



A Systematic Review on Efficacy of Patient Controlled Static Stretching Device in Reducing Upper Extremity Dysfunction in Hemiplegic Stroke Patients

Dr. Nidhi Haresh Dhanesh (PT), Dr. Ashish Kakkad, Dr. Rahul Chhatlani (PT)

1. PhD scholar, Assistant Professor, Faculty of Physiotherapy, Marwadi University, Rajkot –Gujarat, India.
2. Professor, Faculty of Physiotherapy, Marwadi University, Rajkot – Gujarat, India.
3. PhD scholar, Assistant Professor, Faculty of Physiotherapy, Marwadi University, Rajkot –Gujarat, India.

(Received: 27 October 2023

Revised: 22 November

Accepted: 26 December)

KEYWORDS

Spasticity,
stretching
device, upper
extremity
dysfunction

ABSTRACT:

Introduction: Stroke is a health problem and leading cause of disability worldwide. Upper extremity dysfunction due to spasticity, weakness and non-use are most common factors affecting quality of life. Many different stretching techniques are used in treatment of spasticity, patient controlled stretching device were developed to reduce effort and time of therapist and patient.

Objective: To conduct a systematic review on effectiveness of Stretching device in reducing spasticity and improving upper extremity function.

Method: A systematic review of the English language literatures was undertaken for articles published between January 2005 to December 2023. MEDLINE and PUBMED were searched for the use of stretching device in upper extremity dysfunction. Studies were selected on based on inclusion criteria. Two independent reviewers screened and identified suitable studies. Methodological quality and risk of bias was assessed using a modified PEDro scale.

Result : Very less number of studies are available on effectiveness of patient controlled stretching device in stroke patient and sample size in studies are also smaller but in most of studies it is found to be effective.

Conclusion : Low quality of evidence is there on effectiveness of patient controlled stretching device in reducing spasticity and improving upper extremity hand function. Further studies with larger sample size and better study design are needed to draw proper conclusion.

1. Introduction

Stroke is a “clinical syndrome characterized by rapidly developing clinical symptoms and/or signs of focal and at times global loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.”¹ The overall prevalence rate for stroke in Indian population is rural area = 84 – 262 per 100,000² Urban area= 334 – 424 per 100,000. The risk of stroke doubles every 10 years, 2 after the age of 55 years and two thirds of all strokes occurs in people older than the age of 65 years.³Crude incidence of stroke ranged from 108 to 172/100,000 people per year, crude prevalence from 26 to 757/100,000 people per year.³ Approximately 65% of all stroke patients experience spasticity⁴, which can

result in functional disability due to muscle tightness and joint stiffness of the affected extremity.⁵ Appropriate management of spasticity is a crucial issue during the rehabilitation of stroke patients due to its high prevalence and close link with functional success. Wrist flexors spasticity and wrist extensors weakness creates difficulty in grasp and release activity. Limited independence of stroke survivors associated with upper extremity impairments severely affects quality of life.⁶ Patient with moderate to severely affected arm function is insufficiently able to generate voluntary movements to participate in regular arm – hand skill training at start of rehabilitation program they may develop non-use due to lack of participation in program. There are many modalities for management of spasticity in stroke



patients. These include medication, stretching exercise, nerve block, muscle wash, neuromuscular electrical stimulation, repetitive transcranial magnetic stimulation, serial cast application, antispastic brace, and surgery^{7,8,9}. Among these modalities, stretching exercise is a process by which tissue is lengthened by an external force in order to eliminate tightness that has the potential to cause a contracture. It has been considered a basic management modality for spasticity and has been used commonly due to its easy availability, fewer side effects, and economic efficiency^{8,9}. Patient controlled Stretching devices were developed by various authors for reduction of spasticity, improving hand function and reducing time and effort of therapist. Many such devices have been developed but so far to our knowledge no systemic reviews on effectiveness of this patient-controlled device for upper extremities are not found. So for evidence based practice there is need to conduct systemic review to critically analyze effectiveness of patient controlled stretching devices on upper extremity dysfunction following stroke before introducing this device in treatment plan.

2. Objectives

The objective of this systematic review is to provide an updated evidence synthesis that includes all published trials to date about use of patient controlled stretching device to improve upper extremity function after stroke.

3. Methods

ELIGIBILITY CRITERIA-

INCLUSION CRITERIA - Upper limb stretching device - Stroke patients age > 18 years - Published in peer reviewed journal Design RCT, Systemic review and meta-analyses.

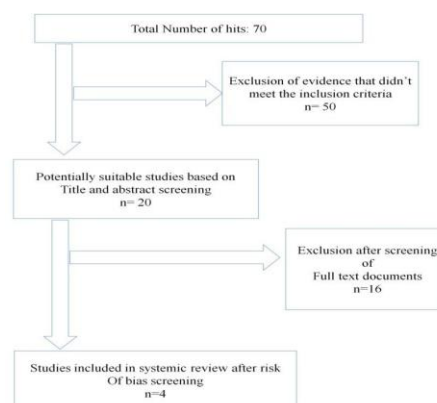
EXCLUSION CRITERIA - Plagiarized or unethical studies - Studies including other interventions like NEMS, etc - Studies including condition other than stroke Studies before survey dates.

Identification of studies: A comprehensive search strategies was developed using the US national library of medicine and national institute of health. Clinical evidence databases were searched from January 2010 to December 2023. Titles, abstracts and full text articles, where necessary were screened for eligibility reviewer.

Methodological quality assessment: A modified version of physiotherapy evidence database [Modified PEDro] scale was used to assess the methodological quality of included studies. One point was awarded for each criterion that was clearly satisfied according to prespecified guidelines, and the 11 items

summed to give a total methodological quality score out of 10. Two reviewers completed formal training for using the PEDro scale and independently rated each eligible study

DATA EXTRACTION AND ANALYSIS



4. Results

In this study Out of 70 articles, 4 articles are selected and their results show that static stretching is used to reducing upper extremity dysfunction in hemiplegic stroke patients.

AUTHOR	SAMPLESIZE	OUTCOME	CONCLUSION
Yong et al. (2011) ¹¹	n = 21 (20 min/session, 2 session/day for 3 weeks)	MAS PEDro= 6/10	stretching device effectively reducespasticity in chronic stroke patients
Hae min jo et al. (2013) ¹²	n = 10 (2 session / day for 4weeks)	MAS wrist & hand component ofFMA AROM PEDro= 5/10	Static stretching effectively reduces spasticity and improve motor functionin subjects with severe spasticity and weakness following stroke
Eun Hyuk kim et al. (2013) ¹³	n = 15 (10 min/ session, 2session/day for 4 weeks)	MAS PEDro= 7/10	Devised stretching effectively reducespasticity in chronic stroke patients
Woo H. Jang et al. (2016) ¹⁴	n = 21(14 minute/session,3 session / dayfor 4 weeks)	MAS FMA AROM PEDro=7/10	Static stretching effectively reduces spasticity and improve motor functionin subjects with chronic hemipareticstroke

METHODOLOGICAL QUALITY:

Most of studies received score of around 6 out of 10 Criteria that met least number of studies were blinding of patient, therapist who administers the treatment and blinding of all assessors who measured one key outcome.

OUTCOME MEASURE

3 outcome measures were used by studies selected –

- 1.Modified ashworth scale
- 2.Wrist and hand component of FMA
- 3.Active ROM



5. Discussion

Stretching is found to be beneficial for reducing spasticity and improving hand functions by many authors in hemiplegic stroke patients. Stretching device were developed by various authors to reduce time & effort of therapist as well as patient. Compared with the number of stretching devices for lower extremity spasticity, fewer stretching devices for hand and wrist spasticity have been developed.¹⁴ As an outcome measure MAS, FMA and AROM can be used. Stretching device was effective in reducing MAS SCORE and FMA score but effectiveness in AROM score was not found. 2 studies used AROM as outcome didn't found improvements in AROM pre and post comparison^{12&13}

This systemic review shows that available evidence has found stretching device to be effective in reducing upper extremity dysfunction in hemiplegic stroke patients.

However, there are very few studies, small sample size, no long-term effects studied and Lack of blinding.

More research in this area is needed, better quality RCT, larger sample size and long term follow up is needed to draw proper conclusion.

For further recommendation all type of neurological conditions with spasticity should be included and other types of treatment along with stretching device can be included.

References

- 1) Carr JH, Shepherd RB. Neurological Rehabilitation Optimizing Motor Performance. 2nd edition. Churchill Livingstone (2010)
- 2) Jeyaraj Durai Pandian, Paulin Sudhan. Stroke Epidemiology and Stroke care services in Indian Journal of stroke 2013; 15 (3): 128-134.
- 3) Jones, S. P., Baqai, K., Clegg, A., Georgiou, R., Harris, C., Holland, E.-J., Kalkonde, Y., Lightbody, C. E., Maulik, P. K., Srivastava, P. M., Pandian, J. D., Kulsum, P., Sylaja, P., Watkins, C. L., & Hackett, M. L. (2022). Stroke in India: A systematic review of the incidence, prevalence, and case fatality. *International Journal of Stroke*, 17(2), 132–140.
- 4) Gallichio JE. Pharmacologic management of spasticity following stroke. *Phys Ther* 2004; 84:973-81.
- 5) Sahrmann SA, Norton BJ. The relationship of voluntary movement to spasticity in the upper motor neuron syndrome. *Ann Neurol* 1977; 2:460-5.
- 6) P Gerlach-Hahn, A. Jansen-Troy, and S. Leonhardt, "A survey on robotic devices for upper limb rehabilitation," *Journal of Neuroengineering and Rehabilitation*, vol. 11, 2014.
- 7) Darcy Umphred A. Neurological Rehabilitation. 5th edition. Philadelphia: Elsevier Publication; 2007.
- 8) S.H. Jang, S.H. Ahn, S.M. Park, S.H. Kim, K.H. Lee and Z.I. Lee, Alcohol neurolysis of tibial nerve motor branches to the gastrocnemius muscle to treat ankle spasticity in patients with hemiplegic stroke, *Arch Phys Med Rehabil* 85 (2004), 506–508.
- 9) N.A. Lannin, I. Novak and A. Cusick, A systematic review of upper extremity casting for children and adults with central nervous system motor disorders, *Clin Rehabil* 21 (2007), 963–976.
- 10) Albanese, E., Bütikofer, L., Armijo-Olivo, S., Ha, C., & Egger, M. (2020). Construct validity of the Physiotherapy Evidence Database (PEDro) quality scale for randomized trials: Item response theory and factor analyses. *Research synthesis methods*, 11(2), 227–236.
- 11) Yong Jae Jung et al. The effect of a stretching device on hand spasticity in chronic hemiparetic stroke patients *NeuroRehabilitation* 29 (2011) 53–59
- 12) Hae Min Jo et al, Improvements in spasticity and motor function using a static stretching device for people with chronic hemiparesis following stroke; *NeuroRehabilitation* 32 (2013) 369–375
- 13) Eun Hyuk Kim et al, The Effect of a Hand-Stretching Device During the Management of Spasticity in Chronic Hemiparetic Stroke Patients; *Ann Rehabil Med* 2013;37(2):235-240.
- 14) Woo Hyuk Jang et al. The effect of a wrist-hand stretching device for spasticity in chronic hemiparetic stroke patients; *European Journal of Physical and Rehabilitation Medicine*; June 2015;52; 65-71.