of this reciprocal inhibition, an active reduction in resistance takes place in the target muscle. A reduced excitability of motor neurons placed within the stretched muscle, causing reciprocal inhibition, provides muscle compliance by permitting muscle lengthening (Yuktasira et al., 2009). Whereas several studies have determined variations between using a TPT and PNF or ballistic stretching analysis has not demonstrated indisputably that one technique is better than another. Both PNF and traditional stretching are commonly advocated techniques (Yuktasira et al., 2009). PNF stretch techniques have been demonstrated to extend joint range of motion as compared to non-PNF stretch techniques. PNF stretch techniques to passive mobilization and reported that the PNF procedure resulted in larger gains in gait.

1.2 Rationale

Amputation is the leading cause of disability worldwide. In under developed countries like Bangladesh it also causes impairment where health support system including rehabilitation is not available. For proper rehabilitation of amputee patient need physiotherapy. Most of the patients are taking medical treatment for their problem. Moreover a large part of population has lack of physical fitness, didn't regular physical exercise and has poor knowledge about rehabilitation programmed. Still health care delivery system in Bangladesh allows an individual patient to receive medical treatment for managing amputee patient for their proper improvement of ambulatory function. In order to have a successful rehabilitation for the amputee, certain factors need to be considered. Some of the factors are: age, health status, cognitive status, sequence of onset of disability, concurrent disease and comorbidity, and the level of amputation. The wide variation reported in the success of functional ambulation with a prosthesis after below knee amputation appears to be related to age and concurrent disease. The higher the level of amputation and loss of joints, long bone length, and muscle insertion, the greater the impairment of normal locomotor mechanisms. This leads to increased energy costs in prosthetic control and functional ambulation and a greater likelihood of functional limitation and disability.

PNF training is such treatment approach which is very effective in some study. This technique applied in India very recently but such research was not applied in Bangladesh. Proprioceptive neuromuscular facilitation (PNF) is common practice for increasing range of motion, though little research has been done to evaluate theories behind it. Proprioceptive neuromuscular facilitation shows potential benefits if performed correctly and consistently. If I found this technique effectiveness, I think it may very helpful in our professional as well as unilateral transtibial amputee sufferers also.

1.3 Objectives

General objective:

i. To compare the PNF techniques & TPT techniques for improving ambulatory functions in transtibial amputees.

Specific objectives:

i. To find out the socio demography of the unilateral transtibial amputees.
ii. To identify the most effective treatment for improving ambulatory functions.

1.4 Hypothesis

Null Hypothesis

$H_{\circ}$: $\mu_1 - \mu_2 = 0$ or $\mu_1 \geq \mu_2$, where the experimental group and control group mean difference is same or control group is higher than experimental group.

Alternative Hypothesis

Ha: $\mu_1 - \mu_2 \neq 0$ or $\mu_1 \neq \mu_2$, where the experimental group and control group mean difference is not same.

Where,

$H_{\circ}$= Null hypothesis

Ha =Alternative hypothesis

μ_1=mean difference in initial assessment

μ_2= mean difference in final assessment

1.5 Operational definition

Amputation

Amputation is the surgical removal of all or part of a limb or extremity such as an arm, leg, foot, hand, toe, or finger. There are many reasons an amputation may be necessary. The most common is poor circulation because of damage or narrowing of the arteries, called peripheral arterial disease. Without adequate blood flow, the body's cells cannot get oxygen and nutrients they need from the bloodstream.

Functional performance

A technique to define the requirements of a project, product or service based on the required functions and the specific needs related to those functions. For each function, needs are expressed in terms of assessment criteria, levels of performance and flexibility for each level.

Locomotor Capabilities Index (LCI)

Locomotor Capabilities Index (LCI) were developed to delineate the prosthetic profile of the person with LLA but more specifically to identify the factors related to prosthetic use or nonuse the LCI refers to one particular question of the PPA (Prosthetic Profile of Amputation) but can be used independently.

Prosthetic rehabilitation

The Prosthetic rehabilitation program provides limb absence rehabilitation for patient who have experienced amputation as a results of various cause like trauma, infection or congenital etc.

Proprioceptive neuromuscular facilitation (PNF)

A method of stretching muscles to maximize their flexibility that is often performed with a partner or trainer and that involves a series of contractions and relaxations with enforced stretching during the relaxation phase.

Transtibial amputation

Transtibial amputation is the amputation of the lower leg between the ankle and the knee. It is also called below-knee (B-K) amputation.

CHAPTER-II: LITERETURE REVIEW

Lower limb amputation incidence rates vary greatly in the literature. In part, this reflects the variation between countries, but also the study population selected in each. It ranges from 0.2 per 10,000 total population for first major amputation in Japan, to 115.7 per 10,000 population aged over 90 years in Sweden (Sansam et al., 2009). Following lower limb amputation a proportion of individuals will successfully learn to use a prosthetic limb. Depending on the sample studied and the definition of what constitutes "success", this proportion may be as low as 5% or as high as 100% (Brunelli et al., 2006). Better walking ability with a prosthesis is increased with the use of following rehabilitation (Gailey, 2006) and successful prosthetic rehabilitation has been shown to be significantly increased chance of living at home after lower limb amputation (Sansam et al., 2009). However, it is difficult accurately to predict mobility following rehabilitation with a prosthetic limb. The ability to estimate an individual's potential to walk with a prosthesis is important as this influences the type of prosthesis that will be suitable. This prediction can also be useful in informing amputees as to the likely outcome of rehabilitation and thus help them plan for future environmental requirements, such as at home, work or for social activities. A better understanding of the influence of various factors on walking potential will assist with this. This systematic review forms the first part of a larger research project investigating mobility following lower limb amputation.

Lower limb amputation is a permanent surgical procedure that has important functional and sequelae that can influence the daily activity of the person with amputation (van Twillert et al., 2014). Although rehabilitation aims to address these measuring the effect of these interventions on rehabilitation outcomes of people who have had an LLA remains a challenge (Coffey et al., 2014). The selected outcomes must be related to rehabilitation goals that are specific to each person and associated with premorbid function (Horne & Neil, 2009). This is surprising given that amputee rehabilitation programs have common goals to improve mobility and functioning through prosthetic fitting to assist community reintegration and to ultimately improve the overall functional activity of persons with an LLA (Zidarov et al., 2009). The best possible restoration of mobility and locomotor

function represents the cornerstone of rehabilitation programs (Franchignoni et al., 2007). The best possible restoration of mobility and locomotor function is a primary goal of rehabilitation programs following lower limb amputation. Amputation may involve a single limb (unilateral), both the upper or lower limbs (bilateral), or a combination of upper and lower limb amputations (multiple amputations). Amputation may be performed at various anatomical levels (Larsson et al., 2009).

Lower limb amputation may involve removal of one or more toes, part of the foot, ankle disarticulation (disarticulation is the amputation of a body part through a joint), trans-tibial (below the knee) amputation knee disarticulation, trans-femoral (above the knee) amputation, hip disarticulation and hemi-pelvictomy (removal of half of the pelvis). In high income countries, dysvascularity is the foremost cause of amputation; as a corollary the majority of amputations involve the lower limbs (Ziegler-Graham et al., 2008). The importance of an intact knee joint for providing the TTA patient with the ability to return to high-level mobility activities following rehabilitation. The majority of studies reported better walking ability and greater ability to achieve ADLs after distal and unilateral amputations compared with more proximal or bilateral amputations (Obalum & Okeke, 2009).

Increased age was associated with significantly less prosthetic ambulation and age does have a role in prosthetic and functional determinations but that it should not restrict candidacy. The age of the amputees ranged from below 20 years to above 70 years. The most common age group for amputation was 21-30 years of age, accounting for 32.0%of all amputees. The 31-40 year age group was second, accounting for 23.2% of all amputees, and the 20 years and below age group was third (14.2%) (Pooja & Sangeeta, 2013).

Persons with diabetes mellitus account for half of those with peripheral vascular disease (Carroll & Edelstein, 2006). With development of new surgical techniques, including bone graft and joint replacement as well as advancement in chemotherapy and radiation, the incidence of amputation due to osteosarcoma has decreased significantly.

Congenital limb deficiencies are another cause of amputation. Amputation can be performed as a disarticulation of a joint or as a transection through a long bone. The level of amputation is usually named by the joint or major bone through which the amputation

has been made (Shurr & Michael, 2000). An amputation that involves the lower extremity can affect an individual's ability to stand and walk, requiring the use of prosthetics and, often, an assistive device for mobility.

A proportion of individuals with lower limb amputation will successfully learn to use a prosthetic limb. Depending on the sample studied and the definition of what constitutes "success", this proportion may be as low as 5% or as high as 100% (Kisner & Colby, 2007). Better walking ability with a prosthesis is associated with the use of following rehabilitation protocol and successful prosthetic rehabilitation has been shown to be significantly associated with an increased chance of living at home after lower limb amputation. However, it is difficult accurately to predict mobility following rehabilitation with a prosthetic limb (Pooja & Sangeeta, 2013). The ability to estimate an individual's potential to walk with a prosthesis is important as this influences the type of prosthesis that will be suitable. This prediction can also be useful in informing amputees as to the likely outcome of rehabilitation and thus help them plan for future environmental requirements, such as at home, work or for social activities. A better understanding of the influence of various factors on walking potential will assist with this (van Twillert et al., 2014).

The prosthetist and the physical therapist, as members of the rehabilitation team, often develop a very close relationship when working together with lower-limb amputees. Physiotherapy plays a crucial role in the post-prosthetic management of lower-limb amputees (Hindle et al., 2012). Prosthetic gait training has several goals: to help amputees adapt to their new condition, to achieve optimal weight bearing on the prosthesis, to improve balance and reaction to disturbance, to restore the optimal gait pattern, to reduce the amount of energy needed to walk and to teach amputees how to perform daily operations like sitting down and walking up and down stairs. All this will help amputees regain their self-confidence and play an active role in society. The physical therapy treatment started at the 2nd day after the trans-tibial amputation (Kofotolis et al., 2005).

There are two training programed including pre-prosthetic training and prosthetic training phase. Pre-prosthetic training phase focused on the abilities of bed transfers, bed - (wheel) chair transfers and ambulation with crutches. Secondary objectives where on impairments; strengthening of hip extensors and abductors, knee extensors and lengthening of hip

flexors, knee flexors and hip adductors. Physical exercises and educated was provided to perform strengthening and stretching. A PNF based therapy, in which techniques such as Rhythmic Initiation, Combination of isotonics was used to teach the patient coordinated movements in synergies imitating functional movements. Repeated Stretch through Range and Dynamic Reversals where used to promote muscle strength and Hold Relax techniques aimed at increasing AROM (Hindle et al., 2012). The prosthesis provided was a Patella tendon bearing prosthesis. The patient has been trained in donning and doffing of the prosthesis and how to determine the appropriate socks also how to adjust them.

The patient's rehab was undertaken in an interdisciplinary team approach which is shown to promote higher levels of teamwork and team effectiveness and makes rehabilitation more likely to succeed (Korner, 2010). Traditional prosthetic training consisting of a pre-prosthetic phase and a prosthetic phase. The pre-prosthetic phase consisted of muscle strengthening exercises and the prosthetic phase consisted of weight bearing on the prosthetic limb, weight shifting, balance exercises and gait training. The treatment focus was initially on having the amputees learn to shift their weight towards the side of the prosthesis (Kisner and Colby, 2007). This began with the patient standing in the parallel bars. Forward backward and sideways weight shifting exercises were administered so that amputees could experience the orientation of their center of mass over the base of support. To promote increased weight bearing on the prosthesis, single limb loading and weight shifting exercises were administered whilst the sound limb was advanced. The amputee also learned side stepping and stepping forward and backward with the sound and prosthetic limbs. The therapists used none of the PNF principles and techniques (e.g., manual contact, verbal command, vision, and timing for emphasis, resistance, approximation, and stretch (Adler et al., 2007).

PNF is an approach to therapeutic exercise that combines function-based diagonal patterns of movement with techniques of neuromuscular facilitation to evoke motor responses and improve neuromuscular control and function. PNF can be used to: develop muscular strength and endurance; facilitate stability, mobility, neuromuscular control and coordinated movements; and to lay a foundation for the restoration of function (Kisner and Colby, 2007; Adler et al, 2007). PNF’s functional movement patterns are diagonal and

spiral, often crossing the midline of the body. PNF uses these movement patterns as everyday tasks and skills, from picking up a bottle of water to throwing and kicking, naturally involve diagonal and spiral movements (Burton and Brigham, 2011).

Proprioceptive Neuromuscular Facilitation (PNF) is a stretching technique utilized to improve muscle elasticity and has been shown to have a positive effect on active and passive range of motions (Funk et al., 2003). Recent research has been focused on the efficacy of the intervention on certain outcome measures, such as passive range of motion (PROM), active range of motion (AROM), peak torque and muscular strength. This review is important for the justification of its usage within therapeutic and athletic settings in order to rehabilitate injuries by gaining AROM and PROM or improving performance (Bradely et al., 2007).

In clinical settings, PNF is already utilized by therapists to restore functional range of motion (ROM) and increase strength in patients who have sustained soft tissue damage or received invasive surgeries. Two techniques are seen in the literature more frequently than others, the contract-relax method (CR) and the contract-relax-antagonist-contract method (CRAC) of PNF. The CR method included the target muscle (TM) being lengthened and held in that position while the participant contracted the TM to its maximum isometrically for an allotted amount of time (Mikolajec et al., 2012). This was followed by a shorter relaxation of the TM that usually included a passive stretch. The CRAC method followed the exact same procedure as the CR method, but was continued further. Instead of just passively stretching the TM, the participant contracted the antagonist muscle to the TM for another allotted period of time. PNF has also been found to increase muscular performance when performed in regard to exercise. If performed before exercise, it will actually decrease muscular performance; however, studies have shown that if PNF is performed either after or without exercise it increases muscular performance (Marek et al., 2005; Mikolajec et al., 2012). In order to maintain these increases, both for ROM and muscular performance, it necessary to do at least two sets of PNF each week.

Research behind stretching has been relatively inconclusive in examining the effects of static stretching (SS), ballistic stretching (BS), and PNF stretching on outcome measures, such as injury prevention and athletic performance. The only noted difference between the

three stretching protocols has been PNF's ability to cause a larger magnitude of gains within subjects' ROM, both active and passive (Funk et al., 2003). There are almost no physiological mechanisms that lead to an increase in ROM proposed in the literature. The four theoretical mechanisms discussed in the literature will be further discussed in this review. These four mechanisms are: autogenic inhibition, reciprocal inhibition, stress relaxation, and the gate control theory (all of which provide potential ways for PNF to increase ROM) (Sharman et al., 2006; Rowlands et al., 2003).

PNF has been compared to the traditional methods of stretching (SS and BS) when it comes to ROM, athletic performance, and power output (Funk et al., 2003). However, its effect on muscular function is less clear, as it decreases muscular function when performed before exercise yet increases it when performed afterward (Bradley et al., 2007; Marek et al., 2005; Mikolajec et al., 2012). This effect on muscular function is discussed in this review paper. Other factors that can affect the desired effects of PNF include, the age and gender of the person PNF is being performed on, the duration of the contraction, the specific muscles being stretched, the technique employed (CR or CRAC), and the percentage of the maximal voluntary isometric contraction (MVIC) performed. Only a few studies that were found discussed these other factors (Feland and Marin, 2004; Rowlands et al., 2003). PNF stretching provide a foundation upon which application of this technique will be validated, along with describing PNF as a means of gaining more ROM and helping to develop muscular strength and performance.

Four theoretical physiological mechanisms for increasing ROM were identified: autogenic inhibition, reciprocal inhibition, stress relaxation, and the gate control theory (Sharman et al., 2006; Rowlands et al., 2003). Each of these theoretical mechanisms are reflexes that occur when the Golgi tendon organs (GTOs) in the tendons of the TM, or in the antagonist muscle to the TM, detect harmful stimuli (such as a stretching sensation or during a contraction). Each theory can be used to explain why an increase in ROM during both the CR and CRAC methods of PNF.

Autogenic Inhibition- Autogenic Inhibition is what occurs in a contracted or stretched muscle in the form of a decrease in the excitability because of inhibitory signals sent from the GTOs of the same muscle (Sharman et al., 2006). This tension causes activation of Ib

afferent fibers within the GTOs. Afferent fibers send signals to the spinal cord where the stimulus causes the activation of inhibitory interneurons within the spinal cord. These interneurons place an inhibitory stimulus upon the alpha motor neuron, decreasing the nerves' excitability and decreasing the muscles' efferent motor drive (Sharman et al., 2006). It is theorized that this reflex occurs as the body attempts to spread the workload evenly across the motor unit within the muscle, assisting the asynchronous recruitment of the body in preventing specific motor units from fatiguing. This chain reaction causes the TM to relax, which is one of the driving theories behind the increased elongation of the muscle fibers during the CR and CRAC methods of PNF stretching (Rowlands et al., 2003). Autogenic inhibition relies on the body's self-regulatory mechanisms of the GTOs in order to protect structures. However, in the case of both CR and CRAC PNF stretching, contraction of the TM during stretching and contraction of the antagonist muscle (CRAC) take advantage of this mechanism to decrease muscle tension, allowing for elongation of the muscles fibers. This allows the CRAC method of PNF stretching to take advantage of the viscoelastic properties of the musculotendinous units, allowing the muscle to "creep" and elongate, thus increasing the ROM of the subject. Although, there is uncertainty as to how much of a part GTOs play in PNF stretching, and the long term improvements seen in subjects as a result (Sharman et al., 2006).

Reciprocal Inhibition- Reciprocal inhibition is what occurs in the TM when the opposing muscle is contracted voluntarily in the form of decreased neural activity in the TM (Sharman, 2006). It occurs when an opposing muscle is contracted in order to maximize its contraction force, in this case, the TM relaxes. This relaxation of the TM is a result of the decrease in the neural activity, and the increase of inhibition of proprioceptive structures in the TM (Rowlands et al., 2003). Inhibition of the electrical activity in the stretched TM occurs due to the neurons' continuation of firing in the TM, the contraction of the antagonist muscles would be resisted and diminished by the force of the TM continuing to receive signals to contract. On a spinal level, Ia afferent fibers enter the spinal cord and give off collateral branches that interact with interneurons in the spine, which then send signals to the alpha-motor neuron in the GTOs of the TM. The effect of this connection is inhibitory and causes relaxation of the TM (The Nervous Statement, 2003; Sharman et al., 2006). The mechanism of PNF referred to above, is the way in which TM

and its antagonist muscles work together. When one contracts, the other relaxes and is thus inhibited in order to prevent the muscles from working against one another.

Stress Relaxation- Stress relaxation is what occurs when the musculotendinous unit (MTU), which involves the muscles and the connected tendons, is under a stress (Sharman et al., 2006). Both muscles and tendons have viscoelastic properties in which they exhibit characteristics of both viscous and elastic materials. A viscoelastic material both resists shear flow and strain linearly when stress is applied and returns to the original form once the stress is removed from the MTU. As what was mentioned before, when the MTU falls under a constant stretch, a phenomenon known as "stress relaxation" occurs. This decreases the force generated by the viscous material when it resists the elongation stimulus that stretching causes within the MTU. Because the viscous material loses its ability to resist the stretch over time, the MTU slowly increases in length, a property that is referred to as "creep" of the MTU (Sharman et al., 2006). There is a limit to how far a muscle can "creep," as the longer a MTU gets, the higher the passive torque (resistance of MTU to stretching) and the muscle's stiffness become (Sharman et al., 2006). Though, as the stretch is held, the stress relaxation occurs and there is a decrease in the passive torque and muscle stiffness that lasts for a short period of time (Sharman et al., 2006). This is a protective mechanism to prevent muscle tearing and maintain a healthy relationship between the contractile units of the muscle sarcomere. When the CR method is utilized in PNF stretching, the contraction of the TM increases the tensile stress upon the MTU, encouraging the "creep" of the muscle fibers when in an elongated orientation. This is similar to the CRAC method, except for the fact that the contraction of the antagonist muscle applies more tensile force on the TM.

PNF is a stretching technique utilized to increase ROM and flexibility. PNF increases ROM by increasing the length of the muscle and increasing neuromuscular efficiency. PNF stretching has been found to increase ROM in trained, as well as untrained, individuals. Effects can last 90 minutes or more after the stretching has been completed (Funk et al., 2003). The duration of these effects can vary because of various things, such as changes in the percentage of MVIC asked for and the duration of the contraction of the TM during PNF stretching (Feland and Marin, 2004; Rowlands et al., 2003).

CHAPTER-III: METHODOLOGY

3.1 Study design

The aim of this study was to find out the effectiveness of between PNF technique and TPT among trans-tibial amputee patients attended at Prosthetics and Orthotics unit at CRP-Savar. Experimental design of quantitative research which was Randomized Control Trial sign was chosen because the experimental study is the best way to find out the effectiveness of the study.

A pre-test (before intervention) and post-test (after intervention) was administered with each subject of both groups to compare the effects of both treatment procedure before and after the treatment.

3.2 Study area

Study area was unilateral transtibial amputee patients who attended in the Prosthetics & Orthotics unit of Centre for the Rehabilitation of the Paralyzed (CRP), Savar. Because these patients came at CRP from all over the Bangladesh from all economic groups for comprehensive rehabilitation, so it reflected the entire population.

3.3 Study Population

The study participants are first screened in accordance with the inclusion and exclusion criteria. The populations of this study are the transtibial amputee in Bangladesh specially in the Prosthetics & Orthotics unit of Centre for the Rehabilitation of the Paralyzed (CRP), Savar.

3.4 Sampling technique

Simple random sampling technique was used for this study. Subjects, who met the inclusion criteria, were taken as sample in this study. 10 patients with unilateral transtibial amputee were selected from Prosthetics & Orthotics unit of physiotherapy department of CRP, Savar and then 5 patients were randomly assigned to Experimental group comprising of PNF treatment approaches with other normal strengthing treatment and 5 patients were assigned to Control group with only normal strengthing treatment for this study.

3.5 Inclusion criteria

- Lack of muscle contractures or lack of limitations in the joint range of motion.
- Absence of other limb segments.
- First time prosthetic user.
- A minimum stump length of one-third of the tibial length.

3.6 Exclusion criteria

- A history of vascular disease.
- Hypertension.
- Phantom pain.
- Neuroma.
- Cardiac disease.
- Gross deformities of stump such as tightness, contracture or deformity.

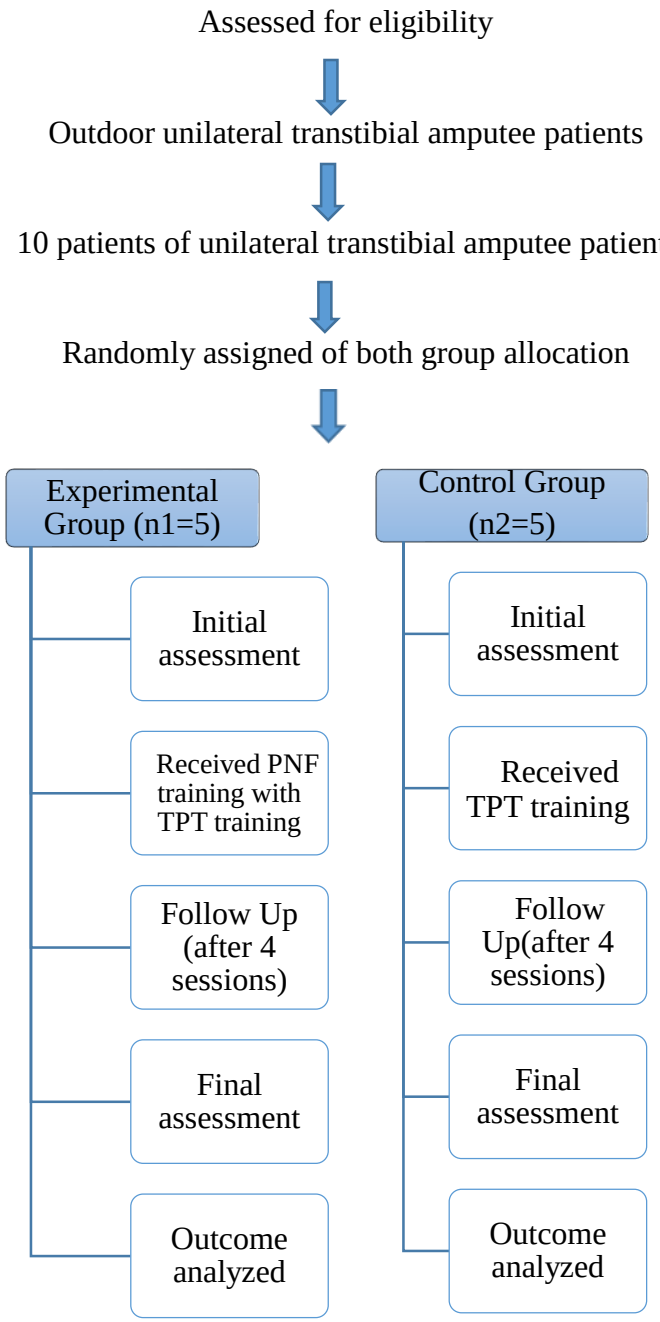
3.7 Sample size

According to inclusion & exclusion criteria the researcher had taken 10 participants as sample. Due to time limitation the researcher had to choose 10 participants to conduct this study; within the short time it could not be possible to conduct the study with a large number subjects.

3.8 Randomization

Subjects, who fulfill the inclusion criteria, was taken as sample in this study. Ten unilateral transtibial amputee patients were selected from outdoor Prosthetics and Orthotics department of CRP (Savar). From the outdoor patients with unilateral transtibial amputee condition, 10 patients randomly selected from outdoor Prosthetics and Orthotics, CRP and then 5 patients with unilateral transtibial amputee were randomly assigned to PNF with traditional prosthetic training group and 5 patients to the only traditional prosthetic training group for this randomized control trial study. When the samples were collected, the researcher randomly assigned the participants into experimental and control group, because it improved internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc. for the control and E1, E2, E3 etc. for experimental group. Total 10 samples included in this study, among them 5 patients were selected for the experimental group (received PNF with traditional prosthetic training) and rest 5 were selected for control group (traditional prosthetic training only).

Flowchart of the phases of True Experimental Study



A flowchart for a Randomized Control Trial of a treatment program including traditional physiotherapy with PNF strengthing for patient with unilateral transtibial amputee.

3.9 Treatment Protocol

PNF strengthing training was applied by a graduate qualified physiotherapist who is expertized in PNF technique to the patients of experimental group and home advice given to the patients. Both group received treatment weekly two days in two weeks.

Experimental Group Treatment Protocol

The amputees received 2 weeks of pre-prosthetic phase training and prosthetic phase training. The 1st week consisted of the pre-prosthetic phase, which included strengthening of the lower limbs. All muscles of amputated and sound limbs underwent resistance training. The muscles trained included the hip flexors, extensors, abductors, adductors, knee flexors and extensors, irrespective of the muscle strength. One set of 10 repetitions of movement in each plane was performed while using sandbags to provide resistance. The total duration of each session was typically 30 minutes. The second week consisted of the prosthetic phase, which included muscle strengthening, weight bearing, weight shifting and balance exercise. The amputees performed one set of 10 repetitions of movement in each plane. The total duration of each session was typically 30 minutes. All aforementioned trainings were based on PNF principles and techniques. The initial prosthetic training was performed by using parallel bars. The four main techniques were resistance, approximation, slow reversal, and rhythmic stabilization.

Control Group Treatment Protocol

The participants in this group were treated with traditional strengthing training consisting of a pre-prosthetic phase and a prosthetic phase. The pre-prosthetic phase consisted of muscle strengthening exercises, just as in the PNF group. The prosthetic phase, however, consisted of weight bearing on the prosthetic limb, weight shifting and balance exercises. The therapists used none of the PNF principles and techniques (e.g., manual contact, verbal command, vision, and timing for emphasis, resistance, approximation, and stretch). Each treatment session lasted typically 30 minutes.

3.10 Method of data collection

To conduct this study, the researcher collected data through using different types of measurement tools. The researcher has used Locomotor Capabilities Index scale for ambulatory functional improvement measurement with the prosthesis.

3.10.1 Data collection tools

The organized material was questionnaires, consent forms, paper, pen & a pencil. All questionnaires designed to conduct the interviews.

3.10.2 Questionnaire

The questionnaire was developed under the advice and permission of the supervisor following certain guidelines. There were socio-demographic questions & 14 questions on different locomotor activities which were measured by examiner and each question was formulated to identify the improvement of locomotor activities.

3.11 Measurement tools

3.11.1 Locomotor Capabilities Index (LCI)

The LCI is a self-administered scale that is composed of 14 questions on different locomotor activities, which were selected primarily from the locomotor disabilities classification of the World Health Organization. Each item was rated on a five-level ordinal scale (0 to 4 points). The scale ranged from “not able” to “able to accomplish the activity alone”, which indicated the degree of perceived independence in performing each of the 14 activities whilst wearing the prosthesis. Higher scores reflect greater locomotor capability with the prosthesis and less dependence on external assistance. The index can be divided into two 7-item subscales that covered basic and advanced items, respectively (Parkar et al., 2010)

3.12 Data collection procedure

The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at department, the patients were assessed by qualified physiotherapist. Four sessions of treatment was provided for every subject.

Ten subjects were chosen for data collection according to the inclusion criteria. The researcher divide all participants into two groups and coded C1 (5) for control group and E1 (5) for experimental group. Experimental group received traditional physiotherapy with PNF strengthing training and control group received only traditional physiotherapy.

Data was gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form which was formatted by the researcher. Pre-test was performed before beginning the treatment. The same procedure was performed to take post-test at the end of four session of treatment. Researcher gave the assessment form to each subject before starting treatment and after four session of treatment and instructed to put mark on the LCI scale questionnaire. The researcher collected the data both in experimental and control group in front of the qualified physiotherapist in order to reduce the biasness. At the end of the study, specific test was performed for statistical analysis.

3.13 Ethical consideration

The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guidelines and World Health Organization (WHO) Research guidelines. The proposal of the dissertation including methodology was approved by Institutional Review Board (IRB) and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). Again before the beginning of the data collection, the researcher obtained the permission ensuring the safety of the participants from the concerned authorities of the clinical setting and was allotted with a witness from the authority for the verification of the collected data. The researcher strictly maintained the confidentiality regarding participant's condition and treatments.

3.14 Informed Consent

The researcher obtained consent to participate from every subject. A signed informed consent form was received from each participant. The participants were informed that they have the right to meet with outdoor doctor if they think that the treatment is not enough to control the condition or if the condition become worsen. The participants were also informed that they were completely free to decline answering any question during the study and were free to withdraw their consent and terminate participation at any time. Withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they would still get the same facilities. Every subject had the opportunity to discuss their problem with the senior authority or administration of CRP and have any questioned answer to their satisfaction.

3.15 Data analysis

Statistical analysis was performed by using Microsoft Office Excel 2013 and scientific calculator. Data was analyzed by using SPSS version 20.00 to compute the descriptive statistics using pie chart, bar chart and also percentage and parametric tests were conducted using paired t-test and unrelated t-test.

The researcher had calculated the variables mean, mean difference, standard deviations, standard error, degree of freedom and significant level to show that experimental group and control group mean difference in within group was significantly different than the standard table values. In the between group, the data shows that the mean difference was greater than the control group. The researcher had tested mean variables stating problem to test using t statistic, which is paired t-test and also unrelated t-test.

3.15.1 Statistical Test

In order to ensure that the research have some values, the meaning of collected data has to be presented in ways that other research workers can understand. In other words the researcher has to make sense of the results. As the result came from an experiment in this research, data analysis was done with statistical analysis.

All participants were code according to group to maintain participant's confidentiality. All subjects of both experimental and control group score their locomotor function before starting treatment and after completing treatment. Improvement of locomotor function for both groups and the differences between pre-test and post-test score.

According to Hicks (2009), experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is interval or ratio should be analyzed with unrelated t test. This test is used when' the experimental design compares two separate or different unmatched groups of subjects participating in different conditions. When calculating the unrelated t test, you find the value called 't' which you then look up in the probability tables associated with the t test to find out whether the t value represents a significant difference between the results from your two groups.

$$t = \frac{\bar{d}}{SE(\bar{d})} = \frac{\bar{d}}{\frac{SD}{\sqrt{n}}}$$

Where,

$\bar{d}$= mean of difference (d) between paired values,

$SE(\bar{d})$= Standard Error of the mean difference

SD= standard deviation of the differences d and

n= number of paired observations.

3.15.2 Level of Significant

In order to find out the significance of the study, the "p" value was calculated. The p values refer to the probability of the results for experimental study. The word probability refers to the accuracy of the findings. A p value is called level of significance for an experiment and a p value of <0.05 was accepted as significant result for health service research. If the p value is equal or smaller than the significant level, the results are said to be significant.

In this way researcher had calculated paired t-value and significant level and have presented in the following tables-

Table 1: LCI Questionnaire (Basic activities initial & final paired t-test)

		Experimental			Control		
Serial no	Variables	df	t	Significant level	df	t	Significant level
Pair1	Pre-test Get up from chair Post-test Get up from chair	4	1.633	0.178	4	2.449	0.070*
Pair 2	Pre-test Walk in the house Post-test Walk in the house	4	4.000	0.016*	4	2.449	0.070*
Pair 3	Pre-test Walk outside on even ground Post-test Walk outside on even ground	4	1.633	0.178		4.000	0.016*

Pair 4	Pre-test Go up the stairs with a handrail Post-test Go up the stairs with a handrail	4	3.207	0.033*	4	2.449	0.070*
Pair 5	Pre-test Go down the stairs with a handrail Post-test Go down the stairs with a handrail	4	3.207	0.033*	4	2.449	0.070*
Pair 6	Pre-test Step up a sidewalk curb Post-test Step up a sidewalk curb	4	4.000	0.016*	4	4.000	0.016*
Pair 7	Pre-test Step down a sidewalk curb Post-test Step down a sidewalk curb	4	2.449	0.070*	4	1.633	0.178

Table 2: LCI Questionnaire (Advanced activities initial & final paired t-test)

		Experimental			Control		
Serial no	Variables	df	t	Significant level	df	t	Significant level
Pair1	Pre-test Pick up an object from the floor Post-test Pick up an object from the floor	4	1.633	0.178	4	1.633	0.178
Pair 2	Pre-test Get up from the floor	4	3.207	0.033*	4	1.000	0.374

	Post-test Get up from the floor						
Pair 3	Pre-test Walk outside on uneven ground Post-test Walk outside on uneven ground	4	1.000	0.374	4	1.000	0.374
Pair 4	Pre-test Walk outside in inclement weather Post-test Walk outside in inclement weather	4	1.000	0.374	4	6.000	0.004*
Pair 5	Pre-test Go up a few steps without a handrail Post-test Go up a few steps without a handrail	4	6.532	0.003*	4	6.000	0.004*
Pair 6	Pre-test Go down a few steps without a handrail Post-test Go down a few steps without a handrail	4	6.000	0.004*	4	1.000	0.374
Pair 7	Pre-test Walk while carrying an object Post-test Walk while carrying an object	4	1.633	0.178	4	4.000	0.016*

Unrelated t test

Unrelated t test was used to compare difference between two means of independent variables. Selection of test of hypothesis was two independent mean differences under independent t distribution.

Formula: test statistic t is follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$$

Where,

$\bar{x}_1$ = Mean of the Experimental Group,

$\bar{x}_2$ = Mean of the Control Group,

$n_1 =$ Number of participants in the Experimental Group,

n_2 = Number of participants in the Control Group,

S = Combined standard deviation of both groups.

Table 3: LCI Questionnaire (Basic activities Final-unpaired-t-test)

Serial no	Variables	t	df	Significant level
1	Get up from a Chair	4.000	8	0.004*
2	Walk in the house	4.000	8	0.004*
3	Walk outside on uneven ground	1.000	8	0.347
4	Go up the stairs with a handrail	2.449	8	0.040*
5	Go down the stairs with a handrail	2.449	8	0.040*
6	Step up a sidewalk curb	2.121	8	0.067*
7	Step down a sidewalk curb	1.500	8	0.172

Table 4: LCI Questionnaire (Advanced activities Final-unpaired-t-test)

Serial no	Variables	t	df	Significant level
1	Pick up an object from the floor	0.343	8	0.740
2	Get up from the floor	0.667	8	0.524
3	Walk outside on uneven ground	0.894	8	0.397
4	Walk outside in inclement weather	0.632	8	0.545
5	Go up a few steps without a handrail	0.632	8	0.545
6	Go down a few steps without a handrail	0.577	8	0.580
7	Walk while carrying an object	0.535	8	0.608

CHAPTER- IV : RESULTS

4.1: Socio-Demographical variables

4.1.1. Mean age of the participants

In this study among the participants mean age of experimental group was 41.2 years and control group mean age was 24.4 years.

4.1.2 Sex of the participants:

Among all participants 70% was male and 30% was female.

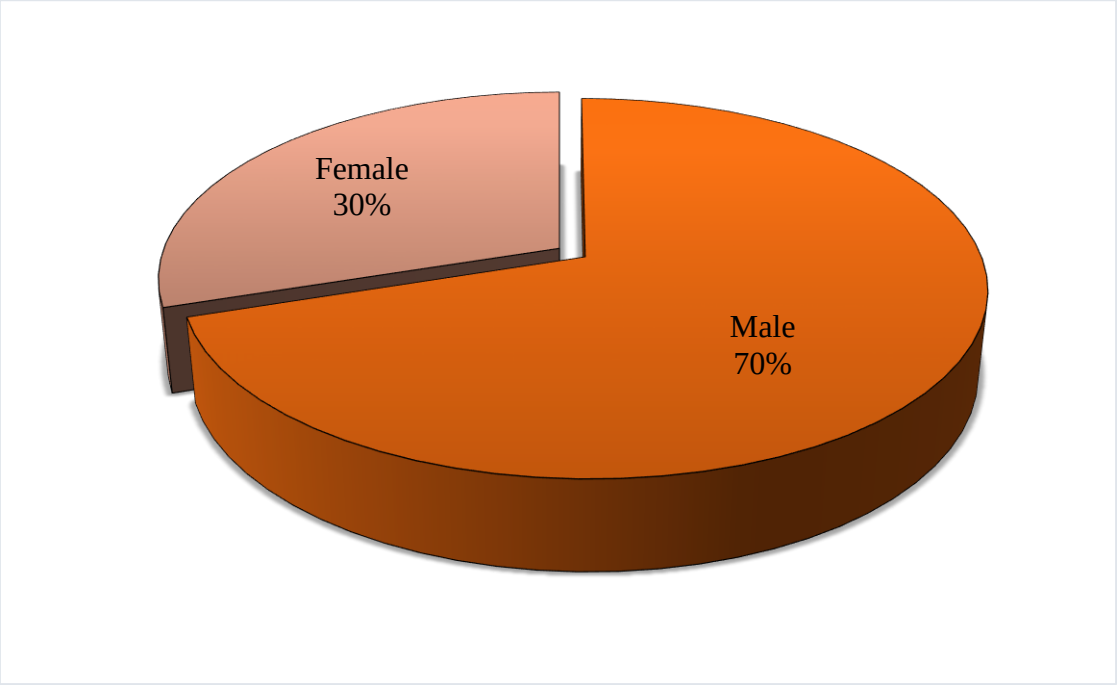


Figure 1: Sex of the participants

4.1.3 Educational status of the participants

In this study 10% was illiterate, 40% was completed some primary education, 10% was completed secondary education, 10% was completed higher secondary education and 30% was completed bachelor and masters.

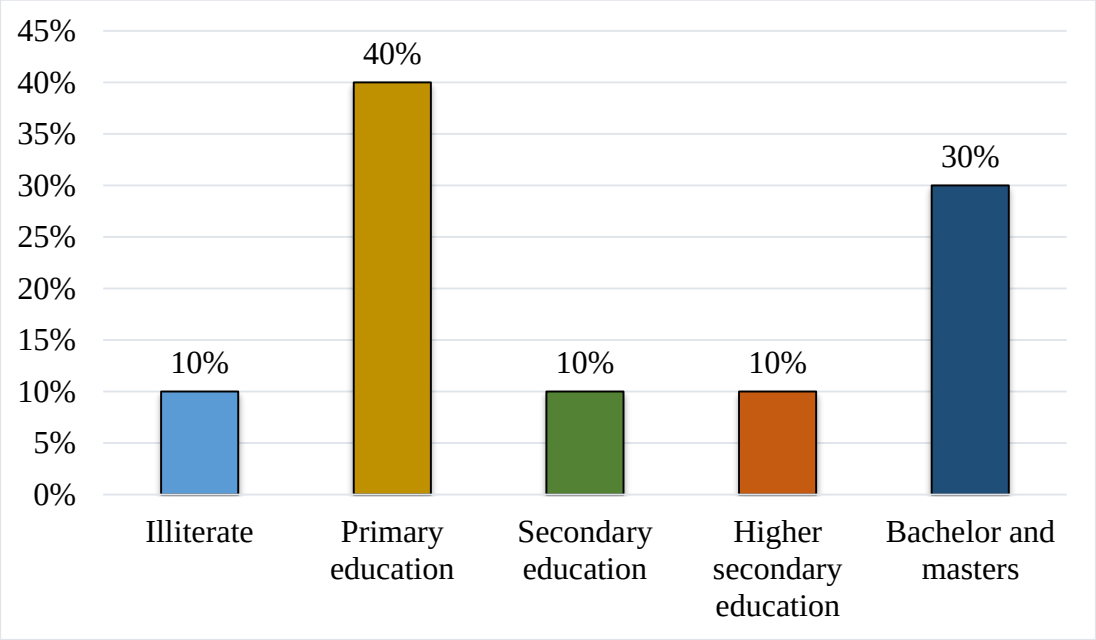


Figure 2: Educational status of the participant

4.1.4 Living area of the participants

In this study about 40% people were lived in urban area about 60% people were lived in rural areas.

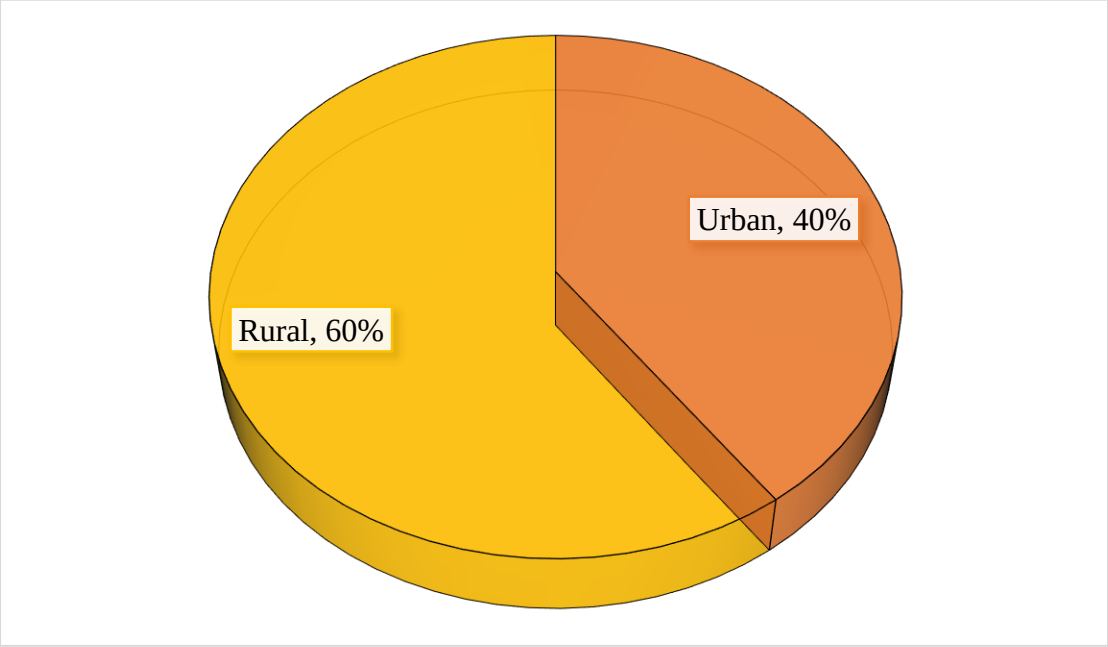


Figure 3: Living area of the participants.

4.1.5 Causes of amputation

In this study 70% cause of the amputation was accident, 20% cause of the amputation was diabetes and 10% cause of the amputation was congenital.

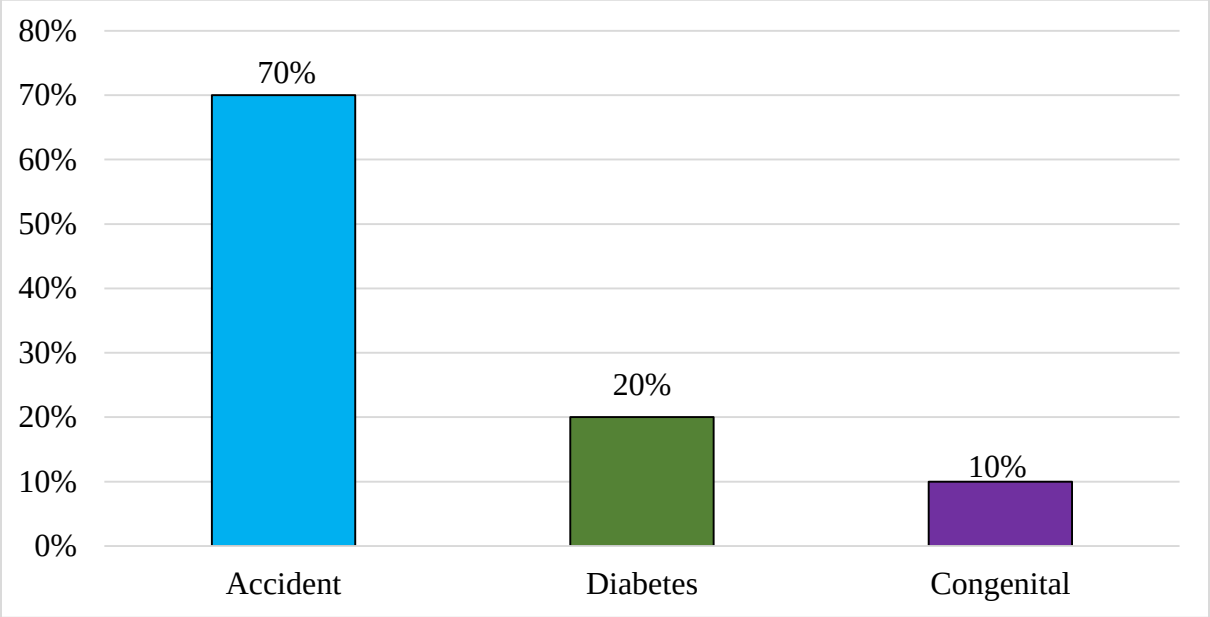


Figure 4: Causes of amputation of the participant

4.1.6 Amputation site of the participants

In this study 60% participants were right sided amputee patients and 40% were left sided amputee patients.

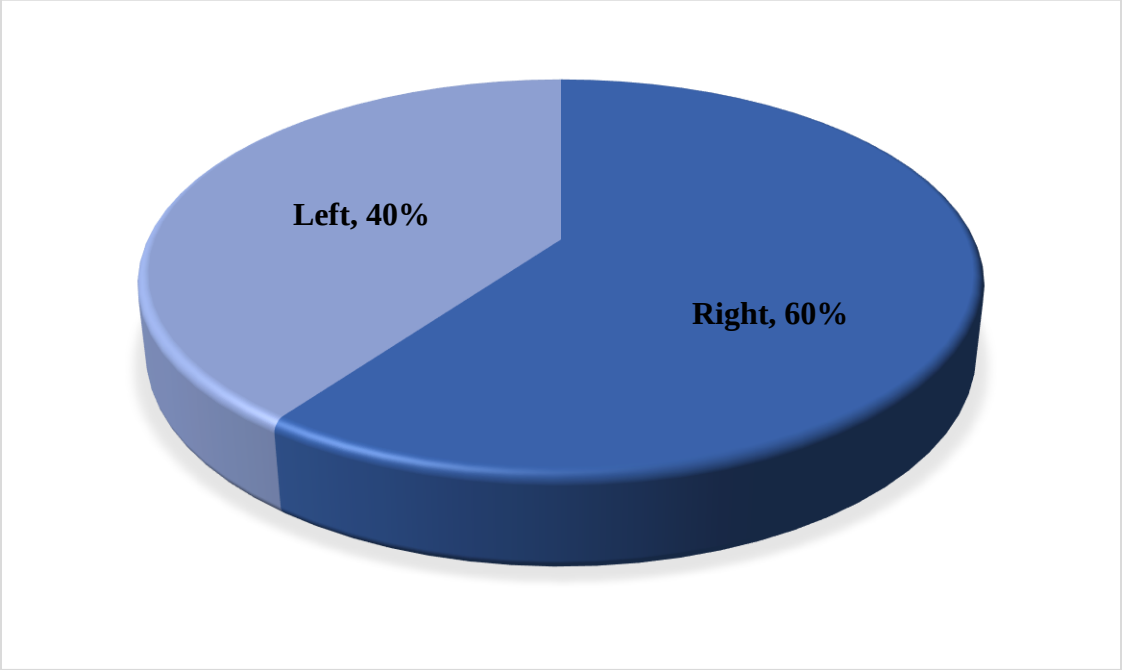


Figure 5: Amputation site of the participant

4.2 LCI Questionnaire

4.2.1 Get up from a chair

This study found that, basic activities like get up from a chair the observed t value was 1.633, mean difference was 0.400, Standard deviation was ±.548 in experimental group. In control group observed t value was 2.449, mean difference was 0.600 and standard deviation was ±0.548. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in both groups which were less than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Both groups in aspect of get up from a chair were not statistically significant at 0.178% and 0.070% level. But the mean difference of control group was greater than experimental group that means traditional strengthing exercise training was effective than PNF strengthing training to improve ambulatory function. . The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 4.000. The observed t value was greater than the table value that indicate null hypothesis was rejected and alternative hypothesis was accepted that means PNF strengthing training was effective than the traditional strengthing training.

4.2.2 Walk in the house

This study found that, basic activities like walk in the house the observed t value was 4.000, mean difference was 0.800, Standard deviation was ±0.447 in experimental group. In control group observed t value was 2.449, mean difference was 0.600 and standard deviation was ±0.548. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in experimental group were greater than standard t value and control group observed t value was less than standard t value that mean null hypothesis was rejected and alternative hypothesis was accepted that means PNF strengthing training was effective than the traditional strengthing training. Experimental group in aspect of walk in the house was statistically significant at 0.016% level and control group was not statistically significant at 0.070% level. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value

was 4.000. The observed t value was greater than the table value that indicate null hypothesis was rejected and alternative hypothesis was accepted that means PNF strengthing training was effective than the traditional strengthing training treatment.

4.2.3 Walk outside on even ground

This study found that, basic activities like walk outside on even ground the observed t value was 1.633, mean difference was 0.400, Standard deviation was ±0.548 in experimental group. In control group observed t value was 4.000, mean difference was 0.800 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in walk outside on even ground in experimental group were less than standard t value and control group observed t value was greater than standard t value that means null hypothesis was accepted and alternative hypothesis was rejected. Experimental group in aspect of walk outside on even ground was not statistically significant at 0.178% level and control group was statistically significant at 0.016% level. The mean difference of experimental group was less than control group that means PNF strengthing exercise training was less effective than the traditional strengthing training to improve ambulatory function. . The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 1.000. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that means PNF strengthing training was less effective than the traditional strengthing training.

4.2.4 Go up the stairs with a handrail

This study found that, basic activities like go up the stairs with a handrail the observed t value was 3.207, mean difference was 1.200, Standard deviation was ±0.837 in experimental group. In control group observed t value was 2.449, mean difference was 0.600 and standard deviation was ±0.548. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in go up the stairs with a handrail in experimental group was greater than standard t value and control group observed t value was less than standard t value that mean null hypothesis was rejected and alternative hypothesis was accepted. Experimental group in aspect of go up the stairs with a handrail was statistically significant at 0.033% level and control group was not statistically significant at 0.070% level. The mean difference of experimental group was greater than control group that means PNF strengthing exercise training was more effective than traditional strengthing training to improve ambulatory function. .The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 2.449. The observed t value was greater than the table value that indicate null hypothesis was rejected and alternative hypothesis was accepted that mean there PNF strengthing training was effective than traditional strengthing training.

4.2.5 Go down the stairs with a handrail

This study found that, basic activities like go down the stairs with a handrail the observed t value was 3.207, mean difference was 1.200, Standard deviation was ±0.837 in experimental group. In control group observed t value was 2.449, mean difference was .600 and standard deviation was ±0.548. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in go down the stairs with a handrail in experimental group was greater than standard t value and control group observed t value was less than standard t value that mean null hypothesis was rejected and alternative hypothesis was accepted. Experimental group in aspect of go down the stairs with a handrail was statistically significant at 0.033% level and control group was not statistically significant at 0.070% level. The mean difference of experimental group was greater than control group that means PNF strengthing exercise training was more effective than

traditional strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 2.449. The observed t value was greater than the table value that indicate null hypothesis was rejected and alternative hypothesis was accepted that mean PNF strengthing training was effective than the traditional strengthing training.

4.2.6 Step up a sidewalk curb

This study found that, basic activities like step up a sidewalk curb the observed t value was 4.000, mean difference was 0.800, Standard deviation was ±0.447 in experimental group. In control group observed t value was 4.000, mean difference was 0.800 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in both groups were greater than standard t value that mean null hypothesis was rejected and alternative hypothesis was accepted. Experimental group in aspect of step up a sidewalk curb was not statistically significant at 0.070% level and control group was statistically significant at 0.016% level. The mean difference of both groups were equal that means PNF strengthing exercise training and traditional strengthing training both are effective to improve ambulatory function. .The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 2.121. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training less effective than the traditional strengthing training.

4.2.7 Step down a sidewalk curb

This study found that, basic activities like step down a sidewalk curb the observed t value was 2.499, mean difference was 0.600, Standard deviation was ±0.548 in experimental group. In control group observed t value was 1.633, mean difference was 0.400 and standard deviation was ±0.548. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in step down a sidewalk curb in both groups which were less than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Both groups in aspect of step down a sidewalk curb

was not statistically significant at 0.070% and 0.178% level. But the mean difference of experimental group was greater than control group that means PNF strengthing exercise training was more effective than traditional strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 1.500. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training was less effective than the traditional strengthing training.

4.2.8 Pick up an object from the floor

This study found that, advanced activities like pick up an object from the floor the observed t value was 1.633, mean difference was 0.400, Standard deviation was ±0.548 in experimental group. In control group observed t value was 1.633, mean difference was .600 and standard deviation was ±0.548. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in pick up an object from the floor in both groups which were less than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Both groups in aspect of pick up an object from the floor was not statistically significant at 0.178% and 0.178% level. But the mean difference of control group was greater than experimental group that means traditional strengthing exercise training was effective than PNF strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 0.343. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training was less effective than the traditional strengthing training.

4.2.9 Get up from the floor

This study found that, advanced activities like get up from the floor the observed t value was 3.207, mean difference was 1.200, Standard deviation was ±0.837 in experimental group. In control group observed t value was 1.000, mean difference was 0.200 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value in get up from the floor in experimental group which was greater than standard t value that mean null hypothesis was rejected and alternative hypothesis was accepted. Experimental group in aspect of get up from the floor was statistically significant at 0.033% and in control group was not statistically significant at 0.374% level. But the mean difference of experimental group was greater than control group that means traditional strengthing exercise training was less effective than PNF strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 0.667. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training less effective than traditional strengthing training.

4.2.10 Walk outside on uneven ground

This study found that, advanced activities like walk outside on uneven ground the observed t value was 1.000, mean difference was 0.400, Standard deviation was ±0.894 in experimental group. In control group observed t value was 1.000, mean difference was 0.200 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value walk outside on uneven ground in both groups were less than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Both groups in aspect of walk outside on uneven ground was not statistically significant at 0.374% and 0.374% level. But the mean difference of experimental group was greater than control group that means PNF strengthing exercise training was effective than traditional strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same

significant level and same degree of freedom observed t value was 0.894. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training less effective than the traditional strengthing training.

4.2.11 Walk outside in inclement weather

This study found that, advanced activities like walk outside in inclement weather the observed t value was 1.000, mean difference was 0.400, Standard deviation was ±0.894 in experimental group. In control group observed t value was 6.000, mean difference was 1 .200 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value walk outside in inclement weather in experimental group was less than standard t value and control group was greater than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Experimental group in aspect of walk outside in inclement weather was not statistically significant at 0.374% and control group was statistically significant at 0.004% level. The mean difference of experimental group was less than control group that means PNF strengthing exercise training was less effective than traditional strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 0.632. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training less effective than the traditional strengthing training.

4.2.12 Go up a few steps without a handrail

This study found that, advanced activities like go up a few steps without a handrail the observed t value was 6.532, mean difference was 1.600, Standard deviation was ±0.548 in experimental group. In control group observed t value was 6.000, mean difference was 1 .200 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value go up a few steps without a handrail in experimental group was greater than standard t value and control group was greater than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Experimental group in aspect of go up a few steps without a handrail was statistically significant at 0.003% and control group was statistically significant at 0.004% level. The mean difference of experimental group was more than control group that means PNF strengthing exercise training was more effective than traditional strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 0.632. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training was less effective than the traditional strengthing training.

4.2.13 Go down a few steps without a handrail

This study found that, advanced activities like go down a few steps without a handrail the observed t value was 6.000, mean difference was 1.200, Standard deviation was ±0.447 in experimental group. In control group observed t value was 1.000, mean difference was 0.200 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value go down a few steps without a handrail in experimental group was greater than standard t value and control group was less than standard t value that mean null hypothesis was rejected and alternative hypothesis was accepted. Experimental group in aspect of go down a few steps without a handrail was statistically significant at 0.004% and control group was not statistically significant at 0.374% level. The mean difference of experimental group was more than control group that means PNF strengthing exercise training was more effective than traditional

strengthing training to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 0.577. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training was less effective than the traditional strengthing training.

4.2.14 Walk while carrying an object

This study found that, advanced activities like walk while carrying an object the observed t value was 1.633, mean difference was 0.800, Standard deviation was ±1.095 in experimental group. In control group observed t value was 4.000, mean difference was 0.800 and standard deviation was ±0.447. 5% level of significant at 4 (four) degrees of freedom standard t value was 2.78 and observed t value walk while carrying an object in experimental group was less than standard t value and control group was more than standard t value that mean null hypothesis was accepted and alternative hypothesis was rejected. Experimental group in aspect of walk while carrying an object was not statistically significant at 0.178% and control group was statistically significant at 0.016% level. The mean difference of both groups were equal that means both PNF strengthing exercise training and traditional strengthing training were effective to improve ambulatory function. The Unrelated/independent t test in between group at 5% level of significant and 8 degrees of freedom standard table value was 2.306 and at the same significant level and same degree of freedom observed t value was 0.535. The observed t value was less than the table value that indicate null hypothesis was accepted and alternative hypothesis was rejected that mean PNF strengthing training less effective than the traditional strengthing training.

CHAPTER V DISCUSSION

The purpose of this study was to identify effectiveness of PNF strengthening training along with traditional strengthening training in patients with unilateral transtibial amputee. In the study, a total of 10 patients were recruited and they were a randomly assigned into 2 groups. Both groups were assessed to determine the improvement of ambulatory functional outcome measured. According to the results of this study, there is a significant improvement of ambulatory function of the unilateral transtibial amputees of the group which received proprioceptive neuromuscular facilitation technique (PNF). The individual's locomotor capabilities index, who received PNF training, demonstrated significant independence in basic and advanced activities of daily living as compared to the traditional strength training group. There is no significant difference in the advanced activities of people having transtibial amputation in experimental PNF and control (traditional strength training) group. The study found the improvement of walk in the house, go up the stairs with a handrail, go down the stairs with a handrail, step up a sidewalk curb, get up from the floor and stair up without a handrail ambulatory functional activities in unilateral transtibial amputees by using PNF techniques which is effective more than control group.

A rehabilitation programme consisting chiefly of the PNF technique led to improvement in voluntary movement of the hemiplegic lower limb (Kawahira et al., 2004). The improvement in walking speed enhanced an individual’s ability to negotiate real-world over ground environments (e.g., steps, obstacles, and uneven surfaces) and to walk independently and confidently (Jaffe et al., 2004). What factors may explain the better outcomes in the PNF group? When a muscle contraction is resisted, the muscle’s response to cortical stimulation increases. Active muscle tension produced by resistance is an effective proprioceptive facilitation. The magnitude of the facilitation is related directly to the amount of resistance. Proprioceptive reflexes from the contracting muscle increase the response of synergists at the neighboring joints. This facilitation can spread in the proximal-to-distal direction and in the distal-to-proximal direction. Antagonists of the facilitated muscles are usually inhibited. If the muscle activity in the agonists becomes

intense, there may also be activity in the antagonistic muscle groups (i.e., co-contraction) (Adler et al., 2007).

Resistance to balance and motion is most effective when it occurs in the diagonal direction. The direction of motion can be controlled by standing in the chosen diagonal. Resisted gait activities are an exaggeration of normal motion. When strong motion are resisted during standing and walking, irradiation will facilitate the contraction of the weaker muscles of the trunk and lower extremity. Large amplitude body motions are resisted during weight shifting. Resistance to large-amplitude motions helps the individuals to gain the strength and skills needed to stand and walk functionally approximation through the pelvis during stance and stretch reflex to the pelvis during swing facilitate the muscles of the lower extremity and trunk. When pelvic motion and stability are facilitated, the leg can function more efficiently (Adler et al., 2007). Proprioceptive neuromuscular facilitation focuses on movements that resemble the activities of daily living such as walking; it therefore may lead to better carryover of training effects.

The exercise therapy appeared to have significantly beneficial effects on the balance ability (Howe et al., 2007). The functional exercise, strength training, and stretching has positive effects in improving the performance of gait (Brandalize et al., 2011). Physical therapy plays a crucial role in enhancing functional performance of people with lower extremity amputations. Hence it has its scope in every rehabilitation center (Rau et al., 2007).

The main limitation of this study was its short duration. Treatment session was small and only given in 4 session. The study was conducted with 10 patients of unilateral transtibial amputee which was a very small number of samples in both groups and was not sufficient enough for the study to generalize the wider population of this condition. The research was carried out in CRP, Savar such a small environment, so it was difficult to keep confidential the aims of the study for blinding procedure. Therefore, single blind method was used in this study. There was no available research done in this area in Bangladesh. So, relevant information about unilateral transtibial amputee patient with specific intervention for Bangladesh was very limited in this study.

CHAPTER VI CONCLUSION AND RECOMMENDATION

The result of this experimental study have identified the effectiveness of PNF strengthening exercise with traditional strengthening physiotherapy are better treatment than the traditional training for improving ambulatory function for unilateral transtibial amputee. Participants in the PNF strengthening exercise with Traditional strengthening training group showed a greater benefit than those in the only traditional strengthing group, which indicate that PNF strengthening exercise with traditional strengthening exercise can be an effective therapeutic approach for patients with transtibial amputee.

Proprioceptive neuromuscular facilitation technique was better in improving locomotion and functional status of people with transtibial amputation as compared to the traditional prosthetic strengthening training. Research indicates that PNF techniques are effective in improving and maintaining ROM, increasing muscular strength and power, and increasing athletic performance, especially after exercise. However, proper protocol and consistency must be followed to attain and maintain the benefits of PNF techniques. Four theoretical mechanisms were proposed as being responsible for these benefits, although there is little empirical evidence to support these mechanisms.

Despite the limitations of the study particularly small sample size, the results of the study give further motivation to controlled clinical trials with sufficient time and sample size. It could be suggested that for future study can be carried out with role of PNF strengthing exercise in athletic function as well as performance. Further research should be completed to prove the efficacy of each of these mechanisms in the factors affected by PNF.

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APPENDIX

Consent Form

I am Razia Sultana, 4th year student of Bsc in Physiotherapy in Bangladesh Health Profession Institute. I am conducting a research and the title is- **"Efficacy of proprioceptive neuromuscular facilitation strengthening techniques versus traditional strengthening training to improve ambulatory function for unilateral transtibial amputee."** which is included my course. For that I'm asking you to answer some questions, which will take about 20-30 minutes. It also ensures that the information you provide will be kept confidential.

Participation here depends on your own will. If you want, you can skip your name from the list of participants at any time. In addition, if you have any questions as a participant in this study or if there is any problem, you can contact me or Mohammad Anwar Hossain, Head of The Department of Physiotherapy, CRP, Savar, Dhaka-1343.

Do you have any questions before starting the research?

Can I start this interview with your permission?

Yes.....

No.....

Participant's signature & date _____

Witness's signature & date _____

Researcher's signature & date _____

অনুমতি পত্র

আমি রাজিয়া সুলতানা , বাংলাদেশ হেলথ প্রফেশন ইন্সিটিউট এর বি এস সি ইন ফিজিওথেরাপী কোর্সের চতুর্থ বর্ষের একজন ছাত্রী। আমি একটি গবেষণা করছি যার শিরোনাম হল, **"এক পাশের হাঁটুর নীচ পর্যন্ত পা কাটা রোগীদের চলনশক্তি উন্নয়নের জন্য প্রোপ্রিওসেপটিভ নিউরোমাসকুলার সুবিধার শক্তিশালীকরণ কৌশল বনাম প্রথাগত শক্তিশালীকরণ প্রশিক্ষণের কার্যকারিতা"**। যেটা আমার কোর্সের অন্তর্ভুক্ত। এই জন্য আমি আপনার কাছে কিছু প্রশ্নের উত্তর জানতে চাচ্ছি, যেটাতে প্রায় ২০- ২৫ মিনিট সময় লাগবে। এটাও নিশ্চিত করছি যে আপনি যেসব তথ্য প্রদান করবেন তার গোপনীয়তা বজায় থাকবে।

এখানে অংশগ্রহন আপনার নিজের ইচ্ছার উপর নির্ভর করে। আপনি চাইলে যে কোন সময় অংশগ্রহণকারীর তালিকা থেকে নিজের নাম বাদ দিয়ে চলে যেতে পারেন। এ ছাড়াও যদি আপনার এই গবেষণায় অংশগ্রহনকারী হিসেবে কোন প্রশ্ন থাকে অথবা কোন সমস্যা থাকে তাহলে আপনি আমার সাথে যোগাযোগ করতে পারেন বা মোহাম্মদ আনোয়ার হোসেন, ফিজিওথেরাপি বিভাগের প্রধান, সিআরপি, সাভার, ঢাকা-১৩৪৩ এর সাথে যোগাযোগ করতে পারেন।

গবেষণাটি শুরু করার আগে আপনার কোন প্রশ্ন আছে?

আমি কি আপনার অনুমতি পেয়ে এই সাক্ষাতকারটি আরম্ভ করতে পারি?

হ্যাঁ.....

না .....

অংশগ্রহণকারীর স্বাক্ষর এবং তারিখ _____

সাক্ষীর স্বাক্ষর এবং তারিখ _____

গবেষকের স্বাক্ষর এবং তারিখ _____

Data Collection Form

Questionnaire (English)

Questionnaire sheet

Title: "Efficacy of proprioceptive neuromuscular facilitation strengthening techniques versus traditional strengthening training to improve ambulatory function for unilateral transtibial amputees."

Part-1: Patient's identification (To be collected from medical record/respondent):

1.1	Identification number:
1.2	Date of interview:
1.3	Name of respondent:
1.4	Address: House number/Village: P.O: P.S: District:
1.5	Contact number:

Part 2: Socio-demographic information (To be collected from medical record/respondent):

QN	Question and filters	Response
2.1	Age	
2.2	Sex	1. Male 2. Female
2.3	Body weight	
2.4	Height	……..……m (1 feet = .3048 meter)
2.5	What is your marital status?	1. Married 2. Unmarried 3. Divorced 4. Separated
2.6	What is your religion?	1. Islam 2. Hinduism 3. Christian 4. Buddha
2.7	What is your educational status?	1. Illiterate 2. Primary education 3. Secondary education 4. Higher secondary education 5. Bachelor & masters

2.8	What is your occupation?	Before amputation- After amputation-
2.9	How much is your monthly income?	
2.10	What is your residential area?	1. Urban 2. Rural
2.11	Cause of amputation	
2.12	Side of amputation	1. Right 2. Left

Part 3: Ambulatory function related questions

Whether or not you wear your prosthesis, at the present time, would you say that you are "able" to do the following activities WITH YOUR PROSTHESIS ON?

Please **circle the number** that best describes your capability.

ITEM	NO	YES, if someone helps me	YES, if someone is near me	YES, alone, with ambulation aids	YES, alone, without ambulation aids
Basic Activities					
1. Get up from a chair	0	1	2	3	4
2. Walk in the house	0	1	2	3	4
3. Walk outside on even ground	0	1	2	3	4
4. Go up the stairs with a handrail	0	1	2	3	4
5. Go down the stairs with a handrail	0	1	2	3	4
6. Step up a sidewalk curb	0	1	2	3	4
7. Step down a sidewalk curb	0	1	2	3	4
Basic Activities Score					
Advanced Activities					
1. Pick up an object from the floor (when you are standing up with your prosthesis)	0	1	2	3	4

2. Get up from the floor (e.g. if you fall)	0	1	2	3	4
3. Walk outside on uneven ground (e.g. grass, gravel, slope)	0	1	2	3	4
4. Walk outside in inclement weather (e.g. rain,)	0	1	2	3	4
5. Go up a few steps (stairs) without a handrail	0	1	2	3	4
6. Go down a few steps (stairs) without a handrail	0	1	2	3	4
7. Walk while carrying an object.	0	1	2	3	4
Advanced Activities Score					
Total Score					

প্রশ্নপত্র

শিরোনামঃ এক পাশের হাঁটুর নীচ পর্যন্ত পা কাটা রোগীদের চলনশক্তি উন্নয়নের জন্য প্রোপ্রিওসেপটিভ নিউরোমাসকুলার সুবিধার শক্তিশালীকরণ কৌশল বনাম প্রথাগত শক্তিশালীকরণ প্রশিক্ষণের কার্যকারিতা।

পর্ব-১। রোগীর সনাক্তকরনঃ (রোগীর তালিকা পুস্তক/রোগীর নিকট থেকে সংগৃহীত)

১.১	সনাক্তকরণ সংখ্যাঃ
১.২	সাক্ষাতকারের তারিখঃ
১.৩	উত্তরদাতার নামঃ
১.৪	ঠিকানাঃ বাড়ী নং/গ্রামঃ ইউনিয়নঃ থানাঃ জেলাঃ
১.৫	যোগাযোগ নম্বরঃ

পর্ব-২। রোগীর সামাজিক জনতাত্তিক তথ্যাবলী(রোগীর তালিকাপুস্তক/রোগীর নিকট থেকে সংগৃহিত)

প্রশ্ন নং	প্রশ্ন	উত্তর
২.১	বয়স	
২.২	লিঙ্গ	১। পুরুষ ২। মহিলা
২.৩	শরীরের ওজন	
২.৪	উচ্চতা	..... মিটার (১ ফুট = .৩০৪৮ মিটার)
২.৫	আপনার বৈবাহিক অবস্থা কি?	১।বিবাহিত ২। অবিবাহিত ৩। তালাকপ্রাপ্ত ৪। পৃথকীকৃত ৫। অন্যান্য(নির্দিষ্টকরণ)
২.৬	আপনার ধর্ম কি?	১। ইসলাম ২। হিন্দুধর্ম ৩। খ্রিস্টান ৪। বুদ্ধ
২.৭	আপনার শিক্ষা অবস্থা কী?	১। নিরক্ষর ২। প্রাথমিক শিক্ষা ৩। মাধ্যমিক শিক্ষা ৪। উচ্চ মাধ্যমিক শিক্ষা ৫। স্নাতক অথবা স্নাতকোত্তর

২.৮	আপনার পেশা কি?	পা কেটে যাওয়ার পূর্বেঃ পা কেটে যাওয়ার পরেঃ
২.৯	আপনার মাসিক আয় কত?	
২.১০	আপনার বসবাসের এলাকা কেমন?	১। শহর ২।গ্রাম
২.১১	পা কেটে যাওয়ার কারণঃ	
২.১২	পা কেটে যাওয়ার পাশ	১। ডান ২। বাম

পর্ব-৩: চলনশক্তি কাজ **সম্পর্কিত প্রশ্ন**

আপনি বর্তমান সময়ে, আপনার চলাচলের উপকরণ ব্যবহার করেন কি বা কিনা, আপনি কি "সক্ষম" নিম্নলিখিত কার্যক্রম করতে?

অনুগ্রহ করে এমন সংখ্যাটি সন্নিবেশ করান যা আপনার সামর্থ্যকে সর্বোত্তমভাবে বর্ণনা করে৷

পদ	না	**হ্যাঁ, কেউ আমাকে সাহায্য করে যদি**	**হ্যাঁ, কেউ আমার কাছাকাছি যদি**	**হ্যাঁ, একা, চলন সহায়ক সঙ্গে**	**হ্যাঁ, একা,** চলন **সহায়ক ছাড়া**
মৌলিক ক্রিয়াকলাপ					
১৷ একটি চেয়ার থেকে উঠা	০	১	২	৩	৪
২৷ বাড়ির মধ্যে হাঁটা	০	১	২	৩	৪
৩৷ এমনকি মাটিতে বাইরে হাঁটা	০	১	২	৩	৪
৪৷ একটি রেলিং দিয়ে সিঁড়ির উপরে উঠা	০	১	২	৩	৪
৫৷ একটি রেলিং দিয়ে সিঁড়ি নিচে যান	০	১	২	৩	৪
৬৷একটি রাস্তার ফুটপাতের প্রতিবন্ধক ধাপের উপর দিয়ে	০	১	২	৩	৪
৭৷ একটি রাস্তার ফুটপাতের প্রতিবন্ধক ধাপে ধাপ নিচে	০	১	২	৩	৪
মৌলিক ক্রিয়াকলাপ স্কোর					

উন্নত কার্যক্রম					
১। মেঝে থেকে একটি বস্তু বাছাই করুন (যখন আপনি আপনার অঙ্গবিন্যাস সঙ্গে দাঁড়িয়ে আছে)	০	১	২	৩	৪
২। মেঝে থেকে উঠুন (যেমন যদি আপনি পড়ে থাকেন)	০	১	২	৩	৪
৩। অসম ভূমিতে হাঁটা (যেমন ঘাস, নুড়ি, ঢাল)	০	১	২	৩	৪
৪। খারাপ আবহাওয়ার মধ্যে বাইরে হাঁটা (যেমন , বৃষ্টি)	০	১	২	৩	৪
৫। একটি রেলিং ছাড়া কিছু পদক্ষেপ (সিঁড়ি) উপরে যান	০	১	২	৩	৪
৬। একটি রেলিং ছাড়া কিছু পদক্ষেপ (সিঁড়ি) নিচে যান	০	১	২	৩	৪
৭। একটি বস্তু বহন করার সময় হাঁটুন	০	১	২	৩	৪
উন্নত ক্রিয়াকলাপ স্কোর					
সম্পূর্ণ ফলাফল					

Permission letter

25th April, 2017

The Head of the Department,

Department of Physiotherapy,

Center for the Rehabilitation of the paralysed (CRP),

CRP, Chapain, Savar, Dhaka-1343.

Subject: Application for permission to collect data.

Dear Sir,

With due respect and humble submission to state that I am Razia Sultana, student of 4th year B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The ethical board of BHPI has approved my research project entitled on **"Efficacy of proprioceptive neuromuscular facilitation strengthening techniques versus traditional strengthening training to improve ambulatory function for unilateral transtibial amputee."**To conduct this research, I want to collect data from the transtibial amputee patient who are receiving treatment in Prosthetics & Orthotics department at CRP. So, I need your permission for data collection from the unilateral transtibial amputee patient at Prosthetics & Orthotics department. I would like to assure that anything of my study will not be harmful for the participants.

I therefore, pray and hope that you would be kind enough to grant me and give me the permission to collect data from Prosthetics and Orthotics department.

Sincerely Yours,

Razia Sultana

Razia Sultana

Class roll: 01

4th year student of B.Sc. in Physiotherapy

Session: 2012-2013

BHPI, CRP, Savar, Dhaka-1343.

Approved
26/04/17

Seen
26/04/17

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনষ্টিটিউট (বিএইচপিআই)

BANGLADESH HEALTH PROFESSIONS INSTITUTE (BHPI)

(The Academic Institute of CRP)

CRP-Chapain, Savar, Dhaka, Tel: 7745464-5, 7741404 , Fax: 7745069

BHPI-Mirpur Campus, Plot-A/5, Block-A, Section-14, Mirpur, Dhaka-1206. Tel: 8020178,8053662-3, Fax: 8053661

তারিখ ঃ ০৩.০৫.২০১৭

প্রতি
ইনচার্জ
প্রস্থেটিক্স এন্ড অর্থোটিক্স বিভাগ
সিআরপি, সাভার, ঢাকা।

বিষয় ঃ রিসার্চ প্রজেক্ট (dissertation) প্রসঙ্গে।

জনাব,

বিএইচপিআই'র ৪র্থ পেশাগত বিএসসি ইন ফিজিওথেরাপি কোর্সের ছাত্রী রাজিয়া সুলতানাকে তার রিসার্চ সংক্রান্ত কাজের জন্য আগামী ০৮.০৪.২০১৭ তারিখ থেকে ০৮.০৫.২০১৭ তারিখ পর্যন্ত সময়ে আপনার নিকট প্রেরন করা হলো। তার রিসার্চ শিরোনাম

"Efficacy of proprioceptive neuromuscular facilitation strengthening techniques versus traditional strengthening training to improve ambulatory function for unilateral transtibial amputee."

তাই তাকে সার্বিক সহযোগীতা প্রদানের জন্য অনুরোধ করছি।

ধন্যবাদান্তে

মোঃ ওবায়দুল হক
সহযোগী অধ্যাপক ও বিভাগীয় প্রধান
ফিজিওথেরাপি বিভাগ
বিএইচপিআই।

Forwarded to research and evaluation dept -
Dear concern,
please see the application regarding research project.
I am forwarding for ethical approval from your dept -
Thank you
PLO

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref. CRP-BHPI/IRB/10/17/143

Date: 15.10.2017

To
Razia Sultana
B.Sc. in Physiotherapy
Session: 2012-2013.
Student ID: 112120001.
BHPI, CRP, Savar, Dhaka-1343, Bangladesh.

Subject: "Efficacy of proprioceptive neuromuscular facilitation strengthening techniques versus traditional strengthening training to improve ambulatory function for unilateral transtibial amputee."

Dear Razia Sultana,
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application on 14/08/2016 to conduct the above mentioned thesis, with yourself, as the Principal investigator. The Following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Thesis Proposal
2	Questionnaire (English and Bengali version)
3	Information sheet & consent form.

Since the study involves Locomotor Capabilities Index (LCI) scale questionnaire and socio-demographic information with ambulatory function related questions that take 25 to 30 minutes and have no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09:00 AM on August 17, 2016 at BHPI.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,
Millat Hossain
Muhammad Millat Hossain
Assistant Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh.