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Original Article

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Robotic Training for Upper Limb Rehabilitation

Anusha Sampath*, Savita Tamaria*, Smriti Singh*

Abstract

This paper discusses the benefits of Robotic therapy for upper limb rehabilitation in patients post stroke. Rehabilitation robotics is a field of research dedicated to understanding and augmenting rehabilitation through the application of robotic devices. Robots can be used to generate objective measures of patient's impairment and therapy outcome, assist in diagnosis, customize therapies based on patient's motor abilities, and assure compliance with treatment regimens and maintain patient's records. It is shown in many studies that there is a significant improvement in upper limb motor function after stroke using robotics for upper limb rehabilitation.

Keywords: Cerebro-vascular accident; Upper limb rehabilitation; Robotic therapy.

Introduction

Limb impairment can be a serious impediment to a person being able to independently perform the activities of daily living. This can have a negative effect on their quality of life. One of the primary causes of limb impairment is stroke.[1]

Stroke or cerebral vascular accident, is the sudden death of brain cell due to inadequate blood flow. The WHO clinically defines stroke as the rapid development of clinical signs and symptoms of focal neurological disturbance lasting for more than 24 hours, or leading to death with no apparent cause other than of vascular origin (WHO 2005). Stroke increases with age, individual Indian studies have estimated that the prevalence rates increases from 21/100,000 for the 20-40 age group to 625/100,000 in the 60+ year age group (Ghamija *et al* 2000).[2]

Although prospective epidemiological studies are lacking, findings of several longitudinal studies indicate that in 30% to 66% of hemiplegic stroke patients, the paretic arm remains without function when measured 6 months after stroke, whereas only 5% to 20% demonstrate complete functional recovery.[3]

It was also found in many studies that, 30% to 60% of patients treated with traditional rehabilitation, a residual functional impairment of the paretic arm and consequently of ADLs is common. There is strong evidence that intensity as well as task specificity are the main drivers in an effective treatment program after stroke. In addition, this training should be repetitive, functional, meaningful, and challenging for a patient.[4,5]

Although occupational and physical therapies are widely accepted treatments for upper extremity dysfunction in stroke patients, they are labor intensive and therefore expensive.6 Applying robot-assisted therapy enables patients to practice intensively with their upper paretic limb.[5,7]

Robots can be used to generate objective measures of patient's impairment and therapy outcome, assist in diagnosis, customize therapies based on patient's motor abilities,

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and assure compliance with treatment regimens and maintain patient's records.[6]

Systematic review confirms the potential for robotic assisted devices to elicit improvements in upper limb function.[5,8]

Moreover virtual reality provided a unique medium where therapy can be provided within a functional, purposeful and motivating context and can be readily graded and documented.[9]

For the upper extremity, the most employed and deployed therapeutic robot is the MIT-Manus.[10,11,12] Many other devices have been designed to deliver arm therapy in individuals with stroke, like the ARM Guide (Assisted Rehabilitation and Measurement guide)[13], the MIME (Mirror-Image Motion Enabler)[14,15], the InMotion Shoulder-Elbow Robot[3,16], and the Bi- Manu-Track[17] were tested in at least 1 RCT.

The MITMANUS is a robot that allows subjects to execute reaching movements in the horizontal plane. This 2 degrees of freedom (DoF) robot enables unrestricted movements of the shoulder and elbow joints.[10] The ARM Guide is a trombone-like device and has 4 controlled DoF.[13] The MIME robot consists of a 6-DoF robot arm. The robot enables the bilateral practice of a 3-DoF shoulder-elbow movement, whereby the nonparetic arm guides the paretic arm.[18] The InMotion Shoulder-Elbow Robot, which is the commercial version of MIT-MANUS, has 2 DoF and provides shoulder elbow training in the horizontal plane with a supported forearm.[16] The Bi-Manu-Track is designed to specifically train distal arm movements by practicing bilateral elbow pronation and supination as well as wrist flexion and extension in a mirror or parallel fashion.[17] NeReBot allows to train in the acute and post–acute stroke phase of the patient on 3-dimensional movements of the arm (flexion and extension, pronation and supination, adduction and abduction, circumduction), not only while sitting but also in the supine position.

Robots can be used in a local or domestic setting, for this it has a number of features that are not required for robots intended primarily for use in a specialist rehabilitation centre setting. These include low cost, portability, robustness and a strong emphasis on safety and also allowing to monitor patient progress. These variables can be adjusted by a therapist throughout the course of rehabilitation therapy to optimize patient recovery post stroke.1 Robot-based assessment measures are highly repeatable, have the potential to detect smaller changes than standard manual assessment measures and could potentially reduce the time it takes to administer an assessment.[19,20]

Types

There are two types of rehabilitation robot from the mechanical design point of view:

1) End-effector based robots
2) exoskeleton-type robots.

MIT-MANUS is an example to the end-effector based robots, which interacted with subjects at the end of robot arm.[12] The design of end-effector could adapt to subjects with different body size. While exoskeleton-type robots can resemble human anatomy and apply torque to specific joints, moreover, the working-space of the rehabilitation training provided by such kinds of exoskeletons could approximate the working-space performed by human subjects.[21,22]

Control strategy is another important factor to affect the training effect of robot-aided rehabilitation. MIT-MANUS applied impedance control in the robot-assisted upper limb rehabilitation, and it could keep a compliant trajectory under perturbation and promote interaction between subject and robotic system.[12]

The important feature of MIME was that patients could use the unaffected sides to control the affected sides to practice mirror-image movement by a bimanual position feedback strategy. The admittance control could facilitate the movement with providing target position, velocity, and acceleration

based on interactive torque.[23]

Recent studies show that mechanical help from robotic system should better not be conducted in a passive mode, and 'assist-as-needed' help is provided to promote brain reorganization.[24,25]

Recently, many researchers used EMG signals to continuously control exoskeleton-type robots. These robots were designed like human's joints and could be worn by the human operators as an assistive devices. The systems were under the voluntary control, functioning like additional muscle groups to provide additional forces.[26,27,28,29,30]

Method

Dosage in stroke rehabilitation trials usually uses the duration-based measure of therapy and provides the information regarding the amount of minutes or days per week of therapy provided.[16] Most Randomized trials have offered the treatment in sessions lasting 30 minutes to 1.5 hours, with 3 to 5 sessions per week for 3 to 8 weeks.[31,32,18,33]

According to a recent research, performing about 300 repetitions of task specific UE training per session was feasible in stroke rehabilitation.[34] Even greater duration or intensity of rehabilitation resulted in more functional improvement.[35]

Studies

Yu-wei Hsieh *et al* did a pilot randomized study on 18 patients to find the effects of Treatment Intensity in Upper Limb Robot-Assisted Therapy for Chronic Stroke patients. Patients were randomly divided into 3 groups, with each group receiving higher intensity Robotic therapy, lower intensity Robotic Therapy using Bi-Manu track and conventional therapy respectively. It was found that patients in the higher intensity Robotic Therapy group had better outcomes than those in the lower intensity RT group and the CR group on UE motor function, muscle strength, performance of daily function, and bimanual ability function, muscle strength, performance of daily function, and bimanual ability.[36]

Caitlyn Bosecker et al did a study on 111 community-dwelling volunteers who had suffered a stroke, to test the performance of linear regression models to estimate clinical scores for the upper extremity from systematic robot-based metrics. The subjects were trained for 18 hours with the InMotion robot. Twenty kinematic and kinetic metrics were derived from movement data recorded with the shoulder-and elbow InMotion robot. Kinematic metrics were aggregated into macro-metrics and micro-metrics and collected from 111 chronic stroke subjects. It was found in this study that in addition to delivering high-intensity, reproducible sensorimotor therapy, these devices are precise and reliable "measuring" tools that can be expanded with multiple sensors to record simultaneously kinematic and force data. These measurements are objective and repeatable and can be used to provide patients and therapists with immediate measures of motor performance. Reducing the time to evaluate improvement or deterioration and ultimately increasing the efficiency of patient's care.[37]

Rong Song *et al* did a study to evaluate the feasibility of robot-assisted rehabilitation using myoelectric control on upper limb motor recovery. Sixteen subjects after stroke had been recruited for evaluating the tracking performance and therapeutical effects of myoelectrically controlled robotic system. In this study, an exoskeleton-type rehabilitation robotic system was designed to provide voluntarily controlled assisted torque to the affected wrist. Voluntary intention was involved by using the residual surface electromyography from flexor carpi radialis and extensor carpi radialis on the affected limb to control the mechanical assistance provided by the robotic system during wrist flexion and extension in a 20- session training. The system also applied constant resistant torque to the affected wrist during the training. The study results indicate that robot-aided therapy with

voluntary participation of patient's paretic motor system using myoelectric control might have positive effect on upper limb motor recovery.[38]

Antonio Frisoli *et al* did a study in a group of nine chronic stroke patients with right-side hemiparesis. In this study the effects of a robotic-assisted rehabilitation training with an upper limb robotic exoskeleton for the restoration of motor function in spatial reaching movements were investigated. The robotic assisted rehabilitation training was administered for a period of 6 weeks including reaching and spatial antigravity movements. To assess the carry-over of the observed improvements in movement during training into improved function, a kinesiologic assessment of the effects of the training was performed by means of motion and dynamic electromyographic analysis of reaching movements performed before and after training. The robot aided training showed a statistical significant improvements of kinesiologic (movement time, smoothness of motion) and clinical parameters, as a result of the increased active ranges of motion and improved co-contraction index for shoulder extension/flexion. These changes can be explained as a result of the motor recovery induced by the robotic training, in terms of regained ability to execute single joint movements and of improved interjoint coordination of elbow and shoulder joints.[39]

Stefano Masiero *et al* did a Randomized control Trial on 34 hemiparetic patients to find the effectiveness of a Robotic Assistive Device (NeReBot) for the Upper Extremity During Early Inpatient Stroke Rehabilitation. All participants received a total daily rehabilitation treatment for 120 minutes, 5 days per week for 5 weeks. The control group received standard therapy for the upper limb. The experimental group received standard therapy (65% of exercise time) associated with robotic training (35% of exercise time). It was concluded that, the robot therapy by NeReBot did not lead to better outcomes compared with conventional inpatient rehabilitation.[40]

Federica Bovolenta *et al* did a pilot study which aimed at verifying the improvement on the motor impairment and functionality in 19 patients with chronic hemiparesis after stroke treated with a robot-aided rehabilitation protocol using the ReoGo system (Motorika Medical Ltd, Israel). The treatment consisted of a total of 20 sessions lasting 45 minutes each, 5 days a week, for a total period of 4 weeks. Evaluations were done immediately before and after treatment and 1 month after cessation of the treatment. This pilot study led to the finding of a clinical improvement and excellent patients compliance.[41]

Gert Kwakkel *et al* did a review involving 218 patients shows a positive trend toward robot-assisted therapy for the proximal upper limb when compared with conventional treatment modalities with regard to motor recovery when measured with the FM assessment scale (FMA) or the arm and hand impairment part of the Chedoke- McMaster Stroke Assessment Scale (CMSA).[11]

References

1. Stephen Curran, Nigel J Kent, David Kennedy, James Conlon. Development of a Robotic Platform for Upper Limb Rehabilitation. Department of Mechanical Engineering, Dublin Institute of Technology.
2. Ghamija R, Mittal S, Bansal B. Trends in Clinico-epidemiological correlates of stroke in the community. *J Indian Acad Clin Med*. 2000; 5(1): 28-31.
3. Kwakkel G, Kollen BJ, van der Grond J, Prevo AJ. Probability of regaining dexterity in the flaccid upper limb: impact of severity of paresis and time since onset in acute stroke. *Stroke*. 2003; 34: 2181-2186.
4. Van Peppen RP, Kwakkel G, Wood-Dauphinee S, Hendriks HJ, Van der Wees PJ, Dekker J. The impact of physical therapy on functional outcomes after stroke: what's the evidence? *Clin Rehabil*. 2004; 18: 833-862.
5. Kwakkel G, Kollen BJ, Lindeman E. Understanding the pattern of functional recovery after stroke: facts and theories. *Restor*

Neurol Neurosci. 2004; 22: 281-299.

6. Caitlyn Bosecker Laura Dipietro, Bruce Volpe, and Hermano Igo Krebs. Kinematic Robot-Based Evaluation Scales and Clinical Counterparts to Measure Upper Limb Motor Performance in Patients with Chronic Stroke. *Neurorehabil Neural Repair*. 2010; 24: 62.
7. Butefisch C, Humelsheim H, Denzler P,Mauritz KH. Repetitive training of isolated movements improves the outcome of motor rehabilitation of the centrally paretic hand. *J Neurol Sci*. 1995; 130: 56-68.
8. Timmermans AA, Seelen HA, Willmann RD, Kingma H: Technology-assisted training of arm-hand skills in stroke: concepts on reacquisition of motor control and therapist guidelines for rehabilitation technology design. *J Neuroeng Rehabil*. 2009; 6: 1–18.
9. Sveistrup H. Motor rehabilitation using virtual reality. *J NeuroEng Rehabil*. 2004; 1(1): 10.
10. Krebs HI, Hogan N, Aisen ML, Volpe BT. Robot-aided neurorehabilitation. *IEEE Trans Rehabil Eng*. 1998; 6: 75-87.
11. Kwakkel G, Kollen BJ, Krebs HI. Effects of Robot-Assisted Therapy on Upper Limb Recovery after Stroke: A Systematic Review. *Neurorehabil Neural Repair*. 2008; 22: 111–121.
12. Krebs HI,Volpe BT,Aisen ML,Hogan N. Increasing productivity and quality of care: robotic-aided neurorehabilitation. *J Rehabil Res Dev*. 2000; 37: 639-652.
13. Reinkensmeyer DJ, Kahn LE, Averbuch M, McKenna-Cole AN, Schmit BD, Rymer WZ. Understanding and treating arm movement impairment after chronic brain injury: progress with the ARM Guide. *J Rehabil Res Dev*. 2000; 37: 653-662.
14. Burgar CG, Lum PS, Shor PC, Van der Loos HFM. Development of robots for rehabilitation therapy: the Palo Alto VA/Stanford experience. *J Rehabil Res Dev*. 2000; 37: 663-673.
15. Lum PS, Burgar CG, Shor PC. Evidence for improved muscle activation patterns after retraining of reaching movements with the MIME robotic system in subjects with post-stroke hemiparesis. *IEEE Trans Neural Syst Rehabil Eng*. 2004; 12: 186-194.
16. Daly JJ, Hogan N, Perepezko EM, *et al*. Response to upper-limb robotics and functional neuromuscular stimulation following stroke. *J Rehabil Res Dev*. 2005; 42(6): 723-736.
17. Basmajian JV, Gowland CA, Finlayson AJ, Hall AL, Swanson LR, Stratford PW. Stroke treatment: comparison of integrated behavioural physical therapy vs. traditional physical therapy programs. *Arch Phys Med Rehabil*. 1987; 68: 276-272.
18. Lum PS, Burgar CG, Shor PC, Majmundar M, Van der Loos M. Robot-assisted movement training compared with conventional therapy techniques for the rehabilitation of upper-limb motor function after stroke. *Arch Phys Med Rehabil*. 2002; 83(7): 952-959.
19. Bosecker C *et al*. Kinematic Robot-Based Evaluation Scales and Clinical Counterparts to Measure Upper Limb Motor Performance in Patients With Chronic Stroke. *Neurorehabilitation and Neural Repair*. 24(1): 62-69.
20. Margaret A. Finley, Laura Dipietro, Jill Ohlhoff, Leah MacClellan, Christine Meister, Jill Whitall, Richard Macko, Christopher T. Bever, Hermano I. Krebs, Neville Hogan, Short-duration robotic therapy in stroke patients with severe upper-limb motor impairment. *Journal of Rehabilitation Research & Development*. 2005; 42: 683-692.
21. Banala SK, Agrawal SK, Seok HK, Scholz JP. Novel gait adaptation and neuromotor training results using an active Leg exoskeleton. *IEEE/ASME Trans Mechatronics*. 2010; 15: 216–225.
22. Kyoungchul K, Tomizuka M. Control of exoskeletons inspired by fictitious gain in human model. *IEEE/ASME Trans Mechatronics*. 2009; 14: 689–698.
23. Colombo R, Pisano F, Micera S, Mazzone A, Delconte C, Carrozza MC, Dario P, Minuco G. Robotic techniques for upper limb evaluation and rehabilitation of stroke patients. *IEEE Trans Neural Syst Rehabil Eng*. 2005; 13(3): 311–324.
24. Aoyagi D, Ichinose WE, Harkema SJ, Reinkensmeyer DJ, Bobrow JE. A robot and control algorithm that can synchronously assist in naturalistic motion during body weight supported gait training following neurologic injury. *IEEE Trans Neural Syst Rehabil Eng*. 2007; 15(3): 387–400.
25. Marchal CL, Reinkensmeyer DJ. Review of control strategies for robotic movement

training after neurologic injury. J Neuroeng Rehabil 2009, 6:20.

26. Rosen J, Brand M, Fuchs MB, Arcan M. A myosignal-based powered exoskeleton system. *IEEE Trans Systerms, Man, and Cybernetics*. 2001; 31(3): 210–212.
27. Rosen J, Fuchs MB, Arcan M. Performances of hill-type and neural network muscle models—towards a myosignal based exoskeleton. *Comput Biomed Res.* 1999; 32: 415–439.
28. Cheng HS, Ju MS, Lin CCK. Improving elbow torque output of stroke patients with assistive torque controlled by EMG signals. *J Biomech Eng*. 2003; 125: 881–886.
29. Song R, Tong KY, Hu X, Li L. Assistive control system using continuous myoelectric signal in robot-aided arm training for patients after stroke. *IEEE Trans Neural Syst Rehabil Eng*. 2008; 16(4): 371–379.
30. Hu XL, Tong KY, Song R, Tsang VS, Leung PO, Li L. Variation of muscle coactivation patterns in chronic stroke during robot-assisted elbow training. *Arch Phys Med Rehabil.* 2007; 88: 1022–1029.
31. Hesse S, Werner C, Pohl M, Rueckriem S, Mehrholz J, Lingnau ML. Computerized arm training improves the motor control of the severely affected arm after stroke: a single-blinded randomized trial in two centers. *Stroke*. 2005; 36: 1960-1966.
32. Kahn LE, Zygman ML, Rymer WZ, Reinkensmeyer DJ. Robot-assisted reaching exercise promotes arm movement recovery in chronic hemiparetic stroke: a randomized controlled pilot study. *J Neuroeng Rehabil*. 2006; 3: 12.
33. Volpe BT, Lynch D, Rykman-Berland A, *et al*. Intensive sensorimotor arm training mediated by therapist or robot improves hemiparesis in patients with chronic stroke. *Neurorehabil Neural Repair*. 2008; 22: 305-310.
34. Birkenmeier RL, Prager EM, Lang CE. Translating animal doses of task-specific training to people with chronic stroke in 1-hour therapy sessions: a proof-of-concept study. *Neurorehabil Neural Repair*. 2010; 24: 620-635.
35. Byl NN, Pitsch EA, Abrams GM. Functional outcomes can vary by dose: learning-based sensorimotor training for patients poststroke. *Neurorehabil Neural Repair*. 2008; 22: 494-504.
36. Yu-wei Hsieh, Ching-yi Wu, Wan-wen Liao, Keh-chung Lin, Kuen-yuh Wu, and Chia-yi Lee. Effects of Treatment Intensity in Upper Limb Robot-Assisted Therapy for Chronic Stroke: A Pilot Randomized Controlled Trial. *Neurorehabilitation and Neural Repair*. 2011; 25(6): 503–511.
37. Caitlyn Bosecker, Laura Dipietro, Bruce Volpe, and Hermano Igo Krebs. Kinematic Robot-Based Evaluation Scales and Clinical Counterparts to Measure Upper Limb Motor Performance in Patients With Chronic Stroke. *Neurorehabil Neural Repair*. 2010; 24: 62.
38. Rong Song, Kai-yu Tong, Xiaoling Hu and Wei Zho. Myoelectrically controlled wrist robot for stroke Rehabilitation. *Journal of NeuroEngineering and Rehabilitation*. 2013; 10: 52.
39. Antonio Frisoli, Caterina Procopio. Positive effects of robotic exoskeleton training of upper limb reaching movements after stroke. *Journal of NeuroEngineering and Rehabilitation*. 2012; 9: 36.
40. Stefano Masiero, Mario Armani. Trial of a Robotic Assistive Device for the Upper Extremity During Early Inpatient Stroke Rehabilitation. *Neurorehabilitation and Neural Repair*. 2014; 28(4): 377–386.
41. Federica Bovolenta, Patrizio Sale. Robot-aided therapy for upper limbs in patients with stroke-related lesions. Brief report of a clinical experience. *Journal of NeuroEngineering and Rehabilitation*. 2011; 8: 18.

Original Article

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Integrated Neuromuscular Inhibition Technique Reduces Pain Intensity on Upper Trapezius Myofascial Trigger Point

Varun K. Singh*, V. Prem, H. Karvanan*****

Abstract

Objective: The objective of the study was to examine the effect of integrated neuromuscular inhibition technique (INIT) in the treatment of MTrP of upper trapezius using pressure pain threshold (PPT) and visual analog scale (VAS). **Method**: Fifteen participants who came to manipal hospital, eight of them were randomized into INIT group and seven of them were randomized into conventional group. Two outcome measures were 1) Pain Pressure Threshold (PPT) and 2)Visual Analogue Scale (VAS) taken at baseline and after 2 weeks. **Results**: When PPT was compared between the group there was no significant change demonstrated, the mean change score between the group was 1.33 lbf/cm2 (p-value>0.05) but the mean change score of VAS between the group was 14.61 mm (p-value<0.05), there was a significant improvement in VAS observed between the group. **Conclusion**: INIT is effective in relieving pain in participants with upper trapezius MTrP.

Keywords: Myofascial trigger point; Integrated neuromuscular inhibition technique; Upper trapezius; Vapocoolant spray-stretch and pressure pain threshold.

Introduction

Myofascial trigger point (MTrP) is seen in medical practice with a point prevalence from 10% to 18% and lifetime prevalence from 30% to 50%.[1,2] MTrP is commonly recognised as muscle knots and discrete, hypersensitive, localized hard palpable nodules located within taut bands of skeletal muscles that affect any age group.[3] MTrP results from injured or overloaded muscle ûbers. The resulting microtrauma leads to involuntary shortening and loss of oxygen and nutrient supply, with increased metabolic demand on local tissues.[3,4] MTrPs are common in postural muscles of the neckincluding upper trapezius, levator scapulae, sternocleidomastoid and scalene. Studies states that upper trapezius being one of the most predominantly affected muscle.[3,5]

The treatment approaches for MTrPs are invasive and non-invasive. Non-invasive therapy consists of manual therapy and electrotherapy. MTrPs are commonly managed using manual therapy techniques which involve spray-stretch,[6] muscle energy technique,[7] strain-counterstrain,[8] integrated neuromuscular inhibition technique,[9] ischemic compression,[10] transverse friction massage.[11] Electrotherapy modalities most frequently used are transcutaneous electrical nerve stimulation,[12] laser therapy[13] and ultrasound.[14] Invasive therapy mainly involves dry needling[15] and injections.[16]

Vapocoolant spray-stretch and transcutaneous electrical nerve stimulation (TENS) are effective conventional treatments commonly used for MTrP in practice.[3,17] In a study,integrated neuromuscular inhibition technique has shown effectiveness in treatment of upper trapezius MTrP, where this technique

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was compared with muscle energy technique. However, main limitation of the study was the lack of a control group.[18] Hence, current study aimed at comparing integrated neuromuscular inhibition technique with conventional treatment, which will be used as control group.

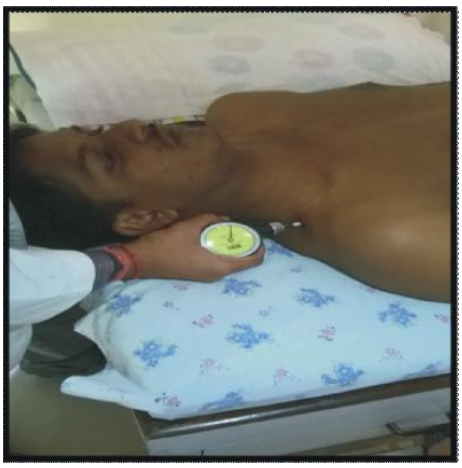
Purpose of the Study

The purpose of the study was to determine the effect of integrated neuromuscular inhibition technique versus conventional treatment on upper trapezius MTrP using pressure pain threshold (PPT) and visual analog scale (VAS) as outcome variables.

Methodology

A single blinded, randomized controlled pilot trial was conducted between February 2013 to march 2014 in outpatient department of Manipal Hospital, Bangalore. Fifteen participants, meeting the inclusion criteriawere selected for the study purpose. The participants were randomly divided into 2 groups, Intervention (INIT) group and control (vapocoolant spray-stretch) group. Eight participants were recruited in intervention group and seven participants in control group. Participants with palpable MTrP on either side of the upper trapezius muscle, aged between 18 to 40 years, presenting with cardinal signs: taut band, palpable nodule, jump sign, pain recognition and referred pain pattern(depending upon the location of MTrP) to posterolateral aspect of neck and mastoid processor extending to side of the head, temporal bone and angle of jaw were included. Participants presenting with MTrP secondary to cervical radiculopathy, frozen shoulder, cervicogenic headache, previous neck surgery, red flags (malignant tumour, history of unexpected weight loss)andparticipants who underwent physiotherapy treatment three months prior were excluded.

Figure 1: Pressure Pain Threshold Measurement at Upper Trapezius



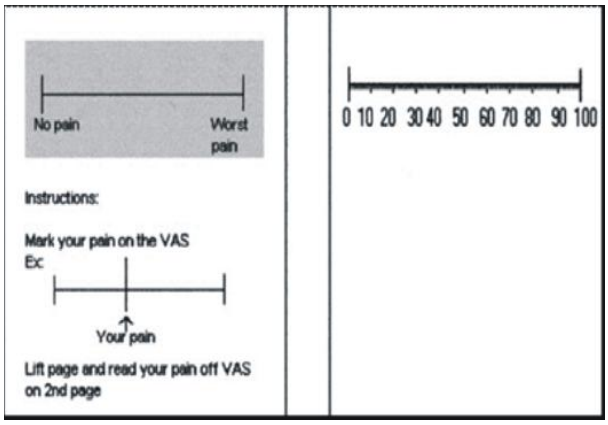
Variables

Outcome variables used for this study were pressure pain threshold (PPT) for pressure pain sensitivity and visual analog scale (VAS) for pain intensity.

Pressure Painthreshold (PPT)

Pressure algometer device which displays the pressure in units of lbf and which has 1 cm diameter rubber probe on the tip of a piston was used. It was applied to the participants perpendicularly on the myofascial trigger point with increasing the pressure 1 kg/cm2 (2.2 lbf/cm2) per second. The pressure was stopped when the participants expressed that pain had started. The value of pressure was recorded as lbf/cm2. The intrarater

Figure 2: Visual Analog Scale



repeatability of PPT is moderate to good with an intraclass correlation coefficient(ICC 0.78–0.93).[25]. It was repeated three times and average of the three scores were taken. The minimally clinical important difference of PPT is reported to be 1.5kg/cm2(3.30 lbf/ cm2).[28]

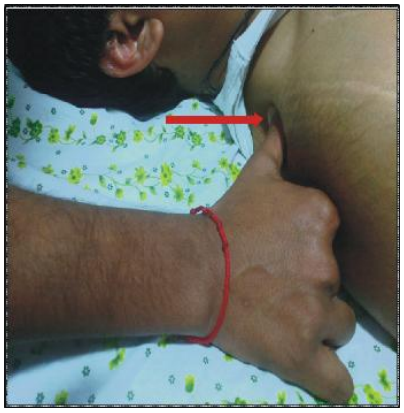
Visual Analog Scale (VAS)

The participants perceived pain levels wereassessed via a 100 mm visual analog scale (VAS). Participants were asked to score the intensity of the pain using 100 mm pain scale. Participants were asked to rate their pain with zero (0) being no pain andhundred (100) being the worst pain they could imagine. The intra rater reliability of VAS is good with intra class correlation coefficient (ICC-0.97).[26] Thirteen mm difference on the VAS represents the smallest measurable change in pain intensity that is clinically important.[29]

Procedure

The study was approved byinstitutional review board of School of Allied Health Sciences, Manipal Hospital, Bangalore. Participants were screened based on inclusion and exclusion criteria. Those who were enrolled, informed consent was taken and randomized into intervention or control groups by using block randomization. The intervention group was treated by integrated neuromuscular inhibition techniques (INIT), a combination ofischemic compression (IC), muscle energy technique (MET) andstrain-counterstrain (SCS), however control group was treated by conventional treatment, a combination of vapocoolant spray-stretch and transcutaneous electrical nerve stimulation (TENS). Anassessor blinding was done. After enrolment,outcome measures (pressure pain threshold and visual analog scale) were taken as baseline measurement. Both the groups were treated three times per week till two consecutive weeks. Outcome measures were assessed at baseline and 2nd week post treatment.

Figure 3: Ischemic Compression Technique



Intervention Group

Integrated Neuromuscular Inhibition Technique (INIT): Participants were positioned in supine lying with small towel roll under their neck to reduce tension in upper trapezius muscle. The following threetechniques were applied in the sequential order:ischemic compression (IC), strain counterstain technique (SCS) and muscle energy technique (MET).[18]

Ischemic Compression (IC): A manual digital pressure was applied through the thumb of the physical therapist directly on the MTrP on the upper trapezius muscle, to producea tolerable pain within pain intensity of the participant. The pressure applied, was sustained and progressively increased by reinforcing with the thumb or finger of the other hand until atissue resistance is encountered. Contact was maintained till the tissue barrier was released and pressure wasmaintained up to one and a half minute. The procedure was repeated three times per

Figure 4: Strain-Counterstrain Technique

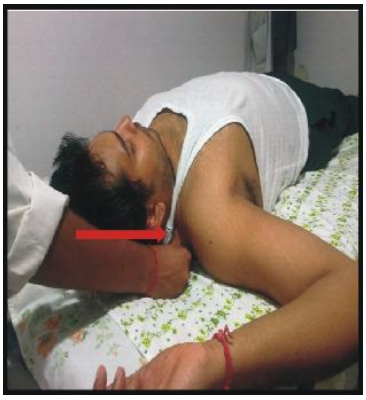


Figure 5: Muscle Energy technique Technique

treatment session.

Strain-Counterstrain Technique (SCS): Moderate digital pressure was applied on MTrP If pain wasreproduced, the pressure was maintained over the MTrP and the position of ease was identiûed. The position of ease was often produced through positioning the muscle in a shortened or relaxed position. For upper trapezius this is achieved in supine lying with the head side bent towards the involved side while the examiner positioned the ipsilateral arm in ûexion, abduction and external rotation to reduce the reported MTrP pain. Once the position of ease was identiûed, it was held for 20 to 30 second and repeated for three repetitions per treatment session.

Muscle Energy Technique (MET): In MET each isometric contraction was held for 7–10 seconds and was followed by further contralateral side bending, ûexion, and ipsilateral rotation to maintain the upper trapezius stretch. Each stretch was held for 30 seconds and was repeated three times per treatment session.

The duration of INIT was approximately 20-25 minutes.

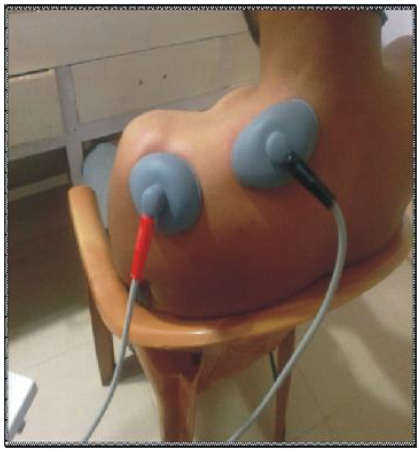
Figure 6: Vapocoolant Spray-Stretch Technique

Conventional Group

Vapocoolant Spray and Stretch Technique: The participants was sit comfortably in relaxed position in a low backed, ûrm seated armchair with the ûngers of each hand hooked under the chair seat. The physical therapist stretch the upper trapezius muscle (with the MTrP) for maximum lengthening and pressed the participants head forward to raise the occiput. At the same time, the physical therapist applied the vapocoolant spray in parallel sweeps from the acromion to the mastoid area (From insertion to origin) and it was repeated for 3 repetitions per treatment session.[17]

Transcutaneous Electrical Nerve Stimulation (TENS): Phyaction guidance e, Manufacturer: Gymna Unify NV, Pasweg 6A, 3740, Bilzen, Belgium; machine was used for TENS therapy. The negative electrode of the TENS unit was placed on the MTrP of the upper trapezius muscle. The positive electrode was placed on the insertion site of

Figure 7: Placement of Electrode in transcutaneous Electrical Nerve Stimulation (TENS)



Positive electrode at insertion site
Negative electrode at MTrP

Figure 8: Phyaction Guidance E-machine for Transcutaneous Electrical Nerve Stimulation (TENS)

the upper trapezius muscle. The current, with an asymmetrical rectangular biphasic form, was applied at a pulse repetition frequency of 100Hz and 50-microsecond duration. The intensity was set at a level that each participant felt but that was not strong enough to produce muscle contraction.[17]

The duration of vapocoolant spray – stretch and TENS was for 20 – 25 minutes.

Results

Statistical analysis was done by using SPSS version 16.0. Baseline characteristics including means and standard deviations (SD) were described. The mean differences with SD for the outcome measures for pressure pain threshold (PPT) and visual analogue scale (VAS) were calculated for the time periods of baseline to 2 weeks. As the data was normally distributed, a paired-t test was used to assess the within group differences and a repeated measures analysis of variance (ANOVA) was used to assess between group differences for all the outcome measures (VAS and PPT). The confidence interval was set at 95% with a level of significance 0.05. The power of the study was calculated at 0.80.

Thirty-one participants were screened, 15 participants met the inclusion criteria and enrolled in the study, among them eight participants were allocated to Intervention group and seven participants were allocated to control group. The baseline characteristics of 15 participants are given in the Table 1.

The mean and standard deviation of pressure pain threshold (PPT) and visual analog scale (VAS) at baseline and 2nd week are shown in Table 2.

The within group mean change score of pressure pain threshold and visual analog scale are given in Table 3.

The between group mean change score of pressure pain threshold and visual analog scale are given in Table 4.

At the end of 2nd week, a significant change was demonstrated within group score of PPT in intervention group (p-value<0.05) but there was no significant change in score of PPT in control group (p-value>0.05), in intervention group and control group the mean change score was 2.38 lbf/cm2 and 1.05 lbf/cm2 respectively. However when PPT was compared between the group there was no significant change demonstrated, the mean change score between the group was 1.33l bf/ cm2 (p-value>0.05).

VAS improved significantly for both the groups at the end of 2nd week (p-value<0.05). The within group change scores from baseline

Table 1: Baseline Characteristics of the Participants

Characteristics	Intervention group (n=8)	Control group (n=7)
Age in years (Mean ± SD)	27.75 ± 2.96	31.71 ± 3.95
Gender [no.(%)]		
Male	5 (62.5%)	5 (71.4%)
Female	3 (37.5%)	2 (28.5%)
Hand dominance R-L [no.(%)]	8 (100%), 0 (0%)	6 (90%), 1 (10%)
Side of involvementR-L [no.(%)]	6 (75%), 2 (25%)	3 (43.9%), 4 (57.1%)

Figure 9: CONSORT Flowchart of the Study

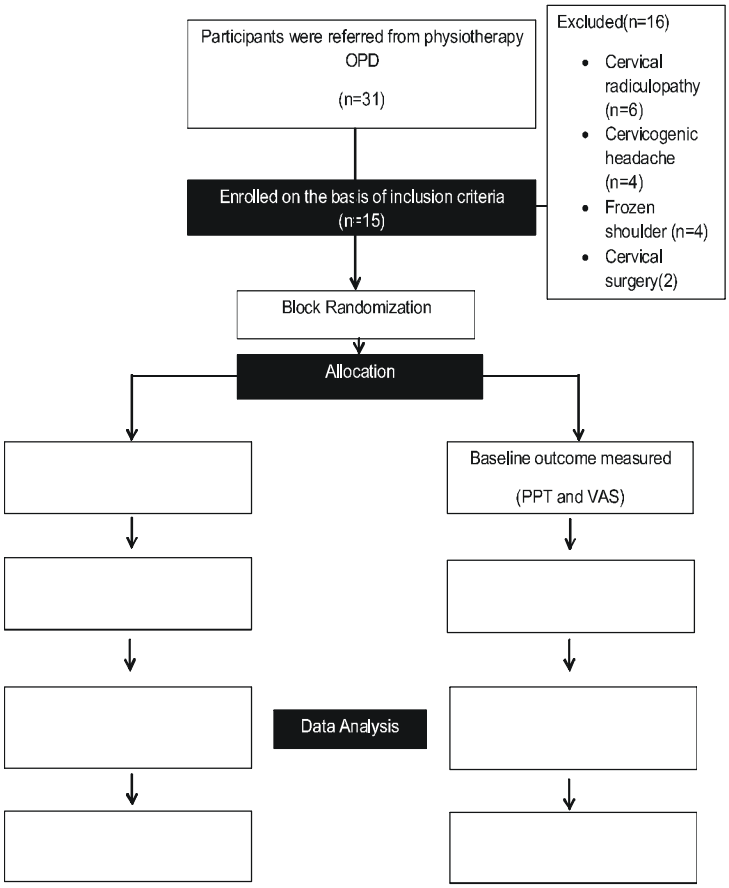


Table 2: Mean and Standard Deviation of Pressure Pain Threshold (lbf/cm²) and Visual Analog Scale (mm)

	Intervention Group(n=8) Mean ± SD		Control Group(n=7) Mean ± SD	
Outcomes	Baseline	two weeks	Baseline	two weeks
PPT	2.93 ± 1.69	5.31 ± 0.65	2.00 ± 1.63	3.05 ± 1.69
VAS	68.25 ± 8.56	31.62 ± 13.08	63.86 ± 8.85	41.85 ± 14.82

Table 3: Within Group Mean Change Score of Pressure Pain Threshold (lbf/cm²) and Visual Analog Scale (mm)

	Intervention Group		Control Group	
Outcomes	**Baseline-2weeks (Mean ± SD)**	***p*-value**	**Baseline-2weeks (Mean ± SD)**	***p*-value**
PPT	2.38 ± 1.80	0.007	1.05 ± 1.33	0.082
VAS	36.62 ± 10.11	0.001	22.01±10.64	0.002

Table 4: Between Group Mean Change Score of Pressure Pain Threshold (lbf/cm²) and Visual Analog Scale (mm)

Outcomes	**Two weeks (Intervention-Control)**	***p*-value**
PPT	1.33	0.137
VAS	14.61	0.017

to 2nd week for intervention and control group was 36.63 mm and 22.01 mm respectively. Though the mean change score of VAS between the group was 14.61 mm (*p*-value<0.05), there was a significant improvement in VAS observed between the group.

Discussion

The aim of the current study was to determine the effect of integrated neuromuscular inhibition technique versus conventional treatment on participants with upper trapezius MTrP. The result of the current study showed statistically significant improvement in mean change score of PPT at the end of 2nd week in intervention group, however there was no statistical significant difference seen in control group. There was no statistical significant difference observed when PPT score was compared between the groups.The mean change score of VAS when compared within group and between the groups showed statistical significant improvement at the end of 2nd week.

Result from current study revealed that within group mean change score of PPT was 2.38 lbf/cm2 and 1.05 lbf/cm2 for intervention and control group respectively at the end of 2nd week. The minimal detectable change (MDC) for PPT is reported to be 1.19 lbf/cm2 (0.54 kg/cm2)30 which was attained by intervention group but not by control group. However when PPT was compared between the groups the mean change score was 1.33 lbf/cm2 at the end of 2nd week and a 2.20 lbf/cm2 (1.5 kg/cm2) is the minimal clinical important difference (MCID) reported for PPT.28There was a clinical significant difference observed in intervention group in contrast to control group on comparison of mean change score of PPT. Similarly, there was no clinical significant difference observed between groups in the outcomes of PPT. The result of current study, states that both INIT and vapocoolant spray-stretch are equally effective treatment techniques for the treatment of upper trapezius trigger points in the outcomes of pressure pain sensitivity. Study done byHou R. C. et al, reported a difference in PPT of 1.88lbf/cm2 (0.86 kg/cm2) in PPT immediately after giving spray-stretch with TENS.[17]

The mean change score of VAS for intervention group was 36.63 mm at the end of 2nd week whereas the control group has a mean change score of 22.01 mm. The minimum detectable change (MDC) for VAS is reported to be 30 mm31, which was achieved by the intervention group unlike control group at the end of 2nd week. However, the VAS showed a mean change score of 14.61 when compared between the groups at the end of 2nd week, which is more than minimal clinical important difference (MCID) of 13 mm.[29] There was a clinical significant difference observed in intervention group compared to control group. Moreover, when VAS was compared between the groups it was clinically significant. Current study shows that INIT is superior over vapocoolant spray-stretch and TENS in treatment of upper trapezius trigger points in the outcomes of pain intensity. Thisis in accordance with study done by. Amit V. Nagrale and colleague's where they reported a difference of 1.98 cm at 2nd week in the visual analogue scale and suggested that INIT is effective technique in relieving pain.[18] On the other hand study done by Abha Sharma and colleague's, reported a difference of 4.13 cm at 2nd week in the visual analogue scale and proposed that INIT can be used as effective treatment in relieving pain in participants with upper trapezius trigger points.9 Study done by Hou R.C. *et al* reported a difference of 4.13 cm immediately following spray - stretch and TENS and suggested an effective treatment combination for upper trapezius trigger points.[17]

The superiority of the INIT approach over the spray – stretch and TENS may be due to specific to MTrP and an addition of ischemic compression.[7] Ischemic compression decreases the sensitivity of painful nodules in muscle.[32] Local compression may balance

the length of sarcomeres in the involved MTrP and subsequently decrease the pain.[33] Furthermore, the successive tissue relaxation created by attaining a shortened position of upper trapezius MTrP eases in strain-counterstrain has been anticipated as a mechanism of assisting local circulation that allows hastening nutrient supply and metabolic waste removal in living tissue. By passively shortening the muscle, SCS allows normal muscle spindle activity to return and neurophysiologic regulation of muscle spindle activity decreases spindle discharge and reûexive contraction upon shortening. This reduction in local tone further results in modiûcation of neural reporting and improved local circulation.[8] Moreover, muscle energy technique, which helps in retaining normal muscle tone by reciprocal inhibition andpost isometric relaxation. These changes eventually facilitate a reorganizing of the neural reporting structures ensuing in a more normal resting length, improved circulation, and reduced pain.[7] The limitation of the study was that it was a short duration study with no follow up.

Future Research

Studies with large sample size and long term follow up is required for better outcome of study.

Relevant to Clinical Practice

Integrated neuromuscular inhibition technique can be used for the treatment of MTrP pain in the upper trapezius muscle.

Conclusion

Integrated neuromuscular inhibition technique is superior over vapocoolant spray-stretch in measures of pain intensity. HoweverIntegrated neuromuscular inhibition technique and vapocoolant spray-stretch is equally effective on pressure pain sensitivity in participants with upper trapezius myofascial trigger points.

References

1. Cakit BD, Genc H, Altuntas V, Erdem, HR. Disability and related factors in patients with chronic cervical myofascial pain. *Clin Rheu*. 2009; 28: 647-54.
2. Skootsky AS, Jaeger B, Oye RK. Prevalence of myofascial pain in general internal medical practice. *Th West J of Med*. 1989; 151: 157-60.
3. Travell J, Simons DG, Simons LS. Myofascial pain and dysfunction: trigger point manual. The upper half of the body. 2nd ed. Voll. I. Baltimore, MD: Lippincott Williams & Wilkins; 1999, 1–85.
4. Borg-Stein J, Simons DG. Myofascial pain. *Arch Phys Med Rehab*. 2002; 83: S40 - S47.
5. Page P, Clare CF. The assessment and treatment of muscle imbalance: the janda approach. USA: Human Kinetics; 1967, 111-23.
6. Hong CZ, Chen YC, Pon CH, Yu J. Immediate effects of various physical medicine modalities on pain threshold of an active myofascial trigger point. *J of Muscul Pain*. 1993; 1: 37–53.
7. Chaitow L. Muscle energy techniques. 2nd ed. Edinburgh: Churchill Livingstone; 2001.
8. Wong CK. Strain counterstrain: Current concepts and clinical evidence. *Man Ther*. 2012; 17: 2-8.
9. Abha S, Angusamy R, Kalra S, Singh S. Efficacy of post-isometric relaxation versus integrated neuromuscular ischaemic technique in the treatment of uppertrapezius trigger points. *Ind J of Phys and Occu Ther*. 2010; 4: 1-5.
10. Kannan P. Management of myofascial pain of upper trapezius: a three group comparison study. *Glob J of Health Sci*. 2012; 4: 46-52.
11. Cyriax JH, Cyriax PJ. Cyriax's illustrated manual of orthopaedic medicine.2nd ed. London: Butterworth Heinemann; 1992, 19-29.
12. Fernandez RAL, Santoûmia VG, Rodríguez JG, Fernandez-de-las-Penas C. Effects of burst-type transcutaneous electrical nerve stimulation on cervical range of motion and latent myofascial trigger point pain sensitivity. *Arch Phys Med Rehabil*. 2011; 92: 1353-58.
13. Pontinen PJ, Airaksinen O. Evaluation of myofascial pain and dysfunction syndromes and their response to low level laser therapy. *J of Muskul Pain*. 1995; 3: 149–54.

14. Gam AN, Warming S, Larsen LH. Treatment of myofascial trigger points with ultrasound combined with massage and exercise. *Pain*. 1998; 77: 73–79.
15. Cummings TM, White A R. Needling therapies in management of myofascial trigger point pain: a systematic review. *Arch of Phy Med and Rehab.* 2001; 82: 986 – 82.
16. Lavelle DE, Lavelle W, Smith SH. Myofascial Trigger Points. *Anaesth Clin*. 2007; 25: 841-51.
17. Hou CR, Tsai LC, Cheng KF, Chung KC, Hong CZ. Immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger point sensitivity. *Arch of Phy Med and Rehab*. 2002; 83:1406–14.
18. Nagrale AV, Glynn P, Joshi P, Ramteke G. The efficacy of an integrated neuromuscular inhibition techniques on upper trapezius trigger points in subjects with nonspecific neck pain. *J of Man and Manip Ther*. 2010; 18: 37-43.
19. Gerwina RD, Shannonc S, Hong CZ, Hubbardg D, Gevirtz RH. Interrater reliability in myofascial trigger point examination. *Pain*. 1997; 69: 65-73.
20. Leesa KH. Myofascial trigger points: the current evidence. *Phys Ther in Sports*. 2004; 5: 2-12.
21. Gemmell H, Hilland A. Immediate effect of electric point stimulation (TENS) in treating latent upper trapezius trigger points. *J Bodyw Mov Ther*. 2011; 15: 348-54.
22. Fernandez LC, Campo SM, Carnero FJ, Page MCJ. Manual therapies in myofascial trigger point treatment: a systematic review. *J of Body and Mov Ther*. 2005; 9: 27-34.
23. Simons DG, Dommerholt J. Myofascial pain syndromes:trigger points. *J of Musculo Pain*. 2004; 12: 51-60.
24. Reeves JL, Jaeger B, Radford G. Reliability of the pressure algometer as a measure of myofascial trigger point sensitivity. *Pain*. 1986; 24: 313–21.
25. Ylinen J, Nykanen M, Kautiainen H, Hakkinen A. Evaluation of repeatability of pressure algometry on the neck muscles for clinical use. *Man Ther*. 2007; 12: 192-97.
26. Bijur PE, Silver W, Gallagher JE. Reliability of the visual analogue scale for measurement of acute pain. *Acad Emer Med*. 2001; 12: 1153-57.
27. Boonstra AM, Schiphorst P, Henrica R, Michiel F, Jitze B, Roy E. Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. *Inter J of Rehab Res*. 2008; 2: 165-69.
28. Chesterton LS, Sim J, Wright CC, Foster NE. Interrater reliability of algometry in measuring pressure pain thresholds in healthy humans using multiple raters. *Clin J Pain*. 2007; 23 (9): 760-66.
29. Gallagher EJ, Liebman M, Bijur PE. Prospective validation of clinically important changes in pain severity measured on a visual analog scale. *Ann of Emerg Med*. 2001; 38: 633-38.
30. Koo KT, Guo J, Brown MC. Test-retest reliability, repeatability and sensitivity of an automated deformation controlled indentation on pressure pain threshold measurement. *J of Manip and Physiol Ther*. 2013; 36: 84-90.
31. Lee JS, Hobden BE, Stiell IG, Wells GA. Clinically important change in the visual analog scale after adequate pain control. *Acad Emerg Med*. 2003; 10: 1128-30.
32. Travell J, Simons DG. Myofascial pain and dysfunction: The trigger point manual. The lower extremities. Voll. II. Baltimore, MD: Lippincott Williams & Wilkins; 1999, 1-20.
32. Kostopoulos D, Nelson AJ, Ingber RS, Larkin RW. Reduction of spontaneous electrical activity and pain perception of trigger points in the upper trapezius muscle through trigger point compression and passive stretching. *J of Muscul Pain*. 2008; 16: 267-79.

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Original Article

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Effect of Radial Shock Wave Diathermy on Various Musculoskeletal Disorders

Savita Tamaria*, Anusha Sampath*, Smriti Singh*

Abstract

This paper discusses the value of radial shock wave diathermy in treatment of various musculoskeletal disorders. Radial shock-wave therapy (RSWT) is a pneumatically generated, low- to medium-energy type of shock-wave therapy.

Shockwaves have been used for 15 years as an alternative treatment for musculoskeletal disorders. The treatment consists of mechanical acoustic waves that are transmitted through liquid and gaseous media.Their biological effect comes from the mechanical action of (mechanical) ultrasonic vibrations on tissues.

Shockwaves can be focal or radial. Focal shockwaves have high tissue penetration power (10 cm) and impact force (0.08–0.28 mj/mm^2). They produce mechanical and biological effects of greater intensity, including destruction of fibrosis and stimulation of neovascularization in treated tissues.

Keywords: Radial shockwave diathermy & musculoskeletal disorders.

Introduction

Shockwave therapy can be used to treat wide variety of musculoskeletal condition, in particular those involving areas were measure connective tissue attaché to the bone.[1] Shockwaves can be focal or radial. Focal shockwaves have high tissue penetration power (10 cm) and impact force (0.08–0.28 mj/mm2). They produce mechanical and biological effects of greater intensity, including destruction of fibrosis and stimulation of neovascularization in treated tissues. Radial shockwaves are pneumatic waves that are generated by air compressors. They transmit radially, with lower penetration (3 cm), less impact (0.02–0.06 mj/mm2) and limited biological effect. They have been shown to be effective for treating musculoskeletal disorders that are more superficial, with clinical results that are similar to those of focal shockwaves.[1] The effect of radial shockwaves is less intense, but they have been shown to cause disintegration of fibroses and calcifications and increase blood circulation at the treated location.

Common sites that can be successfully treated are:

Foot – planter fasciitis, heel spurs ,achillis tendonitis

Knee – patellar tendinitis, jumpers knee, shin pain

Elbow – Tennis or Golfers elbow

Shoulder – rotator cuff tendinitis & calcification

Hip – trochantric bursitis

Muscles- various trigger point throughout the body & muscle tension

Bone – Stress fracture & Non union

Nerves – Morten Neuroma[2]

Shockwave therapy is the recent development that is used successfully by health care providers that specialized in

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musculoskeletal disorder.

Advantages of RSWD[3]

Quickly reduces pain

No medication is needed

Avoid surgery or anesthesia

No side effect

No risk of allergies

Accelerated healing

Effective for chronic conditions

Shockwave therapy accelerate the healing process by activating the body self healing power particularly in cases where the body has been unable to do its own. It stimulates metabolism and enhance blood circulation which enables damage tissue to regenerate and eventually heal. The body responds by increasing the blood circulation and metabolism in the impact area which in turn accelerates the body's own healing processes. The shockwaves break down injured tissue and calcifications.

The treatment relieves pain by producing an analgesic effect on the treatment area. The high energy acoustic waves that are transmitted through the surface of the skin are spread radially(Spherically) into the body and the body responds with increase metabolic activity around the area of pain. This stimulate and accelerate the healing process and especially useful for those suffering from chronic heel, shoulder, knee, elbow & back pain .

Studies

Various studies in which radial shockwave diathermy is used for various musculoskeletal disorders

Liu s, zhail *et al* conducted a study on radial extracorporeal pressure pulse therapy for primary long bicipital tenosynovitis a prospective randomized controlled therapy in may 2012 in their study 79 adults with long wave tenosynovitis were randomly received either active (1500pulses , 8hz, 3 bars) or sham treatment through four sessions that were held once a week. All of these adults were assessed before treatment and at the time interval of 1, 3, and 12 months since the completion of the treatment. And they have found that mean scores of VAS shows significant & sustained reduction from the 5.67±1.32 at baseline to 2.58±1.49 at one month, 1.83±1.25 at three months and 1.43±0.94 at 12th month from the baseline were as sham group's mean VAS was 6.04±0.97 before treatment and stabilized at 5.57±0.84 at 12 months.[4]

Wang *et al* conducted a study on effect of extracorporeal shockwave therapy in musculoskeletal disorders. Which was published in journal of orthopedic surgical research in 2012 and they have found that ESWT (Extracorporeal shockwave diathermy) shows positive & beneficial effects of the therapy the success rate ranged from 65% to 91% and the complications are low and negligible.[5]

Henk van der Worp, Johannes Zwerver, Inge van den Akker-Scheek and Ron L Diercks conducted a study in 2011 on Tendinopathy of Patella Shockwave) it is a two-armed randomised controlled trial in which the effectiveness of focussed shockwave therapy and radial shockwave therapy are directly compared. Outcome assessors and patients are blinded as to which treatment is given. Patients undergo three sessions of either focused shockwave therapy or radial shockwave therapy at 1-week intervals, both in combination with eccentric decline squat training. Follow-up measurements are scheduled just before treatments 2 and 3, and 1, 4, 7 and 12 weeks after the final treatment. The main outcome measure is the Dutch VISA-P questionnaire, which asks for pain, function and sports participation in subjects with patellar tendinopathy. Secondary outcome measures are pain determined with a VAS during ADL, sports and decline squats, rating of subjective improvement and overall satisfaction with the treatment. Patients will also record their sports activities, pain during and after these activities, and concurrent

medical treatment on a weekly basis in a web-based diary. Results will be analysed according to the intention-to-treat principle. Radial shockwave generators generate waves that are very different from those generated by focused shockwave generators. Radial shockwaves lack the characteristic features of shockwaves such as a short rise-time, a high peak pressure and non-linearity.[6] Another difference is that radial shockwaves have a more superficial effect on tissue, compared to focused shockwaves which reach a maximal energy in the focus that is located deeper into the tissue.[7] Since the exact working mechanism of shockwave therapy is not well understood, this difference does not imply that radial shockwave therapy is less effective than focused shockwave therapy.[8] Each therapy may even have a different working mechanism.[9]

It is not known whether there is a difference in effectiveness between these therapies as treatment for PT. Therefore, the aim is of this study is to directly compare the effects of focused shockwave therapy and radial shockwave therapy on patellar tendinopathy in a blinded randomised controlled trial.[10]

Angelo Cacchio, studied the Effectiveness of Radial Shock-Wave Therapy for Calcific Tendinitis of the Shoulder: Ninety patients with radiographically verified calcific tendinitis of the shoulder were tested. Subjects were randomly assigned to either a treatment group (n=45) or a control group (n=45). Pain and functional level were evaluated before and after treatment and at a 6-month follow-up. Radiographic modifications in calcifications were evaluated before and after treatment. The treatment group displayed improvement in all of the parameters analyzed after treatment and at the 6-month follow-up. Calcifications disappeared completely in 86.6% of the subjects in the treatment group and partially in 13.4% of subjects; only 8.8% of the subjects in the control group displayed partially reduced calcifications, and none displayed a total disappearance.[11]

Giuseppe Mangone, Radial extracorporeal shock-wave therapy in rotator cuff calcifictendinosis An observational study was carried out in the period between October 2008 and September 2009 in our outpatient clinic with 62 patients, divided into 3 groups: group A 36 patients treated only with RESWT, group B 26 patients treated only with HPLT and group C 16 patients with only short term improvement with HPLT retreated with RESWT. Patients were evaluated with Constant-Murley scale before and after treatment (immediately, 1 month and 3 months) for mean constant score, pain and range of movement. Data were examined statistically with SPSS. Criteria for inclusion and exclusion were defined.

Patients treated with HPLT have shown good clinical results but have returned to original syndrome 1 month after treatment. RESWT has given improvement after treatment extended in time (3 months) in terms of pain and recover of functionality with a limited number of applications.[12]

References

1. Ogden JA, Alvarez RG, Levitt R, Marlow M. Shock wave therapy (Orthotripsy) in musculoskeletal disorders. *Clin Orthop Relat Res*. 2001; 387: 22–40.
2. Ogden JA, Tóth-Kischkat A, Schultheiss R. Principles of shock wave therapy. *Clin Orthop Relat Res*. 2001; 387: 8–17.
3. Gerdesmeyer L, Gollwitzer H, Diehl P, Wagner K. Radial extracorporeal shock wave therapy in orthopaedics. *J Miner Stoffwechs*. 2004; 11: 36–9.
4. liu S, Zhai L, Jing R, ZhaoB *et al*. Radial extracorporeal pressure pulse therapy for primary long bicipitaltenosynovitis a prospective randomized controlled therapy ultrasound. *Med Biol*. 2012; 38(5): 727- 35.
5. Wang *et al*. Study on effect of extracorporeal shockwave therapy in musculoskeletal disorders. *Journal of Orthopedic Surgical Research*. 2012; 7: 11.
6. Cleveland RO, Chitnis PV, McClure SR. Acoustic field of a ballistic shock wave therapy device. *Ultrasound Med Biol*. 2007; 33(8): 1327-1335.

7. McClure S, Dorfmnller C. Extracorporeal shock wave therapy: Theory and equipment. *Clinical Techniques in Equine Practice.* 2003; 2(4): 348-357.
8. Cleveland RO, Chitnis PV, McClure SR. Shock Wave Therapy: What Really Matters Reply. *Ultrasound Med Biol*. 2008; 34(11): 1869-1870.
9. Maier M, Schmitz C. Shock Wave Therapy: What Really Matters. *Ultrasound Med Biol.* 2008; 34(11): 1868-1869.
10. Henk van derWorp*, Johannes Zwerver, Inge van den Akker-Scheek and Ron L Diercks The TOPSHOCK study: Effectiveness of radial shockwave therapy compared to focused shockwave therapy for treating patellar tendinopathy - design of a randomised controlled trial. *BMC Musculoskeletal Disorders.* 2011; 12: 229 doi:10.1186/1471-2474-12-229.
11. Angelo Cacchio, Marco Paoloni, Antonio Barile. Effectiveness of Radial Shock-Wave Therapy for Calcific Tendinitis of the Shoulder: Single-Blind. *Randomized Clinical Study Physical Therapy*. 2005.
12. Giuseppe Mangone, AltinVeliaj. Radial extracorporeal shock-wave therapy in rotator cuff calcifictendinosis. *Clin Cases Miner Bone Metab*. 2010; 7(2): 91–96.

Original Article

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The Effect of Supine and Sitting Recovery Positions on Heart Rate Recovery and Rate Pressure Product Following Six Minute Exercise Test in Patients Undergoing Coronary Artery Bypass Grafting

Jatinder Kaur*, Bhawna Ghai, Parmveer Kaushal***, Ravinder Narwal******

Abstract

Aim & Objective: Ischemic heart disease is among the most common causes of death and disability in the world. The Indian subcontinent has among the highest rates of cardiovascular disease globally, which is estimated to be six fold higher in the urban areas. This has led to an increase in number of Coronary artery revascularization surgeries. The aim of this study was to determine whether there is any effect of recovery positions on heart rate recovery and myocardial oxygen consumption in patients undergoing CABG following six minute exercise test. **Methods:** This experimental study was based on the pre operative assessment for inclusion and exclusion criteria, the patients were randomly assigned to the two groups. Two six minute walk tests were performed each on the day before surgery and following CABG on fourth and seventh postoperative day and the dependent variables were measure. **Conclusion:** The study thus concluded that there is improvement in the heart rate measures and functional capacity following CABG. The heart rate recovery was found to vary with different recovery positions and was better in the supine lying position, when compared to sitting position.

Keywords: Autonomic nervous system; Phase I cardiac rehabilitation; Six minute walk test; Revascularization; Hear rate recovery.

Introduction

Ischemic heart disease is among the most common causes of death and disability in the world. The Indian subcontinent has among the highest rates of cardiovascular disease globally, which is estimated to be sixfold higher in the urban areas. Coronary heart disease manifests, on an average, almost 10 years earlier in the subcontinent compared with the rest of the world, resulting in substantial number of CHD deaths. This has led to an increase in number of Coronary artery revascularization surgeries. Myocardial revascularization by coronary artery bypass grafting (CABG) surgery is an effective measure for reducing the symptoms and mortality in patients with unstable or severe coronary artery disease.[1,2]

Profound derangement of the autonomic regulation of cardiac function has been reported after CABG and in severe cardiac diseases like myocardial infarction (MI) and Coronary Artery Disease. Several factors have been proposed to be responsible for the attenuation of vagal control of the sinoatrial node immediately after CABG such as nonspecific effects of recovery from general anesthesia, myocardial infarction or ischemia, reduced left myocardial function, perioperative stress responses, concomitant medication, or procedure-related causes, such as direct mechanical injury to vagus nerve, phrenic nerve or sinus node.[3,4]

Imbalance in the autonomic cardiovascular control has been shown to increase the risk for adverse cardiac events and sudden cardiac death, in patients with CAD and ischemic heart disease (IHD). Thus, the status of the autonomic nervous system (ANS) is a major

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determinant of cardiovascular health and prognosis.[5]

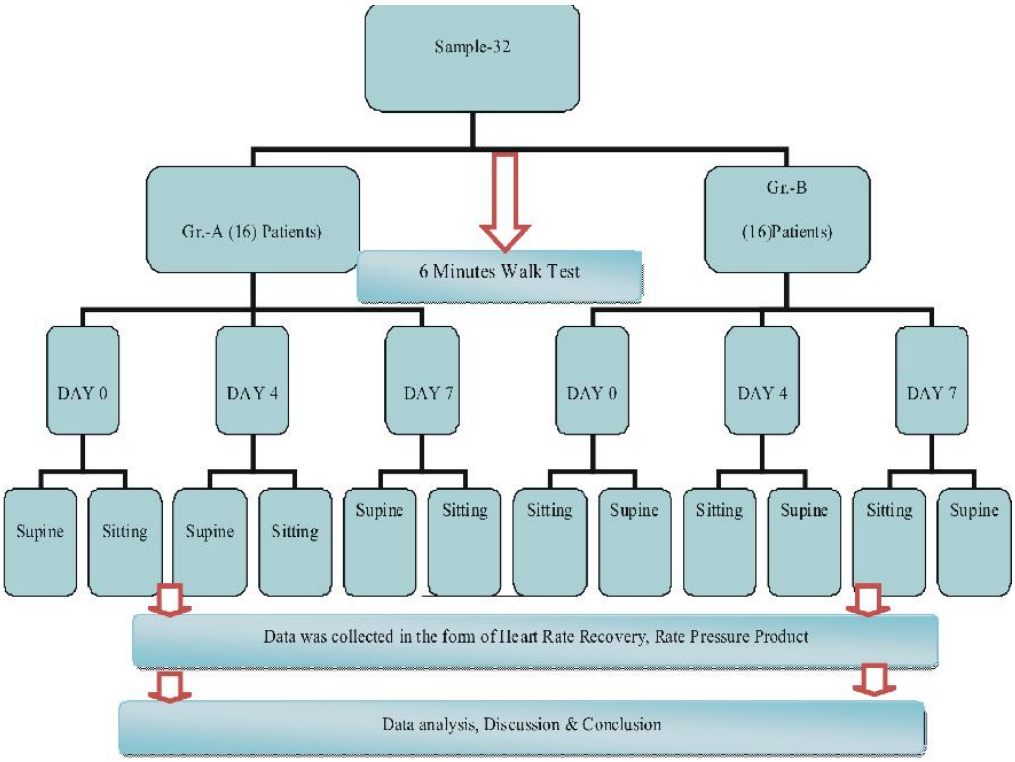
The heart rate response to dynamic exercise follows a well-defined pattern modulated by the balance between vagal and sympathetic activity. During exercise, the heart rate increases (initial transient) due to withdrawal of parasympathetic tone and increase in sympathetic tone. The fall in heart rate immediately after exercise (final transient) is considered a function of vagal reactivation. Thus, impaired vagal-dependent cardio protection can be assessed through varied patterns of heart rate behavior at rest, during initial and the final heart rate transients. Various studies have demonstrated that impaired initial and final HR transient (as measured during the first 1 or 2 min. of the post exercise period, both during maximal and sub-maximal exercise) are significantly powerful and independent predictors of cardiovascular mortality. In fact, these measures are more straightforward and easily obtained measurements than other indices of cardiac vagal tone.[6]

Though, there are certain issues that deserve further investigation due to great diversity of methods used to investigate heart rate recovery (HRR) including- test characteristics (maximal vs submaximal); different recovery times (from 30s to 5 min); recovery position (standing, sitting, supine or lateral decubitus), variable criterion for abnormality.[7]

The six-minute walk test (6MWT) is a simple test that is commonly used to assess the functional status of patients in a number of conditions including severe cardiopulmonary disease. It is safe, feasible, well tolerated and reproducible measurement of functional capacity in stable patients even within a week of uncomplicated myocardial infarction. Therefore, the test might be useful for the evaluation of exercise tolerance in phase I of inpatient cardiovascular rehabilitation programs in adult and older patients shortly after uncomplicated cardiac surgery.[8]

The review of literature suggests that various studies have examined improvement in HRR

Schematic Representation of Methodology



through exercise in cardiac rehabilitation population. It may thus be summarized that the immediate post operative physiotherapeutic interventions given in recovery phase following CABG may prove to be beneficial for the autonomic modulation. Thus, the aim of this study was to determine whether there is any effect of recovery positions on Heart Rate Recovery and Rate Pressure Product in patients undergoing CABG.

Figure 1: Patient Performing Six Minute Walk Test

Methodology

This experimental study was based on the sample size of 32 subjects .All the patients were recruited from CTVS Max Superspeciality Hospital Mohali , Chd, Punjab. The subjects were included in the study through the method of sample of convenience and matched according to the Inclusion Criteria with male subjects having age group 49-72 yrs. Subjects were exclusion having any sign of unstable cardiovascular status,uncontrolled sinus tachycardia >160 bpm, Resting Systolic B.P. >180 mmHg, Resting Diastolic B.P. >100 mmHg, LVEF< 40%, Atrial or ventricular dysrythmia, Orthostatic BP drop of >20 mm Hg or more, Acute systemic illness or fever, Implanted pacemaker, Use of IABP, Any post operative myocardial infarction or pulmonary complications, Prolonged ventilator dependence (> 24 hrs 2), or prolonged ICU stay (> 48 hrs.).

Procedure

Following the clinical assessment the method of study was explained to the patient and they were required to sign an informed consent. The patients were then randomly assigned to the two groups - group A and group B. using the lottery method.Date was collected in the form of depended variables Heart Rate Recovery, Rate Pressure Product, pre-surgery and post surgery on fourth and seventh post-operative day. Heart rate monitor and SpO2 probe were used as Instrumentation Recovery Position – Supine lying and Sitting were used as independent variables. The six minute walk tests were performed on a day before surgery and following CABG on fourth and seventh postoperative day. Two six minute walk tests were performed on each day, one in the morning at 9a.m. and another at 1p.m., to account for the diurnal variations in the autonomic nervous system responses.[9]

Protocol

Group A - After 6MWT's, the patients were subjected to the supine lying position in the morning and to the sitting position in afternoon.

Group B - After 6MWT's, the patients assumed sitting position in the morning and supine lying position in the afternoon. The patient assumed supine lying position on the bed, and sitting position refers to the 90° upright sitting position on a chair, with back of the patient supported.

The patients were explained the procedure for 6MWT and the recovery position according to the assigned group. The 6MWT was then demonstrated to the patient by the therapist. The patient performed a trial for 6MWT. The participants were instructed to walk from one end of the corridor to the other.[9]

The 6MWT was performed after an interval of one hour from the trial test, on the day before surgery and on the fourth postoperative

day. The age adjusted maximum heart rate was calculated before the test [by; (220- age)]. The teleguard was attached to the patient, including the ECG leads (attached to patient's chest), SpO2 probe and the NIBP apparatus. The heart rate was monitored through the telemetry monitor; blood pressure by NIBP apparatus and the SPO2 by the finger probe. At rest; heart rate, blood pressure, SPO2, dyspnea and fatigue level of the patient was noted in the upright sitting position. Following the test, in recovery position, all the parameters were measured, at an interval of one minute till five minutes of recovery. HRR1, HRR2, HRR3, HRR4, HRR5, RPP1, RPP2, RPP3, RPP4, RPP5, were calculated. CABG patients in both the groups received the similar standard post operative physiotherapy protocol of the hospital. On the fourth and seventh postoperative day, six minute walk tests were again performed. All the data was collected by the researcher student.[10]

Data Analysis

The data was analyzed using the Statistical Package for Social Sciences (SPSS, version 15.0, Chicago, II, U.S.A.) The data was analysis by using paired T-Test for within group differences and the between group analysis was done using Independent T-Test.

Fig 2: HRR Comparison between the Supine and Sitting Position within Group A

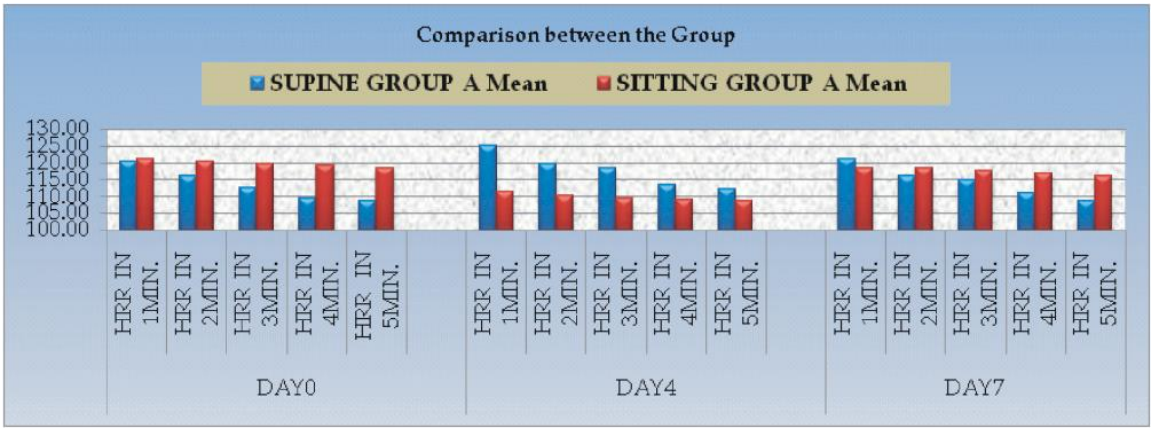


Fig 3: SBP Comparison between the Supine and Sitting Position within Group A

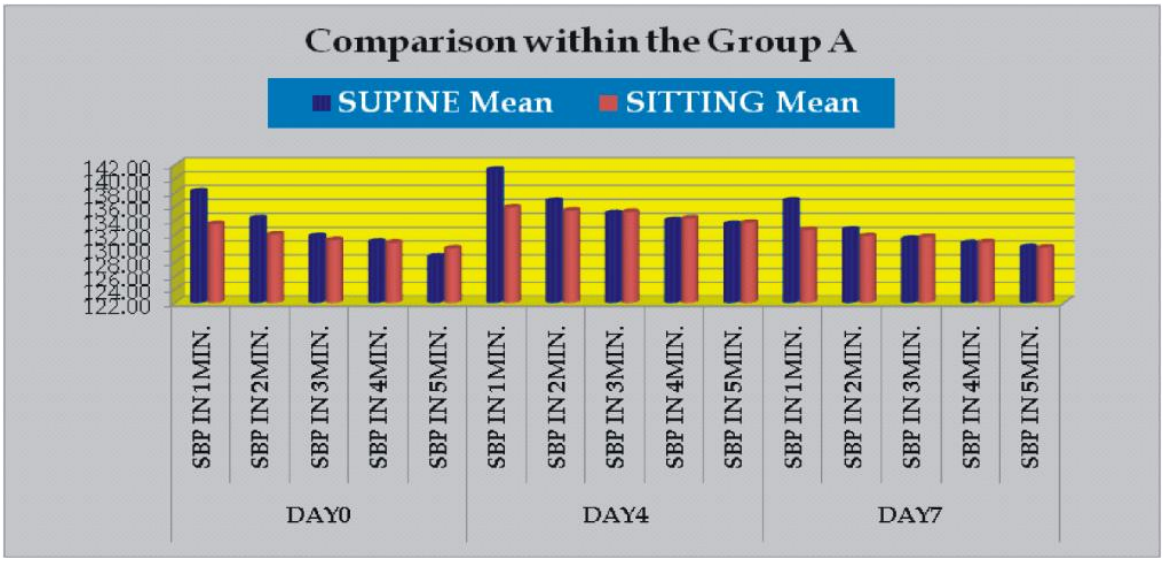


Fig 4: RPP Comparison between the Supine and Sitting Position within Group A

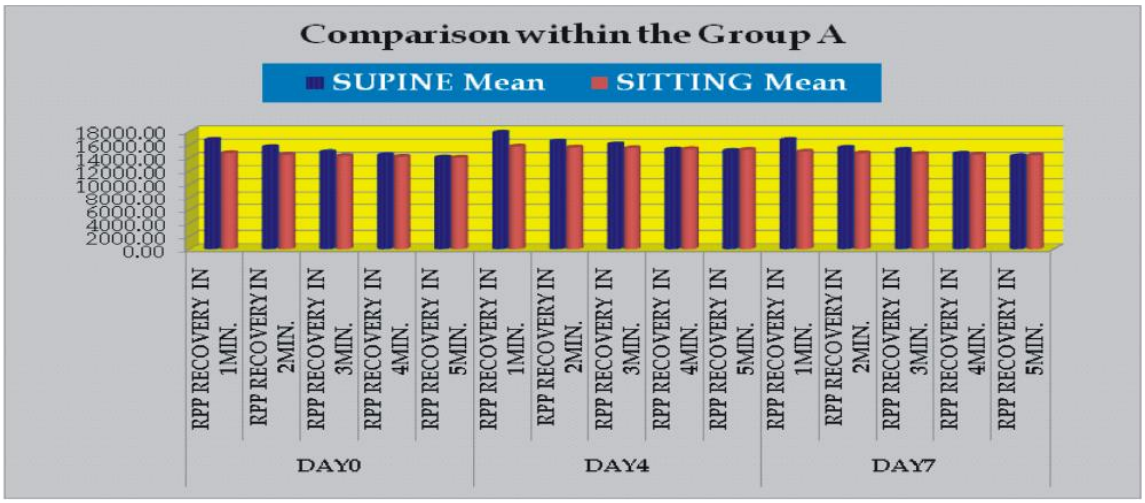


Fig 5: HRR Comparison between the Supine and Sitting Position within Group B

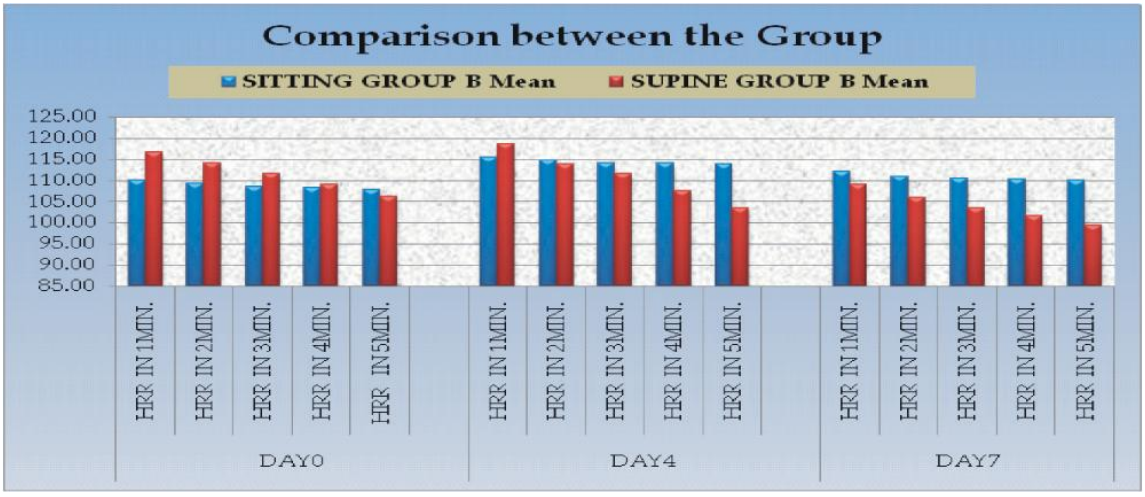


Fig 6: SBP Comparison between the Supine and Sitting Position within Group B

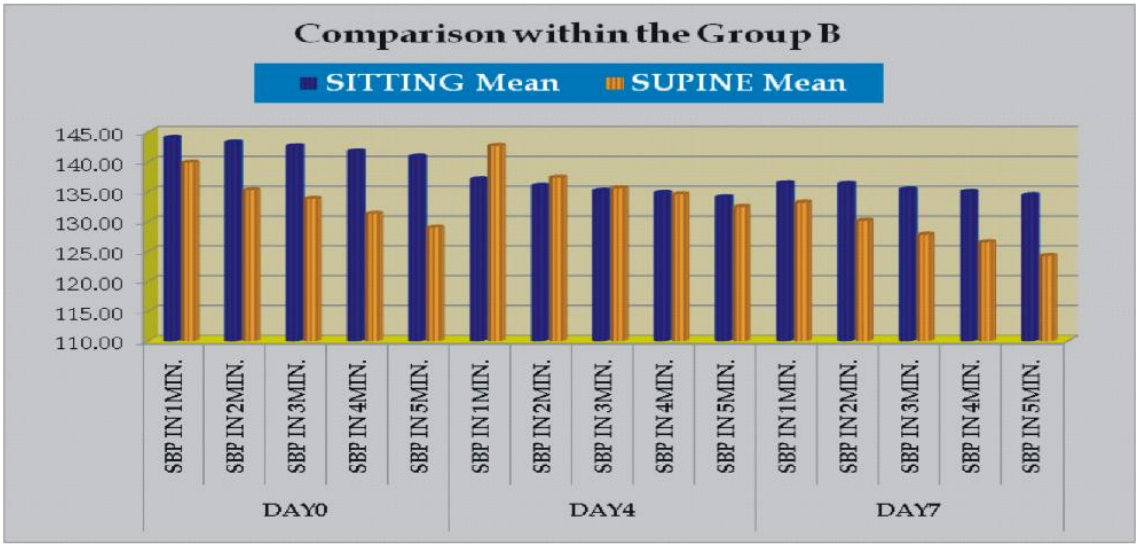


Fig7: RPP Comparison between the Supine and Sitting Position within Group B

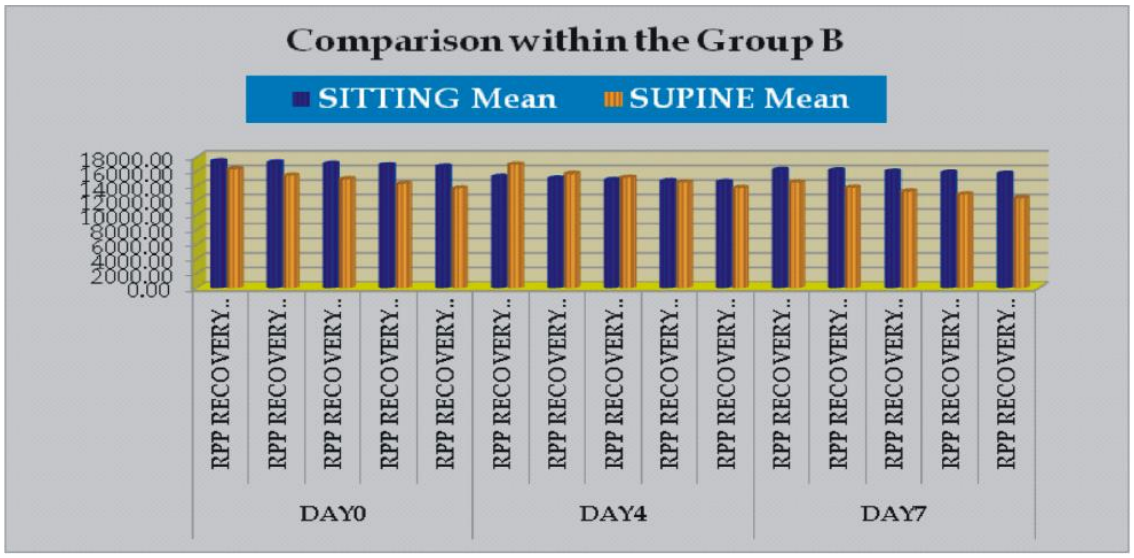


Table 1: HRR Comparison between the Groups within T-Test

	HRR Data	Sitting Group A		Supine Group B		T Test		
	HRR in min.	Mean	SD	Mean	SD	T Test	P Value	Table Value
Day0	HRR -1min.	110.06	7.853	116.69	11.400	1.91	0.065	2.04
	HRR -2min.	109.19	7.774	114.13	10.800	1.48	0.148	2.04
	HRR -3min.	108.63	7.830	111.63	10.664	0.91	0.372	2.04
	HRR -4min.	108.25	7.987	109.00	11.213	0.22	0.829	2.04
	HRR -5min.	107.75	7.912	106.06	11.682	0.48	0.636	2.04
Day4	HRR -1min.	115.50	6.683	118.56	10.450	0.99	0.331	2.04
	HRR -2min.	114.69	7.227	113.88	11.401	0.24	0.811	2.04
	HRR -3min.	114.06	6.904	111.56	11.165	0.76	0.452	2.04
	HRR -4min.	114.00	7.062	107.50	11.478	1.93	0.063	2.04
	HRR -5min.	113.75	7.057	103.50	11.713	3.00	0.005	2.04
Day7	HRR -1min.	112.06	12.113	108.94	8.021	0.86	0.396	2.04
	HRR -2min.	111.00	12.033	105.94	8.683	1.36	0.183	2.04
	HRR -3min.	110.38	11.977	103.50	7.694	1.93	0.063	2.04
	HRR -4min.	110.19	11.901	101.50	7.099	2.51	0.018	2.04
	HRR -5min.	110.00	12.072	99.38	7.771	2.96	0.006	2.04

Table 1: RPP Comparison between the Groups within T-Test

	RPP Table	Supine Group A		Sitting Group B		T Test		
	RPP recovery in min.	Mean	SD	Mean	SD	T Test	P Value	Table Value
Day0	RPP - 1min.	16687.19	1965.192	17394.19	2038.459	1.00	0.326	2.04
	RPP - 2min.	15602.06	1973.695	17203.13	1987.882	2.29	0.029	2.04
	RPP - 3min.	14838.50	1994.045	17032.56	2020.897	3.09	0.004	2.04
	RPP - 4min.	14350.38	1885.533	16841.88	2002.587	3.62	0.001	2.04
	RPP - 5min.	14034.88	1756.049	16612.75	1969.166	3.91	0.000	2.04
Day4	RPP - 1min.	17749.38	2264.146	15255.06	1321.892	3.81	0.001	2.04
	RPP - 2min.	16428.44	2128.535	14974.25	1381.148	2.29	0.029	2.04
	RPP - 3min.	16029.94	2174.175	14778.50	1374.919	1.95	0.061	2.04
	RPP - 4min.	15260.06	2380.340	14651.31	1350.694	0.89	0.381	2.04
	RPP - 5min.	15002.50	2170.676	14544.88	1381.515	0.71	0.482	2.04
Day7	RPP - 1min..	16671.44	2454.548	16198.63	2140.177	0.58	0.566	2.04
	RPP - 2min.	15478.38	2439.772	16142.25	2125.185	0.82	0.418	2.04
	RPP - 3min.	15193.50	2437.354	15964.88	2131.245	0.95	0.348	2.04
	RPP - 4min.	14589.44	2396.385	15813.81	2181.276	1.51	0.141	2.04
	RPP - 5min.	14221.13	2177.914	15653.50	2166.993	1.86	0.072	2.04

Results

Discussion

The complex interaction of the Autonomic Nervous System (ANS) and the cardiovascular system (CVS) during exercise can be easily assessed by the heart rate recovery (HRR) after exercise. There is abundant literature evidence supporting the view that, there is impairment of the Cardiovascular (CV) autonomic function following CABG. Thus, this randomized trial evaluated the changes in HRR after exercise in the patients undergoing CABG.[11]

Secondly, the study also explored the effect of the different recovery positions, i.e., supine and sitting on the HRR and the myocardial oxygen consumption. It is well known that the CV drugs may interfere with the control of the sinus node (e.g. beta blockers, calcium channel antagonists etc.). For this reason, the patients enrolled in this study had similar drug regime. This study is able to signify the differences using the Six Minute Walk Test to evaluate the changes in the HRR after exercise in the patients undergoing CABG and the effect of recovery position of HRR and RPP. Heart rate rise may also be due to more energy demand as the patients have walked a longer mean distance following and the altered postoperative hemodynamic of these patients.

Heart Rate Recovery

The heart rate recovery has been strongly supported as a measure of the parasympathetic control of SA node at rest and during exercise. The attenuated HRR has been found to be an independent and strong predictor of mortality; even in the absence of the cool down period, age, resting BP and heart rate, Diabetes mellitus, use of antihypertensive medications, previous myocardial revascularization, exercise capacity, ß-blockers, ACE inhibitors and calcium channel blockers.[12,17]

The present study evaluated the variation of HRR- (1) with increasing recovery time, (2) following CABG and (3) with different recovery positions. This finding can be attributed to the normal interplay of the ANS after exercise. The withdrawal of the sympathetic and reactivation of the parasympathetic nervous system during recovery would have caused this improvement with time. Similarly, James V. Freeman *et al* suggests that the abrupt rise of parasympathetic discharge to the sinus node, which causes the drastic HR reduction in the immediate recovery phase after the peak exercise, should be caused by a "dynamic" modulation of sinus node in response to a CV challenge.[13,14]

The preoperative HRR in the patients in this study was found to be abnormal at 2nd minute of recovery, which is in accordance with previous findings which suggest that the cardiac vagal modulation is reduced in patients with CAD or previous myocardial infarction. But, the recovery at 1st minute which has also been supported as a measure to predict CV mortality was found normal preoperatively in this study. The similar findings have been reported in a study by Seref Demirel et al which showed that only 17% of their patient population showed abnormal HRR responses despite of the status that may have influenced the autonomic activity. It may thus be inferred that the HRR at 2nd minute is more sensitive to detect the impaired autonomic modulation in the CAD patients. [15]

Heart rate recovery, in this study, showed a significant improvement at all time points on all days. This finding is contradictory to the available literature which suggests that there is depression of the cardiac autonomic modulation following CABG; which reaches its lowest levels 3-6 days after surgery, returning to the normal values 30-60 days following surgery. It has been found that the induction of anesthesia during surgery causes a decrease in HRV .The systemic inflammation that follows CABG has been found to decrease the autonomic modulation of heart.[16]

Since, it has been found that recovery from

30 secounds - 2 minutes is vagally mediated and later recovery depends on sympathetic modulation,[17] the improvement in HRR at 2nd minute in this study may suggest that the revascularization (CABG) may also improve HRR postoperatively. Also, the clinical administration of the cardiovascular drugs including ß- blockers and calcium channel blockers have been found to have no significant impact on the prognostic value of Heart Rate Recovery.[17]

The improvement in HRR may be related to the molecular mechanism underlying the regulation of the Heart Rate Recovery. The chromosome CHRM2 plays a fundamental role in cardiac autonomic regulation. This genetic variation is also associated with inter individual variability in modulation of HR after maximal exercise. Since, the post exercise HRR has been shown to be an independent predictor of mortality both in healthy subjects and in various patient groups, the findings may provide important clues to understanding molecular mechanisms underlying the regulation of HRR and its association with adverse cardiac events.[18]

Rate Pressure Product (RPP)

The Rate Pressure Product (RPP) or the double product which signifies the myocardial oxygen consumption was evaluated for its variation (1) during recovery, (2) following CABG and (3) with different recovery positions. The heart rate and blood pressure response of the post CABG patients is determined by a complex interaction of many factors including- drugs (ß- blockers, calcium channel blockers, ACE inhibitors and diuretics), post surgical stress, expectation from surgical procedure and exercise.

The results showed a significant reduction in the RPP during recovery (over 5 minutes). The RPP was found to increase significantly from preoperative to postoperative period, though the increase was insignificant from fourth to seventh postoperative day. This is supported by the available literature which suggests that there is arterial vasodilatation immediately following the exercise and decrease in HR during recovery due to sympathetic withdrawal and parasympathetic reactivation, which would have caused the reduction in RPP during recovery.[17]

The increase in RPP following surgery may be attributed to the surgical stress due to acute injury to the myocardium during the surgery. The RPP best defines the response of coronary circulation to the myocardial metabolic demands.[60] The increased metabolic demand of the acutely injured myocardium increases its oxygen requirement to perform the work of the myocardial contractility, thus justifying increased RPP following surgery. The insignificant increase from fourth to seventh postoperative day may be due to the recovery of the injured myocardium from the acute stress of the surgery.[19]

Effect of Positions on Heart Rate Recovery and Rate Pressure Product

The present study suggests that recovery in the supine position following the six minute walk test in the immediate phase following CABG is better than recovery in the sitting position. This is because of more HRR and lower RPP (myocardial oxygen consumption) in supine position when compared to the sitting recovery position. The results are supported by similar findings in the study by B. Kramer *et al,* which reported higher RPP at rest in sitting position and higher heart rates and RPP during exercise in the sitting position.

This may be because; there is transient decrease in the venous return immediately following exercise, which reduces coronary blood flow when the HR and the myocardial oxygen demands may still be high. Thus, when the patient assumes the supine position following exercise, the venous return is increased, which increases the stroke volume, thus reducing the need for HR to increase, to adequately augment the cardiac output to meet the increased metabolic requirements of the body. This is supported by the fact that the stroke volume and heart rate are inversely

related to each other.In contrast to the above situation, during recovery in the sitting position; the venous return is further reduced which requires the heart rate to increase proportionately, to enhance the cardiac output which in turn requires the increased myocardial contractility, thus increasing the myocardial oxygen consumption, i.e., RPP.[20]

Also, the blood catecholamine levels have been found to be higher in the upright position than in the supine lying position. These higher catecholamine levels correspond to the enhanced sympathetic activity in the sitting position than in supine position, thus favoring recovery in the supine position.[18]

The results also suggest that HRR varies with different recovery positions. This may help to reduce the current methodological variations prevailing to investigate the HRR after the exercise.

Six Minute Walk Distance

The six minute walk test in this study was well tolerated by all the patients with no need for pauses or interruptions due to symptoms except for two patients who stopped test at 4 minutes 10 seconds during the morning test on fourth postoperative day and another patient who also interrupted the test on the fourth postoperative day, during the afternoon test, at 5 minutes 21 seconds due fatigue[.7,9]

The safety of the early mobilization and stair climbing following CABG has been demonstrated by Sen-Wei Tsai *et al*. The six minute walk test can be safely executed in the early phase following CABG. These evidences thus suggest that the six minute walk test might be useful for evaluation of exercise tolerance in phase I and phase II of inpatient cardiac rehabilitation programs or to assess functional responses to selected interventions early after the acute event. Also, the distance walked on the second trial of this test has been found to better reflect the true measurement, which was similarly used in this study for interpreting the results.[21]

The improvement would have been because of the exercises of the hospital based inpatient physiotherapy protocol administered similarly to all the patients of both the groups. Also, the drugs such as ß- blockers and ACE inhibitors have been found to improve exercise capacity. Thus, there might be role of these drugs in improving the walk distance significantly.

So on the bases of above discussion it can be concluded that patients must be advised to assume supine lying position for recovery following the test as this position allows earlier recovery and reduced myocardial work.

Conclusion

The adverse effects of CABG on the cardiac autonomic modulation are presently over exaggerated.The six minute walk test can be safely administered as early as fourth postoperative day following elective CABG.The heart rate recovery varies with the recovery position and has been found to be better in the supine position when compared to the sitting position.The normal exercise responses (i.e., normally declining heart rate and RPP during recovery), following surgery suggests that cardiac surgery (CABG) per se does not cause any impairment in responses to the submaximal exercise.

Clinical Relevance

The present study suggests that the exercise capacity of the patients can be safely assessed by using six minute walk test (the submaximal exercise test), during Phase I cardiac rehabilitation following CABG. The significant mortality predictors of cardiovascular autonomic nervous modulation may be modified (improved) in the early phase following CABG. The patients must be advised to assume supine lying position for recovery following the test as this position allows earlier recovery and reduced myocardial work.

Limitations & Future Research of the Study

This study is limited to small & male dominated sample. The improvement in HRR in the study may also be attributed to the positional regime provided to the patients during their inpatient stay in the hospital. Although, this positional regime factor with Phase -1 exercise protocol may be tested to find out any significant improvement in HRR because the positive effects of exercise on ANS under the stress conditions have been found following 2 weeks of Phase II cardiac rehabilitation training. Thus, whether short term training provided during Phase I cardiac rehabilitation can positively effect the impaired autonomic modulation or not, cannot be certained at this moment due to lack of the available evidence and warrants further investigation into this matter. The study should be replicated with a larger sample size & female subjects to confirm the present findings, though the present study had statistical power > 85%.

References

1. Abhinav Goyal *et al*. The burden of Cardiovascular Diseases in the Indian subcontinent. *Indian J Med Res.* 2006; 124: 235-244.
2. Pedro Paulo S Soares, Adalgiza M Moreno *et al*. Coronary artery bypass surgery and longitudinal evaluation of the autonomic cardiovascular function. *Critical Care.* 2005; 9(2): R124-131.
3. Jurij-Matija Kalisnik, Viktor Avbelj *et al*. Comparison of Sequential Changes in Heart Rate Variability After On-Pump and Off-Pump Coronary Artery Bypass Grafting. *Minimally Invasive Cardiac Surgery.* 2001; S88-S96.
4. Brian M Curtis and James H O'Keefe. Autonomic Tone as a Cardiovascular Risk Factor: The Dangers of Chronic Fight or Flight. *Mayo Clinic Proceedings.* 2002; 77: 45-54.
5. Michael S Lauer. Heart Rate Response in Stress Testing: Clinical Implications. *ACC Current Journal Review.* 2001; 16-19.
6. Claudia Fiorina, *et al*. The 6-min walking test early after cardiac surgery. Reference values and the effects of rehabilitation programme. *Eur J Cardiothorac Surg.* 2007; 32: 724-729.
7. Patricia Angélica de Miranda Silva, *et al*. Clinical Reliability of the 6 Minute Corridor Walk Test Performed Within a Week of a Myocardial Infarction. *Int Heart J.* 2006; 47: 533-540.
8. Lucini, Daniela MD *et al.* Effects of cardiac rehabilitation and exercise training on autonomic regulation in patients with coronary artery disease. *American Heart Journal*. 2002; 143(6): 977-983.
9. Cristina Opasich *et al.* Distance Walked in the 6-Minute Test Soon After Cardiac Surgery. *Chest.* 2004; 126: 1796-1801.
10. Elved Roberts *et al*. Validity of the 6-minute walk test for assessing heart rate recovery after an exercise-based cardiac rehabilitation programme. *Physiotherapy.* 2006; 92(2): 116-121.
11. Saoirse E o' Sullivan, Christopher Bell. The effects of exercise and training on human cardiovascular reflex control. *Journal of the Autonomic Nervous System.* 2000; 81: 16-24.
12. JS Macmillan, Leslie L Davis, Carol F Durham *et al*. Exercise and Heart Rate Recovery. *Heart and Lung: The Journal of Acute and Critical Care.* 2006; 35(6): 383-390.
13. James V Freeman *et al*. Autonomic Nervous System Interaction With the Cardiovascular System During Exercise. *Progress in Cardiovascular Diseases.* 2006; 48(5): 342-362.
14. Archana Mishra *et al*. Heart Rate Recovery as a Predictor of Mortality With or Without Revascularization. *Indian Heart J.* 2009; 61: 74-79.
15. Seref Demirel *et al*. Heart Rate Variability After Coronary Artery Bypass Graft Surgery: A Prospective 3 / Year Follow-Up Study. *ANE.* 2002; 7(3): 247-250.
16. Michael S Chen *et al*. Heart Rate Recovery and Impact of Myocardial Revascularization on Long-Term Mortality. *Circulation.* 2004; 110: 2851-2857.
17. KKA Witte *et al*. Chronic heart failure, chronotropic incompetence, and the effects of beta blockers. *Heart.* 2006; 92: 481-486.
18. Arto J Hautala, *et al*. Heart rate recovery after maximal exercise is associated with acetylcholine receptor M2 (CHRM2) gene polymorphism. *Am J Physiol Heart Circ Physiol.*

2006; 291: H459–H466.

19. MT La Rovere *et al*. Autonomic nervous system adaptations to short-term exercise training. *Chest.* 1992; 101: 299-303.
20. Jurij M Kalisnik *et al.* Assessment of Cardiac Autonomic Regulation and Ventricular Repolarization after Off-Pump Coronary Artery Bypass Grafting. *The Heart Surgery Forum.* 2006; 9(3): E661 - E667.
21. Sen-Wei Tsai *et al*. The effect of cardiac rehabilitation on recovery of heart rate over one minute after exercise in patients with coronary artery bypass graft surgery. *Clinical Rehabilitation.* 2005; 19(8): 843-849.

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Review Article

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Prevalence of Joint Pain Episodes and Association of BMI with Body Weight Perception in Young Adults: A Prospective Study

Richa Rai*, M.P.S. Negi, Charu Chopra*****

Abstract

Objective: To establish whether college going males and females having normal body mass index perceive themselves as normal and are satisfied with their body image perception and to know prevalence of the joint pain episodes in them. **Materials and Methods:** Database was collected from population of 200 people including 100 girls and 100 boys between the age group of 18- 25years of age by stratified purposive random sampling in North Delhi. Subjects were informed about filling up of the questionnaire, they were provided with instruction to fill that on consenting to participate. **Results:** The frequency of self perception differed significantly ($p<0.001$) between the two genders. Also, frequency of joint pain episode was significantly ($p<0.05$) different. **Conclusion:** It is thus concluded that gender differences related to perceived weight related to BMI are consistent among young adults. Females are most likely to perceive themselves as too fat or little fat while males perceives themselves as too thin or a little thin despite of having a normal BMI. Also frequency of joint pain episodes are higher in females than in males. Findings of present study are expected to contribute to obesity and body image concern research by underscoring the importance of sociocultural influences of shaping realistic body image and having implications for prevention and early intervention for establishing healthy behavior pattern during adolescence.

Keywords: BMI; Body image; Joint pains; Weight perception.

Introduction

The growing rate of obesity among children and adults is a global health concern. High levels of overweight population affects the country.Corresponding to this trend, large proportion of population is unsatisfied with their extra pounds and trying to loose them. In addition to actual weight perceived weight status is an important determinant of eating and weight loosing behavior.[1]

Perceived weight does not always reflect actual weight status based on BMI{body mass index}. This is a concern, as inappropriate weight perception can lead to unhealthy behavior including eating disorders, and excessive physical workouts leads to musculoskeletal problems. Universities and colleges on other hand, represents opportunities for reaching large numbers of students to promote appropriate weight perception and healthy eating behavior.[2,3]

Actual weight perception may be influenced by food habits and food environment, nutritional environments, nutritional knowledge, physical workout, cultural norms and expectation and mass media depiction of what constitute an ideal figure, in addition to lifestyle difference that affects physical activities.[2,3]

Obesity and malnutrition pose a major risk of chronic disease including type-2 diabetes, cardiovascular disease, hypertension, hypotension, stroke and certain types of cancer.

Body image is an important element of the intricate mechanism of one's own density.

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Gardener defines it as "the mental picture we have of our body measure, contour and shape, and are freely related to those characteristics and to our body part.[4]

The subjective component of body image refers to one's satisfaction with their own body size. Sociocultural environment seems to be an important variable in the level of distortion and subjective body image disorders.[5]

Identifying and measuring the magnitude of body image self perception distortion would be relevant for clinical evaluation of those individuals who are at risk of obesity or becoming malnutrition. The assessment of body perception in relation with weight status is important in order to understand likelihood of an individual to get involved in healthy behavior.

The chronic intake of energy below the level of expenditure induces rapid loss in body weight and muscle mass accompanied by profound changes in physiology and behavior. Together these causes starving person to become weak, apathic, depressed and unable to work productively and these changes are more evident in gastrointestinal system, skin, blood cells, nervous system and musculoskeletal system. Skin lesion, malabsorption, indigestion, anemia, neurological or behavioral changes and of special concern, the loss of immune responses, accompanies severe malnutrition.[2,3,6]

The term 'body image' refers to the picture of our own body which we form in our mind—in its physiological, libidinous, and sociological aspects.Body image distortion occurs when a person's views about his or her body are significantly different from reality.[7]

Many factors impact the perception of one's own body image including media, peer group, ethnic group and family values8.The disparity between height and weight leads to problem with self esteem when one feels that he or she is not meeting the demands of ideal body shape and size. Anorexia nervosa and bulimia cause dramatic weight fluctuation and interfere with normal life and cause damage vital bodily functions.[9]

Body Mass Index

One of the methods for statistical measure of body weight is BMI (body mass index). BMI provides a simple numerical value which is the measure for person's fatness or thinness allowing health professionals to discuss over and underweight problems more objectively in the patient. According to the WHO guidelines, BMI = weight(kg)/ height(m)2 where Underweight = <17, Normal = 17-25, Overweight = 25-30 &Obese = >30.[10]

So the following study was taken up to establish whether college going males and females having normal body mass index perceive themselves as normal and are satisfied with their body image perception and to know prevalence of the joint pain episodes in them.

Materials and Methods

Database was collected from population of 200 people including 100 girls and 100 boys between the age group of 18-25 years of age by stratified purposive random sampling in North Delhi. Questionnaire was made to fill by the subject, on consenting to participate. Only the subjects who met the inclusion criteria i.e. Mesomorphs at site and a BMI of 17-25kg/m2,males and females of Age 17 to 25 and unmarried were selected for the study. Subjects diagnosed of any pathology/disorder, undergoing hormonal therapy, psychologically impaired and having any chronic disorder were excluded from the study. A standard and calibrated digital weighing machine scale certified by ISO 9001:2000 was used and weight was measured to the nearest 100th gram. A non-stretchable measuring tape was used to measure height to the nearest 0.5 cm.

The subjects were asked to fill the questionnaire and their body mass index was measured from the data obtained. Males and females were compiled separately.

Three separate models with dichotomous

responses were employed.

1. Just right
2. too much thin or little thin
3. too much fat or little fat

The weight was calculated in kilograms and height in meters and BMI as calculated in kg/ m2 was compared with student's own perception about their body size.

The questionnaire consisted of few questions which was used to assess the perception of the person, any joint pains reported, physical activeness, diet pattern and any problem related to that and the demographic data of the individual.

Statistical Analysis

Continuous data were summarized as Mean ± SD while discrete (categorical) in %. Continuous groups were compared by independent Student's t test while categorical groups were compared by chi square (÷2) test or Fisher's exact test. A two-sided (á=2) p<0.05 was considered statistically significant.

Results

The basic characteristics of two gender groups are summarized in Table 1. The mean age of two groups were similar (p>0.05). However, the mean height, weight, and BMI of males were significantly (p<0.001) different and higher as compared to females. The frequency of self perception differed significantly (p<0.001) between the two genders withfrequency of LF and TMF being significantly higher in females as compared to males while TMT, LT and JR were significantly higher in males as compared to females. The actual perception (i.e. perception according to BMI) did not differ (p>0.05) between the two groups. However, frequency of joint pain episode was significantly (p<0.05) different and higher in females as compared to males.

The association of actual perception with self perception between the two gender groups is summarized in Table 2. Table 2 showed that the self perceptionsdid not differ between the two genders when compared to actual perception "under weight" and "over weight" while differed significantly (p<0.001) when compared to actual perception "normal weight". According to actual perception "normal weight", the frequency of self perception LT (7.4% vs. 40.7%, p<0.001) and JR (12.3% vs. 26.4%, p=0.021) were

Table 1: Basic Characteristics (Mean ± SD) of Two Groups

Characteristics	Females (n=100)	Males (n=100)	p value
Age (yrs)	21.26 ± 1.69 (18-25)	20.96 ± 2.09 (18-25)	0.265
Height (cm)	160.71 ± 4.42 (152-173)	171.04 ± 6.87 (157-190)	p<0.001
Weight (kg)	54.45 ± 6.39 (45-71)	64.97 ± 7.23 (47-90)	p<0.001
BMI (kg/m^2)	21.08 ± 2.30 (17.63-28.80)	22.19 ± 1.95 (17.28-28.41)	p<0.001
Self perception:			
TMT	0 (0.0%)	5 (5.0%)	
LT	8 (8.0%)	38 (38.0%)	
JR	14 (14.0%)	27 (27.0%)	p<0.001
LF	69 (69.0%)	28 (28.0%)	
TMF	9 (9.0%)	2 (2.0%)	
Actual perception:			
Under weight (BMI: 16.00-18.49 kg/m^2)	10 (10.0%)	3 (3.0%)	
Normal weight (BMI 18.50-24.99 kg/m^2)	81 (81.0%)	91 (91.0%)	0.084
Over weight (BMI:25.00-29.99 kg/m^2)	9 (9.0%)	6 (6.0%)	
Joint pain episode:			
Yes	19 (19.0%)	7 (7.0%)	0.019

Numbers in parentheses indicates the range (min-max)

Table 2: Association of Actual Perception with Self Perception between Two Groups

Actual perception	Gender	Self perception					p value
		TMT	LT	JR	LF	TMF	
Under weight (n=13)	Females (n=10)	0 (0.0%)	1 (10.0%)	4 (40.0%)	5 (50.0%)	0 (0.0%)	0.284
	Males (n=3)	1 (33.3%)	0 (0.0%)	1 (33.3%)	1 (33.3%)	0 (0.0%)	
Normal weight (n=172)	Females (n=81)	0 (0.0%)	6 (7.4%)	10 (12.3%)	57 (70.4%)	8 (9.9%)	p<0.001
	Males (n=91)	4 (4.4%)	37 (40.7%)	24 (26.4%)	24 (26.4%)	2 (2.2%)	
Over weight (n=15)	Females (n=9)	0 (0.0%)	1 (11.1%)	0 (0.0%)	7 (77.8%)	1 (11.1%)	0.244
	Males (n=6)	0 (0.0%)	1 (16.7%)	2 (33.3%)	3 (50.0%)	0 (0.0%)	

Table 3: Distribution of Misperception between Two Groups

Actual perception	Gender	Self perception		p value
		Correct	Incorrect	
Under weight (n=13)	Females (n=10)	1 (10.0%)	9 (90.0%)	0.423
	Males (n=3)	1 (33.3%)	2 (66.7%)	
Normal weight (n=172)	Females (n=81)	10 (12.3%)	71 (87.7%)	0.023
	Males (n=91)	24 (26.4%)	67 (73.6%)	
Over weight (n=15)	Females (n=9)	8 (88.9%)	1 (11.1%)	0.235
	Males (n=6)	3 (50.0%)	3 (50.0%)	

significantly (p<0.05 or p<0.001) lower while LF (70.4% vs. 26.4%, p<0.001) and TMF (9.9% vs. 2.2%, p=0.032) were significantly (p<0.05 or p<0.001) higher in females as compared to males.

Assessing the misperception, the self perception were further sub grouped in three groups by considering "TMT + LT" as "under weight", JR as "normal weight" and "LF + TMF" as "over weight" andthe frequency were then compared with actual perceptions (under weight, normal weight and over weight) and summarized in Table 3. The misperception under weight was higher in females as compared to males but not differ statistically (90.0% vs. 66.7%, p=0.423). In contrast, the misperception overweight weight was higher in males as compared to females but also not differ statistically (11.1% vs. 50.0%, p=0.235). However, the misperception normal weight differed between the two genders and significantly (p<0.05) higher in females as compared to males (87.7% vs. 73.6%, p=0.023).

Discussion

The present study was taken up to establish whether college going males and females having normal body mass index, perceive themselves as normal and are satisfied with their body image perception & prevalence of the joint pain episodes in them.

In a study done almost 2 decades earlier, Dwyer, J.T. Feldman & Mayer J. studied 446 females of senior high school and anthropometric measurements were taken to determine the body fat levels. 37% of girls reported that they were on a diet on the day of their interview, while 61.4 % reported that they had dieted sometime in their lives. However , only 15 % of the girls were found to be obese. When asked that most important reason for dieting, 43 % were concerned with beauty and good looks. It is also important to note that this study was done long before the widespread introduction and use of diet soft drinks and diet food like Lean Cuisine.[11,12]

The data obtained from present study also confirms that, perception of body image in young adults do not coincide with desired body type. Two different tendencies emerged: while the girls aim for longer, slimmer body shape, boys in general, apart from having

sometimes felt overweight unlike their female peer, feels too thin.

This appearing contradictive view can be explained by the fact that boys like to have robust and muscular constitution. Amongst the 200 subjects taken, 179 had normal BMI. But there is large difference between the perceived body image and habits among the individuals of both gender groups. As from the results we can conclude that, both young males and females have altered perception about their body weight. This can produce harmful effects to the individuals both mentally and physically as supported by a study done by Isomaa, Rasmus in 2011 where they have concluded that an incorrect perception of being underweight was more prevalent than an incorrect perception of being overweight among adolescent males, and that this incorrect perception was related to social anxiety and that eating disorders are common among adolescent females and rare among adolescent males.[9]

Some previous studies have suggested that the ideal BMI for female attractiveness preferred by women is significantly lower than that preferred by men.[13] Most of the females, even though having normal BMI, have a tendency to adopt comparatively more numbers of strategies to reduce weight. From the data calculated in our study also, the frequency of self perception differed significantly ($p<0.001$) between the two genders with frequency of LF and TMF being significantly higher in females as compared to males while TMT, LT and JR were significantly higher in males as compared to females. Also it has been observed that according to actual perception "normal weight", the frequency of self perception LT (7.4% vs. 40.7%, $p<0.001$) and JR (12.3% vs. 26.4%, $p=0.021$) were significantly ($p<0.05$ or $p<0.001$) lower while LF (70.4% vs. 26.4%, $p<0.001$) and TMF (9.9% vs. 2.2%, $p=0.032$) were significantly ($p<0.05$ or $p<0.001$) higher in females as compared to males. This situation can affect females more intricately and plays an important role in health related problems. Anorexia nervosa can be one of them- a " nervous loss of appetite" reflecting preoccupation with dieting and thinness and refusal to eat enough food to maintain normal body weight.[4]

On the other hand, in contrast, the misperception overweight, weight was higher in males as compared to females but also did not differ statistically (11.1% vs. 50.0%, $p=0.235$). This again may pose as an upcoming problem in young male adults9, due to excessive eating there could be bulimia like features like "ox hunger", binge eating like characteristics, where the person consumes calorically dense food within several hours, followed by intense feeling of guilt.[4] Cardiovascular problem may occur due to this tendency of overeating. Study suggested that adolescent with excessive perception of weight are more likely to adopt unhealthy behaviors or manipulate the consumption of certain of food stuffs. This discomfort with one's body image within population cannot have anything but obvious repercussion in life.

Lautman M. in 1991, had studied that the mass media's portrayal of the thin, ideal female body is well documented. Advertisers explicitly target the body image of women in the marketing of food and exercise products and the effects of this practice were just beginning to be explored in that decade by other researchers also viz Kaltenbach,1991.[12] The trend continued and further stated by other researchers vizStice, Schupak-Neuberg, Shaw, Stein in 1994 also that the increasing number of articles and advertisements promoting diet, weight-control and fitness coexists with the systematic decrease of satisfaction with one's own body image.[14]

Another research was conducted in Poland and included several groups of participants i.e 13-14 year old pupils, and the data they collected supported women's dissatisfaction with their body image and different ideal body images among female groups. The results seem to be very important for the explanation of the mechanism of development of eating disorders. As studied by them and other

authors viz Silverstein, Perdue, Peterson & Kelly in 1986 and Myers &Biocca in 1992, media presented an unrealistic or idealised picture of physical attractiveness Every day, women were informed that they should eat very little and be slim. Extremely thin top models, became a representation of the ideal standard & objects of comparison for many young women. Very often they were also not conscious that photographs they found in women's magazines were manipulated and they believed that their appearance should be similar to that of the models. In this way a cult of unreal beauty is created as studied by Marzano-Parisoli,2001.[15,16]

It is thus concluded that gender differences related to perceived weight related to BMI are consistent among young adults. Females are most likely to perceive themselves as too fat or little fat while males perceives themselves as too thin or a little thin despite of having a normal BMI. Also frequency of joint pain episodes are higher in females than in males.

Findings of present study are expected to contribute to obesity and body image concern research by underscoring the importance of sociocultural influences of shaping realistic body image and having implications for prevention and early intervention for establishing healthy behavior pattern during adolescence. This helps to figure out the basic tendencies among males and females regarding their body image and all practices related to modify their body image which unknowingly can harm them. Steps to carry out adequate and urgent measures of an informative education in order to prevent further dramatic development in this area, through systematic intervention for prevention and treatment, based on concrete knowledge is required as it has been observed that the misperception normal weight differed between the two genders and significantly ($p<0.05$) higher in females as compared to males (87.7% vs. 73.6%, $p=0.023$).

Conclusion

It is thus concluded that gender differences related to perceived weight related to BMI are consistent among young adults. Females are most likely to perceive themselves as too fat or little fat while males perceives themselves as too thin or a little thin despite of having a normal BMI. Also frequency of joint pain episodes are higher in females than in males.

References

1. Obesity: preventing and managing the global epidemic: report of a WHO Consultation. Geneva: World Health Organization; 2000 (WHO Technical Report Series, 894).
2. Carlo Pruneti, Federico Fontana, LorenzaBicchieri. Eating Behavior And Body Image Perception: An Epidemiological Study On Italian Adolescents.*Acta Bio Medica Ateneo Parmense*. 2004; 75: 179-184.
3. Dunkley TL. Examination of a model of multiple socio cultural influences or adolescent girl's body dissatisfaction and dietary restraint. *Adolescence*. 2001; 36(142): 265-79.
4. Mc Ardle, William D. Exercise Physiology: Nutrition, energy and human performance. William D. McArdle, Frank I. Katch, Victor L. Katch.- 7th Edition. 2010; 807-808.
5. Martin AR, Nieto JM, Jimenez MA, *et al*. Unhealthy eating behaviour in adolescents. *Eur J Epidem*. 1999; 15(7): 643-8.
6. Miles L. Physical activity and health. *Nutrition Bulletin*. 2007; 32: 314-363.
7. Schilder P. The image and appearance of the human body. Oxford, England: Kegan Paul; 1935, 353.
8. Holmqvist K, Frisén A. Body dissatisfaction across cultures: findings and research problems. *Eur Eat Disord Rev*. 2010; 18(2): 133-46.

9. Isomaa, Rasmus, *et al*. Longitudinal concomitants of incorrect weight perception in female and male adolescents. *Body Image.* 2011; 8(1): 58-63.
10. WHO. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. WHO Technical Report Series 854. Geneva: World Health Organization; 1995.
11. Dwyer JT, Feldman JJ, & Mayer J. Adolescent dieters: Who are they? *The American Journal of Clinical Nutrition.* 1967; 20(10): 1045-1056.
12. Myers Philip N, and Frank A Biocca. The elastic body image: The effect of television advertising and programming on body image distortions in young women. *Journal of Communication.* 1992; 42(3): 108-133.
13. Thompson J Kevin, and Kay Psaltis. Multiple aspects and correlates of body figure ratings: A replication and extension of Fallon and Rozin (1985). *International Journal of Eating Disorders* 1998; 7(6): 813-817.
14. Stice E, Schupak-Neuberg E, Shaw HE, Stein RI. Relation of Media Exposure to Eating Disorders Symptomatology: An Examination of Mediating Mechanism. *Journal of Abnormal Psychology.* 1994; 4: 836-840.
15. AlicjaG³êbocka, Jaros³awKulbat . Ideal Body Images of Female Body Shape in Normal and Pathological Groups . *Polish journal of applied Psychology.* 2005; 3(1).
16. J Corey Butler, Richard M Ryckman. Perceived and Ideal Physiques in Male and Female University Students. *The Journal of Social Psychology.* 133(5): 751-752.

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Review Article

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Effect of Contralesional rTMS on Hand Function in Chronic Stroke: Case Series

Vivek Sharma*, Harraman Kaur*, Divya Gupta**

Abstract

Repetitive transcranial magnetic stimulation (TMS) is a non-invasive technique to stimulate the cortical regions of the brain. rTMS can be used as a therapeutic adjunct to improve motor recovery following stroke, because of its potential to modulate cortical excitability. Depending on essential parameters of the stimulation frequency and number of trains of stimuli, rTMS can produce lasting up or down- regulation of the corticospinal system. At lower frequency (1-Hz) rTMS can suppress the excitability of the motor cortex causing an inhibitory effect; whereas at higher frequencies (>1 Hz) rTMS can increase cortical excitability causing facilitation. Many studies suggest that following stroke, there is exaggerated interhemispheric inhibition of the ipsilesional hemisphere, by the contralesional hemisphere. We report findings of a few stroke patients, where rTMS was given over the contralesional hemisphere to see its effect on the affected hand function.

Keywords: rTMS; Repetitive transcranial magnetic stimulation; Stroke; Ipsilesional hemisphere; Contralesional hemisphere; Hand function.

Introduction

Transcranial magnetic stimulation (rTMS) is a non-invasive technique to stimulate the cortical regions of the brain. The term rTMS means repetitive transcranial magnetic stimulation as it is delivered at regular intervals. A number of forms of brain stimulation, in particular rTMS, have been studied for improving post-stroke deficits. However, the ability of rTMS to modulate cortical excitability makes its as a therapeutic adjuvant that may enhance motor recovery following stroke.[1,2,3] The technique of rTMS is purely based on the Faraday's law of magnetism, which states "when an electric current passes along a wire a magnetic field is induced in the surrounding space" and this magnetic field induces depolarisation in the neurons stimulated. Depending on essential parameters of the stimulation frequency and number of trains of stimuli, rTMS can produce lasting up or down- regulation of the corticospinal system. At lower frequency (1-Hz) rTMS can suppress the excitability of the motor cortex causing an inhibitory effect; whereas at higher frequencies (>1 Hz) rTMS can increase cortical excitability causing facilitation.[3,4]

Stroke may affect the balance of transcallosal inhibitory pathways between primary motor areas in both hemispheres: the ipsilesional hemisphere not only gets disrupted by stroke itself but also by the resulting asymmetric inhibition from the contralesional hemisphere. This exaggerated interhemispheric inhibition of the ipsilesional hemisphere, in particular primary motor area (M1), by contralesional M1 can lead to down regulation of excitability in neurons that have survived the stroke. Therefore, it is believed that contralesional M1 virtual lesion by using rTMS at low frequency causes paradoxical functional facilitation of the affected hand in

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Table 1: Demographic Details and Scores of Patients

S. No	Age (years)	Gender	Diagnosis	Side of hemiplegia	Time since onset (months)				
						Pre FMA	Post FMA	Pre BI	Post BI
1	72	Male	Periventricular infarct	Right	24	8	8	75	75
2	55	Male	Middle cerebral artey infarct	Right	12	8	10	75	75
3	27	Male	Traumatic brain injury	Left	36	38	38	100	100
4	35	Male	Stroke	Left	50	27	27	100	100
5	45	Male	Basal ganglia bleed	left	13	2	3	35	35

stroke patients.[4,5] Many studies using rTMS suggest that inhibitory rTMS over the contralesional hemisphere may be a more effective method of enhancing paretic limb function, although ipsilesional stimulation is still beneficial.[2]

Cases Summary

Informed consent was taken from the patient/immediate family member. Protocol of rTMS was cleared by the institutional ethical board. Patients with uncontrolled seizures, implanted defibrillator, pacemaker, pre-morbid neurological insult, metal implants in head, uncontrolled migraine were excluded from the study.A total of 5 patients were recruited for the pilot study, between December 2013 and January 2014 at Vidyasagar Institute of Mental Health ,Neuro & Allied Sciences (VIMHANS),Delhi.Four of them had stroke and one had hemiplegia following traumatic brain injury. All patients were male ranging in age from 27 to 72 years. All patients were right hand dominant before stroke. 2 of them had right sided hemiplegia and 3 had left sided hemiplegia. The time since onset of hemiplegia ranged between 1 to 4 years. All the patients were ambulatory with or without the use of assistive aid.

All patients were assessed on Fugl Meyer Assessment scale (upper limb and hand component) and Barthel's Index, pre and post rTMS. The rTMS parameters used for each patient were 1-Hz frequency at 100% resting motor potential (RMP) with 30 trains of 30 pulses each and 5 sec interval between each train. The stimulation was applied for a period of 10 days, spread over a period of 2 weeks. During the procedure, patients were comfortably seated in an armchair. rTMS was given with a machine developed by Medicaid systems, Chandigarh, INDIA, the model of the machine used for our study was MedStim-MS30. Hand area of motor cortex in unaffected hemisphere was stimulated using figure-of-eight coil. Resting motor threshold (RMP) was determined for each patient by placing the coil tangentially over the motor cortex of unaffected hemisphere and moving until the smallest possible impulse produced a visible movement of the thumb or fingers of the contralateral hand in atleast half of 10 stimulations. Stimulation intensity was calculated as 100% of RMP for each patient. [6]

Results

Our results showed that 2 out of 5 patients improved on Fugl Meyer Assessment (FMA) of their affected hand and rest of them did not show any change. The change seen in FMA scores was very minor and non-significant; however, no statistical analysis was done due to small number of patients. None of the patients showed improvement on Barthel's

Index (BI) score.

Discussion

There is now growing evidence that contralesional hemisphere impairs, rather than facilitates motor performance in stroke patients. It has therefore been proposed by Ward and Cohen that a down regulation of the contralesional primary motor cortex might be effective for facilitation of motor recovery after a stroke.[5,7,8,9,10] In this study, we hypothesized that reducing the inhibition from the contralesional hemisphere by using 1-Hz rTMS might improve motor performance of the affected hand. Recovery from hemiplegia likely involves motor learning processes. At the cellular and molecular level, learning motor skills is associated with neural plasticity mediated in part by long term potentiation (LTP) and long term depression (LTD). LTP is defined as long lasting synaptic enhancement, where as LTD by the decrease of synaptic activity. LTP and LTD like changes can be induced in healthy and stroke patients using different rTMS protocols. For instance, application of low frequency rTMS (1-Hz) to the hand area of the M1 reduces the excitability of corticospinal projections from the site of stimulation. In addition, inhibitory 1-Hz rTMS to the M1 also increases regional blood flow in the contralateral M1 as detected by positron emission tomography.[1]

The rTMS parameters which we incorporated in this study have been used previously by Khedr *et al* in 2009. They conjectured that patients receiving contralesional 1-Hz rTMS showed more improvement relative to the other interventions (ipsilesional 3-Hz & sham stimulation) on simple motor tasks, stroke impairment and disability.[6] Although the only change in our study was, total number of sessions, khedr *et al* had used it for 5 days and we delivered rTMS for 10 days. Our results did not show much change after the 10 day treatment. As this was a pilot study, so we need to consider few things for our future trials, such as: more number of sessions so that more inhibition of contralesional cortex can take place as the patients are already in chronic stage of stroke, more accurate method of choosing cortical area of stimulation for rTMS, having more specific outcome measures for hand function assessment. For the reference, we would like to discuss some of the studies using contralesional rTMS.

Most of the clinical trials using low frequency rTMs applied to the unaffected hemisphere have demonstrated decreased interhemispheric inhibition of the affected hemisphere and improvement in motor performance. Boggio *et al* reported a case of a stroke patient with severe motor impairment who underwent sham and active repetitive transcranial magnetic stimulation (rTMS) of the unaffected hemisphere. They have shown that a chronic stroke patient with no movements in the affected hand was able to partially gain hand motor function after inhibitory 1-Hz rTMS was applied on the unaffected primary motor cortex.[11] Mansur *et al* investigated the use of low-frequency repetitive transcranial magnetic stimulation (rTMS) to the unaffected hemisphere for improving motor function in 8 patients within 12 months of a stroke. Of these patients, five had mild impairment and three had moderate impairment. Patients showed a significant decrease in simple and choice reaction time and improved performance of the Purdue Pegboard test with their affected hand after rTMS of the motor cortex in the intact hemisphere as compared with sham rTMS. [12] Takeuchi *et al* conducted a double blind study of real versus sham rTMS in 20 stroke patients. They reported an improvement in hand function (pinch acceleration) after giving to low frequency rTMS to the contralesional hemisphere. They also concluded that rTMS reduced the amplitude of motor evoked potentials in contralesional M1 and the transcranial inhibition (TCI) duration.[13] No patients with total paralysis participated in the above two studies.

In contrast, a study done by Werhahn *et al* on 5 stroke patients showed no improvement

in the motor function of the paretic hand after 1-Hz rTMS of the unaffected hemisphere. The inconsistent results may be explained by the patient selection, the type of lesion, the different tasks employed, dose and intensity of rTMS and placement of coil.[4]

References

1. Hoyer EH & Celnik PA. Understanding and enhancing motor recovery after stroke using transcranial magnetic stimulation. *Restor Neurol Neurosci*. 2011; 29(6): 395-409.
2. Corti M, Patten C, & Triggs W. Repetitive transcranial magnetic stimulation of motor cortex after stroke: A focused review. *Am J Phys Med Rehabil*. 2011; 00: 00-00.
3. Rossi S, Hallett M, Rossini PM, & Pascual-Leone A. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. *Clin Neurophysiol*. 2009; 120(12): 2008-2039.
4. Werhahn KJ, Conforto AB, Kadom N, Hallett M, Cohen LG. Contribution of the ipsilateral motor cortex to recovery after chronic stroke. *Ann Neurol*. 2003; 54: 464-72.
5. Fregni F *et al*. A sham-controlled trial of a 5 day course of repetitive transcranial magnetic stimulation of the unaffected hemisphere in stroke patients. *Stroke*. 2006; 37: 2115-2122.
6. Khedr EM, Abdel-Fadeil MR, Farghali A, Qaid M. Role of 1 Hz and 3 Hz repetitive TMS on motor function recovery after acute ischemic stroke. *Eur J Neurol*. 2009; 16: 1323-30.
7. Kim YH *et al*. Repetitive transcranial magnetic stimulation- induced corticomotor excitability and associated motor skill acquisition in chronic stroke. *Stoke*. 2006; 37: 1471-1476.
8. Yozbatiran N *et al*. Safety and behavioural effects of high frequency repetitive transcranial magnetic stimulation in stroke. *Stroke*. 2009; 40(1): 309-312.
9. Nowak DA *et al*. Effects of low frequency repetitive ranscranial magnetic stimulation of the contralesional primary motor cortex on movement kinematics aand neural activity in subcortical stroke. *Arch Neurol*. 2008; 65(6): 741-747.
10. Malcolm MP *et al*. Repetitive transcranial magnetic stimulation as an adjunct to constrained induced therapy: An exploratory randomized controlled trial. *Am J Phys Med Rehabil*. 2007; 86(9): 707-715.
11. Boggio PS *et al*. Hand function improvement with low frequency repetitive transcranial magnetic stimulation of the unaffected hemisphere in a severe case of stroke. *Am J Phys Med Rehabil*. 2006; 85: 927-930.
12. Mansur CG *et al*. A sham stimulation controlled trial of rTMS of the unaffected hemisphere in stroke patients. *Neurology*. 2005; 64: 1802-1804.
13. Takeuchi N, Chuma T, Matsuo Y, Watanabe I, & Ikoma K. Repetitive transcranial magnetic stimulation of contralesional primary motor cortex improves hand function after stroke. *Stroke*. 2005; 36: 2681-2686.

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[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.

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

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[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.

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[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.

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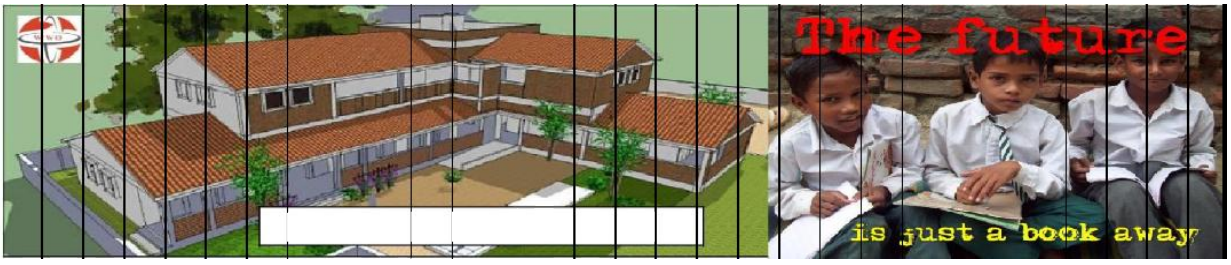

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