ORIGINAL RESEARCH PAPER

Occupational Therapy

CONVENTIONAL EXERCISE PROGRAM VERSUS GRADED MOTOR IMAGERY ALONG WITH CONVENTIONAL EXERCISE PROGRAM IN PHANTOM LIMB PAIN AND BODY IMAGE PERCEPTION IN UNILATERAL TRANSTIBIAL AMPUTATION - A COMPARATIVE STUDY

KEY WORDS: Amputee body image, GMI, 6MWT, PLP, Transtibial amputation

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ABSTRACT

Amputation is a major health burden on the families, society, and medical services. After amputation, phantom limb pain and body image are the major causes which lead to chronic immobility. This paper attempts to investigate the effect of Graded motor imagery (GMI) on phantom limb pain (PLP) and body image in relation to functional mobility following transtibial amputation. Patients attending amputee clinic (n = 20 male, mean age 40.85 years) participated in this study. The measures were Short form McGill pain questionnaire SF-MGPQ), Amputee body image scale (ABIS), Six minutes' walk test (6-MWT). In this study, control group was treated with conventional exercises. Whereas, experimental group was treated with Graded motor imagery (GMI), a new approach to reduce phantom limb pain and develop body image. The result showed significant improvement (P<0.05) in control and experimental group post intervention, suggesting that conventional as well as GMI intervention was equally effective. Thus, GMI can be used as an adjunctive therapy in lower limb amputation with additional benefit to reduce PLP and improve functional status of patients.

Introduction

Phantom limb pain is defined as discomfort or pain in a missing part of the limb. It is a noxious sensation that can be continuous or intermittent, localized or diffuse, that interferes with prosthetic fitting. [1] Higher prevalence (90%) rates of PLP have been reported in people with lower limb amputations. [2] In this study, SF-MPQ is used to assess both the intensity and quality of pain. ABIS is used to assess body image disturbances. [3] and 6MWT is used to assess functional mobility. The different lines of treatment are used to decrease PLP which includes, mirror therapy, sensory discrimination training, virtual reality training. In current study, a new technique, GMI is used to reduce PLP and improve body image in transtibial amputee. It is a form of progressive treatment, designed to train and reorganize the maladaptive plasticity. [4]

MATERIALS AND METHODS

Twenty male patients (10 in each control and experimental group) with the inclusion criteria of aged 18 to 60 years, unilateral transtibial amputation, complaints of phantom limb pain both male & female were included. Patients with polytrauma, cognitive deficits and vision / hearing impairment were excluded. Before intervention, signed informed consent was obtained from all patients. The study was initiated after receiving approval from the institutional ethics committee.

STUDY DESIGN: A prospective and comparative study

ASSESSMENT TOOLS:

1. SF-MPQ [5,6]: It is a multidimensional measure of perceived pain in adults. It contains a total of 15 descriptors (4 affective and 11 sensory). It also includes the Present Pain Intensity (PPI) index and visual analogue scale (VAS) ranges from 0–10. The total Pain Rating Index score is obtained by summing values for (sensory+ affective scores).

2. ABIS [7]: It is 20 items questionnaire. Low scores indicate the relative absence of a body image concern, and higher scores indicates the presence of a more severe problem. The scale 's validity is affirmed and the reliability of this scale to be 0.8.

3.6MWT [8,9]: It is used to assess distance walked by a patient in 6 minute as subtest for aerobic tolerance and endurance to walk in amputee individuals.

STUDY PROCEDURE:

The total of 10 subjects were randomly allocated in control and experimental group each. Control Group received conventional exercises such as desensitization techniques, residual limb care, bandaging for the stump shaping, stretching, & strengthening exercises. [10] Whereas, experimental group received conventional exercises along with GMI. The session was twice a week for 6 weeks of 30 minutes each for both the groups. The patients were assessed at baseline, fourth and sixth week exercise programme for both the groups.

GMI- FIRST PHASE (LATERALITY)[11,12]

A free online ORIENTATE™ android application was downloaded and used for laterality recognition in subjects. The Application consists of level 1,2, & 3 for hand, feet and mixed respectively. Each level has 25 images of various sides. The patient is shown these images and instructed to identify the side of the displayed body part by pressing left or right key on the online android application. It provides a record of right and wrong answers.

GMI- SECOND PHASE (EXPLICIT MOTOR IMAGERY)

It consists of 3 components i.e. static, dynamic, and activity based. The videos of normal individuals were shot by using high resolution camera while performing static, dynamic and activity based functions of lower extremity in a graded manner. These videos are shown to the patient and instructed to IMAGINE & FEEL the movement without flared pain or anxiety. During the session, the therapist describes the actions verbally to the patient to get an idea whether patient has actually started imagining the movements.

GMI- THIRD PHASE (MIRROR VISUAL FEEDBACK)

Patient was made to sit comfortably in front of the mirror (30 x 29.5cm). The patient was instructed to place the amputated limb in the mirror box along with intact limb in front of the mirror. The patient was asked to move the intact limb, while keep the amputated limb hidden in the mirror box. The patient was instructed to move the intact and amputee limb together within pain limits.

DATA ANAYLSIS:

The Data was analyzed using statistical package for social sciences (SPSS v 26.0, IBM). Mean & SD for numerical data has been depicted. For all the statistical tests, p<0.05 was considered to be statistically significant, thus giving a power to the study as 80%.

RESULTS

TABLE NO 1: Comparison between control and experimental groups.

ABIS		C4	C6	E4	E6	Chi Sq value	P value of ANOVA
Mean,(SD)	Pre	54.50 9.883	55.17 4.119	55.00 2.000	55.71 7.931	0.142	0.986 #
	Post	48.00 8.602	39.67 1.633	39.00 1.000	23.71 3.729	14.407	0.002**
	Diff	6.50 1.291	15.50 2.881	16.00 3.000	32.00 7.659	15.985	0.001**
SF-MGPQPRE TOTAL							
Mean (SD)	Pre	7.75 0.500	8.50 0.548	8.67 0.577	7.71 0.488	8.603*	0.035
	Post	4.25 0.500	2.83 1.169	4.33 0.577	1.43 0.535	13.982	0.003**
	Diff	3.5	5.67	4.34	6.28		
6 MWT							
Mean (SD)	Pre	50.25 7.320	53.83 11.017	52.67 15.044	70.00 13.279	6.116	0.106 #
	Post	87.25 6.500	107.67 4.502	111.00 3.606	142.00 10.214	16.509	0.001**
	Diff	37.00 12.832	53.83 8.183	58.33 16.073	72.00 8.165	11.716	0.008**

(C 4) Control group at 4 weeks, (C 6) Control group at 6week, (E 4) Experimental group at 4 weeks, (E 6) Experimental group at 6 weeks.

TABLE NO 2 –Comparison Within Control Group

	PRE			POST			Z VALUE	P VALUE
	Mean	SD	Median	Mean	SD	Median		
ABIS	54.90	6.488	55	43.00	6.683	40	-2.803	0.005**
MGPQ Total	8.20	0.632	8	3.40	1.174	3.5	-2.816	0.005**
MGPQ PPI	1.50	0.527	1.5	0.70	0.483	1	-2.271	0.023*
MGPQ VAS	5.80	0.789	6	3.30	0.83	3	-2.840	0.005**
6MWT	52.40	9.419	55	99.50	11.683	102.5	-2.805	0.005**

TABLE NO 3 –Comparison Within Experimental Group

	PRE			POST			Z VALUE	P VALUE
	Mean	SD	Median	Mean	SD	Median		
ABIS	55.50	6.553	55.5	28.30	8.001	25	-2.807	0.005**
MGPQ Total	8.00	0.667	8	2.30	1.494	2	-2.825	0.005**
MGPQ PPI	1.40	0.516	1	0.40	0.516	0	-2.640	0.008**
MGPQ VAS	5.50	1.179	5	1.00	0.816	1	-2.840	0.005**
6MWT	64.80	15.426	67	132.70	17.224	134.5	-2.805	0.005**

DISCUSSION

The study comprises of 20 unilateral transtibial amputees including all male subjects with mean age (40.85 ±11.81) years. This could be because of our society is male dominating and more susceptible to road traffic and train accidents whereas women are less involved in driving or accident-prone employment.

Table 1, shows, highly significant improvement in experimental as compare to control group in ABIS (P 0.002), MGPQ (P 0.003), & 6MWT (P 0.001) post intervention. Wyona Freysteinson (2017) quoted in her study that amputees experience of viewing self in the mirror develops acceptance of a new normal by improving body image perception in lower limb amputation [13].

Jessica Desrochers et al (2018), in her study has highlighted the importance of physical activity by promoting positive body image perception in lower limb amputation [14]. GMI progressively engages the cortical neural networks in order to improve cortical reorganization through neuroplasticity and helps in reducing PLP (14). This can be supported by Katleho Limakatso et al (2020) concluded that GMI was superior to routine therapy for producing clinically meaningful pain reductions on 10-cm VAS for up to six months after the intervention [15].

According to Table 2 & 3, highly significant (P 0.005) change was observed in pre and post score of ABIS, MQPQ, 6MWT in control as well as experimental group. This is suggesting that conventional as well as GMI intervention was equally effective. This is in accordance with a systematic review done by Holm Thieme et al (2016) compared various types of movement representation technique in PLP patients and concluded the effects of experimental and control groups were similar [16]

Walking distance is one of the determinant of health related quality of life in lower limb amputation. Many studies have stated, that the median walking distance of amputees with PLP is 100–500 meters and without PLP is 500–1000 meters with prosthesis [17]. Whereas in our study, on 6MWT experimental and control group could walk < 500 meters with pylon. This could be due to patients from acute phase were selected for this study. A qualitative study conducted by Wyona Freysteinson et al (2017) strongly recommended use of mirror in rehabilitation process of lower limb amputation to correct gait and balance (13). The limitation of the study was less sample size, and patient had difficulty in differentiating between PLP and residual limb pain.

CONCLUSION

Thus, GMI can be used as an adjunctive therapy in lower limb amputation with additional benefit to reduce PLP which enhances self-control over phantom limb pain and improves functional status of patients.

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