



## COMPARISON OF ANTAGONIST FASCILITATION VERSUS AGONIST INHIBITION ON SPASTICITY IN CHRONIC HEAD INJURY

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### Introduction:

Traumatic brain injury (TBI) is a leading cause of morbidity, mortality, disability and socioeconomic losses in India and other developing countries

It is estimated that nearly 1.5 to 2 million persons are injured and 1 million<sup>1</sup> succumb to death every year in India resulting in deaths, injuries and disabilities of young and productive people of our society.

Road traffic injuries are the leading cause (60%)<sup>2</sup> of TBI followed by falls (20%-25%) and violence (10%). Alcohol involvement is known to be present among 15%-20% of TBIs at the time of injury.

The failure to implement several proven countermeasures and neglect of people's safety has only resulted in increase of TBI. Technological advancements in recent years have clearly reduced the case fatality rates from Injuries and TBI, especially in Urban India.

However, the problem continues to be high in rural and peripheral areas due to lack of adequate trauma care. Many injured continue to live with disabilities resulting in increasing socio-economic burden and poor quality of life. Importance should be given to all three aspects of brain injuries, namely: prevention, management and rehabilitation, integrated through well coordinated activities in a systematic approach.

During a TBI, systemic insults and brain swelling overlap with primary injuries—hematoma, contusion, and diffuse axonal injury<sup>3</sup> (DAI) which can cause even more swelling, leading to increased intracranial pressure<sup>3</sup> (ICP) and decreased cerebral perfusion pressure<sup>3</sup> (CPP).

Brain injuries differ dramatically from patient to patient depending on the location, type, intensity, and duration of the injury. An injury can immediately cause rips in the white matter, brain hemorrhage, swelling, and, most commonly, bruising<sup>4</sup>.

One insult is superimposed on another as, following the injury, the brain begins to experience reduced blood flow and oxygen deficiency.

Within minutes or hours after an injury, tiny holes rip through neuronal membranes and ion channels get stuck open, leaking proteins and neurotransmitters. Free radicals and calcium spread, causing cell death and tissue damage. The damage can be isolated or extensive

Head injuries include both injuries to the brain and those to other parts of the head, such as the scalp and skull.

It can be classified as closed or open<sup>3</sup>. A closed non-missile head injury is where the dura mater remains intact. The skull can be fractured, but not necessarily. A penetrating head injury occurs when an object pierces the skull and breaches the dura mater. Brain injuries may be diffuse, occurring over a wide area, or focal, located in a small, specific area.

Head injury may cause skull fracture, which may or may not be associated with injury to the brain. Some patients may have linear or depressed skull fractures.

If intracranial hemorrhage occurs, a hematoma within the skull can put pressure on the brain. Types of intracranial hemorrhage include subdural, subarachnoid, extradural, and intraparenchymal hematoma<sup>4</sup>

Brain injury can be at the site of impact, but can also be at the opposite side of the skull due to a countercoup effect the impact to the head can cause the brain to move within the skull, causing the brain to impact the interior of the skull opposite the head-impact.

TBI results from an impact to the head that disrupts normal brain function. A head injury may be mild or severe depending on causative factors such as due to falls, motor vehicle crashes, colliding or being struck by an object, and assaults<sup>4</sup>.

Head trauma can sometimes be obvious or discrete. In the case of an open head injury, the skull is cracked and broken by an object that makes contact with the brain.

Other factors which may cause impact on head may be in the form of lacerations, bumps, or bruises

Globally, the incidence of head injury is increasing, mainly due to increasing traffic in low- and middle-income countries Maas et al., 2008<sup>5</sup>. TBI remains a leading cause of death and disability in Europe and the U.S., both in children and young adults. There is therefore a great need to advance clinical care

Head injury may be classified as mild, moderate, severe.....

Mild traumatic brain injury it is estimated that 70%–85% of all traumatic brain injuries fall into the mild category. While they rarely require inpatient rehabilitation, patients commonly report cognitive and behavioural changes from which they recover within 3–6 months<sup>6</sup>

Moderate brain injury is defined as a brain injury resulting in a loss of consciousness from 20 minutes to 6 hours and a Glasgow Coma Scale of 9 to 12

Severe brain injury is defined as a brain injury resulting in a loss of consciousness of greater than 6 hours and a Glasgow Coma Scale of 3 to 8.....<sup>7</sup>

Other Consequences of traumatic brain injury are neurological impairment like motor function impairment sensory loss, spasticity, cognitive impairment, personality and behavioral changes and psychiatric disorders.<sup>8</sup>

Spasticity is a condition in which certain muscles are continuously contracted. This contraction causes stiffness or tightness of the muscles and can interfere with normal movement and gait. Spasticity is usually caused by damage to the portion of the brain that controls voluntary movement. The damage causes a change in the balance of signals between the nervous system and the muscles. This imbalance leads to increased activity in the muscles. Spasticity negatively affects muscles and joints of the extremities<sup>8</sup>

### **Prevalence and Incidence:**

Spasticity affects more than an estimated 12 million people worldwide. About 80 percent of people with cerebral palsy (CP) have varying degrees of spasticity. With an estimated 500,000 people in the United States with some form of CP, this equates to about 400,000 people with some degree of CP-related spasticity.

About 80 percent of people with have varying degrees of spasticity. With an estimated 400,000 people in the United States, this equates to about 320,000 people with some degree of spasticity.

Other conditions that may cause spasticity include: TBI, Spinal cord injury (SCI).Brain damage due to a lack of oxygen Stroke Encephalitis Meningitis Adrenoleukodystrophy Amyotrophic lateral sclerosis Lou Gehrig's disease Phenylketonuria<sup>9</sup>

### **Spasticity in TBI:**

Spastic hypertonia often occurs after a TBI as a result of damage to the brain stem, cerebellum or mid-brain. This damage affects the reflex centers in the brain, interrupting message flow along different nerve pathways. This disruption can cause changes in muscle tone, movement, sensation and reflex. The location of the TBI may determine which areas of the body are affected and what motor deficits occur. The reflex centers in the brain are more complex than those in the spinal cord. Shortly after a brain injury, many people experience a period of increased muscle tone in which their body posture becomes very rigid. Some signals may not reach the reflex centers of the brain, or the brain may send too many signals, causing the muscles to not respond properly<sup>10</sup>.

There are many methods which are used reduce spasticity this may include electrical stimulation, temporary braces or casts, limb positioning, application of cold packs, stretching, biofeedback , and drugs etc.

Electrical stimulation have been investigated a therapeutic regimen using neuromuscular electrical stimulation (NMES) dramatically decreases spasticity of the upper extremity in young patients with cerebral palsy<sup>11</sup>

The application of braces and casts can prevent the formation of contractures in the spastic limb and serial casting and can improve the range of movement in a joint that is already contracted - a new cast being applied every few days as the range improves. Some equipment can also aid positioning, e.g., T roles, wedges, cushions, and foot straps<sup>12</sup>

Correct positioning, certainly for the immobile patient, is an important aspect of management. Incorrect positioning in bed, particularly in the early stages after stroke or brain injury, is a major cause of unnecessary spasticity<sup>13</sup>

Biofeedback is the use of an electrical monitor that creates a signal—usually a sound—as a spastic muscle relaxes. In this way, the person with spasticity may be able to train himself to reduce muscle tone consciously<sup>14</sup>.

Medications frequently used in the treatment of spasticity include baclofen, benzodiazepine, clonidine, dantrolene, gabapentin, botulinum toxin<sup>15</sup>

Icing Application to spastic muscles usually for 10 minutes or longer may improve muscle tone decreases neural, muscle spindle firing and provides inhibition of muscle tone icing inhibits monosynaptic stretch reflex and lowers the receptor's sensitivity, thus inhibits spastic muscles, but the effect is short lived<sup>16</sup>.

Maintain muscle length through passive or active exercise and stretching regimens including standing or splinting can be key in managing spasticity both in the short and the long term conditions, Stretching exercises were developed to manage spasticity, including passive and active stretching, positioning, and isotonic and isokinetic stretching Prolonged muscle stretch reduced motor neuron excitability<sup>17</sup>

**Statement of question:**

Is there any effect of comparison of facilitation and inhibition technique on spasticity in upper limb in chronic head injury.

**Hypothesis:**

**Alternate hypothesis:**

There is more effect of inhibition as compared to facilitation on spasticity in chronic head injury patients.

**Null hypothesis:**

There is more effect of facilitation as compared to inhibition on spasticity in head injury patients.

**Purpose:**

It has been seen that various studies has been done for reduction of spasticity by various mechanism such as , electrical stimulation , icing, drugs, stretching, splinting but very few study has been done using comparison of quick icing and prolong stretching. Therefore this study is design to find out the effect of comparison of facilitation and inhibition technique on spasticity in upper limb in chronic head injury.

**Review of literature**

1) Mohamed Ali Elshafey, Adel Abd-Elaziem, et al ;Vol 2014 (2014), Article ID( 814279). Static stretching splint reduced spasticity and improved motor function. Stretching prevented adhesion of the joint capsule. Slowly sustained stretch managed painful contractures prolonged muscle stretch reduced motor neuron excitability. Stretching exercises increased Achilles tendon cross-sectional area, decreased gastrocnemius and soleus muscle fascicular stiffness and improved walking and crouch posture<sup>18</sup>.

2) Utah State University, Department of Health, Physical Education, Physical Therap. 10/2002; 82(9):880-7. Stretch has become a widely accepted means of treating and preventing contractures in people with spinal cord injuries. For instance, it is now accepted practice in spinal cord injury units for therapists to routinely administer between 2 and 5 min of stretch a day to each major group of soft tissues<sup>19</sup>,

- 3) School of Life Sciences, Oxford, UK. Archives of physical medicine and rehabilitation DOI: 10.1016/j.apmr.2008.02.015 an injury to the brain can cause an abnormal increase in muscle tone called spasticity regular stretching; splints to keep limbs in proper position, and medications are common treatments<sup>20</sup>
- 4) American Association of Neurological Surgeons 5550 Meadowbrook Drive Spasticity November, 2006. Physical therapy for spasticity is designed to reduce muscle tone, maintain or improve range of motion and mobility, increase strength and coordination, and improve comfort<sup>21</sup>. Therapy include stretching and strengthening exercises
- 5) Yeh, C.Y., Tsai, K.H., et al Publication: Engineering in Medicine and Biology Society, 2001. Spasticity frequently obstructs the functional movements in the stroke patients.<sup>22</sup> The prolonged muscle stretch (PMS) has been proven to be an effective approach to reduce excessive muscle tone.
- 6) Department of Physical Medicine and Rehabilitation, College of Medicine, Republic of Korea. 2011; 29(1):53-9. doi: 10.3233 Effect of a stretching device for treatment of hand spasticity in chronic stroke patients it was found that stretching device was effective in relieving hand spasticity in chronic stroke patients<sup>23</sup>.
- 7) Department of Physical Medicine and Rehabilitation, College of Medicine, Republic of Korea. 2013; 32(2):369-75. doi: 10.3233. Effect of a static stretching device on spasticity and motor function for people with chronic hemiparesis following stroke. In this study it was found that the static stretching device effectively relieved spasticity and improved motor function in subjects with severe spasticity and incomplete weakness following stroke<sup>24</sup>.
- 8) Physiotherapy in Spasticity Management VOL.16 NO.7 JULY 2011. Passive stretching programmes, splintage and positioning are manual techniques that can reduce tone immediately<sup>25</sup>.
- 9) Dr. Satkunam Bohannon RW et; al Rehabilitation medicine: 3. Management of adult spasticity November 25, 2003 vol.169 no. 11. Regular stretching is important to prevent contractures and to maintain the range of movement<sup>26</sup>. Therapists should provide spastic patients with a regular, individualized stretching program Bohannon showed that standing in a tilt table reduces spasticity after spinal cord injury
- 10) Kondo, Yasutaka; Nakano, Jiro; et; al. Effects of Prolonged Stretching and Thermotherapy on Muscle Contracture Article July 2012. The study concluded that immobilization led to decreased ROM, collagen fibril movement in the endomysium and increased insoluble collagen and that prolonged stretching can promote recovery<sup>27</sup>.
- 11) Jo HM et al. NeuroRehabilitation, 04/17/2013. Improvements in spasticity and motor function using a static stretching device for people with chronic hemiparesis following stroke<sup>28</sup>; It was found that the static stretching device effectively relieved spasticity and improved motor function in subjects with severe spasticity and incomplete weakness following stroke.
- 12) Jo HM et al. Improvements in spasticity and motor function using a static stretching people with chronic hemiparesis following stroke NeuroRehabilitation, 04/17/2013 suggested that effect of a static stretching device on spasticity and motor function for people with chronic hemiparesis following stroke. In this study it was found that the static stretching device effectively relieved spasticity.
- 13) A. M. O. Bakheit<sup>1</sup>, V. Maynard et al. The effects of isotonic and isokinetic muscle stretch on the excitability of the spinal alpha motor neurones in patients with muscle spasticity 26 aug 2005 DOI: 10.1111 This suggests that the reported reduction in spasticity after muscle stretch is because of mechanisms other than the direct effect on  $\alpha$ MN<sup>29</sup>. However, the lack of a demonstrable benefit of

treatment may be due the fact that we examined the effects of a single, rather than repeated treatment cycles.

**14)** Frank S. Pidcock, Kennedy Krieger et al **Spasticity Management** Journal Vol 2 11 April 2007. The treatment of tight muscle by stretching has been practiced in many cultures as far back in time as the ancient Roman Empire<sup>30</sup>. This basic technique is the cornerstone for the management of spasticity. stretching with well made splints, can result in increased function.

**15)** Effect Of Icing On Spasticity In Hi Cooling of muscles Review Article. Year : 2013 Vol : 7 This inhibits monosynaptic stretch reflex and lowers the receptor's sensitivity, thus inhibits spastic muscles, but the effect is short lived<sup>31</sup>. Different techniques such as quick icing and evaporating spray like ethyl chloride are occasionally used.

**16)** Price R, Lehmann JF, Boswell-Bessette et al Influence of cryotherapy on spasticity 1993; 74:300-4. Cryotherapy and one-hour postcryotherapy measurements of spasticity were performed in 25 subjects with clinical signs of spasticity secondary to traumatic brain injury, spinal cord injury, and stroke<sup>32</sup>. The application of cryotherapy to temporarily reduce spasticity is a widespread clinical practice.

**17)** American Association of Neurological Surgeons 5550 Meadowbrook Drive - Rolling Meadows, Influence of cryotherapy on spasticity November, 2006. Application of cold packs is designed to reduce muscle tone, **maintain** or improve range of motion and mobility

**18)** Effect of cold therapy in relieving spasticity April 2002, Vol 40, No. 4, Pg 167-173. Cold therapy appears to be effective in relieving spasticity. Spasticity measured by clinical and electrophysiological parameters, decreased immediately following treatment and 30 min after treatment. The decrease in spasticity was maintained for 30 min. After 30 min of treatment by cold therapy there was no significant changes in parameters when measured 60 min after treatment.

**19)** The effect of icepack cooling on spasticity SAJSM vol 18 No. 3, 2006. Cooling also has an analgesic effect, slows nerve conduction velocity, and decreases muscle spasm and spasticity.

**20)** Treatment/cold-applications Last Updated: Oct 18, 2014. Application of cold relaxes muscle spasm and minimizes upper motor neuron spasticity<sup>33</sup>. the muscle must be cooled; this process takes 10 minutes in thin patients and up to 60 minutes in more obese persons.....

**21)** Ganesh Bavikatte and Tarek Gaber. Approach to spasticity in General practice: BJMP 2009: 2(3) 29-34. Cooling of muscles this inhibits mono synaptic stretch reflex and lowers the receptor's sensitivity<sup>34</sup>, different techniques such as quick icing and evaporating spray like ethyl chloride are occasionally used.

**22)** Spasticity and Icing JULY 20, 2014. Quick icing is for facilitation and not for inhibition. To inhibit a muscle static icing for 20 minutes should be used with proper method as it reduces the muscle spindle excitability and stimulates GTO inhibition.

**23)** John Christopher A. de Luna, et al ). Icing/quick icing is applied on the skin in 3 quick swipes and water bottled with a towel between swipes for the facilitation of muscle activity and ANS response.<sup>35</sup>

**24)** Neuromuscular /Sensory Stimulation Techniques Rood's Technique August 7, 2009. Quick Cold applications activates thermo receptors : Increases neural firing, Stimulates muscle tone. Performed with the tip of the ice cube, rubbed fast along the length of the muscle to be stimulated from its insertion towards origin.

**25)** C.B. Senth et. al Facilitatory technique to normalize the muscle tone, nov 29, 2008. To normalize the muscle tone from a flaccid state.--Icing, fast brushing, tapping, stroking, quick stretch

26) Namirah Jamshed, MD, and Edward L. Schneider, MD, joint-contractures Vol 18 Issue 8 August, 2010. Alternatives in cases of localized tightness that may be helpful in reducing muscle contractures include vibration to the opposing muscle group, heat, or prolonged icing.

27) Rehabilitation Research and Practice Vol 2014 (2014), Article ID 814279. Functional stretching exercises are effective methods used in rehabilitation of spastic diplegic children; it reduced H\M ratio, increased popliteal angle, and improved gait.

28) Mohamed Ali Elshafey, Adel Abd-Elaziem et. al Copyright 2008. Non-Surgical Treatments for Spasticity in Cerebral Palsy and Similar Conditions. Stretching is the single greatest preventative when it comes to spasticity. Stretching may not eliminate high tone or spasticity but stretching must be done every day and preferably more than once a day, to be effective.

## **Methodology**

### **Sampling**

**Sample size:** 40

**Source of patient:** Various hospitals and nursing homes in and nearby Dehra dun

**Place of study:** Different hospitals and nursing homes in and around Dehra Dun

**Duration of study;** 6 - 8 months

**Selection criteria:** Subjects was selected on the basis of following inclusion and exclusion criteria

### **Inclusion criteria**

- 1) The patient having tone of at least 3 or more on MAS of upper limb.
- 2) Age 25 - 50 male and female, GCS 9 or below 9,
- 3) Patient should not have upper limb fracture or dislocation

### **Exclusion criteria**

- 1) The patient who have tone less than 3 on MAS of upper limb
- 2) GCS more then 9

**Study design** comparative experimental

### **Variable of the study**

Dependent: Spasticity

Independent: Prolong stretching, quick icing

**Instrumentation;** ice cubes, rubber gloves, knee hammer, stop watch

**Procedure:** The patient was divided into two groups, group A and group B .In each group 20 patients were taken. Treatment was given for 6 days a week for 1 month in each group. Group A was treated with quick icing for 10 minutes on antagonist muscle. Group B was treated with long duration sustained stretch up to duration of 1minute.

### **Instrumentation**



**Figure 1: Stop Watch**



**Figure 2: Knee Hammer**



**Figure 3 Rubber Gloves**



**Figure 4: Ice Cube**



**Figure 5: Prolonged Sustained Stretching**



**Figure 6: Quick Icing**



**Figure 8: Quick Icing**

**DISCUSSION**

The results obtained reveal that patients in group: B. Benefited from, prolong sustained stretching. Hence there is a significant reduction in tone in modified ash worth scale. Post intervention as compared to preintervention

On comparison of group: A and group B it was seen that.....  
.....  
.....  
.....scores

revealed that there is a significant reduction in tone .

Group: B have better results than group: A which is statically showed

There is a significant difference in pre-intervention scores and post intervention scores

Thus it shows that those patient who receive prolong sustained stretching

**Limitation of study**

A small sample size was one of the major limitations of the study. As patients are not that much financially stable to bear the expenses of the hospital for longer periods of time that is 3to 4 months for head injury patient.

**Conclusion**

This study thus concludes that prolonged sustained stretching have a significant impact on reduction of tone according to modified ashworth scale. The patient who received prolonged sustained stretching has better results. Thus groupB showed a significant reduction in tone as compared to group A Thus, concluded that sustained stretching on spastic agonist muscle is superior to quick icing on antagonist muscle.

**References**

1. Saatman KE<sup>1</sup>, Duhaime AC, Bullock R, Maas AI, Valadka A, Manley GT; Workshop Scientific Team and Advisory Panel Members. Classification of traumatic brain injury for targeted therapies. 2008 Jul;25(7):719-38. doi: 10.1089/neu.2008.0586

2. Maas AI, Stocchetti N, Bullock R (August 2008). "Moderate and severe traumatic brain injury in adults". *Lancet Neurology* 7 (8): 728–41. doi:10.1016/S1474-4422(08)70164-9. PMID 18635021.
3. Parikh S, Koch M, Narayan RK (2007). "Traumatic brain injury". *International Anesthesiology Clinics* 45 (3)11935. doi:10.1097/AIA.0b013e318078cfe7. PMID 17622833.
4. Collins C, Dean J (2002). "Acquired brain injury". In Turner A, Foster M, Johnson SE. *Occupational Therapy and Physical Dysfunction: Principles, Skills and Practice*. Edinburgh: Churchill Livingstone. pp. 395–96. ISBN 0-443-06224-2. Retrieved 2008-11-13.
5. Hardman JM, Manoukian A (2002). "Pathology of head trauma". *Neuroimaging Clinics of North America* 12 (2): 175–87, vii. doi:10.1016/S1052-5149(02)00009-6. PMID 12391630. "TBI is highest in young adults aged 15 to 24 years and higher in men than women in all age groups."
6. 2001 Market Street, Suite 2900 | Philadelphia, PA 19103 .traumaticbraininjury.com
7. Last full review/revision November 2013 by James E. Wilberger, MD; Derrick A. Dupre, MD
8. Brain Injury Association of Queensland: www.biaq.com.au
9. A service of the U.S. National Library of Medicine National Institutes of Health Page last updated: 07 November 2014
10. American Association of Neurological Surgeons 5550 Meadowbrook Drive - Rolling Meadows, IL - 60008-3852 P 847.378.0500 or 888.566.AANS (2267) F 847.378.0600 .....
11. Neuromuscular Electrical Stimulation and Dynamic Bracing as A Treatment for Upper-Extremity Spasticity in Children with Cerebral Palsy Doi: 10.1054/Jhsb.1998.0002 L.R. Scheker, S.P. Chesher, S. Ramirez.
12. Pandyan AD, Gregoric M, Barnes MP, Wood D, Van Wijck F, Burridge J, et al. Spasticity: Clinical perceptions, neurological realities and meaningful measurement. *Disabil Rehabil* 2005; 27:2-6.
13. Management of spasticity, Michael R Barnes *Age and Ageing* 1998; 27: 239-245
14. Spasticity - Physical Therapy Management Options 01-19-2009, 07:31 PM.....
15. Drugs Used to Treat Spasticity Mariko Kita and Donald E. Goodkin *Drugs* 2000 Mar; 59 (3)
16. Pandyan AD, Gregoric M, Barnes MP, Wood D, Van Wijck F, Burridge J, et al. Spasticity: Clinical perceptions, neurological realities and meaningful measurement. *Disabil Rehabil* 2005; 27:2-6.
17. Mohamed Ali Elshafey,1 Adel Abd-Elaziem,2 and Rana Elmarzouki Gouda. Functional Stretching Exercise Submitted for Spastic Diplegic Children: A Randomized Control Study. *Rehabilitation Research and Practice* Volume 2014 (2014), Article ID 814279)
18. 18) Mohamed Ali Elshafey, Adel Abd-Elaziem, et al ;Vol 2014 (2014), Article ID( 814279). Static stretching splint reduced spasticity and improved motor function
19. Utah State University, Department of Health, Physical Education and Physical Therap. 10/2002; 82(9):880-7.
20. School of Life Sciences, Oxford, UK. Archives of physical medicine and rehabilitation DOI: 10.1016/j.apmr.2008.02.015
21. American Association of Neurological Surgeons 5550 Meadowbrook Drive Spasticity November, 2006 .Physical therapy for spasticity
22. Yeh, C.Y., Tsai, K.H., et al Publication: *Engineering in Medicine and Biology Society*, 2001. Spasticity frequently obstructs the functional movements in the stroke patients
23. Department of Physical Medicine and Rehabilitation, College of Medicine, Republic of Korea. 2011; 29(1):53-9. doi: 10.3233 Effect of a stretching device for treatment of hand spasticity in chronic stroke patients
24. Department of Physical Medicine and Rehabilitation, College of Medicine, Republic of Korea. 2013; 32(2):369-75. doi: 10.3233.
25. Physiotherapy in Spasticity Management Vol.16 No.7; July 2011. Passive stretching programmes, splintage

26. Dr. Satkunam Bohannon RW et; al Rehabilitation medicine: 3, Management of adult spasticity November 25, 2003 vol.169
27. Kondo, Yasutaka; Nakano, Jiro; et; al. Effects of Prolonged Stretching and Thermotherapy on Muscle Contracture Article July 2012.
28. Jo HM et al.NeuroRehabilitation, 04/17/2013 .Improvements in spasticity and motor function using a static stretching device for people with chronic hemiparesis following stroke.
29. A. M. O. Bakheit<sup>1</sup>, V. Maynard et. al.The effects of isotonic and isokinetic muscle stretch on the excitability of the spinal alpha motor neurones in patients with muscle spasticity 26 aug 2005 DOI: 10.1111.
30. Frank S. Pidcock, Kennedy Krieger et. al **Spasticity Management** Journal Vol 2, 11 April 2007. The treatment of tight muscle by stretching.
31. Effect of Icing on Spasticity in Cooling of muscles Review Article. Year: 2013 Vol: 7. This inhibits monosynaptic stretch reflex and lowers the receptor's sensitivity.
32. Price R, Lehmann JF, Boswell-Bessette et. al Influence of cryotherapy on spasticity 1993; 74:300-4.
33. Cold-applications, Last updated: Oct 18, 2014. Application of cold relaxes muscle spasm and minimizes upper motor neuron spasticity.
34. Ganesh Bavikatte and Tarek Gaber.· Approach to spasticity in General practice: BJMP 2009: 2(3) 29-34 Cooling of muscles this inhibits mono synaptic stretch reflex and lowers the receptor's sensitivity.
35. John Christopher A. de Luna, et. al icing/quick icing.

## Annexure

### CONSENT FORM

#### DEPARTMENT OF PHYSIOTHERAPY, DOLPHIN (PG) INSTITUTE OF BIOMEDICAL AND NATURAL SCIENCES, MANDUWALA, DEHRADUN

I.....hereby give the consent to participate in the study, "comparisation of antagonist fascilitation versus agonist inhibition on spasticity in head injury". A study being conducted by Mohit bhatt Post graduate Student from the department of physiotherapy, Dolphin P.G Institute of Biomedical & Natural Sciences, Manduwala, Dehradun

I have been informed about the nature and purpose of study.

The above said information has been explained to me in the language I understand. I have been assured that the information I give will be kept confidential. I am free to withdraw from the study at anytime I wish to.

Date:

(Signature)

Language used:

**MASTER CHART**

**ON THE BASIS OF MODIFIED ASWORTH SCALE**

**GROUP A - (Icing in Chronic head injury patient)**

<b>S. No.</b>	<b>PRE TREATMENT SESSION(0WK)</b>	<b>POST TREATMENT SESSION (AFTER 1month)</b>
1	3	2
2	3	1+
3	3	2
4	2	1+
5	3	2
6	3	2
7	4	4
8	4	4
9	3	1+
10	3	2
11	4	1+
12	3	2
13	4	4
14	3	2
15	3	3
16	4	4
17	4	4
18	3	3
19	3	3
20	3	3

**GROUPB - (Sustained agonist stretching in chronic head injury patient)**

<b>Sr. No.</b>	<b>PRE TREATMENT SESSION(0WK)</b>	<b>POST TREATMENT SESSION (AFTER 1month)</b>
<b>1</b>	<b>3</b>	<b>1+</b>
<b>2</b>	<b>3</b>	<b>1+</b>
<b>3</b>	<b>4</b>	<b>4</b>
<b>4</b>	<b>3</b>	<b>1+</b>
<b>5</b>	<b>3</b>	<b>1</b>
<b>6</b>	<b>4</b>	<b>4</b>
<b>7</b>	<b>3</b>	<b>1</b>
<b>8</b>	<b>4</b>	<b>4</b>
<b>9</b>	<b>3</b>	<b>1+</b>
<b>10</b>	<b>3</b>	<b>2</b>
<b>11</b>	<b>3</b>	<b>1+</b>
<b>12</b>	<b>3</b>	<b>1+</b>
<b>13</b>	<b>4</b>	<b>4</b>
<b>14</b>	<b>3</b>	<b>2</b>
<b>15</b>	<b>3</b>	<b>1+</b>
<b>16</b>	<b>4</b>	<b>4</b>
<b>17</b>	<b>3</b>	<b>1+</b>
<b>18</b>	<b>3</b>	<b>1</b>
<b>19</b>	<b>3</b>	<b>2</b>
<b>20</b>	<b>3</b>	<b>1+</b>