Physiotherapy and Occupational Therapy Journal

POTJ

Editor-in-Chief
Meenakshi Singh
Amity Institute of Physiotherapy, Noida

Former Editor-in-Chief
Narasimman S., Mangalore

Associate Editor
Senthil P Kumar
School of Allied Health Science and Research, Sharda university, Greater Noida

National Editorial Advisory Board

Asir John Samuel, Mullana
Beulah Jebakani, Pondicherry
Davinder Kumar Gaur, Delhi
Manisha Uttam, Patiala
Neeraj Kumar, Greater Noida
Ravinder Narwal, Deharadun
Sanjai Kumar, Meerut
Shivani Bhatt, Changa
Vaibhav Agarwal, Dehradun
Vencita Priyanka Aranha, Mullana

International Editorial Advisory Board

Goh Ah Cheng, Shinshu University, Japan
Kedar Mate, McGill University, Montreal, Hutchinson, Canada
Krunal Desai, Physical Medicine & Rehabilitation Hospital, Kuwait
Md. Abu Shaphe, Jazan University, Saudi Arabia

Managing Editor
A. Lal

Publication Editor
Manoj Kumar Singh

Indexing information: *NLM catalogue & locator plus, USA; Index Copernicus, Poland; Indian Citation Index (ICI), India; EBSCO Publishing's Electronic Databases, USA; Academic Search Complete*, USA; *Academic Search Research & Development, USA; ProQuest, USA; Genamics JournalSeek, OCLC World Cat.*

© 2018 Red Flower Publication Pvt. Ltd. All rights reserved.

The views and opinions expressed are of the authors and not of the **Physiotherapy and Occupational Therapy Journal**. Physiotherapy and Occupational Therapy Journal does not guarantee directly or indirectly the quality or efficacy of any product or service featured in the the advertisement in the journal, which are purely commercial.

Corresponding address

Red Flower Publication Pvt. Ltd.
48/41-42, DSIDC, Pocket-II, Mayur Vihar, Phase-I
Delhi - 110 091 (India)
Phone: 91-11-22756995, 22754205, 45796900
E-mail: info@rfppl.co.in
Website: www.rfppl.co.in

The Physiotherapy and Occupational Therapy Journal's (pISSN: 0974–5777, eISSN: 2455-8362, Registered with Registrar of Newspapers for India: DELENG/2007/22242) on topics pertaining to physical therapy and rehabilitation. Coverage includes geriatric therapy, pain management techniques, cardiac, orthopaedic and pulmonary rehabilitation, working with stroke patients, occupational therapy techniques and much more. The editorial contents comprise research papers, treatment notes and clinical observations, case histories, professional opinion and memoirs and comments on professional issues. The Editorial Board's mission is to publish significant research which has important implications for physiotherapy and occupational therapy. Our vision is for the journal to be the pre-eminent international publication of the science and practice of physiotherapy and occupational therapy.

Readership: Physiotherapist, Occupational therapists, medical engineers, epidemiologists, family physicians, occupational health nurses etc.

Subscription Information

Individual (1 year): Contact us

Institutional (1 year): INR9000/USD703

Payment methods

Bank draft / cashier s order / check / cheque / demand draft / money order should be in the name of **Red Flower Publication Pvt. Ltd.** payable at **Delhi**.

International Bank transfer / bank wire / electronic funds transfer / money remittance / money wire / telegraphic transfer / telex

1. **Complete Bank Account No.** 604320110000467
2. **Beneficiary Name (As per Bank Pass Book):** Red Flower Publication Pvt. Ltd.
3. **Address:** 41/48, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091(India)
4. **Bank & Branch Name:** Bank of India; Mayur Vihar
5. **Bank Address & Phone Number:** 13/14, Sri Balaji Shop,Pocket II, Mayur Vihar Phase- I, New Delhi - 110091 (India); Tel: 22750372, 22753401. **Email:** mayurvihar.newdelhi@bankofindia.co.in
6. **MICR Code:** 110013045
7. **Branch Code:** 6043
8. **IFSC Code:** BKID0006043 (used for RTGS and NEFT transactions)
9. **Swift Code:** BKIDINBBDOS
10. **Beneficiary Contact No. & E-mail ID:** 91-11-22754205, 45796900, E-mail: info@rfppl.co.in

Online You can now renew online using our RFPPL renewal website. Visit http://rfppl.co.in/subscribe.php?mid=7 and enter the required information and than you will be able to pay online.

Send all Orders to: Subscription and Marketing Manager, Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi - 110 091(India), Mobile: 8130750089, Phone: 91-11-45796900, 22754205, 22756995. E-mail: sales@rfppl.co.in.

Physiotherapy and
Occupational Therapy Journal

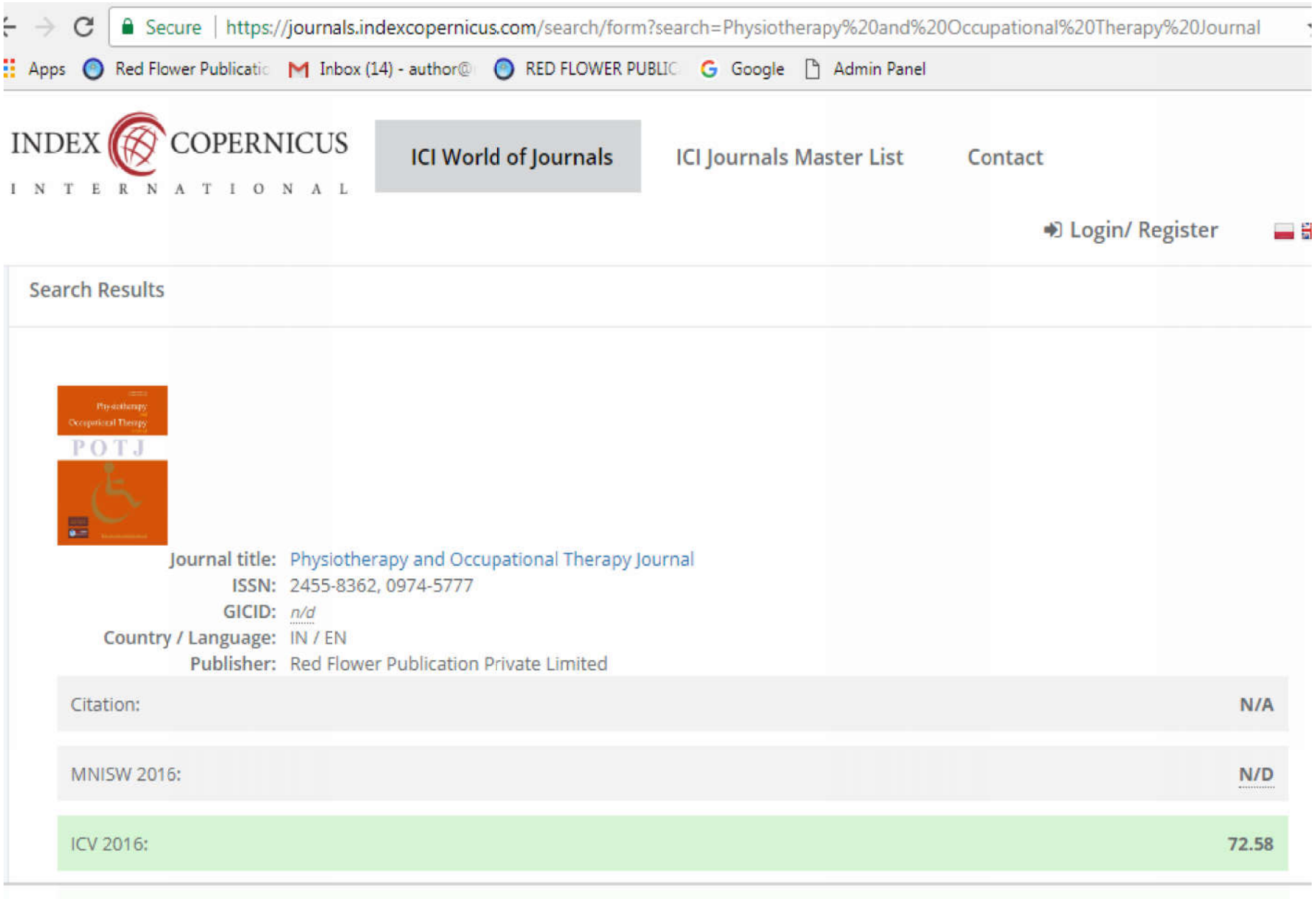
POTJ

April - June 2018
Volume 11, Number 2

Contents

Original Articles

Case Report


Secure
https://journals.indexcopernicus.com/search/form?search=Physiotherapy%20and%20Occupational%20Therapy%20Journal
Apps
Red Flower Publicatic
Inbox (14) - author@
RED FLOWER PUBLIC
Google
Admin Panel
INDEX COPERNICUS
INTERNATIONAL
ICI World of Journals
ICI Journals Master List
Contact
Login/ Register
Search Results
POTJ
Journal title: Physiotherapy and Occupational Therapy Journal
ISSN: 2455-8362, 0974-5777
GICID: n/d
Country / Language: IN / EN
Publisher: Red Flower Publication Private Limited
Citation: N/A
MNISW 2016: N/D
ICV 2016: 72.58

Original Article

Physiotherapy and Occupational Therapy Journal
Volume 11 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/potj.0974.5777.11218.1

Effect of Close Kinematic Chain Exercise and Open Kinematic Chain Exercise on Q- Angle and Navicular Drop

Shatrudhan Das[1], Niraj Kumar[2], Ekta Pandey[3]

Abstract

Introduction: The Q- angle is the angle formed by the encounter of two lines, one that starts at the anterior superior iliac spine and goes to center of the patella and another that goes from the tibial tuberosity to the center of the patella [1]. Many experts favor closed chain over open chain exercises. They do so under the assumption that they are safer and more functional. The terms open and closed kinematic chain have frequently led to polarizing and contradictory discussions both in scientific literature & in everyday practice of various therapists clinicians and trainers.Controversial arguments for and against open kinetic chain and closed kinematic chain exercise [4]. One of the methods currently used in clinical practice is measurement of the navicular drop. Depending of the foot size the dynamic navicular drop for healthy persons is on average 5.3 mm (±18mm) but can vary up to 15 mm in problematic cases [10]. *Need of the Study:* Compare the effectiveness of and close kinematic chain exercises Open kinematic chain exercises on Gluteus maximus, Q angle and navicular drop in the knee joint for improve the strength of Gluteus maximus muscle and quadriceps muscle. I want to diagnose & compare of Q angle and navicular drop at the fatigue level exercise. *Methods:* It is an experimental study design. Subjects were randomly assigned into two groups. A and B. Group A subjects received close kinematic chain and Group B open kinematic chain exercises at the fatigue level. *Conclusion:* In present study we found that both type of exercise protocols either close kinematic chain or open kinematic chain exercise are equally effective. Therefore data from present study support our null hypothesis. *Discussion:* This study was designed to obtain more thorough understanding of the effect of exercise induces fatigue in the CKC and OKC on the Q- angle, and navicular drop. The study is done to compare the CKC and OKC on Q- angle and navicular dropping after exercise and before exercise in the dominant lower extremity. Before implementing the experiment, the pre values of various ranges of the two group were compared between them using independent 't' –Test and the result shown to be non significant which forms the baseline of this study. *Study Limitations:* How-ever despite of best effort and state of the class facilities this study to had some limitations such as small sample size, gender limitations, non specific study population which provides just a glimpse of possibilities with more accurate and better rehabilitation outcomes. Future studies should include patient focused population, large sample size, specific study population i.e. athletes from various discipline of sports.

Keywords: Close Kinematic Chain Exercise (CKC); Open Kinematic Chain Exercise (OKC); Q- Angle and Navicular Drop.

Introduction

The Q- angle is the angle formed by the encounter of two lines, one that starts at the anterior superior iliac spine and goes to center of the patella and another that goes from the tibial tuberosity to the center of the patella [1]. It creates a lateral force vector on the patella and predisposes the patella to displacement during activation of the quadriceps. Normal value of the Qangle has been shown to vary between 10 and 14 for men and 14 and 17 for women [2].

Closed kinetic chain exercises allow functional muscle recruitment patterns to occur throughout multiple joints are frequently used in strengthening and functional rehabilitation of the lower limb. The squat is a closed kinetic chain exercise & is a complex movement involving the ankle, knee and hip joints [3].

Author Affiliation: [1,3]Lecturer [2]Associate Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.

Reprint Request: Niraj Kumar, Associate Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.
E-mail: drnirajkumar25@gmail.com

© Red Flower Publication Pvt. Ltd.

Many experts favor closed chain over open chain exercises. They do so under the assumption that they are safer and more functional. The terms open and closed kinematic chain have frequently led to polarizing and contradictory discussions both in scientific literature & in everyday practice of various therapists clinicians and trainers. Controversial arguments for and against open kinetic chain and closed kinematic chain exercise.

Muscle can be strengthened through resistance training which can be divided into OKC & CKC exercises. OKC exercise occurs when the movement allows the distal part of the limb to move freely while proximal part is fixed. CKC exercise is a movement wherein the distal part is fixed as when the sole of the foot makes contact with the ground or the exercise equipment with the distal part fixed movement at any one joint in the kinetic chain requires motion as well at the other joints in the kinetic chain [5].

Navicular drop is a commonly used clinical measure that response that represents a composite measure of foot pronation. In an effort to better understand the potential influence of static posture faults on dynamic knee function, we examined how subjects who were high or low on ND and QA may differ in their neuromuscular control strategies under functional, weight bearing conditions [8].

One of the methods currently used in clinical practice is measurement of the navicular drop. Depending of the foot size the dynamic navicular drop for healthy persons is on average 5.3 mm(±18mm) but can vary up to 15 mm in problematic cases. The NP has been suggested to be the most appropriate parameter for the assessment of foot pronation as it is a valid indicator of talonavicular motion and rear foot movement. The size of navicular drop appears to have important consequences for subjects who participaten in weight bearing sports such as running. Too much movement of the navicular (i.e. the foot collapse during loading place the subject in higher risk of developing injuries to the medial side of shin as well as the knee [10].

Need of the Study

Compare the effectiveness of and close kinematic chain exercises Open kinematic chain exercises on Gluteusmaximus, Q angle and navicular drop in the knee joint for improve the strength of Gluteus maximus muscle and quadriceps muscle.

I want to diagnose & compare of Q angle and navicular drop at the fatigue level exercise.

Aims and Objectives

To evaluate the effectiveness of close kinematic chain exercises of Quadriceps muscle, Gluteus maximus muscle and naviculardroping.

To evaluate the effectiveness of Open kinematic chain exercise of Quadriceps muscle, Gluteus maximus muscle and navicular dropping.

To compare the effect of open kinematic and close kinematic exercise of Q angle, Gluteus Maximus muscle and navicular drop.

Hypothesis

Null Hypothesis

There will be no significant difference on effectiveness in close kinematic chain exercise upon open kinematic chain exercise in increasing the navicular dropping.

Alternative Hypothesis

There would be a significant effect of close kinematic chain exercises over open kinematic chain exercises on the increasing the strength of Gluteus Maximus muscle and slight increasing the Q angle and no change the navicular dropping.

Review of Literature

Lephart SM, pincivero DM, Giraldo JL, Fu FH (2011) [15]

Conducted a study and concluded that combination of open and close chain exercises will ultimately be necessary to stimulate normal function and optimize the return to activities, especially in throwing, strinking, running and kicking sports. They also mentioned that the closed chain exercises enhance joint compression, activate knee and tibia coupled motions, control joint position and stimulate proprioception, closed chain exercises should therefore be utilized in knee, and hip rehabilitation for functional return to must athletic activities from all types of knee injuries.

Blasier RB, Carpenter JE, Huston LJ(1994) [16]

Sudied the comparison of two techniques i.e. OKC and CKC and that both OKC and CKC

resistance exercise improved joint reposition sense in healthy subject and these exercises are designed for strengthening program to improve neuromuscular control may also be of benefit to individuals with knee proprioceptive deficits.

Yoo Jung Kwon, Soo Jin Park, John Jefferson, and Kyoung Kim, (2013) [17]

Compared the open kinematic chain exercises and close kinematic chain exercises and resulted that closed kinematic chain exercises had an important role in significantly improved dynamic balance of healthy adults, while OKC exercise produced a positive, but not significant improvement.

Tillman et al. (1995) [21]

Studied and concluded that an excessively large Q-angle can increase calcaneal eversion, thus positioning the subtalar joint in pronation. These changes would partially be respon-sible for the drop of foot's longitudinal arches. And compared the Q-angle value and the positioning of the subta-lar joint between genders and found a significant discrepancy only with regards to the Q-angle value (13.1±3.0^{o} in men *versus* 17.5±3.8^{o} in women).

Vanzeli, C.H.G., Reis, A.C.F., Pereira, A.G. et al. [22]

Studied and concluded that the inflammatory diseases such as infectious arthritis, rheumatoid arthritis, synovial diseases ranging from nonspecific synovitis, which can have numerous causes, including viral, until synovial tumors (e.g sinovyal sarcoma), passing through specific synovitis (e.g. pigmented villonodular synovitis), chondrocalcinosis (pseudo gout limestone) are the cause of biomechanical changes of the knee joint, which suggests a directed change at Q angle.

Andrews, Harrelson and Wilk, (2000) [24]

Studied and concluded that the Complications of lateral displacement occur more often in women and may be due to the slight increase in lateral traction exerted by the quadriceps mechanism. Dysfunction of the oblique vastus medial is, tense lateral structures, including the iliotibial band, patellar retinaculum and the greater subtalar pronation that results in increased Q angle value are responsible for lateral patellar displacement.

Methodology

A sample of 30 patients was taken part in this study and this study was done in SGRRIMHS/ SMIH department of physiotherapy at Patel Nagar Dehradun. It is an experimental study design. The duration of study 6 weeks. Random Sampling was done. Subjects were randomly divided into 2 groups. Inclusion no history of hip, knee and ankle joint pain presently or recently, Only males subjects taken with the age of 20-30 yr., no past history of pain & trauma as well as surgery, subjects should not be suffering any lower back pain, neuralgia, hip pain, knee pain, ankle pain, neuromuscular disorder. Subjects were excluded any stiffness around hip, knee and ankle joints, history of recent stress fracture or dislocation or subluxation around hip, knee and ankle joints, Any types of diseases around hip, knee and ankle joints, History of neuromuscular disorder, Hyper laxity of knee joint, non compliance with testing procedures and if the subject is unable to understand instruction or to provide informed consent. All subjects were given verbal instructions for the procedure and consent form was obtained from each one of them, prior to participation in the study. Goniometer used in each & every patients. Instrumentation for data collection includes Inchitap, observation couch, Quadriceps table, Marker, Foot supporter and scale.

Procedure

Each subject's descriptive data and information regarding thigh dominance, injury status and game history were recorded to satisfy the subject selection criteria. An objective examination was done to evaluate and observe knee, hip and ankle both statically and dynamically in relation to its role in the entire kinematic chain (CKC and OKC) for both the lower limb and looked for any asymmetry, deformity, atrophy etc. A physical examination was done which consisted of thorough evaluation of both hip, knee, and ankle range of motion.The Q angle, navicular drop and MMT of gluteus maximus muscle begins with the establishment of measurement reference point. These measurement were done into two phase fist pre exercise and second post exercise at fatigue level in closed kinematic chain and open kinematic chain (CKC and OKC).

MMT of Gluteus Maximus checked by comfortably in prone position with 90 degree knee bending and instructed to the subjects to elevate the thigh with bearable resistance (Figure 1).

The Q angle were measurement into two phase first was done the supine anatomical resting position and second was done standing anatomical resting position. In supine position, the subjects were lying on couch comfortably in anatomical resting position and marking the point on the ASIS , centre of patella and tibial tuberosity then line was drawn from centre of patella to ASIS and centre of patella to tibial tuberosity. After that formed the angle of these line and measured the angle by the help of goniometer (Figure 2). In standing position, bilateral standing anatomical resting position the measurement of Q angle procedure same as supine position (Figure 3).

Fig. 1: MMT OF Gluteus maximus (pre ex. and post ex.)

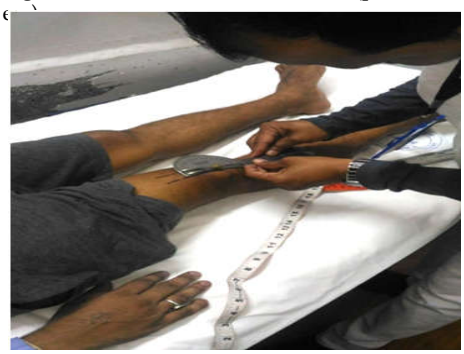


Fig. 2: Measure the Q angle in the knee joint supine position (pre ex. & post ex.)

Fig. 3: Measure the Q angle in the knee joint standing position(pre ex. and post ex.)

Navicular dropping measurement were done into two phase first high sitting and second was one leg standing anatomical resting position. In high sitting position, the subjects were sitting in high sitting with on the foot supporter in 90 degree knee bending then marked the point of navicular tuberosity and then checked the height from on the foot supporter ground level to navicular tuberosity by used of scale (Figure 4). In standing position, the subjects were standing on one leg on the foot supporter then marked the point of navicular tuberosity and then same as high sitting procedure (Figure 5).

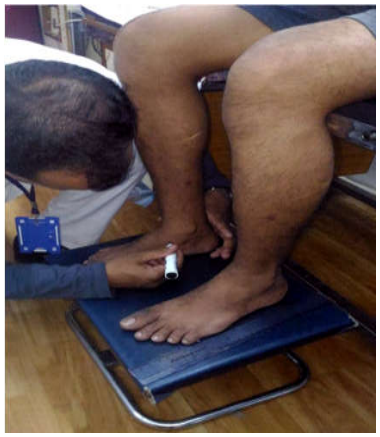


Fig. 4: Measure the Nevicular drop in the high sitting position(pre ex. and post ex.)

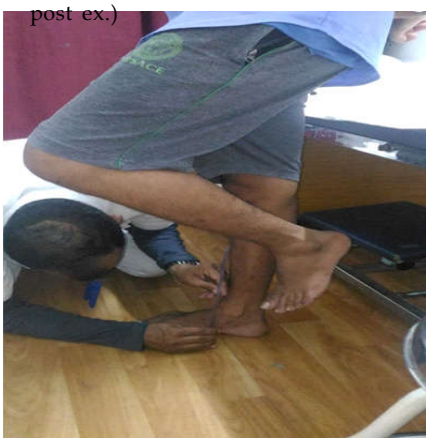


Fig. 5: Measure the Nevicular drop in the unilateral standing position (pre ex. and post ex.)

Instructions to the Patient

1. Subjects were asked to be regular for the treatment sessions as deemed by the researcher.
2. Subjects were asked to report any discomfort during the study period and briefed about the use of safety switch.

Group A: Group A (15 patients) received Close Kinematic Chain (CKC)

Exercise Protocal: Exercise order use a certain pattern generator in the order of the fatigue level .Subjects must be comfortable with performing the exercises to prevent any potential variations. No time will be limit for the session of exercises and No limits of subject to performing the repetition of exercises. The exercises were doing in two group.

Close kinematic chain exercise/ squating exercise: these concentrate on a contraction of the Quadriceps muscle, Gluteus Maximus muscles, Hamstring muscles and lower back, leg muscle, upper part of the body straight line standing position in stabilization on the comfortable plane surface. In standing position, lower limb part of body on the plane surface on standing position. The upper extremity should be on the side of the body placed in straight line. Slowly the hip and knee moves downwards and upwards movements and maintaining straight line on the ground. Before these movement of the part were fixed and stabilized on the ground. These movements are doing as well as they should be fatigue (Figure 6).

Group B: Group B (15 patients) received Open Kinematic Chain Exercise (OKC).

Fig. 6: To perfume the close kinematic chain exercise

Open Kinematic Chain Exercise (OKC)

Weight lifting exercise: These concentric on a co-contraction of the Quadriceps muscles. Stabilize the above knee joint and hip joint and distal part of leg free. In high sitting position, Sitting on the quadriceps table at high sitting position where distal part of leg and leg free move with weight and proximal and above knee joint is stabilized. Upper extremities hand are griped the hand arm of quadriceps table at straight line position then doing the movement of leg with weight on full range of motion of knee joint (Figure 7).

Fig. 7: To perfume the open kinematic chain exercise

After completing the above mentioned task same procedure of measuring each variables were repeated and recorded and compared.

Data Analysis

Data was analyzed using SPSS (version13.0) software and the results of present study are as follows. On analyzing pre exercise and post exercise data of group which performed close kinematic exercises the mean & SD for GMMMT was 3.87±0.516 & 4.2±0.41 respectively and the group which performed open kinematic exercise the mean & SD was 4.06±0.45 and 4.5±0.51 for GMMMT respectively. Results were calculated by using 0.05 level of significance.

Results

On analyzing pre exercise and post exercise data of group which performed close kinematic exercises the mean & SD for GMMMT was 3.87±0.516 & 4.2±0.41 respectively and the group which performed open kinematic exercise the mean & SD was 4.06±0.45 and 4.5±0.51 for GMMMT respectively.

Table 1 showed that mean±SD of Q- angle was 16.2±4.28 (ST), 16.47±5.11 (SU) pre exercise & 15.47±3.50 (ST) ,15.53±3.71 (SU) post exercise in group performing close kinematic exercise.

Table 2 showed that in group performing open kinematic exercise the mean±SD of Q- angle was 14.4± 4.7 (ST), 15.13± 3.7 (SU) in pre exercise group & 14.6±1.9(ST), 15.3±2.4 (SU) in post exercise group.

Tables 1 & 2 showed that on analyzing the data obtained (from both the groups performing close

kinematic or open kinematic exercise) for Navicular drop test, the results showed significant differences between pre and post exercise values in both groups.

Table 1: Mean, Standard Deviation of Close Kinematic Chain Exercise (pre and post exercise) on GMMT, Q-Angle, & Navicular Drop

Close Kinematic Exercise					
GMMMT (N=15)					
PRE	AVRG	SD ±	POST	AVRG	SD ±
	3.87	± 0.516		4.2	± 0.414
Q ANGLE (N=15)					
PRE	AVRG	SD ±	POST	AVRG	SD ±
ST	16.2	± 4.28	ST	15.47	± 3.50
SU	16.47	±5.11	SU	15.53	± 3.717
NAV DROP (N=15)					
PRE	AVRG	SD ±	POST	AVRG	SD ±
HST	5.13	± 0.638	HST	5.14	± 0.725
BLST	4.67	± 0.767	BLST	4.7	± 0.746
ULST	4.96	± 0.678	ULST	4.93	± 0.694
DS	4.94	0.70	DS	5.0	±0.797

Table 3 showed that to compare the changes (if any) in various parameters of pre and post exercise levels in test groups, Paired "t" test has

Table 2: Mean, Standard Deviation of Open Kinematic Chain Exercise (pre and post exercise) on GMMT, Q-Angle, and Navicular Drop

Open Kinematic Exercise					
GMMMT (N=15)					
PRE	**AVRG**	**SD ±**	**POST**	**AVRG**	**SD ±**
	4.06	± 0.45		4.5	± 0.45
Q ANGLE (N=15)					
PRE	**AVRG**	**SD ±**	**POST**	**AVRG**	**SD ±**
ST	14.4	± 4.7	ST	14.6	± 4.7
SU	15.13	± 3.71	SU	15.3	± 3.7
NAV DROP (N=15)					
PRE	**AVRG**	**SD ±**	**POST**	**AVRG**	**SD ±**
HST	5.22	0.51	HST	5.2	± 0.51
BLST	5.09	± 0.49	BLST	5.12	±0.49
ULST	5.21	±0.45	ULST	8.28	± 0.45
DS	5.29	± 0.51	DS	5.2	± 0.51

Table 3: T-test for closed kinematic chain and poen kinematic exercises (showing mean, SD, t-value and significance)

Close kinametic exercise					
GMMT (pre exercise GMMT-post exercise GMMT)					
	Mean	**SD**	**t-value**	**DF**	**Sig (2-tailed)**
Pre GMMT- Post GMMT	0.33	0.48	2.64	14	0.019
Q- ANGLE (Pr exercise-Post Exercise)					
	MEAN	**SD**	**t-value**	**DF**	**Sig (2-tailed)**
Pre ST-Post ST	0.73	3.4	0.82	14	0.422
Pre SU – Pro SU	0.93	4.1	0.86	14	0.402
Navicular Drop (Pre Exercise-Post Exercise)					
	MEAN	**SD**	**t-value**	**DF**	**Sig (2-tailed)**
Pre HST-Post HST	0.006	0.13	0.18	14	0.855
Pre BLST-Post BLST	0.033	0.13	0.92	14	0.371
Pre ULST- Post ULST	0.026	0.096	1.07	14	0.301
Pre DS- Post DS	0.06	0.105	2.2	14	0.045
Open kinematic exercise					
GMMT (pre exercise GMMT-post exercise GMMT)					
	Mean	**SD**	**t-value**	**DF**	**Sig (2-tailed)**
Pre GMMT- Post GMMT	0.46	0.51	3.5	14	0.004
Q- Angle (Pre xercise-Post Exercise)					
	Mean	**SD**	**t-value**	**DF**	**Sig (2-tailed)**
Pre ST-Post ST	0.13	4.4	0.11	14	0.90
Pre SU – Pro SU	0.20	3.7	0.20	14	0.83
Navicular Drop (Pre Exercise-Post Exercise)					
	Mean	**SD**	**t-value**	**DF**	**Sig (2-tailed)**
Pre HST-Post HST	0.01	0.20	0.25	14	0.86
Pre BLST-Post BLST	0.02	0.24	0.41	14	0.68
Pre ULST- Post ULST	3.06	11.8	1.0	14	0.33
Pre DS- Post DS	0.006	0.59	0.43	14	0.67

Table 4: Correlations Of Closed Kinematic Chain Of Pre And Post Exercise Level

Correlations of Closed Kinematic Chain of Pre and Post Exercise Level																
			Pre-Exercise Level							Post-Exercise Level						
			GMMMT	ST	SU	HST	BLST	ULST	WPST	GMMMT	ST	SU	HST	BLST	ULST	WPST
Pre-Exercise Level		GMMMT	1.000	-.481	-.341	-.206	.030	.012	-.002	.448	-.347	-.350	-.190	-.002	-.016	-.016
	Q Angle	ST	-.481	1.000	.933**	.522*	.455	.383	.499	-.197	.560*	.468	.531*	.444	.446	.469
		SU	-.341	.933**	1.000	.482	.457	.371	.466	-.194	.615*	.578*	.495	.425	.426	.408
	Foot Arch	HST	-.206	.522*	.482	1.000	.927**	.926**	.933**	.019	.607*	.506	.995**	.956**	.945**	.933**
		BLST	.030	.455	.457	.927**	1.000	.967**	.961**	-.019	.422	.346	.935**	.985**	.980**	.963**
		ULST	.012	.383	.371	.926**	.967**	1.000	.949**	.058	.356	.268	.936**	.970**	.988**	.950**
		WPST	-.002	.499	.466	.933**	.961**	.949**	1.000	.117	.416	.304	.951**	.964**	.968**	.981**
Post-Exercise Level		GMMMT	.448	-.197	-.194	.019	-.019	.058	.117	1.000	-.019	-.116	.058	.058	.019	.039
	Q Angle	ST	-.347	.560*	.615*	.607*	.422	.356	.416	-.019	1.000	.936**	.580*	.479	.418	.423
		SU	-.350	.468	.578*	.506	.346	.268	.304	-.116	.936**	1.000	.470	.387	.321	.305
	Foot Arch	HST	-.190	.531*	.495	.995**	.935**	.936**	.951**	.058	.580*	.470	1.000	.964**	.956**	.943**
		BLST	-.002	.444	.425	.956**	.985**	.970**	.964**	.058	.479	.387	.964**	1.000	.987**	.976**
		ULST	-.016	.446	.426	.945**	.980**	.988**	.968**	.019	.418	.321	.956**	.987**	1.000	.977**
		WPST	-.016	.469	.408	.933**	.963**	.950**	.981**	.039	.423	.305	.943**	.976**	.977**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

been performed and the results shows significant difference ($p<0.05$ and $p<0.01$) in each group.

Table 4 showed that the relationship between exercise type (CKC/OKC) and various parameters was examined by calculating Pearson correlation on pre and post exercise data of both the groups with significance level set at $P<0.05$ and the results obtained, shows no significant correlation between GMMMT & Q-angle in pre exercise levels of open kinematic chain exercise group. There is a significant correlation (95% at $P<0.05$) between Navicular drop and GMMMT in HST position. More significant correlation (99% at $P<0.01$) was found between GMMMT and BLST and ULST positions at pre-exercise levels. No significant relation was present between GMMMT & DS at pre-exercise level.

In group performing open kinematic chain exercise there is no significant relation was found between GMMMT and Q-angle. At pre exercise and post exercise levels Table 5 showed that there was no significant correlation present between Navicular drop and Q-angle at pre exercise level.

Table 5: Correlations of Open Kinematic Chain of Pre and Post Exercise Level

Correlations of Open Kinematic Chain of Pre and Post Exercise Level															
		Pre-Exercise Level							Post-Exercise Level						
		GMMMT	ST	SU	HST	BLST	ULST	WPST	GMMT	ST	SU	HST	BLST	ULST	WPST
GMMMT		1.000	.098	.243	.558*	.667**	.667**	.488	.443	.241	.377	.361	.598*	.562*	.451
Q Angle	ST	.098	1.000	.785**	-.029	.118	-.071	-.054	-.156	.670**	.393	.086	.173	-.097	-.002
	SU	.243	.785**	1.000	-.189	.187	.209	.208	.095	.455	.559*	-.015	.202	.148	.243
Navicular drop	HST	.558*	-.029	-.189	1.000	.670**	.501	.456	.529*	-.005	-.054	.837**	.731**	.494	.483
	BLST	.667**	.118	.187	.670**	1.000	.899**	.863**	.357	.134	.415	.516*	.835**	.701**	.866**
	ULST	.667**	-.071	.209	.501	.899**	1.000	.907**	.558*	.049	.435	.434	.750**	.720**	.892**
	WPST	.488	-.054	.208	.456	.863**	.907**	1.000	.466	-.087	.362	.313	.599*	.586*	.994**
GMMMT		.443	-.156	.095	.529*	.357	.558*	.466	1.000	-.188	-.080	.499	.405	.310	.480
Q Angle	ST	.241	.670**	.455	-.005	.134	.049	-.087	-.188	1.000	.631*	.040	.245	.087	-.092
	SU	.377	.393	.559*	-.054	.415	.435	.362	-.080	.631*	1.000	-.044	.298	.417	.345
Navicular drop	HST	.361	.086	-.015	.837**	.516*	.434	.313	.499	.040	-.044	1.000	.770**	.537*	.368
	BLST	.598*	.173	.202	.731**	.835**	.750**	.599*	.405	.245	.298	.770**	1.000	.753**	.623*
	ULST	.562*	-.097	.148	.494	.701**	.720**	.586*	.310	.087	.417	.537*	.753**	1.000	.585*
	WPST	.451	-.002	.243	.483	.866**	.892**	.994**	.480	-.092	.345	.368	.623*	.585*	1.000

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

At post exercise level significant correlation (95% at P<0.05) was present between GMMMT and BLST & ULST positions for Navicular drop among the group performing open kinematic exercises. HST & DS positions for Navicular drop showed no significant correlation in this group.

In group performing close kinematic exercise, at pre exercise level GMMMT has no significant correlation with Navicular drop. But there is significant correlation (95% at P<0.05) between Q-angle (ST) and Navicular drop (HST) at both pre and post exercise levels.

Discussion

This study was designed to obtain more thorough understanding of the effect of exercise induces fatigue in the CKC and OKC on the Q- angle, and navicular drop. The study is done to compare the CKC and OKC on Q- angle and navicular dropping after exercise and before exercise in the dominant lower extremity. Before implementing the experiment, the pre values of various ranges of the two group were compared between them using independent 't' –Test and the result shown to be non significant which forms the baseline of this study.

Significant difference has been resulted from the fatigue induced by the exercise. This result is supported by the study done by Yoo Jung kwon and Soo et al. [1] john Jefferson et al. [2], and kyoungkim et al. who suggested that closed kinematic chain exercises had an important role in significantly improved dynamic balance of healthy adults, while OKC exercise produced a positive, but not significant improvement [5].

This result is also supported by Lephart SM, pincivero DM, Giraldo JL, Fu FH (2011): Their finding suggest that combination of open and close chain exercises will ultimately be necessary to stimulate normal function and optimize the return to activities, especially in throwing, strinking, running and kicking sports. This may form part of the ascending proprioceptive afferent fiber system [15].

As it is proven through various studies that efficient functioning of lower limb is being influenced by various factors such as muscle strength, fatigue level and several other biomechanical constrains. In present study we tried to see the effect of exercise (close and open kinematic) on various parameters such as Q-angle, navicular drop, and strength of gluteus Maximus muscle. The results obtained in this study are in compliance with results of various other studies stating the relations between different parameters [15].

The findings of our study are strongly supported by the results of study done by Hugo Machado et.al comparing the differences in Q-angle values in different positions and found significant differences in Q-angle measurements in supine and standing position.

As the data of present study shows that there is an increase in value of Q-angle from standing position to supine position in each group but when the value of Q-angle of two groups were compared the results showed significant differences between the groups.

The group that performed open kinematic exercises has lower mean value of Q-angle as in comparison to group that performed closed kinematic exercise. Depending upon these findings, open kinematic chain exercise protocol can be in-corporate while planning rehabilitation protocol for persons with knee injuries [6].

In a study done by Yoo JUNG Kwon et.al, depending on the findings, they suggested that an exercise protocol to restore or increase dynamic balance ability the close kinematic exercises are more effective as it involves more than one joint at same time and produces superior eccentric contraction and co-contraction of muscles with reduced shear forces over the joint and data obtained in our study also shows increased mean value of selected parameters at post exercise levels. In same study Yoo Jung Kwon et.al also mentioned that open kinematic exercises are more useful in isolating an individual muscle/muscle group as it produces less force over the involved joints this statement strongly proves the validity of lesser mean value in group performing open kinematic exercises [17].

The Q-angle values differs in accordance to gender and normal values for Q-angle have been noted to vary between 10^o to 14^o for men and 14^o to 18^o for women and an increase in pressure between patella and lateral femoral condyle during quadriceps muscle activity. In a study conducted by Y. Sokhangooei et. al. included subjects with Patellofemoral syndrome and evaluated the efficiency of closed kinematic chain and open kinematic chain exercises on different parameters such as pain, Q-angle and knee proprioception. In particular they found that the subjects with Patellofemoral syndrome have increased Q-angle. They included close kinematic chain exercises and open kinematic chain exercises and noted significant improvement in Q-angle and they stated that both open chain and

closed chain exercises are equally effective. Hence the data from current study is in accordance to results of above mentioned study. But it becomes essential to mention that selection of exercise protocol should be done after a proper assessment of patient's condition and ability [24].

In a study titled "Flat Foot Deformity, Q-angle and Knee pain are interrelated in wrestlers" done by Amir Letafatkat et. al. it is mentioned that the flat foot deformity or excessive Navicular drop may result in patella lateral rotation and increase in Q-angle. Hence, making it necessary for a rehabilitation expert/ sport therapist to choose optimal rehabilitation protocol for the patient [19].

Conclusion

In present study we found that both type of exercise protocols either close kinematic chain or open kinematic chain exercise are equally effective. How-ever, various factors such position of lower extremity, type of exercise, directly or indirectly will affect the prognosis of certain conditions involving lower limb. Furthermore, data obtained from this type studies can be considered as reference values either for making diagnosis, planning a patient specific rehabilitation protocols or even to predict the outcome of any on going rehabilitation protocol. Hence data from present study support our null hypothesis.

Study Limitations

How-ever despite of best effort and state of the class facilities this study to had some limitations such as small sample size, gender limitations, non specific study population which provides just a glimpse of possibilities with more accurate and better rehabilitation outcomes. Future studies should include patient focused population, large sample size, specific study population i.e. athletes from various discipline of sports.

Refrences

1. Sanchez HM, Sanchez EGM, Barauna MA, Canto RST. Evaluation of Q angle in different static postures. Actaortopedicabrasileira .November 2014;22(6):325-9. URL: http://www.scielo.br/aob.
2. Laura H. Lathinghouse, Mark H. Trimble. Effect of isometric Quadriceps Activation on the Q angle in women before and after Quadriceps exercise: Journal orthopaedic and sports physical Therapy. 2000;30(4):211-16.
3. Wilson J, Ferris E, Heckler A, Maitland L, Taylor C. A structured review of the role of gluteus maximus in rehabilitation, New Zealand journal of physiotherapy 2005;33(3):95-100.
4. F. Mayer, A. Schlumberger, R. Vancinegel, Y. Henrotin, W. laube and D. Schmidtbleicher. Training and testing in open versus closed kinetic chain. 2003;11:181-87.
5. Yoo Jung kwon, Soojin park, John Jefferson, Kyoungkimpt. The effect of open and closed kinetic chain exercises on dynamic balance ability of normal healthy adults. Journal of physical therapy science. 2013 June;25(6):671-74.
6. Hugo Machado & Ebefafitness. The funcational impact of navicular drop.www. ebfafitness. com. 2015 May 22.
7. Sandra J Schultz, Christopher R carcia, Bruce M Gansneder and David H Perrin.The independent & interactive effect of navicular drop and quadriceps angle on neuromuscular response to wight bearing perturbation. Journal of athletic training. 2006;3:251-59.
8. McPoil TG, Cornwall MW, Medoff L, Vicenzino B, Forsberg K, Hilz D. The navicular drop test. J Foot Ankle Res. 2008;1:3
9. William M. Austin. Women in Sports, Q Angle, and ACL Injuries. Dynamic Chiropractic. 2003 Oct 6;21(21).
10. Simon L. kappel, Michael S. Rathleff Dan Hermann, ole simonsen, HenrikKarstoft and peter ahrendt: A Novel method for measuring in shoe navicular drop during gait. Sensors. 2012;12(9).
11. Grob K, Ackland, T kuster, MS manestar, M. filgueria: anatomy of Quadricepfemoris muscles; 2016 Jan 6, Wikipedia.
12. Boisen- molar, finn, simonsenerik-b, Tranum-jenson, Jorgen: anatomy of navicular bone from Wikipedia; the fee encyclopedia; 2017 Aug 16.
13. Anne Asher, CPT, Reviewed by Grant Hughes, MS. Open and closed kinetic chain: 2016 Sep 24.
14. Pamela K. Levangie, Cynthia C. Norkin. Text books of joint structure and function, 2010.
15. Lephart SM, Pincivero DM, Giraldo JL, Fu FH The role of proprioception in the management and rehabilitation of athletic injuries. Am J Sports Med. 1997 Jan-Feb;25(1):130-7.
16. Blasier RB, Carpenter JE, Huston LJ. Shoulder proprioception: effect of joint laxity, joint position, and direction of motion. Orthop Rev 1994:23:45-50.
17. Yoo Jung Kwon, Soo Jin Park, John Jefferson, and Kyoung Kim. The Effect of Open and Closed Kinetic Chain Exercises on Dynamic Balance Ability of Normal Healthy Adults. J Phys Ther Sci. 2013 Jun; 25(6): 671–674.
18. Wilson J, Ferris E, Heckler A, Maitland L, Taylor C. A structured review of the role of gluteus maximus

in rehabilitation. New Zealand Journal of Physiotherapy 2005;33(3):95-100.

19. Letafatkar A, Zandi S, Khodayi M, Vashmesara JB. Flat Foot Deformity, Q Angle and Knee Pain are Interrelated in Wrestlers. J Nov Physiother 2013;3:138. doi:10.4172/2165-7025.1000138.
20. Søren Spörndly-Nees, Brian Dåsberg, Rasmus Oestergaard Nielsen, Morten IlumBoesen, and Henning Langberg. The Navicular Position Test–A Reliable Measure of the Navicular Bone Position During Rest and Loading. Int J Sports Phys Ther. 2011 Sep; 6(3): 199–205.
21. Tillman et al. (1995): Tidy's physiotherapy e-book.
22. Vanzeli, C.H.G., Reis, A.C.F., Pereira, A.G. et al. Measurement the "Q" angle through the application of direct method and indirect method. J. Morphol. Sci., 2016;33(3):168-70.
23. Y. Sokhangooei Lathinghouse And Trimble. Effects of isometric quadriceps activation on the Q-angle in women before and after quadriceps exercise. J Orthop Sports Phys Ther. 2000 Apr;30(4):211-6.
24. Andrews, J.R., Harrelson, G.L., Wilk, K.E. Sports Injuries: Prevention, Diagnosis, Treatment and Rehabilitation. 2000.

Original Article

Physiotherapy and Occupational Therapy Journal
Volume 11 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/potj.0974.5777.11218.2

Combined Effect of Mirror Therapy and Thermal Stimulation on Upper Extremity Motor Functions in Post Stroke Hemiparetic Subjects

Shama Praveen[1], Niraj Kumar[2], Archana Chauhan[3]

Abstract

Introduction: Stroke is the leading cause of long term disability among adults and hemiparesis is the most common impairment after stroke. Longitudinal studies of recovery after stroke suggest that on 50% of patients with significant arm paresis recover useful function [1] WHO estimated that in 1990, out of a total of 9.4 million deaths in India, 619,000 were due to stroke. This gives a stroke mortality rate of 73 per 1000,000 (estimated total population 849 million). It is estimated that 600,000 Americans suffer a first stroke each year, and the nation's nearly 4 million stroke survivors are living with consequences [2]. Patient diagnosed with stroke often present with a combination of muscle weakness or muscle imbalance, decreased postural control, muscle spasticity, poor voluntary control, and body mal-alignment [3]. *Aims of the Study:* To analyze the effectiveness of combine motor rehabilitation protocol to improve upper extremity motor recovery in post stroke subjects. *Methods:* On the basis of inclusion and exclusion criteria 30 subjects were randomly divided into two groups. 15 subjects in experimental group (Group A) given mirror therapy and thermal stimulation and 15 subjects in controlled group (Group B). Given general exercises of upper extremity for flexors and extensors were carried out for 4 weeks including active exercises and functional training. *Discussion:* In the present study, aspect of somatosensory stimulation and mirror illusion of normal movement is taken as a point of reference for treatment in hemiplegic with functional dependence on the basis of UEFI. [5,8]. There is a significant change in post intervention in Group A $p \leq 0.05$ which approves improvement in functional activity according to UEFI. The use of mirror therapy creates the mirror illusion of normal movement of the affected hand may substitute for decreased proprioceptive information, thereby helping to recruit the premotor cortex and assisting rehabilitation through an intimate connection between visual input and premotor areas. Clinically this study demonstrated that by using mirror therapy and thermal stimulation as a treatment tool, the improvement was seen in upper extremity functional activity of post stroke hemi paretic subjects. *Conclusion:* Mirror therapy and thermal stimulation was found to be effective in improving functional independence in upper limb post sub-acute stroke. When mirror therapy and thermal stimulation is administered to patients suffering from sub-acute stroke over a period of 4 weeks, it results in an improvement in reaching forwards, grasping, manipulating objects and also improves other fine motor functions of the hand. *Future Research:* 1. Further studies are recommended to minimize these limitations in such a way that larger sample sizes of both the sexes that include various age groups of people are studied. 2. The duration of study can be increased. 3. The inclusion criterion can be improved so that all the subjects show similar functional independence in upper limb at the beginning of the study. 4. Various outcome measures can be used in order to record the functional independence in a better way. 5. Study can also be done to improve lower extremity functions. 6. Study can be done on chronic patients. *Limitations of the Study:* 1. The duration of study was only 4 weeks, so further prognosis and long term benefits could not be recorded. 2. Home exercises were not prescribed to the subjects. 3. Training depends on functional level of patients. 4. Task specificity and stroke severity are important factors in rehabilitation of upper limb. 5. It is difficult to maintain constant temperature. 6. Thermal stimulation cannot be performed on patients with sensory loss.

Keywords: Mirror Therapy; Thermal Stimulation Medium Size Ball; Suitcase; Shirt With Buttons; Comb; Plinth; Mirror; Hot and Cold Packs; Medium Size Jar; Chair; Towels & Shoes With Laces.

Author Affiliation: [1]Lecturer [2]Associate Professor [3]Assistant Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.

Reprint Request: Niraj Kumar, Lecturer, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.
E-mail: samapraveen2901@gmail.com

© Red Flower Publication Pvt. Ltd.

Introduction

Stroke is the leading cause of long term disability among adults and hemiparesis is the most common impairment after stroke. Longitudinal studies of recovery after stroke suggest that on 50% of patients with significant arm paresis recover useful function [1].

Analysis of community surveys from different regions of India shows a crude stroke prevalence rate of about 203 per 1000,000 populations above 20 years of age, amounting to a total of about 1 million cases. The male to female ratio was estimated to be 1.7 WHO estimated that in 1990, out of a total of 9.4 million deaths in India, 619,000 were due to stroke. This gives a stroke mortality rate of 73 per 1000,000 (estimated total population 849 million). It is estimated that 600,000 Americans suffer a first stroke each year, and the nation's nearly 4 million stroke survivors are living with consequences [2].

Patient diagnosed with stroke often present with a combination of muscle weakness or muscle imbalance, decreased postural control, muscle spasticity, poor voluntary control, and body mal-alignment [3].

In many patients with severe stroke, the affected upper limb (UL) never becomes useful, even after therapy. Only about 15% of those suffering from severe stroke recover hand functions [4].

Thr paretic upper limb is a common and undesirable consequence of stroke that increases activity limitation. It has been reported that up to 85% of stroke survivors experience hemiparesis and that 55% to 75% of stroke survivors have continued to have limitations in upper extremity functioning [5].

It has been estimated that 55% of stroke survivors have a nonfunctional upper extremity following initial therapy and 30% of stroke survivors have had some partial recovery of upper extremity functions in terms of range of motion and strength, but are still unable to perform ADLs with the affected upper extremity, which negatively affects their independence and increases the burden of care [6].

When a stroke patient puts his weakened hand in the mirror box and moves his strong hand, the mirror box gives the illusion movements occurring in the hand affected by the stroke. This is done through activation of mirror neurons in the premotor cortex of the brain. In essence the mirror tricks the mind and weak hand into working better [7].

Thermotherapy refers to the application of heat or cold (cryo therapy) for the purpose of changing the cutaneous, intra-articular and core temperature of soft-tissues with the intention of improving the symptoms of certain conditions. Thermal stimulation has been developed to promote upper extremity recovery in stroke patients because thermal stimulation may induce cortical reorganization [8].

Operational Definition of Stroke

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the CNS by a vascular cause, including cerebral infarction, intracerebral hemorrhage (ICH) and subarachnoid hemorrhage and is a major cause of disability and death.

The current World Health Organization definition of stroke, introduced in 1970 and still used is "rapidly developing clinical signs of focal disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin [9].

Operational Definition of Mirror Therapy

Ramchandran originally hypnotized that paralysis following might have a learnt component, which would possibly be 'unlearnt' by means of mirror illusion. Mirror therapy might be a form of visually guided motor imagery. Mirror illusion increases activity in precuneus and posterior cingulated cortex associated areas associated with awareness of self and spatial attention.

Operational Definition of Hemiplegia

In medical jurisprudence. Unilateral paralysis; paralysis of one side of the body, commonly due to a lesion in the brain.in the cerebral form, the hemiplegia is sometimes "alternate" or crossed, that is occurring on the opposite side of the body from the initial lesion.

Statement of Question

Will mirror therapy and thermal stimulation improve the upper extremity motor recovery in hemiparesis patients?

Research Hypothesis

Experimental Hypothesis: This hypothesis states that thermal stimulation and mirror therapy will

improve the motor recovery of paretic upper extremity in post stroke hemi paretic subjects.

Null Hypothesis: This hypothesis states that mirror therapy and thermal stimulation may or may not improve upper extremity functions in stroke cases.

Need of the Study

As there is decreased functional activity of upper extremity among stroke subjects so this study being done to improve the functional activity of upper extremity and to improve the quality of life in hemiplegic subjects.

Aims of the Study

To analyze the effectiveness of combine motor rehabilitation protocol to improve upper extremity motor recovery in post stroke subjects.

Review of Literature

- Hung-Chia Wu, Yu Cing Lin et al. (2010); conducted a comparative study on effect of thermal stimulation on upper extremity motor recovery 3 months after stroke and concluded that upper extremity thermal stimulation programme could provide further improvement in motor function of upper extremity, than those in the controlled group after 3 months of onset [8].
- Holm Thieme, Jan Mehrholz et al. (2013); conducted a study on mirror therapy for improving motor function after stroke and concluded that the mirror therapy could be applied at least as an additional intervention in the rehabilitation of patients after stroke [10].
- Sneha S. Khandare, Singaravelan, Subash M Khatri (2013); compared task specific exercises and mirror therapy to improve upper limb functions in sub-acute stroke patients and concluded that mirror therapy can be added along with task specific exercises in the treatment of sub-acute stroke patients to improve upper limb function [11].
- Andreas Stefan Rothgangel et al. (2011); conducted a study on the clinical aspects of mirror therapy in rehabilitation a systemic review of literature and concluded that the work on mirror therapy needs to be considered in the context of any new treatment modality [17].
- Youn Jookang, Jeonghun Ku et al. (2011); conducted a study on facilitation of corticospinal excitability according to motor imagery and mirror therapy in healthy subjects and stroke patients and concluded that in both groups corticospinal excitability was facilitated by viewing the mirror image of the activity of the ipsilateral hand. These findings provide neurophysiological evidence supporting the application of various mirror imagery programmes during stroke rehabilitation [18].
- Rinu Susan Raju, Prabhakaran S Sharma Jeyaraj D Pandian (2010); conducted a study to analyze psychosocial problems, quality of life and functional independence among Indian stroke survivors and concluded that presence of anxiety, depression and functional dependence were associated with impaired quality of life. There was low prevalence of anxiety and depression [20].
- Peter Appetros, Birgitta Stegmeyer, and Andrews Terent; (2009); conducted studies on sex differences in stroke epidimiologies and shown that stroke is more common in men than in women and concluded that stroke is more common among men but women are more severely ill [21].
- Staphanie E Chiuve, Kathryn et al. (2008); conducted a study on primary prevention of stroke by healthy lifestyle and concluded that a low-risk life style that is associated with a reduced risk of multiple chronic diseases also may be beneficial in the prevention of stroke especially ischemic stroke [24].
- Syamal K. Das, Tapas K. Banerjee, Atanu Biswas, et al. (2008); conducted a survey on stroke; an Indian scenario and gives an analysis that stroke in India is very much on rise [25].
- A Williams Andrews, Stephen E, Folger, et al. (2008); conducted a study on examination of test and measures used most frequently by specialists index of adult stroke and concluded that the result of this study do not identify test and measures that clinicians should use [26].
- Hazhir Sikaroodi, Mehmood Moalmedi et al.(2007); conducted a study on stroke as first manifestation of takayasu arteritis and concluded that neurological involvement is not common in Takayasu disease and neurological syndromes as first manifestation of disease are relatively rare [27].
- Jeyaraj D Pandian, Velandai Shrikanth et al; 2007; Oct; 22; Journal of American heart

association; Vol38; 3063-3069; conducted a study on poverty and stroke in India. A time to Act and concluded that stroke must be a priority on the health agenda in India and other developing countries [28].

- M.D Patel, C Mcevitt et al. (2007); conducted a study on clinical determinants of long term quality of life after stroke and concluded that determinants of health related Quality of life after stroke whether physical or psychosocial aspects of health related quality of life after are being considered. This study provides variable information on factor predicting long term health related quality of life, which can be undertaken into consideration in audits of clinical practice or in future interventional studies aiming to improve health related quality of life after stroke [29].
- Larry B Goldstien, Robert Adams et al. (2006); conducted a study on primary prevention of ischemic stroke and concluded that extensive evidence is available identifying a variety of specific factors that increases the risk of a first stroke and providing strategies for reducing that risk [30].
- Nathank Le, Stephen et al. (2006); conducted a study on muscle impairments and behavioral factors mediate functional limitations and disability following stroke and concluded that the findings warrant future studies to determine whether strength and power, depressive symptoms and low self-efficacy effectively improves function, reduce disability and enhance quality of life in people who have survived stroke [31].
- Lara Cairio, Jose M. Ferro et al. (2006); conducted a study on depression in acute stroke and concluded that depression was present in almost one-half of the acute stroke patients and was related to previous mood disorder but not to stroke type and location [32].
- Haacke, Astrid Althaus et al. (2006); performed a study on long term outcome after stroke and concluded that a substantial proportion of stroke survivors has very poor health related Quality of life [33].
- Tapas Kumar Banerjee, Shayamal Kumar Das. (2006); conducted a study on epidemiology of stroke in India and concluded that there was higher prevalence of cerebral hemorrhage in the community compared to that in western countries [2].
- Caroline Haacke,, Astrid Althaus et al. (2006); conducted a study on long term outcome after stroke and concluded that a substantial proportion of stroke survivors has very poor health related QOL [34].
- Marc Fisher et al. (2005); conducted a study on enhancing the development and approval of acute stroke therapies and concluded that the development of additional acute stroke therapies represents a large unmet need with many remaining challenges and also opportunities to incorporate novel approaches to clinical trial design that will lead to regulatory approval [35].
- Rosmary Martino, Norine Foley et al. (2005); conducted a study on dysphagia after stroke and concluded that the high incidence of dysphagia and pneumonia is a consistent findings with stroke patients. The pneumonia risk is greatest in stroke patients with aspiration [36].
- Lars Peter Kammersgaard, H.S et al. (2004); conducted a stroke study on short and long term prognosis for very old stroke patients and concluded that very old age per se was a strong predictor of outcome and mortality after stoke. Apart from very old age factors such as pre stroke medical and functional status and onset stroke severity should be taken into consideration when planning treatment and rehabilitation after stroke [37].
- Pamela Duncan, Staphanie Studenski et al. (2003); conducted a randomized controlled trial of therapeutic exercises in sub-acute stroke and concluded that the structured progressive programme of therapeutic exercises in persons who had completed acute rehabilitation services produced gains in endurance, balance and mobility and those attributable to spontaneous recovery and usual care [38].
- Wilma M. Hopman, Jane verner et al. (2003); conducted a study on quality of life during and after inpatient stroke rehabilitation and concluded that substantial gains in health related quality of life during inpatient rehabilitation may not be sustained after discharge [39].
- Stefano Parlucci, Gabriella et al. (2003); conducted an functional outcome of ischemic and hemorrhagic stroke patients after inpatient rehabilitation and concluded that the results of this study provide further evidence of better functional prognosis in stroke survivors with hemorrhage stroke [40].

- Stephen Bagg, Alica Paris et al. 2002; Journal of American Heart Association; Vol 33; 179-185; conducted a study on effect of age on functional outcomes after stroke and concluded that the small amount of variation that can be explained by age alone and questionable clinical relevance of such a small effect suggest that there is no justification to patients access to rehabilitation solely because of advanced age [41].
- Thomas A Pearson, Steven N Blair et al. (2002); Journal of American Heart Association updated a guide to comprehensive risk education for adult patients without coronary or other atherosclerotic vascular disease and concluded that practice based systems for risk factor monitoring reminders and support services need to be established, reimbursed and otherwise supported by managed care organizations and third party payers [42].
- Philippa J.Clarke, Joanne M Laurence, Sandra E Black et al. (2000); conducted a study on changes in quality of life over the first year after stroke and concluded that the quality of life of stroke survivors exists throughout the first year of recovery [43].
- L.R Wilason, S.C Gandevia et al. (1999); Journal of Neurology conducted a study on muscle spindle activity in the affected upper limb after a unilateral stroke and concluded that any fusimotor dysfunction is likely to make a mirror contributions to the patients disability [44].
- Rosmarie B King et al. (1996); conducted a study on Quality of life after stroke and concluded that the identification of depression, social support and functional status on predictors Quality of life suggests the need to assist stroke survivors in coping and in maintaining and strengthening their support systems [45].

Methodology

Thirty (30) men and women subjects (45-65years) with radiological diagnosis of stroke and post stroke residual weakness of Upper Extremity and were willing to take treatment for 4 week sessions. and study was done in SGRRIMHS/SMIH department of physiotherapy at Patel Nagar Dehradun. The Subjects were randomly divided into 2 groups. Inclusion criteria, GCS=15, MMSE=30, Both male and female subjects., First ever stroke, MAS<3, Good sitting balance, Sub-acute stroke (4-6 wks.), Impairment of hand functions & Age group 45-65yrs. Subjects were excluded Uncooperative patients, Cognitive impairments, Global aphasia, Any previous injury (fracture) or nerve injury, Sensory impairments, Skin infections & Any visual impairment. All subjects were given verbal instructions for the procedure and consent form was obtained from each one of them, prior to participation in the study.

Instructions to the Patient

1. Subjects were asked to be regular for the treatment sessions as deemed by the researcher.
2. Subjects were asked to report any discomfort during the study period and briefed about the use of safety switch

Procedure

On the basis of inclusion and exclusion criteria 30 subjects were randomly divided into two groups. 15 subjects in experimental group (Group A) given mirror therapy and thermal stimulation and 15 subjects in controlled group (Group B). given general exercises of upper extremity for flexors and extensors were carried out for 4 weeks including active exercises and functional training. Consent was taken after explanation of the procedure and its outcomes. A pretreatment scoring was done via Upper Extremity Functional Index (UEFI) in which the subjects were asked to do the following activities:

1. Lifting a bag of groceries to the waist level
2. Lifting a bag of groceries above your head.
3. Throwing a ball as shown in figure 4.
4. Dressing
5. Grooming your hair as shown in figure 4.5.
6. Opening door
7. Tying or lacing shoes
8. Opening a jar as shown in figure 4.6
9. Doing up buttons.
10. Carrying a small suitcase with your affected limb.

Fig. 1: Showing instruments used in the study

After performing the activities we were asked the subjects to score each activity himself or herself according UEFI score.

0 = Extreme difficulty or unable to perform the activity

1 = Quite a bit of difficulty

2 = Moderate

3 = A little bit of difficulty

4 = No difficulty.

In Experimental group a pre scoring was done via UEFI and after scoring, the patient is seated close to a table in which a mirror (35*35cm) was placed vertically as shown in Figure 3. The involved hand is placed behind the mirror and the non-involved hand in front of the mirror. The practice consisted of non-paretic side wrist and finger flexion and extension movements while patient looked into the mirror watching the image of their non-involved hand, thus seeing the reflection of the hand movements projected over the involved hand. Patients could only see the non-involved hand in the mirror; otherwise the noninvolved hand is hidden from sight. During the session the patient is asked to try to do the same movements with the paretic hand while he is moving the non-paretic hand. The subjects performed the exercises for 30 minutes for mirror therapy and 30 minutes of thermal stimulation for 6 days per week for a consecutive 4 weeks. On the other hand during thermal stimulation Intervention on upper extremity, the heating pad was put on the paretic hand 15 minutes as shown in (Figure 2). Participants were encouraged to withdraw or move the paretic hand from the heating pad when discomfort occurred. After that cold stimulation procedure began and the patient was asked to do the same procedure. A session of thermal stimulation entailed alternate cycles of heat and cold stimulation. While in controlled group general exercises of upper extremity for flexors and extensors were carried out for 4 weeks including active exercises and functional training.

Fig. 2: Showing applying thermal stimulation via heating pads

Fig. 3: Showing patient doing exercises in mirror

Fig. 4: Showing patient throwing a ball

Fig. 5: Showing patient doing combing

Fig. 6: Showing patient doing opening the jar

Result and Interpretation

Statistical Analysis

The appropriate statistical analyses were conducted using the Statistical Package for Social Sciences 11.0. Al1 data were entered into SPSS files from a standardized data form at the time of data collection. Prior to analysis, al1 entries were verified by comparing the recorded data in each file to a printed copy of the data files entered into SPSS. All results were presented as mean standard deviation. All significant p values (~0.05) were indicated in bold type. Frequencies were used to test the data for normality around the mean (data not shown).

Hypothesis Testing For Comparing Two Related Samples

Paired t- test is a way to test for comparing two related samples, involving small values of *n* that does not require the variances of the two populations to be equal, but the assumption that the two populations are normal must continue to apply. For paired t- test, it is necessary that the observations in the two samples be collected in the form of what is called matched pairs i.e., "each observation in the one sample must be paired with an observation in the other sample in such a manner that these observation are somehow "matched" or related, in an attempt to eliminate extraneous factors which are not of interest in test." Such a test is generally considered appropriate in a before and after treatment study. For instance, we may test a group of certain students before and after training in order to know whether the training is effective, in which situation we may use paired t- test.

The paretic upper extremity motor functions were significantly different as described in [Table 1] which is showing the descriptive statistics of UEFI of pre and post scores between the two groups.

Improvement in the upper extremity motor functions also revealed statistically significant differences between the two groups $p<0.05$ in [Table 2].

Table 1: Descriptive Statistics of Upper Extremity Functional Index Pre and Post Score of Experimental and Control Group

	Experimental Group			Control Group		
	Age	**Pre**	**Post**	**Age**	**Pre**	**Post**
Mean	53.0667	14.7333	18.6667	57.6000	8.4000	11.6000
Std. Error of Mean	1.60198	1.29639	1.31897	1.55165	.46599	.42314
Std. Deviation	6.20445	5.02091	5.10835	6.00952	1.80476	1.63881
Variance	38.495	25.210	26.095	36.114	3.257	2.686
Range	18.00	19.00	18.00	17.00	6.00	5.00
Sum	796.00	221.00	280.00	864.00	126.00	174.00

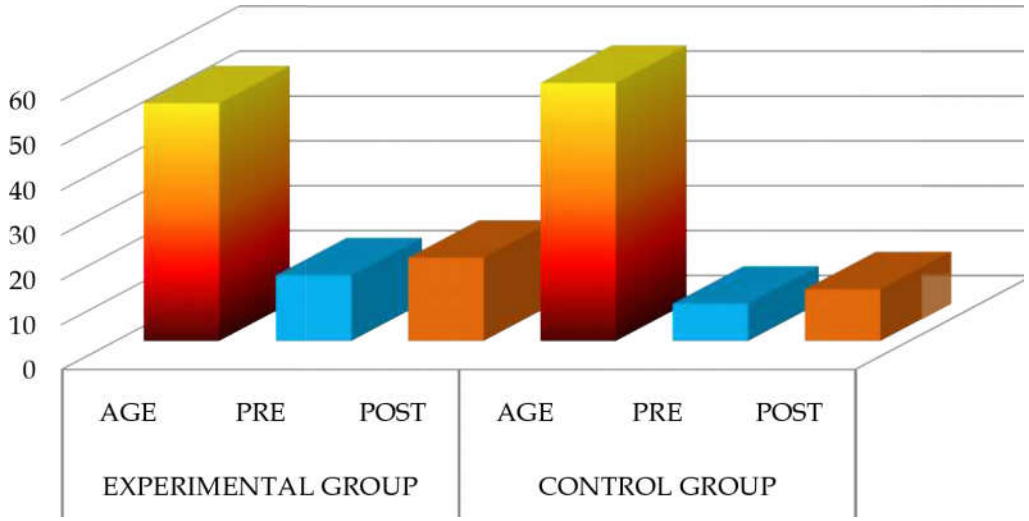
Table 2: Paired Samples Test of Upper Extremity Functional Index Pre and Post Score of Experimental and Control Group

	Paired Differences					t	DF	Sig. (2-tailed)
	Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
				Lower	**Upper**			
Pre Experimental Group - Post Experimental Group	-3.93333	.79881	.20625	-4.37570	-3.49097	-19.071	14	.000
Pre Control Group - Post Control Group	-3.20000	.77460	.20000	-3.62896	-2.77104	-16.000	14	.000
Pre Experimental Group - Pre Control Group	6.33333	5.53775	1.42984	3.26663	9.40004	4.429	14	.001
Post Experimental Group - Post Control Group	7.06667	5.56092	1.43582	3.98713	10.14620	4.922	14	.000

Table 3: Correlations of Upper Extremity Functional Index Pre and Post Score of Experimental and Control Group

		Age Experimental Group	Pre Experimental Group	Post Experimental Group	Age Control Group	Pre Control Group	Post Control Group
Spearman's rho	Age Experimental Group	1.000	-.217	-.253	-.050	.069	.028
	Pre Experimental Group	-.217	1.000	.978**	.233	-.147	-.096
	Post Experimental Group	-.253	.978**	1.000	.246	-.191	-.178
	Age Control Group	-.050	.233	.246	1.000	.127	.086
	Pre Control Group	.069	-.147	-.191	.127	1.000	.890**
	Post Control Group	.028	-.096	-.178	.086	.890**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).



Graph 1: Comparision between uefi expermental and control group

Sub items of the abilities to perform the activities were compared between the two groups via UEFI. The correlations of upper extremity functional index pre and post score of experimental and controlled group were shown in [Table 3].

[Graph 1] showed the comparison between the UEFI of experimental and control group in which there is significant improvement in UEFI (pre and post) of experimental group before and after training session.

The upper extremity motor functions were significantly improved after using mirror therapy and thermal stimulation for 4 weeks as compared with the control group.

Discussion

Mirror therapy and thermal stimulation relatively a new treatment technique developed to promote upper extremity recovery in stroke patients [8].

In the present study, aspect of somatosensory stimulation and mirror illusion of normal movement is taken as a point of reference for treatment in hemiplegic with functional dependence on the basis of UEFI [5,8].

UEFI is a preferred upper limb regional tool due to its superior practical characteristics and clinical utility and comparable psychometric properties [47].

The result of the study confirm that the mirror therapy and thermal stimulation has improved upper limb function as demonstrated with UEFI.

There is a significant change in post intervention in Group A $p \leq 0.05$ which approves improvement in functional activity according to UEFI. The use of mirror therapy creates the mirror illusion of normal movement of the affected hand may substitute for decreased proprioceptive information, thereby helping to recruit the premotor cortex and assisting rehabilitation through an intimate connection between visual input and premotor areas.

Thermal stimulation promotes upper extremity recovery in stroke patients because TS may induce cortical reorganization. TS not only provides somatosensory stimulation but also uses the forced-use strategy to provoke volitional/ reflexive motor activity. It has been proposed that somatosensory stimulation may induce brain plasticity [8].

TS was provided through general hot/cold packs, but it was difficult to provide constant temperature stimulation and avoid tissue damage. The improvement was seen after 4 weeks, but continued improvement was not found and need to be considered as lack of supervision and follow ups.

The control group (Group B) showed non-significant result of $P > 0.05$. In this group, conventional physiotherapy was given to the patient, and shows non-significant results after 4 weeks when compared to pre intervention scores. This states that general exercises or conventional physiotherapy in the form of active and active-assisted exercises are not sufficient for speedy and significant out comes. This result also places stress on proper treatment protocol with proper treatment modalities for patient for expected outcome hence proving experimental hypothesis.

Clinically this study demonstrated that by using mirror therapy and thermal stimulation as a treatment tool, the improvement was seen in upper extremity functional activity of post stroke hemi paretic subjects.

Clinical Relevance

Functional limitation of upper extremity is very common in stroke patients. Various researches have shown effect of physical therapy measures like taping, functional stimulation, PNF etc. in improving functional activity of upper extremity in stroke subjects. Few researches have been published regarding the effectiveness of mirror therapy and thermal stimulation in stroke subjects. This study aims at finding out the effectiveness of mirror therapy and thermal stimulation in combination in improving the functional activity of upper extremity in sub-acute stroke patients. Hence combined treatment by mirror therapy and thermal stimulation should employ in upgrading rehabilitation protocol of hemiplegic subjects.

Future Research

1. Further studies are recommended to minimize these limitations in such a way that larger sample sizes of both the sexes that include various age groups of people are studied.
2. The duration of study can be increased.
3. The inclusion criterion can be improved so that all the subjects show similar functional independence in upper limb at the beginning of the study.
4. Various outcome measures can be used in order to record the functional independence in a better way.
5. Study can also be done to improve lower extremity functions.
6. Study can be done on chronic patients.

Limitations of the Study

1. The duration of study was only 4 weeks, so further prognosis and long term benefits could not be recorded.
2. Home exercises were not prescribed to the subjects.
3. Training depends on functional level of patients.
4. Task specificity and stroke severity are important factors in rehabilitation of upper limb.
5. It is difficult to maintain constant temperature.
6. Thermal stimulation cannot be performed on patients with sensory loss.

Conclusion

Mirror therapy and thermal stimulation was found to be effective in improving functional independence in upper limb post sub-acute stroke. When mirror therapy and thermal stimulation is administered to patients suffering from sub-acute stroke over a period of 4 weeks, it results in an improvement in reaching forwards, grasping, manipulating objects and also improves other fine motor functions of the hand.

Summary

This research was done to find out the combined effect of mirror therapy and thermal stimulation on functional independence of upper limb in sub-acute stroke cases. 30 participants between 45-65

years of age with clinical diagnosis of stroke. Patients were randomly divided into two groups i.e. group A and group B. Each group contain 15 patients and treatment was administered for 6times a week over a period of 4 weeks. The treatment comprises of 30 minutes of mirror therapy and thermal stimulation.

Outcome was measured in terms of UEFI score, to record the functional improvement in the upper limb.

Paired 't' test was done for statistical analysis. Results showed there was significant improvement in functional independence of upper limb, based on pre and post UEFI scores in patients who were administered mirror therapy and thermal stimulation for duration of 4 weeks. On comparing both groups group A shows significant improvement than group B.

References

1. Leeanne M Carey et al. Motor impairment and recovery in the upper limb after stroke. 2005;36:625-629.
2. Tapas Kumar Banarjee et al. Epidemiology of stroke in India. Neurology Asia. 2006;11:1-4.
3. Ewa Jaraczewska et al. Top conduct a study on Kinesiotaping in stroke: Improving functional use of upper extremity in hemiplegia'. Stroke Rehabilitation. 2006;13(3):31-42.
4. John W. Krakauer et al. Arm function after stroke: from physiology to recovery. Seminars in Neurology; 2005;36:625-29.
5. Gunes Yavuzer, Nebahat Sezar et al. Mirror therapy improves Hand Functions in Sub acute Stroke: Randomized controlled trial. Arch Phys Med Rehabilitation; 2008;89:393-98.
6. Johanne Higgins et al. Upper limb function and recovery in the acute phase stroke. Journal of Rehabilitation Research and Development; 2005;42(1):65-76.
7. Holly E Rossitter, Mimi R Borelli, Robin. Cortical Mechanisms of Mirror Therapy After Stroke. 2014.pp.444-52.
8. Hung-Chia Wu, Yu-Ching Lin, Miao-Ju Hsu, Shin-Meiliu, Ching-Lin Hsieh, Jau-Hong Lin. Effect of thermal stimulation on upper extremity motor recovery 3 months after stroke. Journal Of Achieves of phys Med Rehabili. 2010;41:2378-80.
9. Ralph L. Sacco, Scott E. Kasner, Joseph P Broderick Mary George. Journal of American Heart Association updated definition of stroke for the first century. 2013.
10. Holm Thieme, Jan Mehrholz, Marcus Pohl, Johann Behrens, Christian Dohle. Mirror Therapy for Improving Motor Function After Stroke. Journal of American Heart Association. 2013;44:(e1-e2.).
11. Sneha S. Khandare, R. M. Singaravelan, Subhash M. Khatri. Comparison of Task Specific Exercises and Mirror Therapy to Improve Upper Limb Function in Sub acute Stroke Patients. Journal of Dental and Medical Sciences 2013 May-June;7(1):05-14.
12. Jeyaraj Durai Pandian, and Paulin Sudhanb' Stroke Epidemiology and Stroke Care Services in India'. Journal of stroke 2013 Sep;15(3):128-34.
13. Lackland DT, Roccella EJ, Deutsch AF, Fornage M, George MG, Howard G et al. Factors influencing the decline in stroke mortality a statement from the american heart association/american stroke association. Stroke. 2014 Jan 1;45(1):315-53.
14. Monik Jimenez, Stephanie E. Chiuve, Robert J. Glynn, Meir J. Stampfer, Carlos A. Camargo, Walter C. Willett, JoAnn E. Manson, Kathryn M. Rexrode. Alcohol Consumption and Risk of Stroke in Women. Journal of American Heart Association Stroke. 2012;43:939-45.
15. Kate Laver, Stacey George, Susie Thomas, Judith E. Deutsch, , Maria Crotty. Virtual Reality for Stroke Rehabilitation. Journal of American Heart Association 2012;43:e20-e21.
16. Marine Jequier Gygax, Patrick Schneider and Christopher John Newman. Mirror therapy in children with hemiplegia: a pilot study. Journal of Developmental Medicine & Child Neurology 2011 May;53:473–476.
17. Andreas Stefan Rothgangela, Susy M. Brauna, Anna J. Beurskensa, Ru¨diger J. Seitzg and Derick T. Wadee. The clinical aspects of mirror therapy in rehabilitation: a systematic review of the literature. International Journal of Rehabilitation Research 2011;34(1).
18. You Jookang, Jeonghun Ku et al. Facilitation of corticospinal excitability according to mirror imagery and mirror therapy in healthy subjects and stroke patients. Journal of Annals of Rehabilitation. 2011; 35;747-758.
19. Pamela M. Rist, Klaus Berger, Julie E. Buring, Carlos S. Kase, J. Michael Gaziano, Tobias Kurth. Alcohol Consumption and Functional Outcome after Stroke in Men. Journal of American Heart Association. 2010;41:141-46.
20. Rinu Susan Raju, Prabhakaran S. Sarma, Jeyaraj D. Pandian. Psychosocial Problems, Quality of Life, and Functional Independence Among Indian Stroke Survivors. Journal of American Heart Association 2010;41:2932-37.
21. Peter Appetros, Birgitta Stegmayr, Andreas Terént. Sex Differences in Stroke Epidemiology A Systematic Review. Journal of American Heart Association 2009;40:1082-90.
22. Beverley French; Lois H. Thomas; Michael J. Leathley, Christopher J. Sutton, CStat; Joanna McAdam, B Anne Forster, Peter Langhorne, Christopher I.M.

Price, Andrew Walker, Caroline L. Watkins. Repetitive Task Training for Improving Functional Ability After Stroke. Journal of American Heart Association 2009;40:e98-e99.

23. Rober J Adams, Greg Albers et al. Journal of American Heart Association; presented an update to AHA Recommendations for the prevention of stroke in patients with stroke and transient ischemic attacks. 2008;39:1647-52.
24. Stephanie E. Chiuve, Kathryn M. Rexrode, Donna Spiegelman, Giancarlo Logroscino, JoAnn E. Manson, Eric B. Rimm. Primary Prevention of Stroke by Healthy Lifestyle Primary Prevention of Stroke by Healthy Lifestyle. Journal of American Heart Association 2008;118:947-54.
25. Shyamal Kumar Das, Tapas Kumar Banerjee. Stroke Indian Scenario. Journal of American Heart Association 2008;118:2719-24.
26. A Williams Andrews, Stephen E, Folge, Shennon E Norbet and Lindsay et al. A study on examination of test and measures used most frequently by specialists index of adult stroke. Journal of PT. 2008;32:122-28.
27. Hazhir Sikaroodi, Mahmud Motamedi, Hossein Kahnooji, Ali Gholamrezanehad and Nedo Yousefi. Stroke as the first manifestation of Takayasu arteritis. 2007;107:18-21.
28. Jeyaraj D. Pandian, Velandai Srikanth, Stephen J. Read, Amanda G. Thrift. Poverty and Stroke in India A Time to Act. Journal American Heart Association 2007;38:3063-3069.
29. M.D. Patel, C. McKevitt, E. Lawrence, A.G. Rudd and C.D.A. Wolfe. Clinical determinants of long-term quality of life after stroke. Oxford journals 2007;36(3):316-22.
30. Larry B Goldstein, Robort Adams, Mark J. alberts, Lawrence J. Appel, Lawrence M. Brass, Thomas J. degraba, George Howard, Ralph Sacco. Primary prevention of ischaemic stroke. Journal Of American Heart Association. 2006;37:1583-1633.
31. Nathan K LeBrasseur, Stephen P Sayers, Michelle M Ouellette and Roger A Fielding. Muscle Impairments and Behavioral Factors Mediate Functional Limitations and Disability Following Stroke. Journal of American Heart Association 2006; 86(10):1342-50.
32. Lara Caeiro, José M. Ferro, Catarina O. Santos, and M. Luísa Figueria. Depression in acute stroke. Journal of Psychiatry Neuroscience. 2006Nov; 31(6): 377–83.
33. Caroline Haacke, Astrid Althaus, Annika Spottke, Uwe Siebert, Tobias Back, Richard Dodel. Long-Term Outcome After Stroke Evaluating Health-Related Quality of Life Using Utility Measurements. Journal of American Heart Association 2006;37: 193-98.
34. Caroline Haacke, Astrid Althaus, Annika Spottke, Uwe Siebert, Tobias Back, Richard Dodel. Long-Term Outcome After Stroke. Journal of American Heart Association 2006;37:193-98.
35. Marc Fisher et al. Enhancing the Development and Approval of Acute Stroke Therapies. Journal of American Heart Association 2005;36:1808-13.
36. Rosemary Martino, Norine Foley, Sanjit Bhogal, Nicholas Diamant, Mack speechley, Robert Teasell. Dysphagia after stroke. Journal of American heart association. 2005;36:2756-63.
37. Lars Peter Kammersgaard, H.S. Jørgense J. Reith , H. Nakayama, P.M. Pedersen and T. S. Olsen. Short- and long-term prognosis for very old stroke patients'. The Copenhagen stroke Study. Oxford journals 2004;33(2):149-54.
38. Pamela Duncan, Stephanie Studenski, Lorie Richards, Steven Gollub, Sue Min Lai, Dean Reker, Subashan Perera, Joni Yates, Victoria Koch, Sally Rigler, Dallas Johnson. Randomized Clinical Trial of Therapeutic Exercise in Sub acute Stroke. Journal of American Heart Association 2003;34:2173-80.
39. Wilma M. Hopman, Jane Verner. Quality of Life During and After Inpatient Stroke Rehabilitation. Journal of American Heart Association 2003;34: 801-05.
40. Stefano Paolucci, Gabriella Antonucci, Maria Grazia Grasso, Maura Bragoni, Paola Coiro, Domenico De Angelis, Francesca Romana Fusco, Daniela Morelli, Vincenzo Venturiero, Elio Troisi, Luca Pratesi. Functional Outcome of Ischemic and Hemorrhagic Stroke Patients After Inpatient Rehabilitation. Journal of American Heart Association 2003;34: 2861-65.
41. Stephen Bagg, Alicia Paris Pombo, Wilma Hopman. Effect of Age on Functional Outcomes After Stroke Rehabilitation. Journal of American Heart Association 2002;33:179-85.
42. Thomas A. Pearson, Steven N. Blair, Stephen R. et al. AHA Guidelines for Primary Prevention of Cardiovascular Disease and Stroke: 2002 Update Consensus Panel Guide to Comprehensive Risk Reduction for Adult Patients Without Coronary or Other Atherosclerotic Vascular Diseases. Journal of American Heart Association . 2002;106:388-91.
43. Phillippa J Clarke et al. Changes in Quality of Life first year after stroke. Journal of Stroke and Cerebrovascular Disease. 2000;9:121-27.
44. L.R. Wilason, S.C. Gandevia, J.T. Inglis, J.M. Gracies, David Burke. Muscle spindle activity in the affected upper limb after a unilateral stroke. Brain: Journal of Neurology, 1999 Nov 1;122(11):2079–88.
45. Rosemarie B. King. Quality of Life After Stroke. Journal of American Heart Association. 1996;27: 1467-72.
46. Johanne Higgins et al. Upper limb function and recovery in the acute phase stroke. Journal of

Rehabilitation Research and Development; 2005; 42(1):65-76.

47. C. Philip Gabel et al. The upper limb functional Index; Development and determination of reliability, validity and responsiveness. Journal of hand therapy 2006;19(3):328-349.

Original Article

Physiotherapy and Occupational Therapy Journal
Volume 11 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/potj.0974.5777.11218.3

Use of High Grade Mobilization Technique versus Cyriax Manipulation in Improving Abduction & External Rotation in Frozen Shoulder

Shashank Kumar[1], Niraj Kumar[2], Jyoti Sharma[3]

Abstract

Introduction: Shoulder pain is a common problem it is the third most common musculoskeletal complaint in the general population, and accounts for 5% of all general practitioner musculoskeletal consultation [1]. Frozen shoulder is a common cause of shoulder pain affecting 2–5% of the general population [2]. The term ''frozen shoulder'' was first coined by Codman and was subsequently defined as an idiopathic condition of the shoulder characterized by the spontaneous onset of pain in the shoulder with restriction of mobility at the glenohumeral joint in every direction [3,4]. Mobilization techniques can be performed as physiologic movements or accessory movements. In Maitland classification system, a concept of management in which accessory and physiologic passive movements of the joint are applied at various grades of intensity depending on a subject's pain and joint stiffness [7]. Massage has been used for alternatives therapy on musculoskeletal system a modern systematic and clinical technique called friction massage was employed by Cyriax [10]. *Need of Study:* To best of our knowledge no studies have been done on comparison of high grade mobilization and cyriax manipulation in subjects with frozen shoulder. *Methodology:* Each subject was assigned into two groups by random sampling one Group A treated with High grade mobilization technique grade III & IV) with ultrasound and Group B receives Cyriax manipulation with ultrasound. *Conclusion:* The study could be concluded as" There is no significant difference produced between the High grade mobilization technique and cyriax manipulation in reducing pain & increasing shoulder abduction and external rotation in frozen shoulder". *Limitation:* 1. The follow-up to see the long term effects of training is not done. 2. There is need to make an specific inclusion criteria to be developed that can identify which patients will most benefit from the HGMT. 3. This study has not taken into consideration of other than grade III & IV of Maitland mobilization grades. HGMT is not suitable for all kinds of patients. 4. Our sample size was small, and data were collected at only one hospital. 5. No control group. *Future Research:* 1. Future Studies should investigate whether HGMTs is effective in earlier stages of frozen shoulder in decreasing pain and improving ROM. 2. The duration of benefits from the cyriax manipulation may also be an important area for future study. 3. Sample size can be increased with inclusion of more number of subjects to generalize the effect in larger population. 4. Future study should consists of Randomized control TRAIL needed to know the long term effects of Cyriax over Maitland grade III and IV mobilization in frozen shoulder.

Kyewords: High Grade Mobilization Technique; Cyriax Manipulation; Therapeutic Ultrasound Machine; Universal Goniometry; Visual Analogue Scale & Ultra-Sonic Gel.

Introduction

Shoulder pain is a common problem it is the third most common musculoskeletal complaint in the general population, and accounts for 5% of all general practitioner musculoskeletal consultation [1].

Frozen shoulder is a common cause of shoulder pain affecting 2–5% of the general population [2]. The term ''frozen shoulder'' was first coined by Codman and was subsequently defined as an idiopathic condition of the shoulder characterized by the spontaneous onset of pain in the shoulder with restriction of mobility at the glenohumeral joint in every direction [3,4].

Author Affiliation: [1]Lecturer [2]Associate Professor [3]Assistant Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.

Reprint Request: Niraj Kumar, Associate Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.
E-mail: drnirajkumar25@gmail.com

© Red Flower Publication Pvt. Ltd.

The exact pathophysiology of idiopathic frozen shoulder is poorly understood [5.

Owens-Burkhart 1987 in her review of the subjects arrives at a definition that it is a glenohumeral stiffness resulting from capsular restrictions [6].

In Maitland classification system, a concept of management in which accessory and physiologic passive movements of the joint are applied at various grades of intensity depending on a subject's pain and joint stiffness.

The aim of this technique is to restore motion of spin, glide, and roll between joint surfaces and the intensity of the mobilization techniques with rhythmic oscillatory movements usually is categorized according to the 5-grade classification system of Maitland.

Grade I: Small amplitude at the beginning of the range of motion (ROM)

Grade II: Large amplitude not reaching the end of the ROM

Grade III: Large amplitude reaching the limited ROM

Grade IV: Small amplitude at the end of the limited ROM

Grade V: Small amplitude and high velocity at the end of the limited ROM (manipulation or thrust).

Grade 3 and 4 mobilization of Maitland is useful in stage 2 and 3 of frozen shoulder as this grade helps in reducing pain breaking down adhesions within the joints. Grade 3 mobilization also helps to lessen the treatment soreness [7].

Cyriax Manipulation

Massage is a human technique with kneading, squeezing and pressing muscles, has been developed with different techniques from different countries for a long time. Although massage has been used for alternatives therapy on musculoskeletal system a modern systematic and clinical technique called 'friction massage', was employed by Cyriax.

His original massage technique was only focused on transverse movement of connective tissue by deep friction but current friction massages are performed both longitudinally and transversely.

In these days the deep friction massage, employed by James Cyriax, has been considered as one of the therapeutic modality for musculoskeletal conditions in sports medicine and physical therapy in united states [10].

Aims of the Study

To compare the use of high grade mobilization and cyriax manipulation in subjects with frozen shoulder.

Need of Study

To best of our knowledge no studies have been done on comparison of high grade mobilization and cyriax manipulation in subjects with frozen shoulder.

Hypothesis

Null Hypothesis (HO)

There will not be any significant difference between cyriax manipulation and high grade mobilization in improving shoulder abduction and external rotation in frozen shoulder.

Experimental Hypothesis (H1)

There will be significant difference between high grade mobilization than cyriax manipulation and in improving shoulder abduction and external rotation in frozen shoulder.

Operational Definition

Frozen Shoulder

It is a painful restriction of both active and passive shoulder movements due to causes within the shoulder joint. The term ''frozen shoulder'' was first coined by Codman and was subsequently defined as an idiopathic condition of the shoulder characterized by the spontaneous onset of pain in the shoulder with restriction of mobility at the glenohumeral joint in every direction [3-4].

High grade mobilization

Mobilization techniques can be performed as physiologic movements or accessory movements. Grade 3 and 4 mobilization of Maitland is a high grade mobilization useful in stage 2 and 3 of frozen shoulder as this grade helps in reducing pain breaking down adhesions within the joints. Grade 3 mobilization also helps to lessen the treatment soreness. In Grade IV: Small amplitude at the end of

the limited ROM and in Grade V: Small amplitude and high velocity at the end of the limited ROM (manipulation or thrust) [7].

Cyriax Manipulation

Cyriax manipulation is a technique of massage in which with kneading, squeezing and pressing muscles, has been developed with different technique for a long time. Although massage has been used for alternatives therapy on musculoskeletal system a modern systematic and clinical technique called 'friction massage', was employed by Cyriax. His original massage technique was only focused on transverse movement of connective tissue by deep friction but current friction massages are performed both longitudinally and transversely.

Goniometer

A goniometer is a device used in physical therapy to measure the range of motion around a joint in the body. The word goniometer is derived from the Greek terms gonia and metron, which mean angle and measure, respectively.

Review of Littature

Jing-lan Yang, Chein-wei Chang, et al. (2007) conducted a study to compare the use of 3 mobilization techniques end-range mobilization, mid-range mobilization, and mobilization with movement in the management of subjects with frozen shoulder syndrome. Result shows that in subjects with frozen shoulder syndrome, end-range mobilization and mobilization with movement were more effective than mid-range mobilization in increasing mobility and functional ability [12].

Henricus M Vermeulen et al. (2006), conducted a study to compare the effectiveness of high-grade mobilization techniques with that of low-grade mobilization techniques in subjects with adhesive capsulitis of the shoulder. Concluded that In subjects with adhesive capsulitis of the shoulder, HGMTs appear to be more effective in improving glenohumeral joint mobility and reducing disability than LGMTs, with the overall differences between the 2 interventions being small [14].

Joyce CR, Zutshi DW et al. (1975), conducted a study to compare visual analogue scale (VAS) and a 4-point scale (FPS) in patients suffering from prolonged constant pain due to chronic inflammatory or degenerative arthropathy. The VAS was accurate, as reliable as and more sensitive than the FPS in registering the intensity of chronic pain. In this study, the VAS appeared to be more satisfactory than the FPS for patient self-rating of pain intensity [15].

Polly E. Bijur, Wendy Silver et al. (2001), Reliable and valid measures of pain are needed to advance research initiatives on appropriate and effective use of analgesia in the emergency department. Reliability of the VAS for acute pain measurement as assessed by the Intraclass correlation coefficients appears to be high. Ninety percent of the pain ratings were reproducible within 9 mm. These data suggest that the VAS is sufficiently reliable to be used to assess acute pain [16].

Anatomy

The bones that form the shoulder are the clavicle, humerus, and scapula, the latter providing the glenoid fossa, acromion and coracoid processes. These three bones create a ball-and-socket glenohumeral joint, that give the shoulder its wide range of motion in three different planes. In order for this joint to be operational, ligaments, muscles, and tendons must support the bone and maintain the relationship of one to another.Joints are formed by the ligamentous connection between two adjacent bones (Figure 1).

Biomechanics of Shoulder Joint

The movements of the glenohumeral joint include forward lifting of the arm (flexion), backward lifting of the arm (extension), inward

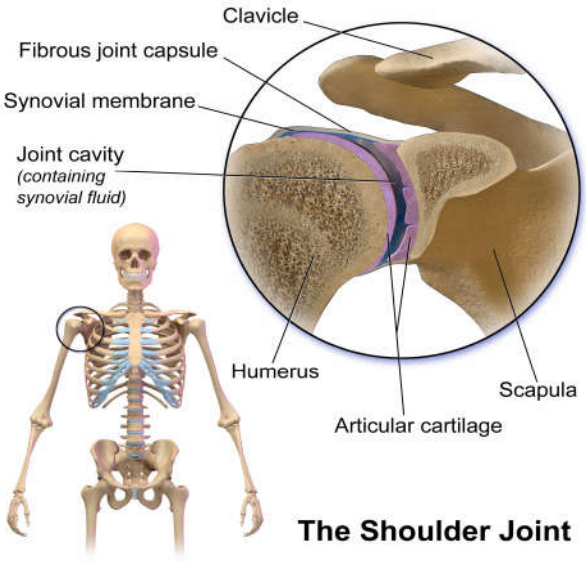


Fig. 1: Shoulder Joint

(internal) rotation, outward (external) rotation, movement of the arm away from the body (abduction) and movement of the arm towards the body (adduction).

Movement at the glenohumeral joint requires motion at the other joints of the shoulder complex. The coordinated movement of these joints during arm movement is referred to as the scapulo-humeral rhythm.

Pathomechanics

Frozen shoulder or adhesive capsulitis is a commonly occurring condition characterized by a capsular pathology associated with pain and progressive loss of passive and active movement. The hallmarks of frozen shoulder syndrome were first described by Duplay in 1872 [18]. He felt the pain and stiffness noted in these patients was not due to arthritis, but rather, was due to soft tissue pathology of the periarticular structures. In 1934, Codman [19] first proposed the term frozen shoulder. He described a slow onset of pain felt near the insertion of deltoid, inability to sleep on the affected side, painful and restricted elevation and external rotation, with a normal radiological appearance. Codman was, however, unable to explain the pathology. It can follow fractures or dislocations about the shoulder, shoulder, cervical or thoracic surgery or immobilization following any upper limb surgery.

Methodology

Sample

Thirty (30) subjects were included in this study. Each subject was assigned into two groups by random sampling one group treated with high grade mobilization technique and another group receives Cyriax for 4 weeks. All the subjects participated in the study after signing the informed consent. The study was conducted in the Department of Physiotherapy, Shri Mahant Indiresh Hospital. Subjects selected were randomly assigned into two group. Inclusion criteria, Patient between ages of 40-60yrs, Having a limited ROM, Patients suffering from frozen shoulder in stage 2 & 3 & Primary idiopathic frozen shoulder. Exclusion criteria subjects were excluded Rotator cuff tears, History of Rheumatoid arthritis, osteoarthritis and malignancies in the shoulder region, Adhesive capsulitis secondary to shoulder dislocation, fractures and reflex sympathetic dystrophy, and Frozen shoulder secondary to neurological disorders. Paired t- test is a way to test for comparing two related samples, involving small values of *n* that does not require the variances of the two populations to be equal, but the assumption that the two populations are normal must continue to apply.

Instrumentation for data collection includes therapeutic Ultrasound machine, Universal goniometry, Visual analogue scale, Couch, Pillow, Cotton and Ultra-sonic Gel.

Procedure

The subjects were assigned into group A and group B by simple random sampling. Group A high grade mobilization technique; group B received cyriax manipulation. Ultrasound therapy and shoulder mobility exercises will be given as a conventional therapy for both the groups. A subjective assessment of pain was done using the 10cm Visual Analog scale (VAS). The shoulder abduction and external rotation ROM measurement was taken by Goniometer in supine-lying.

Group A

- Ultrasound therapy will be given as a conventional therapy.
- Followed by high grade mobilization technique will be given with intensity according to Maitland's grade- III and grade-IV.
- *Ultrasound Therapy:* 1.5W/CM^2 For 6 to 7 minutes.
- *High Grade Mobilization Technique:*

1. Inferior glide- aimed at improvement of the extensibility of the axillary recess.

- Patient positioned in supine lying. Both hands are held close to the humeral head to work with a short-lever arm. Oscillatory movements in the caudal, lateral, and anterior directions will be given.

2. Posterior glide-patient positioned in supine lying. Hand will be placed on the anterior part of the shoulder, and the applied force will be in the posterior and lateral directions.

- Distraction of the humeral head with respect to the glenoid will be performed by pulling the humeral head in the superior, lateral, and anterior directions with a firm grip of both hands close to the humeral head and pushing the scapula on the table.
- In addition, shoulder joint mobility exercise will be given to obtain maximal relaxation of the shoulder muscles [Figure 2].

Group B

- Ultrasound therapy will be given as a conventional therapy.
- Followed by deep friction massage will be given based on cyriax principles along with shoulder joint mobility exercises.
- Acromioclavicular joint-Patient position in half lying or sitting posture.
- Therapist index finger will be placed on the joint and horizontal to and fro friction movement of the whole hand will be given in the sagittal plane.
- Deep friction massage to infraspinatus tendon, supraspinatus tendon will be given.
- Interventions are given for thrice a week for two weeks.
- At the completion of six physical therapy sessions outcome measures will be evaluated and pre and post scores are compared [Figure 3].

Fig. 3: Cyriax manipulation

Data Analysis

Statistical Analysis

The appropriate statistical analyses were conducted using the Statistical Package for Social Sciences 11.0. Al1 data were entered into SPSS files from a standardized data form at the time of data collection. Prior to analysis, al1 entries were verified by comparing the recorded data in each file to a printed copy of the data files entered into SPSS. All results were presented as mean standard deviation. All significant p values (~0.05) were indicated in bold type. Frequencies were used to test the data for normality around the mean (data not shown).

Fig. 2: High grade mobilization

Results

Table 1 illustrate analysis of high grade mobilization in frozen shoulder to improve abduction and external rotation before and after intervention.

Firstly, the mean value of age was 47.9 , VAS was 5.9 AROM 65.3degree, PROM 72.6 degree IN ABDUCTION And AROM Of external rotation was 40.5degree and PROM was 47.5 degree, while, after intervention VAS score was decreases and reached to 4.53 and AROM of abduction was increased by 25 and PROM by 27 and also the AROM of external rotation was rises and reached upto 49 while PROM Hiked by 5.67 .

Table 2 in cyriax manipulation the mean value of age was 53.40 and before intervention the VAS score was 6.00 and AROM of abduction was 82.40 degree and PROM 89.53 degree while, AROM In external rotation was 31.33 degree and PROM was 37.86

Table 1: Statistics of group a- high grade mobilization

Statistics of group a- high grade mobilization											
	Age	Before Intervention					After Intervention				
		Vas	*Abduction*		*External Rotation*		Vas	*Abduction*		*External Rotation*	
			A Rom	*P Rom*	*A Rom*	*P Rom*		*A Rom*	*P Rom*	*A Rom*	*P Rom*
Mean	47.93	5.93	65.33	72.66	40.53	47.53	4.53	90.33	99.66	49.00	53.20
Std. Error Of Mean	1.67	.3002	4.377	4.75	2.853	2.87	.3361	4.89	5.17	2.72	4.26
Std. Deviation	6.47	1.162	16.95	18.40	11.05	11.141	1.302	18.94	20.04	10.55	16.51
Variance	41.92	1.35	287.38	338.81	122.12	124.12	1.69	358.81	401.66	111.42	272.88
Range	22.00	4.00	60.00	65.00	40.00	40.00	4.00	70.00	75.00	35.00	68.00
Sum	719.00	89.00	980.00	1090.00	608.00	713.00	68.00	1355.00	1495.00	735.00	798.00

Table 2: Statistics of Group B- Cyrix Manipulation

Statistics of Group B- Cyrix Manipulation											
	Age	Before Intervention					After Intervention				
		VAS	*Abduction*		*External Rotation*		VAS	*Abduction*		*External Rotation*	
			A Rom	*P Rom*	*A Rom*	*P Rom*		*A Rom*	*P Rom*	*A Rom*	*P Rom*
Mean	53.40	6.00	82.40	89.53	31.33	37.86	4.13	101.33	107.00	43.66	52.00
Std. Error of Mean	1.83	.308	4.29	4.50	3.69	3.87	.336	3.43	3.51	4.12	4.01
Std. Deviation	7.11	1.19	16.64	17.43	14.32	14.98	1.302	13.29	13.60	15.97	15.59
Variance	50.68	1.42	277.11	303.98	205.23	224.69	1.69	176.66	185.00	255.23	242.14
Range	24.00	4.00	55.00	60.00	40.00	50.00	4.00	40.00	40.00	50.00	50.00
Sum	801.00	90.00	1236.00	1343.00	470.00	568.00	62.00	1520.0	1605.00	655.00	780.00

degree but after intervention VAS score decreased by 2 point and AROM in abduction was increased by 19degree and PROM by 18 degree in addition, AROM in external rotation was raised to 43.66 degree and PROM raised to 52 degree.

Discussion

In this study comparing the effectiveness of 2 treatment strategies including mobilization and manipulation techniques in subjects with frozen shoulder, it appeared that high grade mobilization technique is not effective than cyriax manipulation in decreasing VAS and increasing abduction and external rotation range of motion. However, the differences were small overall, and with both treatment strategies, subjects showed clinically significant improvement.

Randomized studies describing the effectiveness of mobilization techniques as a single intervention in subjects with adhesive capsulitis of the shoulder are scarce, and their results are conflicting. The comparison of present results with those of other randomized studies concerning the application of mobilization techniques in adhesive capsulitis is hampered by an insufficient description of the mobilization techniques in the majority of the available trials [17,18,19] and, except for ROM, the use of different outcome measures to evaluate treatment effects [8–11,17].

The results of this study add support to the effects of high grade mobilization technique in improving ROM in patients with frozen shoulder. Although more favorable effects of High grade mobilization technique than of Cyriax manipulation were seen in improving ROM in the present study, we cannot comment on the effectiveness of Cyriax manipulation in improving ROM.

But Cyriax manipulation showed ore reduction in VAS score than high grade mobilization technique: Fusun Guler-Uysal [13] reported the application of cyriax manipulation in frozen shoulder to reduce pain and increase ROM; on comparing their results with the present study, it is supported that VAS reduction occurs with cyriax manipulation.

Winters [20] showed that a combination of exercise, massage and physical applications was less successful in reducing shoulder pain than either steroid injection or mobilization of the joints of the shoulder complex, cervical and thoracic spine. However, specific details of what exercise and massage carried out in this study were not provided by Winters [20].

In this study, over all percentage change in VAS in cyriax manipulation is 32.6%, was superior to High grade mobilization technique, 26.9% in reduction of VAS pain score, Pain relief in cyriax group during and after treatment may be due to modulation of the nociceptive impulses at the level of the spinal cord, the''gate control theory''.

Limitation

1. The follow-up to see the long term effects of training is not done
2. There is need to make an specific inclusion criteria to be developed that can identify which patients will most benefit from the HGMT.
3. This study has not taken into consideration of other than grade III & IV of Maitland mobilization grades. HGMT is not suitable for all kinds of patients.
4. Our sample size was small, and data were collected at only one hospital.
5. No control group.

Recommendations

1. Future Studies should investigate whether HGMTs is effective in earlier stages of frozen shoulder in decreasing pain and improving ROM.
2. The duration of benefits from the cyriax manipulation may also be an important area for future study.
3. The study can be done to compare the effects of grade I and II mobilization of Maitland's, and other manual therapy with cyriax manipulation in frozen shoulder patients
4. Sample size can be increased with inclusion of more number of subjects to generalize the effect in larger population.
5. Future study should consists of Randomized control TRAIL needed to know the long term effects of Cyriax over Maitland grade III and IV mobilization in frozen shoulder.

Conclussion

It can be assumed that both high grade mobilization technique and cyriax manipulation in decreasing pain and improving ROM. Supporting evidence from the literature though seem to be controversial in certain areas, the outcome of this study with no significant statistical changes will lead us to the conclusion of accepting the null hypothesis which could be stated as high grade mobilization technique (grade III & IV) is not effective in reducing pain & increasing shoulder abduction and external rotation than cyriax manipulation.

As there is no significant difference between high grade mobilization technique and cyriax manipulation groups the null hypothesis is accepted and the alternative hypothesis can be rejected. The study could be concluded as" There is no significant difference produced between the grade mobilization technique and cyriax manipulation in reducing pain & increasing shoulder abduction and external rotation in frozen shoulder".

Reference

1. J. Herbert Stevenson, And Thomas Trojian. Evaluation of shoulder pain. The Journal of Family Practice. 2002 July;51(7).
2. Carette S. Adhesive capsulitis: research advances frozen in time. J Rheumatol 2000;27:1329–31.
3. Codman EA. The shoulder. Rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa. Boston: Thomas Todd; 1934.
4. Rundquist PJ, Anderson DD, Guanche CA, Ludewig PM. Shoulder kinematics in subjects with frozen shoulder. Archives of Physical Medicine and Rehabilitation 2003;84:1473–9.
5. Simon Carette Intraarticular Corticosteroids, Supervised Physiotherapy, or a Combination of the Two in the Treatment of Adhesive Capsulitis of the Shoulder Arthritis & Rheumatism 2003 March; 48(3):829–38.
6. Mc Innes. Periarthritis of the shoulder. Canad. M. A.J. 1946 Aug;55.
7. Hannafin JA, Chiaia & Theresa A. Adhesive capsulitis. A treatment approach. Clinical Orthopaedics and Related Research. 2000 Mar;(372):95-109.
8. Taylor NF, Bennell KL. The effectiveness of passive mobilization on the return of active wrist extension following colles' fracture: a clinical trial. New Zealand Journal of Physiotherpy 1994;4:24-28.
9. Maitland GD. Peripheral Manipulation. 2nd ed. London, United Kingdom: Butterworths; 1977.
10. Chamberlain G. Cyriax's friction massage: A review. J. Orthop Sports Phys Ther.1982;4:16-22.
11. James cyriax. Text book of orthopaedic medicine , 11th edition.Vol 2, 2001.
12. Jing-lan Yang, Chein-wei Chang, Shiau-yee Chen, Shwu-Fen Wang and Jiu-jenq Lin. Mobilization Techniques in Subjects with Frozen Shoulder Syndrome: Randomized Multiple- Treatment Trial. Phys Ther 2007 October;87(10):1307–15.
13. Fusun Guler-Uysal, Erkan Kozanoglu. Comparison of the early response to two methods of rehabilitation in adhesive capsulitis. swiss med wkly 2004;134:353–58.
14. Henricus M Vermeulen. End-Range Mobilization Techniques in Adhesive Capsulitis of the Shoulder

Joint: A Multiple-Subject Case Report. Physical Therapy. 2000;80(12):1204–13.

15. Joyce CR, Zutshi DW, Comparison of fixed interval and visual analogue scales for rating chronic pain. Eur J Clin Pharmacol. 1975 Aug 14;8(6): 415-20.
16. Polly E, Reliability of the Visual Analog Scale for Measurement of Acute Pain. Academic Emergency Medicine. 2001 Dec;8(12):1153-7.
17. Bowman C, Jeffcoate W, Patrick M. Bilateral adhesive capsulitis, oligoarthritis and proximal myopathy as a presentation of hypothyroidism. Br J Rheumatol 1988;27:62-64.
18. Duplay E. De la periarthrite scapulo-humerale et des raideurs de l'epaule quien son la consequence. Arch Gen Med 1872;20:513-542.
19. Codman E. The Shoulder. Boston: Todd, 1934.
20. The Shoulder. Ed. 2 ed. Philadelphia: W. B. Saunders Company, 1997.pp.1064-1112.

SUBSCRIPTION FORM

I want to renew/subscribe international class journal **"Physiotherapy and Occupational Therapy Journal"** of Red Flower Publication Pvt. Ltd.

Subscription Rates:
• Institutional: INR9000/USD703

Name and complete address (in capitals): _____

_____

Payment detail:
Online payment link: http://rfppl.co.in/payment.php?mid=15

Cheque/DD: Please send the US dollar check from outside India and INR check from India made payable to 'Red Flower Publication Private Limited'. Drawn on Delhi branch.

Wire transfer/NEFT/RTGS:
Complete Bank Account No. 604320110000467
Beneficiary Name: Red Flower Publication Pvt. Ltd.
Bank & Branch Name: Bank of India; Mayur Vihar
MICR Code: 110013045
Branch Code: 6043
IFSC Code: BKID0006043 (used for RTGS and NEFT transactions)
Swift Code: BKIDINBBDOS

Term and condition for supply of journals
1. Advance payment required by Demand Draft payable to Red Flower Publicaion Pvt. Ltd. payable at Delhi.
2. Cancellation not allowed except for duplicate payment.
3. Agents allowed 10% discount.
4. Claim must be made within six months from issue date.

Mail all orders to
Subscription and Marketing Manager
Red Flower Publication Pvt. Ltd.
48/41-42, DSIDC, Pocket-II
Mayur Vihar Phase-I
Delhi - 110 091(India)
Phone: 91-11-45796900, 22754205, 22756995, Cell: +91-9821671871
E-mail: sales@rfppl.co.in

Original Article

Physiotherapy and Occupational Therapy Journal
Volume 11 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/potj.0974.5777.11218.4

Comparison of the Effectiveness of Core Strenghting Exercise and McKenzie Extension Exercise on the Pain Functional Disability in lumbar PIVD Condition

Jyoti Sharma[1], Niraj Kumar[2], Shashank Kumar[3]

Abstract

Introduction: The term prolapsed disc means the protrusion or extrusion of the nucleus. It is not a onetime phenomenon rather it is a sequence of change in the disc which ultimately leads to its prolapsed. It is a spinal condition that can cause lower back pain as well as numbness, tightness of muscle, pins and needles sensation, and feeling of muscle weakness in the lower body. *Need for Study:* There are many researches being done on the effects of core strengthening exercises and McKenzie extension exercise on low back pain separately. I want to compare both of them to derive a better and effective exercise plan for low back pain of lumbar prolapsed intervertebral disc condition. *Methods:* 30 subjects were selected and divided into 2 groups randomly. The Group A subject received McKenzie extension exercise The group B subject received Core strengthening exercise. Both the group were treated for 2 weeks. The patients were treated for 6 sessions on a week. Pre intervention measurements for pain intensity using VAS, and functional disability using ODI for low back pain (both groups). *Result:* Student t test was used to compare the data of the two groups. The subject's conditions were similar between the groups, with regard to all variables selected. There was significant difference observed with respect to V.A.S. and O.D.I between McKenzie extension exercise and Core strengthening exercise. Hence McKenzie extension exercise were found to be more effective in comparison to core strengthening. *Conclusion:* The present study concluded that McKenzie extension exercise protocol was more effective in comparison to core strengthening in low back pain with PIVD condition.

Keywords: Visual Analogue Scale; Prolapsed Lumabar Intervertebral Disc; Owestry Disability Index; Short Wave Diathermy; Transcutaneous Electrical Nerve Stimulation.

Introduction

The intervertebral disc is the main joint between two consecutive vertebrae in the vertebral column. Each disc consists of three different structures: an inner gelatinous nucleus pulposus, an outer annulus fibroses that surrounds the nucleus pulposus, and two cartilage endplates that cover the upper and lower surfaces of vertebral body [2] (Fig. 1A).

The intervertebral discs lie between the vertebral bodies, linking them together They are the main surrounds a more gelatinous core known as the nucleus pulposus; the nucleus pulpous is sandwiched inferiorly and superiorly by cartilage endplates [3] (Fig. 1A).

The term prolapsed disc means the protrusion or extrusion of the nucleus. It is not a onetime phenomenon rather it is a sequence of change in the disc which ultimately leads to its prolapsed. It is a spinal condition that can cause lower back pain as well as numbness, tightness of muscle, pins and needles sensation, and feeling of muscle weakness in the lower body. This is also referred as a herniated or ruptured disc and is usually caused by normal age related deterioration [1] (Fig. 1B).

Degeneration of the lumbar intervertebral disc is a major factor associated with low back pain. In fact, the risk of developing low back pain increases with the severity of degenerative disc changes. [4].

Core stability' is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion.

Author Affiliation: [1]Assistant Professor, Shree Sahajanand Institute of Management, Bhavnagar, Gujarat 364002, India. [2]Associate Professor [3]Lecturer, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.

Reprint Request: Jyoti Sharma, Assistant Professor, Shree Sahajanand Institute of Management, Bhavnagar, Gujarat 364002, India.
E-mail: drjyotisharmapt@gmail.com

© Red Flower Publication Pvt. Ltd.

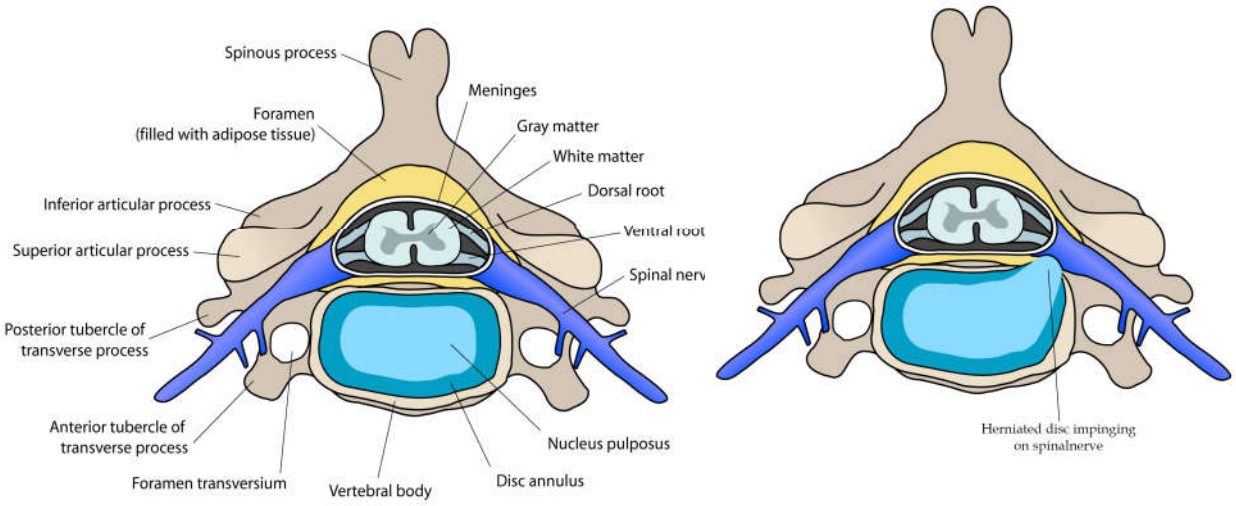


Fig. 1a: vertebral structue and **b:** herniated disc

Core strengthening has become a major trend in rehabilitation. The term has been used to lumbar stabilization, motor control training, and other regimens. Core strengthening is, in essence, a description of the muscular control required around the lumbar spine to maintain functional stability [5].

The most significant biochemical change to occur in disc degeneration is loss of proteoglycan the osmotic pressure of the disc matrix and therefore a loss of hydration [3].

The major player in the stabilizing role for the posterior elements in the lumbar spine is the facet joint. This is an important point in all type of stability evaluation.

Need for Study

There are many researches being done on the effects of core strengthening exercises and McKenzie extension exercise on low back pain separately. I want to compare both of them to derive a better and effective exercise plan for low back pain of lumbar prolapsed intervertebral disc condition.

Aim and Objective of the Study

To compare the effectiveness of Core strengthening versus McKenzie Extension Exercises on pain for Low Back Pain of lumber prolapsed intervertebral disc condition.

To evaluate the effectiveness of McKenzie extension exercise of low back pain, and reducing pain.

To evaluate the effectiveness of Core strengthening exercise of low back pain and reducing pain.

Research Question

Is Core strengthening exercise or McKenzie extension exercise more effective on Pain & functional disability in PIVD?

Hypothesis

Null hypothesis

There will be no significant effect of core strengthening exercise and McKenzie extension exercise on the pain & functional disability in low back pain of lumber prolapsed disc condition.

Alternative Hypothesis

1. There would be a significant effect of the core strengthening exercise Or McKenzie extension exercise on the pain & functional disability in low back pain of lumbar prolapsed intervertebral disc condition.
2. There will be significant correlation between pain value of (VAS) group A McKenzie extension exercise and group B core strengthening exercise.

Operational Definitions

Prolapsed Intervertebral Disc problems: The term prolapsed disc means the protrusion or extrusion of the nucleus. It is not a onetime phenomenon rather

it is a sequence of change in the disc which ultimately leads to its prolapsed. It is a spinal condition that can cause lower back pain as well as numbness, tightness of muscle, pins and needles sensation, feeling of muscle weakness in the lower body [1].

McKenzie- McKenzie extension exercises restore or maintain the lumbar lordosis or decrease low back pain [6] and their aim is centralizing pain, pain relief and regaining functionality [7].

VAS– Visual analogue scale is a psychometric response scale which can be used in questionnaires. It is a measurement instrument for subjective characteristics or attitudes that cannot be directly measured.

1RM (Repetition maximum)-purposes: to provide maximum strength of various muscle and muscle group.

TENS– (Transcutaneous Electrical Nerve Stimulation) TENS is devices used by physiotherapy to aid the management of pain, delivered a low voltage electrical current to nerves via conductive pads called electrodes which are placed over specific area of the skin.

SWD- (Short wave diathermy**)** The use of high – frequency electromagnetic currents as a form of physical therapy.

Review of Literature

Gillan M.G.C, Ross J.C, McLean I.P, Porter R.W, (1998) [8]. The study has showedLumbosacral list is a clinical sign that is frequently associated with low back pain and intervertebral disc lesions. Trunk list was measured over a period of 90 days and patients completed Oswestry Disability Questionnaires. There was a significantly greater resolution of list after 90 days in the group receiving McKenzie treatment compared to the control group.

Moldovan M, (2012) [7]. This is comparative study and the aim of the present study is to compare these two protocols, McKenzie and Williams, in terms of principles and exercises, in order to reveal wich one is more suitable in LBP. They found McKenzie protocol is more efficient than the Williams one in terms of pain relief, pain occurrence while sitting, lumbar mobility.

Gupta S,(2015) [9]. Study is designed to compare the effectiveness of McKenzie Extension Exercises versus William's flexion Exercises for reducing Low Back Pain in B.PT. Students.this is conducted Experimental study, Randomized Control Trial. 30 Low Back Pain subjects were recruited into two groups, outcome measure using NPRS Scale. They found the McKenzie extension exercise group was more effective in reducing low back pain for B.PT. Students as compared to William's Flexion Exercises group.

Roy M. H, Anap D, (2015) [10]. Analysis of this study combined effect of Core Strengthening exercise and McKenzie exercise on PIVD. They found McKenzie and core strengthening exercise is improving the range of motion and reducing pain on PIVD**.**

Szulc P,Wendt M, Waszak M, Tomczak M, Cieœlik K, Trzaska T, (2015) [11]. The aim of this study was to analyze the efficacy of combined treatment with McKenzie method and Muscle Energy Technique (MET), and to compare it with the outcomes of treatment with McKenzie method or stan-dard physiotherapy in specific chronic lumbar pain. The study included 60 men and women with LBP DATA was analyzed with the using of VASTheyfound combined method can be effectively used in the treatment of chronic LBP.

Ferreira P. H, Ferreira M. L,Christopher G Maher C. G, Robert D Herbert R. D,and Kathryn Refshauge (2006) [12]. This study has showed systematic review of the efficacy of specific stabilization exercisefor spinal and pelvic pain. They found that The available evidence suggests that specific stabilization exercise is effective in reducing pain and disability in chronic but not acute low back pain.

Warude T, S. Shanmugam S,(2012)[13]. The aim of this study was to analyze the efficacy of combined treatment with McKenzie and mobilization SNAGS.They found that effectiveness in improving pain, functional ability & ROM in prolapsed intervertebral disc with unilateral radiculopathy, later is more effective**.**

Brian M. Busanich; Susan D. Verscheure (2006) [14]. Analysis the study McKenzie Therapy Improve Outcomes for Back Pain. The study has showed the reliability of McKenzie with the using of Pedro scale. They found that review provides evidence that McKenzie therapy results in a decrease in short-term pain and disability for low back pain patients compared with other standard treatments, such as no steroidal anti-inflammatory drugs.

Hauggaard A, Persson A.L, (2007) [15]. Analysis of this study was to evaluate the effects of specific spinal stabilization exercises in patients with low back pain The intervention method should have

included specific spinal stabilization exercises including co-contraction of multifidus muscles and transverses abdominal muscles. Ten relevant randomized controlled trials with a study population of patients with acute, sub-acute or chronic LBP Seven were high quality and three were low quality. They were found moderate evidence of improved disability and/or pain level, increased multifidi cross-sectional area.

Ponte D. J, Jensen G. J, Kent B. E, (1984) [16]. A comparative study they were randomly assigned to determine whether the Williams or McKenzie protocol of treatment was more effective in both decreasing pain. Subjects required to perform Williams and Mckenzie protocol were assigned accordingly. Twenty-two subjects underwent an initial evaluation which involved six measurements: subjective pain, comfortable sitting time, forward flexion, right and left lateral flexion, and straight leg raise Following the completion of treatment, a second evaluation was performed taking the same six. They found that improvement scores of the two groups indicated that those receiving the McKenzie protocol improved to a significantly.

Audrey L. (1995) [17]. The study was conducted 243 patients with CLBP to determine centralization phenomena They found can help identify sub group within the population with CLBP, could be useful goal tool rehabilitation of low back pain.

Choi G, Raiturker P. P, Kim M. J, Jin C. D, Chae Y. S, Lee S.H, (2005) [18]. The study has showed to determine the effects of a postoperative early isolated lumbar extension muscle-strengthening program on pain, the Seventy-five patients were randomized into an exercise group 20 men, 15 women and a control group 18 men, 22 women . All patients completed the visual analog scale and the Oswestry disability index to assess pain and disability, respectively. Return to work data were also investigated.

Rackwitz B, Bie R.D, Ewert T, Stucki G,(2006) [19]. Analysis to systematic review of randomized controlled trials To evaluate the effectiveness of segmental stabilizing exercises for acute, sub acute and chronic low back pain with regard to pain, recurrence of pain, disability and return to work. Four comparisons were foreseen, 1 effectiveness of segmental stabilizing exercises versus treatment by general practitioner 2 effectiveness of segmental stabilizing exercises versus other physiotherapy treatment,3 effectiveness of segmental stabilizing exercises combined with other physiotherapy treatment versus treatment by GP 4 effectiveness of segmental stabilizing exercises combined with other physiotherapy treatment versus other physiotherapy treatment. They found that segmental stabilizing exercises are more effective than treatment by GP but they are not more effective than other physiotherapy interventions.

Hoy D., Brooks P., Blyth F and Buchbinder R et al. (2010) [20]. Studies cleared that low back pain is an extremely common problem, which most people experience atsome point in their life. Most cases, run a chronic–episodic course. It has a huge impact on individuals, families, communities, governments and businesses throughout the world.

Ehrlich G.,(2003) [21]. The incidence and prevalence of low back pain are roughly the same world over- wherever epidemiological data have been gathered or estimates made – but such pains rank high (often first) as a cause of disability and inability to work, as an interference to the quality of life, and as a reason for medical consultation.

Jayaram M., Kumar M, R. Raja, Prashantha S, Rajeeva A, Veena J, Rajini S. Rao.(20 15)[22]. The aim of this study wasto assess the effectiveness of abdominal strengthening and spinal extensors strengthening along with SWD in reducing pain, disability and improving range of motion in subjects with chronic low back ache, and to compare this effectiveness between the two groups. Treatment outcomes were assessed using VAS for pain intensity, Modified-Modified Schober's Test for range of motion, and Modified Oswestry Disability Questionnaire (MODQ) for functional disability. Shortwave diathermy with abdominal strengthening exercises is more effective than with spinal extensor strengthening exercises in reducing pain and enhancing functional performance in subjects with chronic low back ache.

Brumitt j.,MathesonJ.W., Erik P. Meira,(2013) [23]. The study has showed to evaluatecommon conservative treatment is therapeutic core stabilization exercises, which canaddress pain and musculoskeletal dysfunction in patients with low back pathology rehabilitation strategies to assess core function and promote core stabilization. Each has been developed based on biomechanical models of lumbar segmental stability and observed motor control dysfunction in patients with low back pain.

Research Methodology

This is a comparative study. Thirty (30) subjects participated in this study with prolapsed disc condition and study was done in SGRRIMHS department of physiotherapy at Patel Nagar Dehradun.

The duration of study 2 weeks. Random Sampling was done. Subjects were randomly divided into 2 groups.

Inclusion criteria, Subjects between age 20-50 years, both males and females, Duration of low back pain more than 15 Days, Prolapsed disc with radiating or not radiating pain.

Subjects were excluded if they had any recent spinal surgery or advised for surgery, Subjects with L.B.P of duration less than 15 days, Subjects with any renal diseases, Subjects with spinal conditions like, Tumors, Spondylolysthesis, infection and spinal fracture, Systemic disease– spinal tuberculosis.

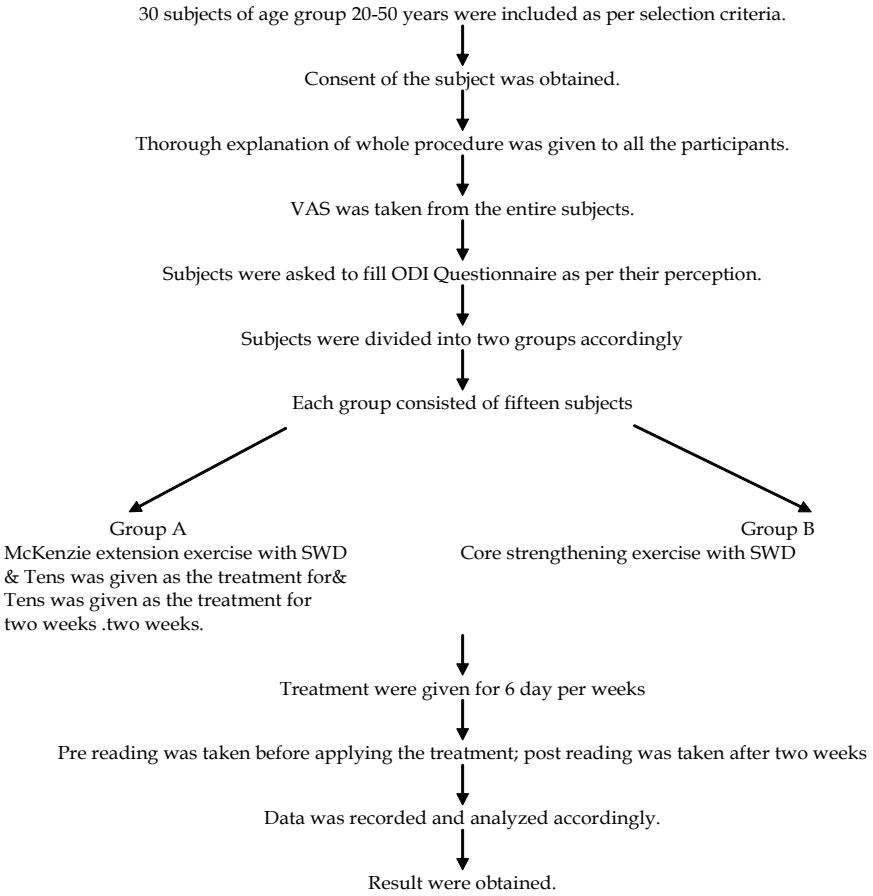
All subjects were given verbal instructions for the procedure and consent form was obtained from each one of them, prior to participation in the study.

Subjects were assessed for prolapsed disc condition. All subjects were given verbal instructions for the procedure and consent form was obtained from each one of them, prior to participation in the study. VAS score and ODI score was measured in each & every patients. Instrumentation for data collection includes Treatment couch, Pain scale visual analog scale, Short wave diathermy, TENS machine, Cotton, MAT, VAS, ODI scale & physioball.

Procedure

Informed consent and pre test data collection: The subjects with PIVD low back pain were assigned into two groups via. Group A& group B. The Group A subject received McKenzie extension exercise The group B subject received Core strengthening

Proctocol



exercise both the group were treated for 2 weeks. 30 volunteers between 20 -50years of ages were volunteered to participate in the study after signing an informed consent statement. A complete clinical assessment was done on all the patients satisfying inclusion criteria. Subjects then divided into 2 groups based on random sampling. The patients were treated for 6 sessions on aweek. Pre intervention measurements for pain intensity using Visual Analog Scale, and functional disability using ODI for low back pain (both groups) VAS was used to evaluate and quantify the perceived pain by the subjects. Origin of the scale is indicated as "NO PAIN" and the terminal end as "MOST SEVERE PAIN". The patient was instructed to move the indicator to represent his/her pain perceived. At the back of the scale 0 to 10 numerical with a distance of 1cm between them were marked.

1. Testing procedure and intervention

Group A: In this group, subject was allowed to perform the McKenzie exercise for low back pain.

SWD applied on radiating pain area for 20 to 30 minute.

TENS applied on radiating pain area for 20 to 30 minute.

Group B: In this group, subject was allowed to perform the Core strengthening exercise for low back pain.

SWD applied on radiating pain area for 20 to 30 minute.

TENS applied on radiating pain area for 20to 30minute

Treatment

Exercise protocol for Group A

1. *Prone Lying*: The patient adopts the prone lying position with the arms alongside the trunk and the head turned to one side. This position is maintained for 20 second repeat 10 times.
2. *Prone on Elbows*: The patient, already lying prone, places the elbows under the shoulders and raises the top half of his body so that he comes to lean on elbows and forearms while pelvis and thighs remain on the couch [Fig. 2.2].
3. Prone press-ups- Lie on your stomach with palms near your shoulders. Slowly push your shoulders up, keeping your hips on the surface and letting your back, Repeat 10 -20 times [Fig. 2.3].
4. Prone Arm/Leg Raises - Lie on stomach on the mat keeping neck in line with straight legs, and arms outstretched overhead.Slowly raise and lower each arm and leg, one at a time5 repetitions on each limbWork alternate limbs by lifting right arm and left leg at the same time 5 repetitions; change to work reverse pair [Fig. 2.4].
5. Standing Extension - While standing, place your hands on your back and lean backward. Hold for 20 seconds and repeat10 times [Fig. 2.5].
6. Prone Lying Superman's Extension exercise - Lie on your stomach on mat with arms and legs extended; retract shoulder blades down and in towards the midline of your spine and maintaining this position, lift opposite arm and opposite leg ensuring that your hips stay in contact with the floor; hold for 5- 10 seconds and reverse sides. Repeat 10-20 times [Fig. 2.1].

Exercise protocol for Group B

The "core" is comprised of several groups of muscles including the transversesabdominus, multifidus, diaphragm and pelvic floor muscles. These muscles work together to produce maximum stability in the abdominal and lumbar (lower) back region.

Fig. 2.1: Prone Lying Superman's Extension exercise

Fig. 2.2: Prone on Elbows

Fig. 2.3: Prone press-ups

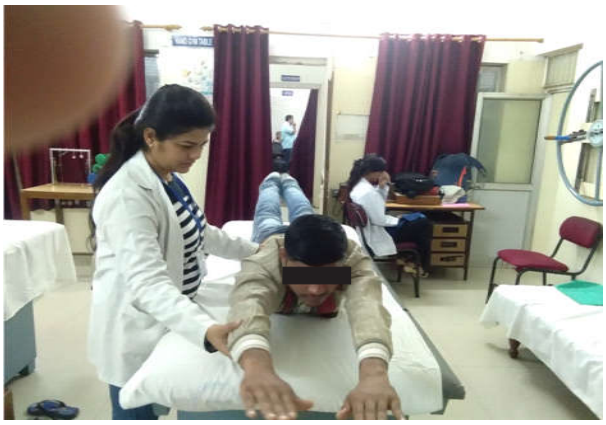


Fig. 2.4: Prone Arm/Leg Raises

Fig. 2.5: Standing Extension

1. *Supine Bridging on Physioball*: Lie facing upward on floor with knees straight, feet resting onphysioball, arms at sides; draw in abdominal muscles and maintainthroughout exercise; slowly lift your butt off floor until trunk is parallel to thighs; hold for 15 seconds; slowly return to starting position. Repeat10-20 times (Fig. 3.1).
2. *Cat&Camel exercise*: Exhale as you sit back onto heels, lower head, tuck chin and reach arms out. Cat- Inhale as you arch the back up and hollow out abdominals while head remains tucked. Camel- Exhale and lower abdominal and reach chin towards ceiling. Tuck chin and sit back into Prayer position. Repeat 10 times (Fig. 3.2).
3. *Bridging exercise*: Lie in the supine position on mat with hips and knees bent to 90degrees with feet flat on floor and arms palm-down at sides; draw inabdominal muscles and maintain throughout exercise; slowly raise yourbutt off the table/mat by using your gluteus and hamstrings until yourtorso is in line with thighs; hold for 15 seconds. Repeat 10 – 20 times (Fig. 3.3).
4. The Wall Squat- Strengthening exercise for back, hips and quads in PIVD patients. Stand with your back against a wall, heels about 18 inches from the wall, feet shoulder-width apart. Tighten abs. Slide slowly down the wall into a crouch with knees bent to about 90 degrees. If this is too difficult, bend knees to 45 degrees and gradually build up from there. Count to five and slide back up the wall. Repeat 5 -10 times (Fig. 3.4).
5. Supine Twist- Lie on your back on mat with hips and knees bent to 90 degrees withfeet flat on floor; draw in abdominal muscles and

Fig. 3.1: Supine Bridging on Physioball- Lie

Fig. 3.2: Cat &Camel exercise

Fig. 3.3: Bridging exercise

Fig. 3.4: The Wall Squat

Fig. 3.5: Supine twist

Fig. 3.6: Isometric exercise

maintain throughoutexercise; slowly and with control, rotate knees to one side keeping hipsin contact with the floor; engage obliques to pull knees back to centerand repeat on opposite side; Repeat 10-20 times (Fig. 3.5).

6. Isometric of back- Supine Abdominal Draw InLie on your back on mat, knees up with feet flat on mat; pull the abs in and push your low back to the mat. Repeat20 times (Fig. 3.6).

Data Analysis

This function gives two samples Student test with a confidence interval for the difference between the means.The student 't' method the null hypothesis that the population means related to two independent, random samples from an approximately normal distribution are equal.

Using statical formula for the mean for a given mean for the mean for a given number of subject, mean of different variable were calculated by-

Assuming equal variances, the test statistic is calculated as:

$$t = \frac{\bar{x}_1 \quad \bar{x}_2}{\sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$s^2 = \frac{\sum_{j=1}^{n1}(x_j \quad \bar{x}_1)^2 + \sum_{i=1}^{n2}(x_i \quad \bar{x}_2)^2}{n_1 + n_2 \quad 2}$$

Where x bar 1 and x bar 2 are the sample means, s^2 is the pooled sample variance, n_1 and n_2 are the sample sizes.

Student "t" test was used to compare the statically reference on VAS and ODI pre and post treatment in group A group B.

Result

The result of this study were analyzed in term of pain relief indicated by decrease in visual analogue score and reduction in score of modified oswestry disability questionnaire, Within and between group differences were compared so as to evaluate the effectiveness of two treatment technique under consideration in present study

Table 1 Statistics Showed the Effectiveness Pre and Post Score of Core Strengthening Exercises and McKenzie Extension Exercise on Low Back Pain of Lumber Prolapsed Disc Condition Two groups were taken into consideration; Group A was given McKenzie extension exercise with SWD and, TENS. Group B was given Core strengthening with SWD and TENS for lumbar area.

Table 2 Student t test was used to compare the data of the two groups Core Strengthen Exercises and McKenzie Extension Exercise. The subject's conditions were similar between the groups, with regard to all variables selected. There was significant difference observed with respect to V.A.S. scale and O.D.I (Oswestry Disability Index) between McKenzie extension exercise and Core

Table 1: Descriptive Statistics Showing the Effectiveness Pre and Post Score of Core Strengthening Exercises and McKenzie Extension Exercise on Low Back Pain of Lumber Prolapsed Disc Condition

			N	Minimum	Maximum	Sum	Mean	Std. Error	Std. Deviation
Group-A	VAS	PRE	15	50.00	80.00	965.00	64.3333	2.88125	11.15902
		POST	15	30.00	65.00	685.00	45.6667	2.48168	9.61150
	ODI	PRE	15	35.00	91.66	843.62	56.2413	4.38506	16.98327
		POST	15	31.66	60.00	660.29	44.0193	2.39214	9.26473
Group-B	VAS	PRE	15	50.00	90.00	940.00	62.6667	3.71184	14.37591
		POST	15	30.00	75.00	755.00	50.3333	3.88730	15.05545
	ODI	PRE	15	31.66	65.00	777.63	51.8420	2.50739	9.71109
		POST	15	26.66	58.33	682.95	45.5300	2.19923	8.51758

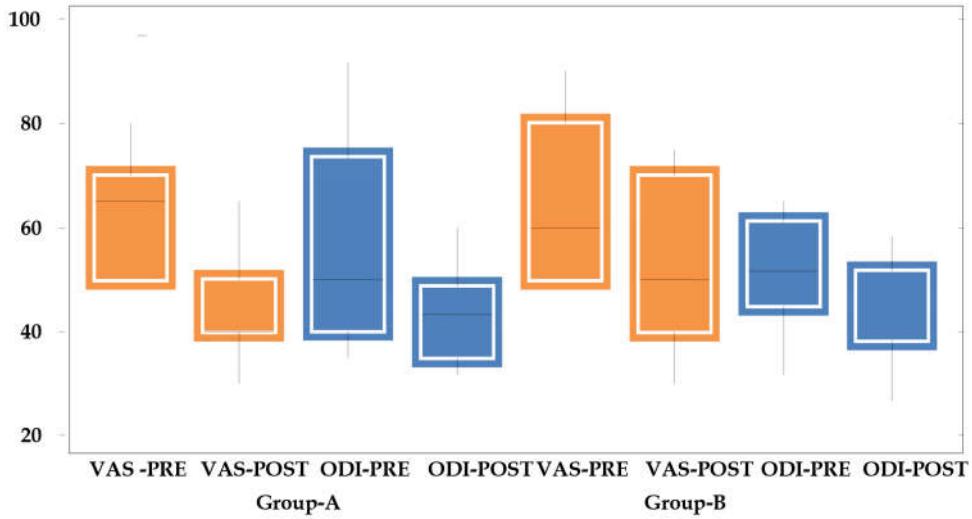
Table 2: 't' Test Comparison of the Effectiveness of Core Strengthen Exercises and McKenzie Extension Exercise on Low Back Pain of Lumber Prolapsed Disc Condition

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	DF	Sig. (2-tailed)
				Lower	Upper			
Group-A VAS- Pre/ Group-B VAS-Pre	1.667	17.499	4.516	-8.019	11.353	.369	14	.718
Group-A VAS- Post/ Group-B VAS-Post	-4.667	16.417	4.238	-13.758	4.424	-1.101	14	.290
Group-A ODI- Pre/ Group-B ODI-Pre	4.399	21.155	5.462	-7.316	16.114	.805	14	.434
Group-A ODI- Post/ Group-B ODI-Post	-1.511	14.609	3.772	-9.601	6.579	-.400	14	.695

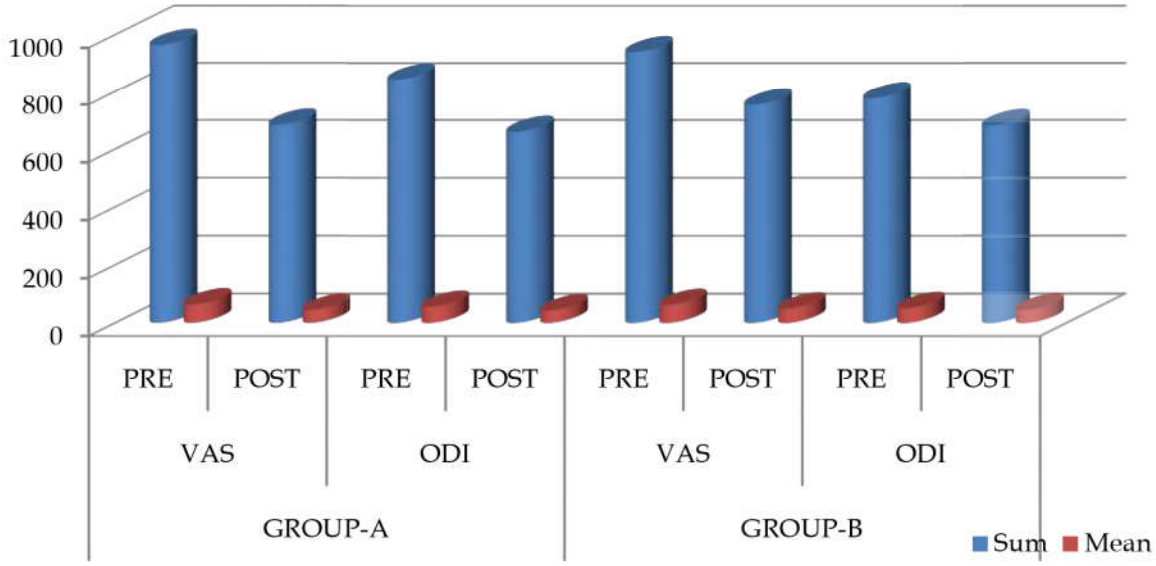
Table 3: Correlations Showing the Comparison of the Effectiveness of Core Strengthen Exercises and McKenzie Extension Exercise on Low Back Pain of Lumber Prolapsed Disc Condition

	Group-A				Group-B			
	VAS-Pre	VAS-Post	ODI-Pre	ODI-Post	VAS-Pre	VAS-Post	ODI-Pre	ODI-Post
Group-A VAS-Pre	1.000	.658**	.861**	.853**	.042	.039	.109	.000
Group-A VAS-Post	.658**	1.000	.489	.486	.091	.111	.140	.118
Group-A ODI-Pre	.861**	.489	1.000	.923**	-.113	-.058	-.057	-.098
Group-A ODI-Post	.853**	.486	.923**	1.000	-.184	-.139	-.074	-.170
Group-B VAS-Pre	.042	.091	-.113	-.184	1.000	.967**	.745**	.779**
Group-B VAS-Post	.039	.111	-.058	-.139	.967**	1.000	.779**	.796**
Group-B ODI-Pre	.109	.140	-.057	-.074	.745**	.779**	1.000	.900**
Group-B ODI-Post	.000	.118	-.098	-.170	.779**	.796**	.900**	1.000

**. Correlation is significant at the 0.01 level (2-tailed).



Graph 1: Showing the Comparison of the Effectiveness of Core Strengthening Exercises and McKenzie Extension Exercise on Low Back Pain of Lumber Prolapsed Disc Condition



Graph 2: Showing The Comparison of Pre And Post Total And Mean Scores Of Group-A And Group-B Of Core Strengthening Exercises And McKenzie Extension Exercise On Low Back Pain Of Lumber Prolapsed Disc Condition

strengthening exercise. Hence McKenzie extension exercise is found to be more effective in comparison to core strengthening.

Table 3 Correlations the Showed Comparison of the Effectiveness of Core Strengthen Exercises and McKenzie Extension Exercise. The result shown that GROUP A McKenzie extension exercise has shown significant improvement on pain and functional disability. Hence null hypothesis is rejected and alternative hypothesis accepted which clearly most effective in reducing pain, and improve functional disability.

Discussion

There were 30 Subjects in this study group A and group B both males and females were included protocol was carried for 2 week. V.A.S., O.D.I. were the deciding parameters to Compare the effectiveness among group A McKenzie extension exercise and group B core strengthening exercise .Outcomes were taken before and after treatment. Functional disability and low back pain was most common factor for all the subjects. As physiotherapy treatment of back pain there are

many approaches, but conventional treatment is normally tailored and includes exercises, Core strengthening and McKenzie extension exercise .Electrotherapy approach in form of superficial and deep heating modalities (SWD) short wave diathermy commonly used therapeutic approach in involves the application of deep heat and this treatment has been reported to have a measurable effect for patients with low back pain.

When the mean values of (Table 1) VAS & ODI were analyzed, it was found statically significant in groups A pre and post intervention. 64.3333 And 45.6667 and mean value of the ODI is 56.2413 and 44.0193.This might be due to McKenzie exercise directional preference that lead to centralization of protruded disc leading to release of impinged nerve. When the protrusion reduces in size, it release first nerve root and then the duramatter, The result from the statistical analysis of the present study indicates the McKenzie extension exercise significant effect of pain & functional disability in low back pain of lumber prolapsed disc condition. The result from the statistical analysis group B the mean values of VAS & ODI were analyzed, pre and post intervention of VAS 62.6667 And 50.3333 and mean value of the ODI is 51.8420 and 45.5300.Strengthening of core muscle may improve specific passive stability that would lead to reduce instability, reduce load on disc so less disc displacement. It leads to less nerve impingement and less radiating pain. Hence we can say core strengthening leads to reduce pain. Pain reduction gives chances to improve mobility thus reduction in overall disability. Core stability is more effective in decreasing pain and may improve physical function activity.

When we compared t test of the Effectiveness of Core Strengthening Exercises and McKenzie Extension Exercise on Low Back Pain of Lumber Prolapsed Disc Conditionit was found statically significant in both group (Table 1, 2, 3) and shown improvement in pain, which represents an improvement in functional disability. Pre value of VAS group A & group B t is .369 (1.667) and Post value of VAS group A & group B (-4.667) t is (-1.101) ODIPre value of group A & group B (4.399) t is (.805) Post value of ODI group A & group B (-1.511) tis (-.400) The McKenzie group a significantly ($P < 0.001$) greater increase in the pain-free movement with improve functional disability. Core strengthening is a protective mechanism that increases strength, which increase stability and reduces the risk of disc displacement, reduced core strength leads to recurrent disc displacement the studies included in the review suggest that McKenzie therapy is more effective than most comparison treatments at short-term follow-up.

When compared both groups of post treatment signifies that all outcome measures showed Correlation significant at the 0.01 level (2-tailed) improvements from baseline values of McKenzie extension exercise. The both techniques shows effectiveness in post treatment outcome measure, McKenzie exercise helped shifting the disc in opposite side of derangement thus reducing the disc prolapsed and core stabilization exercise it strengthened the surrounding muscle thus improving stability. Which is clearly most effective in reducing pain, improve functional disability.

Back pain is strongly associated with degeneration of the intervertebral disc. It is associated with sciatica and disc herniation or prolapsed. Degeneration of the lumbar intervertebral disc is a major factor associated with low back pain. In fact, the risk of developing low back pain increases with the severity of degenerative disc changes [4].

McKenzie therapy improves return-to work status over other treatments. No other comparative treatment was more effective than McKenzie therapy at any identified point in time. Clinical evidence suggests that McKenzie therapy is an effective method for managing back pain in the short term 3 months [14].

Pre-defined selection criteria, most of the results from individual studies and the pooled results reveal that McKenzie therapy was statistically significantly more effective than other treatments in reducing pain and disability at short term follow-up. Our results suggest that McKenzie therapy provides on average 8.6 point greater short term pain reduction (pain measured on a 0 to 100 point scale) than other conservative treatments. The sensitivity analysis revealed a slightly greater effect of 11.4 points [24].

The results of this preliminary study demonstrated that the McKenzie protocol of treatment for low back pain was significantly better than that of Williams in decreasing pain, increasing the period of comfortable sitting time, and increasing the pain-free range [6].

The effect of McKenzie approach on pain and functional disability which showed that there was significant reduction in pain ($p< 0.0001$) and functional disability ($p< 0.0001$) post treatment [25].

Limitation of Study

Population of the patients was small due to certain time limitation.

Short duration of study.

Lesser follow-up periods due lake of time.

Clinical Implication

The study can be applied to patients suffering from prolapsed intervertebral disc condition, there condition can be improved by using McKenzie extension exercise .because McKenzie extension gives result within 3 to 4 days and core strengthening gives result after 10 days, but strength of recovery is better in McKenzie than core. thus clearly it is helpful in alleviating pain in prolapsed disc condition.

Scope for Future Study

The research to be carried out by taking large sample size.

Further studies can be done by using different outcome measures.

Studies with longer duration are recommended with longer follow-up period to assess the benefits.

Further studies can also be done by using different variable.

Conclusion

The present study showed that McKenzie extension exercise protocol was very much effective in low back pain with Prolapsed Lumabar Intervertebral disc Condition. As a treatment intervention it is efficient in relieving pain and functional disability. McKenzie extension exercise helps shifting the disc in opposite side of derangement thus reducing the disc prolapsed whereas core stabilization exercise helps strengthening the surrounding muscle thus improving the stability, here my result significantly shows more effective result in McKenzie treatment to reduce pain& improve functional disability.

References

1. N.P. Singh, Suneeta Koul. Anxiety among the Patient with Lumber Disc Prolapse: A Case Report. 2016 Jan-Mar;3(2):172-75.
2. Bao-Gan Peng. Pathophysiology, diagnosis, and treatment of discogenic low back pain. 2013 April 18;4(2):42-52.
3. P. Prithvi Raj. Intervertebral Disc: Anatomy Physiology-Pathophysiology-Treatment. 2014 Jul 3;8(1):18–44.
4. Dino Samartzis, DSc, Jaro Karppinen, Florence Mok, MSc, Daniel Y.T. Fong, Keith D.K. Luk, Frcse, Frcsg, Fracs, Fhkam, Kenneth M.C. Cheung, Frcs, Fhkcos, Fhkam. A Population-Based Study of Juvenile Disc Degeneration and Its Association with Overweight and Obesity, Low Back Pain, and Diminished Functional Status. 2011 April 6;93(7):662-70.
5. Akuthota, Venu, Ferreiro, Andrea, Moore,Tamara, Fredericson, Michael. CoreStability Exercise Principles Current Sports Medicine. 2008 Jan-Feb.; 7(1):394-402.
6. David Joseph Ponte, Gail J. Jensen, Barbara E. Kent. A Preliminary Report on the Use of the McKenzie Protocol versus Williams Protocol in the Treatment of Low Back Pain. 2017 June 16;6(2):130-39.
7. Mircea moldovan,Therapeutic Considerations and Recovery in Low Back Pain: Williams vs McKenzie. 2008;5(9):58-64.
8. M.G.C. Gillan J.C. Ross I.P. McLean R.W. Porter, The natural history of trunk list,Its associated disability and the influence of McKenzie management. 1998 May 28;7:480–83.
9. Sapna Gupta. A Comparison Betweenmckenzie Extensions Exercises Versus William's Flexion Exercises for Low Back Pain inB.Pt. Students. 2015 Jul-Dec;3(2):51-55.
10. Roy M. H, Anap D. Is McKenzie method with core exercise effective for Patients with disc derangement? A Case Series. 2015;2:26-30.
11. Szulc P, Wendt M, Waszak M, Tomczak M, Cieœlik K, Trzaska T. Impact of McKenzie Method Therapy Enriched by Muscular Energy Techniques on Subjective and Objective Parameters Related to Spine Function in Patients with Chronic Low Back Pain. 2015;21:2918-32.
12. Ferreira P.H, Ferreira M.L,Christopher G Maher C. G, Robert D Herbert R.D, and Kathryn Refshauge. Specific stabilization exercise for spinal and pelvic pain: Systematic review. 2006;52:79–88.
13. Warude T, S. Shanmugam S. The Effect of McKenzie Approach and Mulligan's Mobilization (SNAGS) in Lumbar Disc Prolapsed with Unilateral Radiculopathy. 2012;3:59-63.
14. Brian M. Busanich; Susan D. Verscheure. Does McKenzie Therapy Improve Outcomes for Back Pain? 2006;41:117–19.
15. Hauggaard A, Persson A.L, Specific Spinal stabilisation Exercises In Patients With Low Back Pain. 2007;12:233–2.
16. Ponte D.J, Jensen G.J, Kent B.E. A Preliminary Report on the Use of the McKenzie Protocol versus Williams Protocol in the Treatment of Low Back Pain. 1984;6:130-139.
17. Audrey L. The centralization phenomenon. Its usefulness as a predictor or outcome in conservative treatment of chronic Low back pain. 1995;20:513-520.

18. Choi G, Raiturker P. P, Kim M. J, Jin C. D, Chae Y. S, Lee S.H, The Effect Of Early Isolated Lumbar Extension Exercise Program For Patients With Herniated Disc Undergoing Lumbar Discectomy. 2005;57:764-772.
19. Rackwitz B, Bie R.D, Ewert T, Stucki G. Segmental stabilizing exercises and low back pain. What is the evidence? A systematic review of randomized controlled trials. 2006;20:553-67.
20. Hoy D., Brooks P., Blyth F and Buchbinder R et al. The Epidemiology of low back pain. Best Pract Res Clin Rheumatol. 2010 Dec;24(6):769-81. doi: 10.1016/j.berh.2010.10.002.
21. Ehrlich G. Low back pain. Bulletin of the World Health Organization 2003;81(9):971-76.
22. Jayaram M., Kumar M, R. Raja, Prashantha S, Rajeeva A, Veena J, Rajini S. Rao. A Comparative Study Of Abdominal Strengthening Versus Spinal Extensors Strengthening Accompanied With Swd In Reducing Pain In Chronic Low Back Ache 2015;2:2035-40.
23. Brumitt J., Matheson J.W., Erik P. Meira. Core Stabilization Exercise Prescription,Part I: Current Concepts in Assessment and Intervention. 2013;5:504-09.
24. Helen A Clare, Roger Adams and Christopher G Maher. A systematic review of efficacy of McKenzie therapy for spinal pain. Aust J Physiother. 2004;50(4):209-16.
25. Trupti Warude, S. Shanmugam. The Effect of Mckenzie Approach and Mulligan's Mobilisation (SNAGS) in Lumbar Disc Prolapse with Unilateral Radiculopathy. IJSR 2014 Oct;3(10):59-64.

Original Article

Physiotherapy and Occupational Therapy Journal
Volume 11 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/potj.0974.5777.11218.5

Effect of Stretching on Shortened Quadratus Lumborum Muscle in Non Specific Low Back Pain

Ekta Pandey[1], Niraj Kumar[2], Shatrudhan Das[3]

Abstract

Introduction: Low back pain is an extremely common problem that most people experience at some point in their life Low back pain is well documented to be an extremely common health problem however, its burden is often considered trivial.The common form of low backache is mechanical type and 80-90% patients will complain of dull, achy, diffuse pain and stiffness that is confined to the low back area or may radiate to buttock and hip which results from reflex muscle spasm from primary pain, where there may have trigger points within their muscles [1]. Quadratus lumborum muscle is an important stabilizer of the lumbar spine [2]. The quadratus lumborum, or QL, is a common source of lower back pain [3]. *Purpose of the Study:* To find out the effect of stretching on quadratus lumborum muscle in non specific low back pain. *Methods:* Group A: Group A (15 patients) received core stability warm up and spinal extension exercise. Group B: Group B (15 patients) received the same treatment line with addition of Quadratus Lumborum stretch. *Conclusion:* The study concludes to that there is significant difference on between Group A and GroupB on the basis of Oswestry Low Back Pain Disability Questionnaire. Though there is no significant difference between Group A and Group B on the basis of VAS. *Discussion:* The study was an experimental study which aim to find out the effect of stretching on shortened quadratus lumborum muscle in non-specific low back pain the study designed comprised of 30 subject and they were equally divided into 2 group group A consist of 15 subjects and group B consist 15 subjects the showed an significant result on comparing between the group A and group B the result was significant. *Limitations of Study:* The sample size was small consisting of 30 subjects. Other muscle components which have a significant role in causing non-specific low back pain were not taken into consideration. Marginal tightness in muscle such as Iliopsaos, Hamstring and Tensor fascia Latae was not considered. Body mass index was not controllable. *Future Scope of Study:* Larger sample size can be taken. Study can be conducted for longer duration. Different age groups can be taken.

Keywords: Stability Warm Upexercise; Spinal Extension Exercise; Quadratus Lumborum Stretching; Oswestry Low Back Pain Disability Questionnaire and VAS.

Introduction

Low back pain is an extremely common problem that most people experience at some point in their life Low back pain is well documented to be an extremely common health problem however, its burden is often considered trivial. Low back pain is the leading cause of activity limitation and work absence throughout much of the world , and it causes an enormous economic burden on individuals, families, communities, industry and governments.[6]

Author Affiliation: [1,3]Lecturer [2]Associate Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.

Reprint Request: Niraj Kumar, Associate Professor, Shri Guru Ram Rai Institute of Medical & Health Sciences, Patel Nagar, Dehradun, Uttarakhand 248001, India.
E-mail: drnirajkumar25@gmail.com

© Red Flower Publication Pvt. Ltd.

The common form of low backache is mechanical type and 80-90% patients will complain of dull, achy, diffuse pain and stiffness that is confined to the low back area or may radiate to buttock and hip which results from reflex muscle spasm from primary pain, where there may have trigger points within their muscles [1].

Low back pain is usually classified as 'specific' or 'non-specific'. Specific low back pain is defined as that caused by a specific pathophysiological mechanism, such as disc prolapse or herniated nucleus pulposus, infection, inflammatory arthopathy, tumour, osteoporosis or fracture.[1] Non-specific low back pain is defined as low back pain not attributable to a recognizable, known specific pathology (eg, infection, tumors, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or caudaequina syndrome) [4].

The quadratus lumborum, or QL, is a common source of lower back pain [3]. Because the QL connects the pelvis to the spine and is therefore capable of extending the lower back when contracting bilaterally, the two QLs pick up the slack, as it were, when the lower fibers of the erector spinae are weak or inhibited (as they often are in the case of habitual seated computer use and/or the use of a lower back support in a chair) [4].

De Franca and Levine describe the successful resolution of two patients suffering from low back pain, flank pain, buttock and lateral hip pain using myofascial therapy aimed at restoring QL muscle length and function, coupled with spinal manipulative therapy as indicated. The other article by Bryner describes five cases of unilateral flank pain and local tenderness attributed to involvement of the quadratus lumborum muscle [5].

Aim of the Study

To find out the effect of stretching on quardatuslumborum muscle in non specific low back pain.

Statement of Question

Is there any effect of stretching on quardatuslumborum muscle in non specific low back pain.

Hypothesis

Alternative Hypothesis

There will be the significant effect of stretching on quadratus lumborum muscle in non specific low back pain.

Null Hypothesis

There will not be the significant effect of stretching on quadratus lumborum muscle in non specific low back pain.

Review of Literature

Eyal Lederman Et al 2010 [2] in their study the myth of core stability states that Core stability exercises are no better than other forms of exercise in reducing chronic lower back pain. Any therapeutic influence is related to the exercise effects rather than stability issue.

Mathew O.B. Olaogum and Andreas Kopf 2010 [6] in study chronic nonspecific back painlow state that prevalence of LBP is not a dependent on genetic factor that could predispose person of specific ethnicity or race to this disorder men and women are affected equally but lifestyle may be one of the most important predisposing factor for LBP. therefore LBP is starting to become a major health care problem in all countries in which economic and cultural changes are transforming their societies

Margarita Nordin Federico Balague Christine Cedraschi Et Al 2006 [7] In Study Nonspecific Lower-Back Pain Surgical Versus Nonsurgical Treatment state that in acute NSLBP keeping active as tolerated is the most successful choice. with or without help from a healthcare provider sub acute and CNSLBP are described together to stress the importance of a continuum of care and a stepwise approach where the evidence point to combination therapy of exercise.

J. Moffett and S. McLean 2006 [8] in their study The role of physiotherapy in the management of non-specific back pain and neck pain states that The management of more persistent and disabling back pain and neck pain is challenging and may need to focus on helping the patient to come to terms with their pain. The best approach may be intensive bio-psychosocial rehabilitation with functional restoration, in which physiotherapists will need to collaborate closely.

Stephen May, Chris Little wood and Annette Bishop 2006 [9] in their study Reliability of procedures used in the physical examination of non-specific low back pain: A systematic review **s**tates that This systematic review identified 48 studies that evaluated the reliability of physical examination procedures used in the assessment of the lumbar spine for non-specific low back pain. The methodological quality was only moderate, and conclusions emphasised the findings from high quality studies, defined as $\geq 60\%$ methods score. Many commonly used examination procedures were found either to lack reliability or to have conflicting evidence about their reliability.

Guy Hains, 2002 [10] in study Locating and treating low back pain of myofascial origin by ischemic Compression State that patients reporting low back pain. Chiropractors should carefully assess the lumbar spine, as well as the gluteal, femoral and pelvic regions, attempting to elicit those TPs and TSs that reproduce the patient's chief complaint. Even in cases involving other causes of low back pain (joint dysfunction) the practitioner may augment the patient's recovery by addressing involved soft tissues.

Basal Tawfik Et Al 2001 [11] In Study Symmetry And Linearity Of Trunk Function In Subjects With Non-Specific Low Back Pain state that LBP are both hard to evaluate and diagnose mainly. because of their controversial outcomes since NSLBP subject constitute a high-risk population for further back problem investigation of such patient may lead to understanding of early characteristics of pathological back pain the choice of clerical subject on the one hand and traffic wardens on the other allowed us tp work on two population segments with the same.

Methodology

Thirty (30) subjects participated in this study with low back pain and study was done in SGRRIMHS department of physiotherapy at Patel Nagar Dehradun. The duration of study 2 weeks.Random Sampling was done. Subjects wererandomly divided into 2 groups.Inclusion criteria, Subject between age group (18-25year), Subject who expressed a chief complaint tighten of low back ache more than 12 weeks and Subject who had low back pain after maintaining a certain prolonged posture. Subjectswere excluded if they had any orthopaedic surgery or any other low back surgery eg. PIVD, Spinal tumour, Tb of spine, Fracture of vertebrae and any lower limb injury. All subjects were given verbal instructions for the procedure and consent form was obtained from each one of them, prior to participation in the study.

Subjects were assessed for non- specific low back pain. All subjects were given verbal instructions for the procedure and consent form was obtained from each one of them, prior to participation in the study. VAS score and ODI score was measured in each & every patients.Instrumentation for data collection includes measuring tape, plinth, marker, mat, Oswestry disability index scale & VAS.

Procedure

A minimum of 30 subjects with mean age of 20.33±1.33 were selected according to selection criteria after ethical committee approval.

Instructions to the Patient

1. Subjects were asked to be regular for the treatment sessions as deemed by the researcher.
2. Subjects were asked to report any discomfort during the study period and briefed about the use of safety switch

Group A:

Group A (15 patients) received core stability warm up and spinal extensionexercise.

Core Stability Warm-Up

It consists of curl up, side-bridge and bird dog exercises.

Curl Up Exercise

Stabilization exercises starts with curl up. In order to perform this exercise the patient lies in crook lying position on the mat and then raises the trunk upwards with hands i.e., stretched up in the air forward or hands behind the back. Advise is given to do this exercise for 10 reps. Each repetition is kept for a 10 seconds hold. In this case of curl–up the hands are placed under the lumber spine to preserve a neutral spine posture. Do not flatten the back to the floor. Flattening the back flexes the lumbar spine, violates the neutral spine principle, and increases the loads on the disc and ligaments. One knee is flexed but the other leg is straight to lock the pelvis-lumber spine and minimize the loss of a neutral lumber posture. Alternate the bent leg midway through the repetitions.

Side Bridge Exercises: The side bridge exercise is performed on the mat by patient lying in side lying position. Lie on your side with elbow underneath your shoulder and your knees either bend to 90 degrees or with your legs straight. Then push the floor away from you with your elbow to lift the shoulder up. Lift your hip off the ground maintaining a straight line from your head to your knees. Hold the position for up to 10 seconds, for 6 reps. then repeat on the other side. The potential issue with this exercise is that knee flexion will tend to pull the pelvis into an anterior tilt due to the attachment of the rectus femoris muscle. To prevent this it is important to incorporate a slight posterior pelvic tilt into the exercise.

Bird Dog Exercise: The patient lying is quadruped prone position on the mat performs bird dog exercise. The patient first lifts one hand in the air. Then it is progressed to two point kneeling. The patient lifts one hand in the air and opposite leg in the air. This is repeated with the opposite leg and the hand. Advise is given to do this exercise for 10 reps. Each repetition is kept for a 10 seconds hold.

Spinal Extention Exercises

Exercise No. 1:

This patient lies in prone lying position on the mat and lifts one leg in the air and then the opposite leg in the air. The patient holds each leg in the air for 5 to 10 seconds. This exercise is done 10 repetitions per set. Initially the patient perform only 2-3 sets and slowly it is increased to 10 sets.

Exercise No. 2:

The patient lies in prone lying position on the mat and lifts both hands in the air and holds it for a period of 5 to 10 seconds hold. This exercise is done for 10 repetitions per set. Initially the patients perform only 1-2 sets and then slowly it is increased to 5 sets.

Exercise No. 3:

This exercise is performed with the patient lying in prone lying position on the mat. The patient first lifts one hand in the air and then the opposite leg in the air. This maneuver is repeated with the opposite arm andthe leg. This exercise is done for 10 repetitions per set. Initially the patients perform 2-3 sets only and then slowly it is increased to 10 sets.

Group B:

Group B (15 patients) received the same treatment line with addition of Quadratus lumborum stretch.

Quadratus lumborum stretch in Supine position

1. The patient is supine on the table. The physiotherapist firmly grasps theright foot and ankle and passively stretches the entire leg to pull the hipdown, then across the midline, lengthening the QL on the right.
2. From this starting position, the patient attempts to hip hike (pull theHip bone towards the head). Be sure he is not lifting the leg toward the ceiling (hip flexion). Hold this isometric contraction of the QL for 6 secondsas the patient breathes normally.
3. After the isometric push, the stretcher relaxes and inhales deeply. As herelaxes, maintain the leg in the starting position.
4. As he relaxes, passively stretch the leg down and across the midlinefarther, deepening the right quadratus lumborum stretch.
5. Repeat it 4-5 times.

Data Analyses

Statistics were performed by using SPSS 13. Results were calculated by using 0.05 level of significance.

Using statistical formula for the mean, for a given number of subjects, mean of different variables were calculated by -:

$$X = \frac{\boldsymbol{X}}{N}$$

Where,

N = Number of subjects

X = each subjects value

STANDARD DEVIATION ()

$$\boldsymbol{s} = \sqrt{\frac{\boldsymbol{\Sigma x^2}}{\boldsymbol{N}}}$$

x= deviation of score from mean

N = Number of subjects

t-test of independent means

The formula for the independent t-test is

$$\boldsymbol{t} = \frac{\boldsymbol{X_1} \quad \boldsymbol{X_2}}{\sqrt{\left(\frac{\boldsymbol{SS_1 + SS_2}}{\boldsymbol{n_1 + n_2} \quad \boldsymbol{2}}\right)\left(\frac{\boldsymbol{1}}{\boldsymbol{n_1}} + \frac{\boldsymbol{1}}{\boldsymbol{n_2}}\right)}},$$

where

X_1 is the mean for group 1, $X_2$is the mean for group 2,

SS_1 is the **sum of squares** for group 1, SS_2 is the **sum of squares** for group 2,

$\mathbf{n}_1$ is the number of subjects in group 1, and $\mathbf{n}_2$ is the number of subjects in group 2.

t-test of dependent means

The formula for the dependent t is:

$$t = \frac{\Sigma D}{\sqrt{\frac{n\Sigma D^2 \quad (\Sigma D)^2}{n \quad 1}}}$$

Where D is the difference between pairs of scores,

$D=X_2 - X_1$

df = n – 1 and **n** is the number pairs of subjects in the study.

Results

Group Description	
Total Subjects	30
Group A	15
Group B	15
Level of Significance	95%
P < 0.05	Significant
P > 0.05	Not Significant

The study was an experimental study which aim to find out the effect of stretching on shortened quadratus lumborum muscle in non-specific low back pain the study designed comprised of 30 subject and they were equally divided into 2 groups: (1) group A consist of 15 subjects and (2) group B consist 15 subjects the showed an significant result on comparing between the group A and group B the result was significant.

Table 1 showed that Mean and standard deviation for quadratus lumborum pre-interval for group A is 2.69±0.70 and group B is 2.55±0.61 and post-interval for group A is 4.53±0.58 and group B is 5.06±0.37.

Mean and standard deviation for VAS pre-interval for group A is 5.03±1.67 and group B is 5.26±1.95 and post-interval for group A is 1.75±1.24 and group B is 1.09±0.80 (Table 2).

Table 3 showed that Mean and standard deviation for Oswetry pre interval for group A is 38.20±16.64 and group B is 36.12±9.09 and post interval for group A is 21.67±10.45 and group B is 8.78±4.15

After applying T test comparing mean and standard deviation of pre-QL and post-QL mean difference is 1.83333 and standard deviation .69248 (Graph 1).

Table 1: Mean and SD of QL at Pre, Post and MD (Pre-Post) Interval for the subjects of Group A and Group B

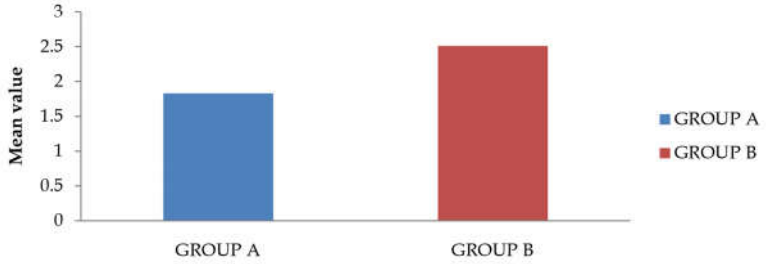
QL	Group A Mean & SD	Group B Mean & SD
Pre-Interval	2.69±0.70	2.55±0.61
Post-Interval	4.53±0.58	5.06±0.37
MD (Pre-Post) Interval	1.83±0.69	2.51±0.42

Table 2: Mean and SD of VAS at Pre, Post and MD (Pre-Post) Interval for the subjects of Group A and Group B

VAS	Group A Mean & SD	Group B Mean & SD
Pre-Interval	5.03±1.67	5.26±1.95
Post-Interval	1.75±1.24	1.09±0.80
MD (Pre-Post) Interval	3.28±0.81	4.17±1.32

Table 3: Mean and SD of Oswestry at Pre, Post and MD (Pre-Post) Interval for the subjects of Group A and Group B

Oswestry	Group A Mean & SD	Group B Mean & SD
Pre- Interval	38.20±16.64	36.12±9.09
Post- Interval	21.67±10.45	8.78±4.15
MD (Pre-Post) Interval	16.53±7.21	27.34±7.47



Graph 1: Comparison of Improvement for QL between Group A and Group B

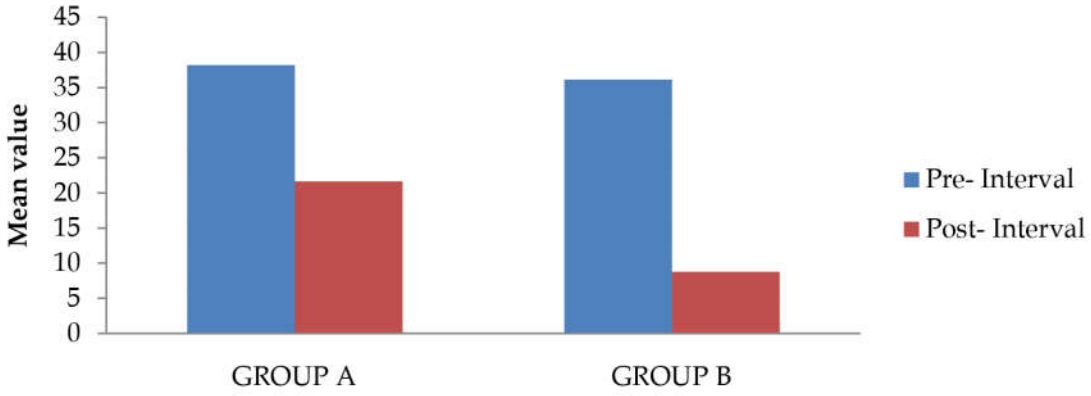
Graph 2 shows that after applying T test comparing mean and standard deviation of pre-VAS and post VAS mean difference is 3.28000 and standard deviation .81346.

After applying T test comparing mean and standard deviation of pre-Oswetry and post-Oswetry mean difference is 16.53267 and standard deviation 7.20913 (Graph 3).

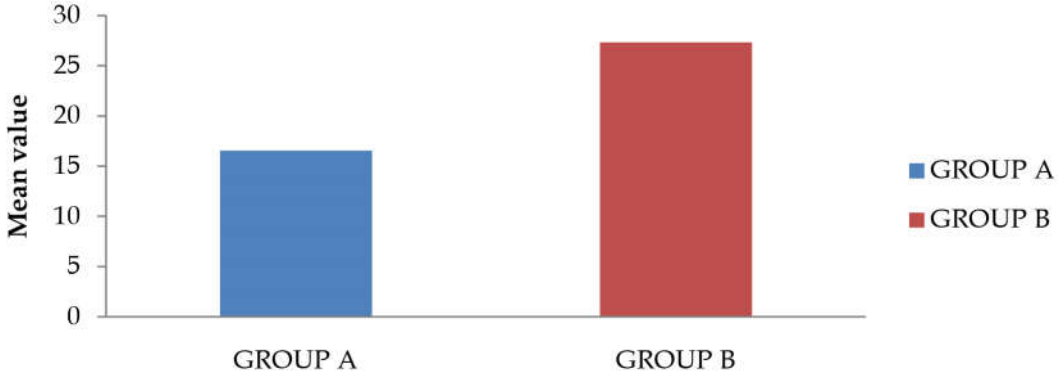
Discussion

The study was an experimental study which aim to find out the effect of stretching on shortened quadratus lumborum muscle in non-specific low back pain the study designed comprised of 30 subject and they were equally divided into 2 groups: (1) group A consist of 15 subjects and (2) group B consist 15 subjects the showed an significant result on comparing between the group A and group B the result was significant. Mean and standard deviation for quadratus lumborumpre interval for group A is 2.69±0.70and group B is 2.55±0.61 and post interval for group A is 4.53±0.58 and group B is 5.06±0.37. Mean and standard deviation for VAS pre interval for group A is 5.03±1.67 and group B is 5.26±1.95 and post - interval for group A is 1.75±1.24 and group B is 1.09±0.80. Mean and standard deviation for Oswetry pre interval for group A is 38.20±16.64 and group B is 36.12±9.09 and post - interval for group A is 21.67±10.45 and group B is 8.78±4.15. After applying Ttest comparing mean and standard deviation of pre QL and post - QL mean difference is 1.83333 and standard deviation .69248. After applying Ttest comparing mean and standard deviation of pre VAS and post - VAS mean difference is 3.28000 and standard deviation .81346. After applying Ttest comparing mean and standard deviation of pre Oswetry and post - Oswetry mean difference is 16.53267 and standard deviation 7.20913. Another study stated that The action of the QL is to extend and laterally flex the spine [2,7,10], and with the spine stable, to raise the pelvic crest [2, 10]. The QL has also been shown to be important for stabilizing the spine under load [12]. Travell & Simons write that the QL, "is one of the most commonly overlooked muscular sources of low back pain and provide an extensive review of the QL muscle [13].

Another study stated that Karen P. Barr The quadratus lumborum is an important lateral stabilizer of the spine.8It is attached to the



Graph 2: Comparison of mean value for Oswestry at Pre and Post Interval within Group A and Group B



Graph 3: Comparison of Improvement for Oswestry between Group A and Group B

transverse processes of the lumbar spine through the thoracolumbar fascia and therefore increases lumbar stiffness. It is a key muscle targeted in physical therapy for lumbar stabilization [14]. Another study stated that Stuart M. McGill The side bridge exercise has been documented to challenge the quadratus lumborum and the muscles of the abdominal wall to enhance spine stability [14]. Another study stated that Stuart McGill True spine stability is achieved with a "balanced" stiffening from the entire musculature including the rectus abdominis and the abdominal wall, quadratus lumborum, latissimusdorsi and the back extensors of longissimus, iliocostalis and multifidus [15]. Another study stated that Sonja kneppers the role of the quadratus lumborum as related to stability demands is associated with its increased activity during periods of lumbar sagittal moments and compression. Another study stated that R.S. Jemmetquadratus lumborum, psoas and transverseabdominis have been described as functioning to maintain spinal stability [10].

Limitations of Study

The sample size was small consisting of 30 subjects.

Other muscle components which have a significant role in causing non-specific low back pain were not taken into consideration.

Marginal tightness in muscle such as Iliopsaos, Hamstring and Tensor fascia Latae was not considered.

Body mass index was not controllable.

Future Scope of Study

Larger sample size can be taken.

Study can be conducted for longer duration.

Different age groups can be taken.

Conclusion

The study concludes to that there is significant difference on between Group A and GroupB on the basis of Oswestry Low Back Pain Disability Questionnaire. Though there is no significant difference between Group A and Group B on the basis of VAS.

References

1. M.W. Van Tulder and G. Waddell Evidence-based medicine for non-specific low back pain 2005;19(4):7-9.
2. Eyal Lederman. The fall of the postural-structural-biomechanical model in manual and physical therapies: exemplified by lower back pain. J Bodyw Mov Ther. 2011 Apr;15(2):131-8.
3. D. Hoy A, P. Brooks B, F Blythc, R. Buchbinder. The Epidemiology of low back pain. Best Pract Res Clin Rheumatol. 2010 Dec;24(6):769-81.
4. Hossain Mhmd, Choudhury Mra, Mojumder Mma, A comparative study of treatment of chronic Backache between conventional method and Trigger point injections.
5. Farasyn A., Meeusen R. Effect of roptrotherapy on pressure pain thresholds in patients with subacute non-specific low back pain. Journal of musculoskeletal pain 2007;15:41-53
6. Mathew O.B. Olaogum and Andreas Kopf. Study chronic nonspecific back painlow. 2010.
7. Margarita Nordin. Back pain: lesson from patient education patient education and counseling. 1995;26:67-70.
8. J. Moffett And S. Mclean. The Role of physiotherapy in the management of non-specific back pain and neck pain rheumatology 2006;45:371–78.
9. May S, Littlewood C, Bishop A. Reliability of procedures used in the physical examination of non-specific low back pain: a systematic review. Aust J Physiother. 2006;52(2):91-102.
10. Guy Hains. Locating and treating low back pain of myofascial origin by ischemic compression. J Can Chiropr Assoc. 2002 Dec; 46(4): 257–264.
11. Bassel Tawfik. Symmetry and linearity of trunk function in specific low back pain clinical biomechanics. 2001;16:114-20.
12. Martin Underwood, Diagnosing acute nonspecific low back pain: time to lower the red flags? Arthritis & rheumatism 2009 Oct;60(10):2855–57.
13. Monica Unsgaard-Tondel, Anne Margrethe Fladmark, Oyvind Salvesenand, Ottar Vasseljen, Motor Control Exercises, Sling Exercises, and General Exercises for Patients With Chronic Low Back Pain: A Randomized Controlled Trial With 1-Year Follow-up. Physical Therapy, 2010 Oct;90(10):1426–40.
14. Barr KP, Griggs M, Cadby T. Lumbar stabilization: core concepts and current literature, Part 1. Am J Phys Med Rehabil. 2005 Jun;84(6):473-80.
15. Stuart M. McGill, Aaron Childs, Craig Liebenson. Endurance Times for Low Back Stabilization Exercises: Clinical Targets for Testing and Training From a Normal Database. Arch Phys Med Rehabil. 1999 Aug;80(8):941-944.

Case Report

Physiotherapy and Occupational Therapy Journal
Volume 11 Number 2, April - June 2018
DOI: http://dx.doi.org/10.21088/potj.0974.5777.11218.6

Effectiveness of Thoracic Screw Thrust Technique in T4 Syndrome

Girija Murugan[1], Subhash M. Khatri[2]

Abstract

Symptoms of the upper extremity, sometimes, doesn't co-relate with cervical radiculopathy or with peripheral nerve involvement. When an ideal examination excludes the probable diagnosis, comparing the symptoms and its history could possibly lead to the striking remembrance of T4 syndrome. According to Grieve, mobilization of the T4 vertebra, reproduces or eliminates the symptoms. The patient was a 43-year-old lady teacher, presented to the physiotherapy outpatient department, with the chief complaint of neck pain and tingling sensation in the left hand for 6 months. Her pain got aggravated while writing on the blackboard and while lifting weights. And eased with hot water fermentation. No positive findings to rule out for any cervical pathology or peripheral nerve involvement. Thoracic screw thrust technique was adopted to relieve pain and to reduce tingling sensation in the left hand for a patient with T4 syndrome. Following 5 sessions of Thoracic screw thrust technique, her scores of NRS for blackboard writing was reduced from 7/10 to 3/10 and for weight lifting from 8/10 to 3/10. And score for Neck Disability Index reduced from 46% to 35% (Driving domain was excluded). This case report describes the successful application of Thoracic screw thrust technique in T4 syndrome. It will probably establish an evidence of this manual therapy technique in T4 syndrome. This report will possibly also emphasize on the differential diagnosis for neck pain and the requirement of an ideal examination for the same.

Keywords: Neck Pain; T4 Syndrome; Screw Thrust Manipulation.

Introduction

Discovering something out of the box is always challenging. This is exclusively true for thoracic spine. Misdiagnosis of the upper thoracic spine problems as that of cervical origin are common, since subjective and objective examinations of cervical spine can have similar signs and symptoms to that of the upper thoracic. As they are very closely related, with regards to cervical movements [1].

Posture is the key for erect spine. Poor posture, overuse and excessive bending, twisting and lifting can lead to have patients present with change of sensations in the upper extremity, either unilaterally or bilaterally [2,3]. Sometimes, these symptoms don't co-relate with a cervical radiculopathy or with peripheral nerve involvement. Potential contributors to these symptoms could be due to the pathology of thoracic outlet syndrome (TOS) or due toautonomic dysfunction of the sympathetic nervous system.When an ideal examination excludes the probable diagnosis, comparing the symptoms and its history could possibly lead to the striking remembrance of T4 syndrome. Mechanism of the condition is unknown, but it is hypothesized that symptoms are of sympathetic origin [4].

The link between the sympatheticand the somatic nervous system is not clearly understood [2]. Possibly, extreme or persistent postures leads to relative arteriolar ischaemia [4]. This can produce repeated injury and repair, with formation of scar. It can also lead to chronic damage and remain as a potential threat to cause further tissue damage [3]. The sympathetic paravertebral ganglia in the thoracic spine are located near to the costovertebral joints. The sympathetic innervation of the head and the hands overlay at the T4 level. Because of the high mechanical sensitivity of the sympathetic ganglia in

Author Affiliation: [1]Masters Student, Department of Orthopedic Physiotherapy, [2]Principal, Dr. APJ Abdul Kalam College of physiotherapy, Pravara Institute of Medical Sciences, Loni, Ahmednagar, Maharashtra 437376, India.

Reprint Request: Girija Murugan, Masters Student, Department of Orthopedic Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni, Ahmednagar, Maharashtra 437376, India.
E-mail: girijamurugan2106@gmail.com

© Red Flower Publication Pvt. Ltd.

the thoracic spine, this area could be a responsible contributor for the head and hand symptoms [5].

The term T4 syndrome is a clinical pattern that involves upper extremity paraesthesia and pain in glove distribution in the hand/s, with or without symptoms in the head and/or neck or upper thorax. Complaint of altered sensation in his/her hands which could be related to the spinal levels T2 – T7 [4]. Thus, in 1997, Evans laid a recommendation to rename the T4 syndrome into "Upper Thoracic Syndrome". This syndrome is more common in women than men in a ratio of 4:1 and usually occurs above the age of 35 [3,4].

Probably, there are no authentic criteria/s to aid in diagnosis of T4 syndrome. Radiographs also do not assist in the diagnosis, rather they may help to rule out other conditions [6]. But, it has been suggested that mobilization of the T4 vertebra, reproduces or eliminates the symptoms [7]. The following case report describes the successful application of Screw thrust technique in T4 syndrome. It will probably establish an evidence of this manual therapy technique in T4 syndrome. This report will possibly also emphasize on the differential diagnosis for neck pain and the requirement of an ideal examination for the same.

Case Description

History

A 43-year-old female primary school teacher presented to the physiotherapy outpatient department, with the chief complaint of neck pain and tingling sensation in the left hand (not in dermatomal pattern), for 6 months. She is in service for past 23 years and is left handed by dominance. On the first onset of pain, she was advised for non-steroidal anti-inflammatory drugs for pain, by a local practitioner. Her symptoms subsided then. After the recurrence of pain, she visited an Orthopaedican, who prescribed her some medications and advised her for physiotherapy. She had dull aching pain in the neck and left periscapular region associated with tingling sensation in the left hand. Pain gets aggravated while writing on the blackboard and while lifting weights. And eased with hot water fermentation. Pain stopped her from lifting weights and to alter her sleeping position frequently. No other relevant past history or family history.

Physical Examination

Grade 2 tenderness along C4-T5 spinous process. Bilateral upper trapezius spasm. Tender spots along left periscapular region. Painful and restricted cervical range of motion.Spurling's compression test was negative. ULTT for left ulnar, median and radial nerves were negative. No positive findings to rule out for thoracic outlet syndrome or carpel tunnel syndrome.

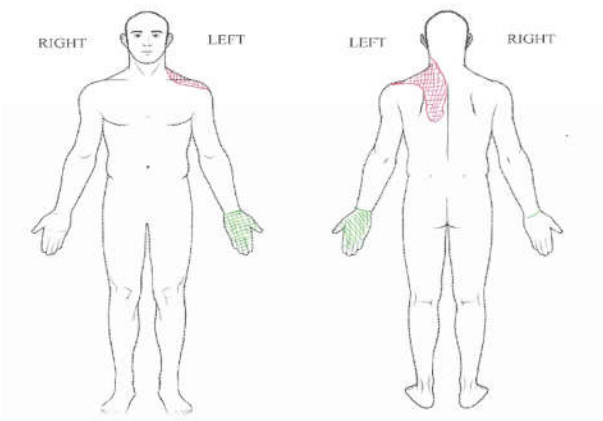


Fig. 1: Patient's Symptom distribution

Investigation

Cervical spine X ray in anteroposterior and lateral views were taken in standing. It revealed a reduced cervical lordosis. No other significant findings were found.

Outcome Measures

The patient's pre-therapy scores of verbal numerical rating scale (NRS) for pain for blackboard writing was 7/10 and for weight lifting was 8/10. Neck Disability Index was 46% (Driving domain was excluded).

Consent

After examination, the therapist explained the findings, about the procedure and the requirement of the procedure. And took her consent in written.

Management

Patient position: Prone lying with pillow under the chest and both the hands held overhead and forehead was resting on the palm of the hands (Normal breathing was ensured).

Procedure

The treatment procedure was explained and her co-operation was requested for. The therapist stood on the right side of the patient. Base of hypothenar

eminence of the therapist's hands are placed just lateral to the spinous process of T4 vertebra (fingers of both the hands are directed in opposite direction). Sustaining a PA glide, therapist's hands are rotated with elbows in extension. Patient was instructed to do inspiration and expiration. And, at the end of expiration, the therapist applied a thoracic screw thrust and listened for a cracking sound during the manipulation. A second thrust was given.

The same procedure was repeated for 5 days, with a brief reassessment every day, before the start of the treatment. A complete reassessment was taken at the end of 5-day treatment. Then, she was given home exercise program for neck range of motion and strengthening exercises.

Post Therapy Scores

Scores of NRS for pain for blackboard writing was 3/10 and for weight lifting was 3/10. Neck Disability Index was 35% (Driving domain was excluded).

Fig. 2: Hand Placement for Thoracic Screw thrust mobilization (Arrows indicates the thrust direction)

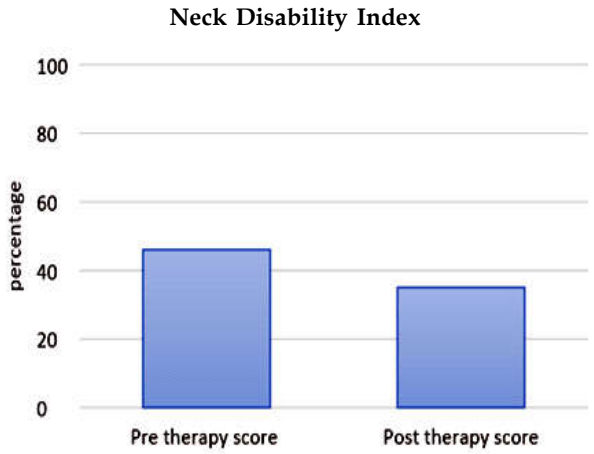


Fig. 3: Neck Disability Index: Reduction in the disability score

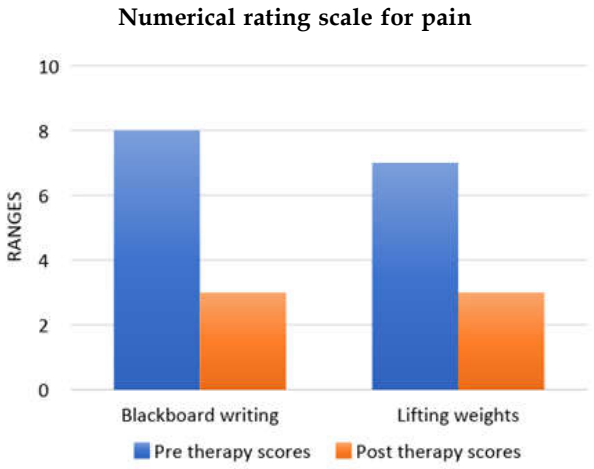


Fig. 4: Reduction in the NRS for Blackboard writing and Lifting weights

Discussion

To the best of our knowledge, this case report is different from previous studies, as this is probably the first attempt to demonstrate the application of thoracic screw thrust technique in T4 syndrome. Also, the evidence concerning the management of T4 syndrome is probably limited. This case report is intended to aid in the resolution of upper limb symptoms experienced in the T4 syndrome through thoracic screw thrust technique.

Mrs. R showed substantial benefit in terms of pain and reduction in tingling sensation in the left hand. Thismight be due to activation of the descending pain inhibitory system projecting from the dorsal periaqueductal gray or by the process in the spinal cord via the gate control theory. It may be also due to the induced reflex inhibition of pain or reflex muscle relaxation by altering the discharge of proprioceptive group I and II afferents [8].

Symptom reduction, may perhaps, also be due to the change in the patient's autonomic activity towards parasympathetic functioning, which could have induced hypoalgesia. The complexity of SNS pathway and variability in symptoms suggest that a more sophisticated model might be required to explain its involvement [9].

But, since, there was pain relief and reduction in tingling sensation in the left hand, within a short span of days, it helped a lot in increasing the patient's confidence in the therapist. It strengthened the therapist- patient relationship and adherence of patient to the treatment.

Conclusion

This case report supports the clinical utility of thoracic screw thrust technique for the treatment of T4 syndrome associated with neck pain.

Limitations and Recommendations

Results of a case studycannot be generalised in a larger sample size. Further research is needed to explore thecomparison of thoracic mobilisation and manipulation in T4 syndrome. Follow up of the patient was not done. Long term effectiveness could be studied to provide a better understanding of the treatment parameters.

References

1. Missed upper thoracic syndrome. Apple Cart: Core Concepts musculoskeletal group newsletter. 2010. Available from http://www.coreconcepts.com.sg/wp-content/uploads/Clinic-Newsletter-2010-05.pdf, viewed on 20/11/2017.
2. Conroy JL, Schneiders AG. The T4 syndrome. Manual therapy. 2005;10:292-96. Available from PMID:16253863 DOI:10.1016/j.math.2005.01.007.
3. Evans P. The T4: syndrome some basic science aspects. Physiotherapy 1997;83(4):186-9. Available from DOI: http://dx.doi.org/10.1016/S0031-9406(05)66077-4.
4. Librone P, Kalantarov E. Resolution of T4 Syndrome Following Chiropractic Care: A Case Report. Vertebral Subluxation Res. 2014.pp.161-8.
5. Löscher S. T4 syndrome – examination, treatment and an update of the literature. IMTA Blog. Available from https://www.imta.ch/en/blog/post/t4-syndrome-examination-treatment-and-an-update-of-the-literature/, viewed on 20/11/2017.
6. DeFranca CG, Levine LJ. The T4 syndrome. J Manipulative Physiol Ther 1995;18(1):34–7. Available from PMID: 7706958.
7. Grieve GP. The autonomic system in vertebral pain syndromes. In: Grieve GP, editor. Common vertebral joint problems. 2nd ed. Edinburgh, Scotland: Churchill Livingstone; 1988.pp.319–29 ch 7.
8. Jowsey P, Perry J. Sympathetic nervous system effects in the hands following a grade III postero-anterior rotatory mobilisation technique applied to T4: A randomised, placebo-controlled trial. Man Ther. 2010;10:248–53. Available from PMID:20093065 DOI: 10.1016/j.math.2009.12.008.
9. Hirai PM, Thomson OP. T4 syndrome. A distinct theoretical concept or elusive clinical entity? A case report. J Bodyw Mov Ther. 2016;20:722-7. Available from DOI: http://dx.doi.org/10.1016/j.jbmt.2016.06.008.

Guidelines for Authors

Manuscripts must be prepared in accordance with "Uniform requirements for Manuscripts submitted to Biomedical Journal" developed by international committee of medical Journal Editors.

Types of Manuscripts and Limits

Original articles: Up to 3000 words excluding references and abstract and up to 10 references.

Review articles: Up to 2500 words excluding references and abstract and up to 10 references.

Case reports: Up to 1000 words excluding references and abstract and up to 10 references.

Online Submission of the Manuscripts

Articles can also be submitted online from http://rfppl.co.in/customer_index.php.

I) First Page File: Prepare the title page, covering letter, acknowledgement, etc. using a word processor program. All information which can reveal your identity should be here. use text/rtf/doc/PDF files. Do not zip the files.

2) Article file: The main text of the article, beginning from Abstract till References (including tables) should be in this file. Do not include any information (such as acknowledgement, your name in page headers, etc.) in this file. Use text/rtf/doc/PDF files. Do not zip the files. Limit the file size to 400 Kb. Do not incorporate images in the file. If file size is large, graphs can be submitted as images separately without incorporating them in the article file to reduce the size of the file.

3) Images: Submit good quality color images. Each image should be less than 100 Kb in size. Size of the image can be reduced by decreasing the actual height and width of the images (keep up to 400 pixels or 3 inches). All image formats (jpeg, tiff, gif, bmp, png, eps etc.) are acceptable; jpeg is most suitable.

Legends: Legends for the figures/images should be included at the end of the article file.

If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks from submission. Hard copies of the images (3 sets), for articles submitted online, should be sent to the journal office at the time of submission of a revised manuscript. Editorial office: Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091, India, Phone: 91-11-22754205, 45796900, 22756995. E-mail: author@rfppl.co.in. Submission page: http://rfppl.co.in/article_submission_system.php?mid=5.

Preparation of the Manuscript

The text of observational and experimental articles should be divided into sections with the headings: Introduction, Methods, Results, Discussion, References, Tables, Figures, Figure legends, and Acknowledgment. Do not make subheadings in these sections.

Title Page

The title page should carry

1) Type of manuscript (e.g. Original article, Review article, Case Report)
2) The title of the article, should be concise and informative;
3) Running title or short title not more than 50 characters;
4) The name by which each contributor is known (Last name, First name and initials of middle name), with his or her highest academic degree(s) and institutional affiliation;
5) The name of the department(s) and institution(s) to which the work should be attributed;
6) The name, address, phone numbers, facsimile numbers and e-mail address of the contributor responsible for correspondence about the manuscript; should be mentoined.
7) The total number of pages, total number of photographs and word counts separately for abstract and for the text (excluding the references and abstract);
8) Source(s) of support in the form of grants, equipment, drugs, or all of these;
9) Acknowledgement, if any; and
l0) If the manuscript was presented as part at a meeting, the organization, place, and exact date on which it was read.

Abstract Page

The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

Introduction

State the background of the study and purpose of the study and summarize the rationale for the study or observation.

Methods

The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

Reports of randomized clinical trials should be based on the CONSORT Statement (http://www.consort-statement. org). When reporting experiments on human subjects, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000 (available at http://www.wma.net/e/policy/l 7-c_e.html).

Results

Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

Discussion

Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

References

List references in alphabetical order. Each listed reference should be cited in text (not in alphabetic order), and each text citation should be listed in the References section. Identify references in text, tables, and legends by Arabic numerals in square bracket (e.g. [10]). Please refer to ICMJE Guidelines (http://www.nlm.nih.gov/bsd/uniform_requirements.html) for more examples.

Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O, Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

More information about other reference types is available at www.nlm.nih.gov/bsd/uniform_requirements.html, but observes some minor deviations (no full stop after journal title, no issue or date after volume, etc).

Tables

Tables should be self-explanatory and should not duplicate textual material.

Tables with more than 10 columns and 25 rows are not acceptable.

Table numbers should be in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.

Explain in footnotes all non-standard abbreviations that are used in each table.

For footnotes use the following symbols, in this sequence: *, ¶, †, ‡‡,

Illustrations (Figures)

Graphics files are welcome if supplied as Tiff, EPS, or PowerPoint files of minimum 1200x1600 pixel size. The minimum line weight for line art is 0.5 point for optimal printing.

When possible, please place symbol legends below the figure instead of to the side.

Original color figures can be printed in color at the editor's and publisher's discretion provided the author agrees to pay.

Type or print out legends (maximum 40 words, excluding the credit line) for illustrations using double spacing, with Arabic numerals corresponding to the illustrations.

Sending a revised manuscript

While submitting a revised manuscript, contributors are requested to include, along with single copy of the final revised manuscript, a photocopy of the revised manuscript with the changes underlined in red and copy of the comments with the point to point clarification to each comment. The manuscript number should be written on each of these documents. If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks of submission. Hard copies of images should be sent to the office of the journal. There is no need to send printed manuscript for articles submitted online.

Reprints

Journal provides no free printed reprints, however a author copy is sent to the main author and additional copies are available on payment (ask to the journal office).

Copyrights

The whole of the literary matter in the journal is copyright and cannot be reproduced without the written permission.

Declaration

A declaration should be submitted stating that the manuscript represents valid work and that neither this manuscript nor one with substantially similar content under the present authorship has been published or is being considered for publication elsewhere and the authorship of this article will not be contested by any one whose name (s) is/are not listed here, and that the order of authorship as placed in the manuscript is final and accepted by the co-authors. Declarations should be signed by all the authors in the order in which they are mentioned in the original manuscript. Matters appearing in the Journal are covered by copyright but no objection will be made to their reproduction provided permission is obtained from the Editor prior to publication and due acknowledgment of the source is made.

Approval of Ethics Committee

We need the Ethics committee approval letter from an Institutional ethical committee (IEC) or an institutional review board (IRB) to publish your Research article or author should submit a statement that the study does not require ethics approval along with evidence. The evidence could either be consent from patients is available and there are no ethics issues in the paper or a letter from an IRB stating that the study in question does not require ethics approval.

Abbreviations

Standard abbreviations should be used and be spelt out when first used in the text. Abbreviations should not be used in the title or abstract.

Checklist

- Manuscript Title
- Covering letter: Signed by all contributors
- Previous publication/ presentations mentioned, Source of funding mentioned
- Conflicts of interest disclosed

Authors

- Middle name initials provided.
- Author for correspondence, with e-mail address provided.
- Number of contributors restricted as per the instructions.
- Identity not revealed in paper except title page (e.g. name of the institute in Methods, citing previous study as 'our study')

Presentation and Format

- Double spacing
- Margins 2.5 cm from all four sides
- Title page contains all the desired information. Running title provided (not more than 50 characters)
- Abstract page contains the full title of the manuscript
- Abstract provided: Structured abstract provided for an original article.
- Key words provided (three or more)
- Introduction of 75-100 words
- Headings in title case (not ALL CAPITALS). References cited in square brackets
- References according to the journal's instructions

Language and grammar

- Uniformly American English
- Abbreviations spelt out in full for the first time. Numerals from 1 to l0 spelt out
- Numerals at the beginning of the sentence spelt out

Tables and figures

- No repetition of data in tables and graphs and in text.
- Actual numbers from which graphs drawn, provided.
- Figures necessary and of good quality (color)
- Table and figure numbers in Arabic letters (not Roman).
- Labels pasted on back of the photographs (no names written)
- Figure legends provided (not more than 40 words)
- Patients' privacy maintained, (if not permission taken)
- Credit note for borrowed figures/tables provided
- Manuscript provided on a CDROM (with double spacing)

Submitting the Manuscript

- Is the journal editor's contact information current?
- Is the cover letter included with the manuscript? Does the letter:

1. Include the author's postal address, e-mail address, telephone number, and fax number for future correspondence?
2. State that the manuscript is original, not previously published, and not under concurrent consideration elsewhere?
3. Inform the journal editor of the existence of any similar published manuscripts written by the author?
4. Mention any supplemental material you are submitting for the online version of your article. Contributors' Form (to be modified as applicable and one signed copy attached with the manuscript)

Instructions to Authors

Submission to the journal must comply with the Guidelines for Authors.

Non-compliant submission will be returned to the author for correction.

To access the online submission system and for the most up-to-date version of the Guide for Authors please visit:

http://www.rfppl.co.in

Technical problems or general questions on publishing with POTJ are supported by Red Flower Publication Pvt. Ltd's Author Support team (http://rfppl.co.in/article_submission_system.php?mid=5#)

Alternatively, please contact the Journal's Editorial Office for further assistance.

Editorial Manager

Red Flower Publication Pvt. Ltd.

48/41-42, DSIDC, Pocket-II

Mayur Vihar Phase-I

Delhi - 110 091(India)

Phone: 91-11-22754205, 45796900, 22756995, Cell: +91-9821671871

E-mail: author@rfppl.co.in

Revised Rates for 2018 (Institutional)

Title	Frequency	Rate (Rs): India		Rate ($):ROW	
Community and Public Health Nursing	Triannual	5500	5000	430	391
Dermatology International	Semiannual	5500	5000	430	391
Gastroenterology International	Semiannual	6000	5500	469	430
Indian Journal of Agriculture Business	Semiannual	5500	5000	413	375
Indian Journal of Anatomy	Bi-monthly	8500	8000	664	625
Indian Journal of Ancient Medicine and Yoga	Quarterly	8000	7500	625	586
Indian Journal of Anesthesia and Analgesia	Monthly	7500	7000	586	547
Indian Journal of Biology	Semiannual	5500	5000	430	391
Indian Journal of Cancer Education and Research	Semiannual	9000	8500	703	664
Indian Journal of Communicable Diseases	Semiannual	8500	8000	664	625
Indian Journal of Dental Education	Quarterly	5500	5000	430	391
Indian Journal of Emergency Medicine	Quarterly	12500	12000	977	938
Indian Journal of Forensic Medicine and Pathology	Quarterly	16000	15500	1250	1211
Indian Journal of Forensic Odontology	Semiannual	5500	5000	430	391
Indian Journal of Genetics and Molecular Research	Semiannual	7000	6500	547	508
Indian Journal of Hospital Administration	Semiannual	7000	6500	547	508
Indian Journal of Hospital Infection	Semiannual	12500	12000	938	901
Indian Journal of Law and Human Behavior	Semiannual	6000	5500	469	430
Indian Journal of Legal Medicine	Semiannual				
Indian Journal of Library and Information Science	Triannual	9500	9000	742	703
Indian Journal of Maternal-Fetal & Neonatal Medicine	Semiannual	9500	9000	742	703
Indian Journal of Medical & Health Sciences	Semiannual	7000	6500	547	508
Indian Journal of Obstetrics and Gynecology	Bi-monthly	9500	9000	742	703
Indian Journal of Pathology: Research and Practice	Monthly	12000	11500	938	898
Indian Journal of Plant and Soil	Semiannual	65500	65000	5117	5078
Indian Journal of Preventive Medicine	Semiannual	7000	6500	547	508
Indian Journal of Research in Anthropology	Semiannual	12500	12000	977	938
Indian Journal of Surgical Nursing	Triannual	5500	5000	430	391
Indian Journal of Trauma & Emergency Pediatrics	Quarterly	9500	9000	742	703
Indian Journal of Waste Management	Semiannual	9500	8500	742	664
International Journal of Food, Nutrition & Dietetics	Triannual	5500	5000	430	391
International Journal of Neurology and Neurosurgery	Quarterly	10500	10000	820	781
International Journal of Pediatric Nursing	Triannual	5500	5000	430	391
International Journal of Political Science	Semiannual	6000	5500	450	413
International Journal of Practical Nursing	Triannual	5500	5000	430	391
International Physiology	Triannual	7500	7000	586	547
Journal of Animal Feed Science and Technology	Semiannual	78500	78000	6133	6094
Journal of Cardiovascular Medicine and Surgery	Quarterly	10000	9500	781	742
Journal of Forensic Chemistry and Toxicology	Semiannual	9500	9000	742	703
Journal of Geriatric Nursing	Semiannual	5500	5000	430	391
Journal of Global Public Health	Semiannual				
Journal of Microbiology and Related Research	Semiannual	8500	8000	664	625
Journal of Nurse Midwifery and Maternal Health	Triannual	5500	5000	430	391
Journal of Organ Transplantation	Semiannual	26400	25900	2063	2023
Journal of Orthopaedic Education	Triannual	5500	5000	430	391
Journal of Pharmaceutical and Medicinal Chemistry	Semiannual	16500	16000	1289	1250
Journal of Practical Biochemistry and Biophysics	Semiannual	7000	6500	547	508
Journal of Psychiatric Nursing	Triannual	5500	5000	430	391
Journal of Social Welfare and Management	Triannual	7500	7000	586	547
New Indian Journal of Surgery	Bi-monthly	8000	7500	625	586
Ophthalmology and Allied Sciences	Triannual	6000	5500	469	430
Otolaryngology International	Semiannual	5500	5000	430	391
Pediatric Education and Research	Triannual	7500	7000	586	547
Physiotherapy and Occupational Therapy Journal	Quarterly	9000	8500	703	664
RFP Indian Journal of Medical Psychiatry	Semiannual	8000	7500	625	586
Urology, Nephrology and Andrology International	Semiannual	7500	7000	586	547

Terms of Supply:

1. Agency discount 10%. Issues will be sent directly to the end user, otherwise foreign rates will be charged.
2. All back volumes of all journals are available at current rates.
3. All Journals are available free online with print order within the subscription period.
4. All legal disputes subject to Delhi jurisdiction.
5. Cancellations are not accepted orders once processed.
6. Demand draft / cheque should be issued in favour of "Red Flower Publication Pvt. Ltd." payable at Delhi
7. Full pre-payment is required. It can be done through online (http://rfppl.co.in/subscribe.php?mid=7).
8. No claims will be entertained if not reported within 6 months of the publishing date.
9. Orders and payments are to be sent to our office address as given above.
10. Postage & Handling is included in the subscription rates.
11. Subscription period is accepted on calendar year basis (i.e. Jan to Dec). However orders may be placed any time throughout the year.

Order from
Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi - 110 091 (India), Tel: 91-11-22754205, 45796900, Fax: 91-11-22754205. E-mail: sales@rfppl.co.in, Website: www.rfppl.co.in