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Acute Effect of Static Stretching Versus Ischemic Compression Technique on Levator Scapulae Muscle Pain in Helmet Users: A Comparative Study

Sagar Nivruttipuri Gosavi [1*], Dr. Priti Patil [2]
[1] Dr. Ulhas Patil College of Physiotherapy, Jalgaon, affiliated to Muhs, Nashik, Maharashtra, India
[2] Assistant Professor, Dr. Ulhas Patil College of Physiotherapy, Jalgaon, affiliated to Muhs, Nashik, Maharashtra, India

* Corresponding Author: **Sagar Nivruttipuri Gosavi**

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Abstract
Motorcycle use in India has surged, making helmets crucial for reducing injury risks. Despite mandatory helmet laws, many riders avoid helmets due to discomfort, particularly neck pain. Research indicates that 69.4% of motorcyclists report neck pain, primarily attributed to the combined weight of the helmet and head, which places excessive mechanical stress on the neck. With an average head weight of 8-12 pounds and helmet weight around 4 pounds, even a healthy neck can be strained during prolonged rides. Poorly fitting helmets exacerbate this, leading to muscle spasms. Specifically, the levator scapulae muscle, which assists in shoulder elevation and neck movement, is often implicated in neck and upper back pain among helmet users. While traditional physiotherapy is commonly applied, it may not fully address the root cause of pain in this group. Few studies have explored the relationship between helmet use and neck pain, emphasizing the need for more targeted research.

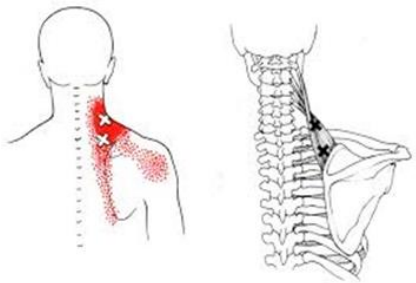
Keywords: Versus Ischemic Compression, Muscle Pain, reducing injury risks

1. Introduction

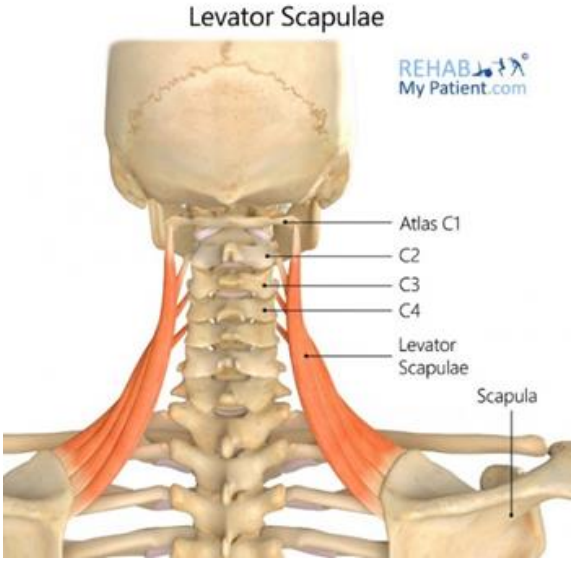
Motorcycles are one of the most popular vehicles in the India, and their use has been rapidly increasing. According to national helmet law it makes helmet use mandatory for motorcycle drivers. Therefore, recognizing the importance of helmet use in reduction of risk of injuries increased the implementation of helmet laws in different countries [1].

In spite of the obvious benefits of helmet use by motorcyclists, unfortunately people have no interest in wearing a helmet. One of the main reason, for this is due to discomfort around the neck. Few other commonest reason for not wearing a helmet were the weight of the helmet causing neck pain (69.4%).Neck pain in helmet users is due to combined weight of the helmet and head due to which the neck become mechanically stressed beyond its capacity. With average head weight of 8-12 pounds, and average helmet weight at around 4 pound, this amount of weight can overcome even a healthy neck with a hard riding [2]. A poor fit helmet adds further more stress to the neck leading to spasm of muscles around the neck.

Many helmet users report experiencing upper back pain, often attribute to the levator scapulae muscle. While convention physiotherapy treatment are employed, they may not specifically target the underlying cause of pain in this demographic.



Levator scapulae located on each side of the neck situated posteriorly arising from posterior tubercle of transverse process of first four cervical vertebrae and is inserted into the medial border of superior angle of scapulae. The muscles act along with trapezius to shrug the shoulder by its raising of the Scapula. If the scapula fixed the muscle assist in cervical extension and used alone flex the neck laterally to one side [6].



However, there are very few studies done on neck pain with helmet users with levator scapulae muscle pain. Different variables of helmet users with levator scapulae muscle pain which may lead to weakness and pain of neck. Helmet also causes restriction on neck movements which could influence the neck and produce pain over the neck region [4].

While using helmet due to its weight neck gets forward into the flexion and to avoid or compensate this movement of neck, the neck stabilizers come into action to stabilize the neck. As the scapula during riding remains stable hence along with the stabilizer the neck extensor i.e. levator scapulae also tries to compensate by neck extension hence, gets fatigue developing tightness and trigger points causing neck pain.

Trigger points are discrete, focal, hyperirritable spots located in a taut band of skeletal muscle. Acute trauma or repetitive microtrauma may lead to the development of stress on muscle fibers and the formation of trigger points [5]. Trigger points develop in the myofascial, mainly in the centre of the muscle belly where the motor end plate enters and it causes muscle to be sore, stiff, weak, and less flexible, and may trigger sensory, motor and autonomic phenomena [6].

The Trigger points are classified as central or primary Trigger point, satellite or secondary Trigger point, Attachment Trigger point, Diffuse Trigger point, Inactive or latent Trigger point, Active Trigger point [6].

The treatment for Levator scapulae trigger point related neck pain includes conservative management with Non-Steroidal Anti Inflammatory Drugs, analgesics, Muscle relaxants, Non manual methods like saline injection and Dry needling and manual methods like Myofascial massage, Ischemic compression technique or Manual inhibition technique, Taping, muscle stripping, deep friction massage, vibration, TENS, IFT, Vapocoolant spray Stretching, Positional release technique, Muscle energy technique, and Strengthening exercises. The current study focuses on two of the above i.e. static stretching and ischaemic compression.

Ischemic compression technique help to reduce the trigger points. Trigger points can be deactivated by temporarily occluding their blood supply and causing a reactive hyperaemia (Increase blood supply): effectively flushing out the muscle of inflammatory exudates and pain metabolites, breaking down scar tissue, and reducing muscle tone. The muscle is nourished by the extra – flow through of blood, nerve ending are desensitized and scar tissue is broken down so that the muscle fibre can move better. In this technique pressure is progressively over the trigger point area or Nodule or taut band in the muscle. The pressure is maintained until the tension is released. The pressure is applied by the therapist thumb, finger pad, knuckles and elbow. The pressure is applied 60 seconds maximum but mostly the desired effect is achieved in 10 – 20 sec., repeated for 3or 4 times.

On the other hand, The Static stretching of a muscle Fiber begins with the sarcomere, the basic unit of contraction in the muscle fiber. As the sarcomere contracts, the area of overlap between the thick and thin myofilaments increases. As it stretches, this area of overlap decreases, allowing the muscle fiber to elongate. Once the muscle fiber is at its maximum resting length (all the sarcomeres are fully stretched), additional stretching places force on the surrounding connective tissue. As the tension increases, the collagen fibers in the connective tissue align themselves along the same line of force as the tension. So, as you continue to stretch, the muscle fiber is pulled out to its full-length sarcomere by sarcomere, and then the connective tissue takes up the remaining slack. When this occurs, it may help to realign any disorganized fibers in the direction of the tension [8].

Hence, the current study focuses on comparison between effectiveness of static stretching and ischemic compression for treating levator scapulae muscle pain.

Need of study

The use of helmet is increasing day by day in many bike users. The helmet use is seen to be associated with neck pain, one of the reasons of which is levator scapulae muscle pain which hampers the basic activity of daily life.

Upper back pain among helmet users, often attributed to levator scapulae muscle issues, poses a unique challenge in physiotherapy treatment. This study aims to develop an

effective intervention protocol tailored specifically for helmet users to alleviate pain efficiently while optimizing the treatment process for enhanced patient convenience. By focusing on identifying the most suitable interventions, this research seeks to reduce the number of sessions required for pain reduction while ensuring the effectiveness of the treatment regimen. The findings of this study will contribute to improving the overall well-being and comfort of helmet users experiencing upper back pain, thus fostering a better understanding of specialized physiotherapy approaches in addressing this prevalent issue. Which reduces recovery time, number of treatment session & maintain recovery for longer time.

Hence, this study aims to compare the effectiveness of two interventions, static stretching and ischemic compression, in alleviating levator scapulae muscle pain among helmet users.

Aim

To study the acute effect of static stretching versus ischemic compression technique on levator scapulae muscle pain in helmet users

Objectives

To find the effect of Static Stretching on pain of levator scapulae in patient with helmet use.

To find the effect of ischemic compression on pain of levator scapulae in patient with helmet use.

To compare the effect of Static Stretching versus Ischemic compression on pain of levator scapulae in patient with helmet use.

Hypothesis

Alternative Hypothesis

There is significant effect of static stretching and Ischemic compression therapy on pain in neck and shoulder in patient with levator scapulae muscle pain.

Null Hypothesis

1. There is no significant effect of static stretching and Ischemic compression therapy on pain in neck and shoulder in patient with levator scapulae muscle pain.

Methodology

Materials: Patient evaluation sheet, chair, plinth, towel, hot pack, pen.

Study Design: Comparative study

Study Population: Helmet users

Sampling Technique: Simple random sampling technique

Sample Size: $n = \frac{2Z1^2 2S^2}{d^2}$

=50 (Group A- 25, Group B- 25)

Study Duration: 6 months

Place of study: Dr. Ulhas Patil College Of Physiotherapy, Jalgaon.

Inclusion criteria

- Subjects with non-specific neck pain
- Both males & females of age 18-35
- Use of helmet more than 1 year
- Levator scapulae tension test positive

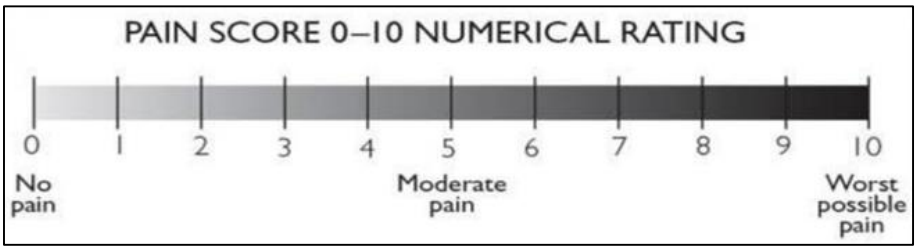
Exclusion Criteria

- Subjects more than 35 years
- Subjects with specific neck pain or shoulder pain such as radiating pain, neurological deficits, tumours of the spine, spondylolisthesis, fracture of cervical vertebrae, ankylosing spondylitis
- Clinical evidence of myelopathy & radiculopathy
- Any spinal deformity
- Systemic infections
- History of any recent cervical spine surgeries

Outcome Measures

- **NPRS (Numerical pain rating scale)**

Pain score of the subjects will be recorded by using the Numerical pain rating scale (NPRS). NPRS is a 10 cm straight line drawn on a paper marked with numbers 0 to 10 where 0 symbolized no pain and 10 symbolized the worst tolerable pain and subjects were asked to mark a point on this line as per the severity of his/her pain which indicates present pain level. The reliability of NPRS according to intraclass correlational coefficient is 0.95 and of validity was 0.94 [12].



Procedure

Permission from institutional ethical committee & concerned Hospital

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Subjects were screened according to the inclusion and exclusion criteria

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Subjects were divided in two groups A & B

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Pre-treatment evaluation of NPRS

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Group A received Static Stretching & Group B received Ischemic Compression technique estimate time 10 min each subject.

↓

Post treatment evaluation of NPRS

↓

Data analysis & Results

To conduct the study Permission from Institutional ethical committee & concerned hospital was taken. Subjects were selected according to the inclusion and exclusion criteria by simple random sampling Technique. Procedure was thoroughly explained to the subjects selected for the study.
Earlier the demographic data of each and every individual was taken in consideration. Then firstly subjects were divided in two groups named Groups A & B. Group A had subjects who were treated with Static stretching, while group B were treated with Ischemic compression.
Baseline Measurements prior the treatment will be taken, that is NPRS for Pain, Levator scapulae Tension test for LS flexibility and these outcomes were again assessed on 3rd day post treatment.

Intervention

Group A: Subjects received Static stretching technique.

Static Stretching

Patient position and procedure: Sitting with the head rotated opposite to side of pain (looking away from the tight side) and forward bent until a slight pull is felt in the posterolateral aspect of the neck. The arm on the side of pain is abducted, and the hand is placed behind the head to help stabilize it in the rotated position. Stand behind the patient and stabilize with one arm; place the other hand (same side as the tight muscle) over the superior angle of the scapula. With the muscle now in its stretched position for 30 sec., have the patient breathe in, then out. Hold the shoulder and scapula down to maintain the stretch as the patient breathes in again. To increase the stretch, press down against the superior angle of the scapula. Repeat 4 time with 1min of interval [7].

Group B: Subjects received manual Ischemic compression technique.

- **Manual Ischemic Compression technique**

Patient position is supine lying or sitting position. The therapist relax muscle first for palpating the trigger point. After locating the trigger point, a firm digital or knuckle compression applied to that area. The pressure will be gentle at the beginning and then gradually progress deeper into the tissue, but it not hurt patient. The ischemic compression will be maintained for 60sec. and released for 15-30 sec [6].

Statistical Analysis

Statistical method used

- The entire data of the study was entered and cleaned in MS Excel before it was statistically analysed in "GraphPad Instat version 3.05".
- All the results are shown in tabular as well as graphical format to visualize the statistically significant difference more clearly.
- The data on quantitative characteristics was presented as Mean ± Standard Deviation (SD) across study group.
- The paired T-test was used for intragroup pre and post comparison of static stretching of levator scapulae muscle group and ischemic compression of levator scapulae muscle group.
- The unpaired T-test was used for intergroup comparison of static stretching of levator scapulae muscle group and ischemic compression of levator scapulae muscle group.
- The entire data was analysed statistically using "GraphPad Instat version 3.05" for MS Windows.

Result

- Statistical analysis was done with paired t test and on intragroup comparison of pre and post of each group the 'P' value of NPRS was found to be extremely significant (P value <0.0001).
- Statistical analysis was done with unpaired t test and on intergroup comparison of Group A and Group B the 'P' value of NPRS, was found to be significant with P value <0.0001respectively.

Table 1: The Gender Distribution of study subjects of group A

Gender Wise Distribution Group A		
Male	21	
Female	4	

Table 2: Intragroup Pre and Post comparison of static stretching of levator scapulae muscle Group (Group A)

Group A				
NPRS	**Mean±Sd**	**t Value**	**p Value**	**Significance**
Pre-treatment	5.32±1.282	15.54	<0.0001	Extremely significant
Post-treatment	3.36±1.114			

Comment: On Intragroup Comparison of pre and post NPRS Score of Group A we found that p value is <0.0001 which implies that Static Stretching is effective for reducing levator scapulae muscle pain in helmet users.

Table 3: The Gender Distribution of Study subjects of group B

Gender Wise Distribution Group B	
Male	21
Female	4

In the study we found 16% females and 84% males with levator scapulae muscle pain in helmet users.

Table 4: Intragroup Pre and Post comparison of ischemic compression of levator scapulae muscle (Group B)

Group B				
NPRS	**Mean±Sd**	**t Value**	**p Value**	**Significance**
Pre-treatment	5.48±1.194	10.48	<0.0001	Extremely Significant
Post-treatment	2.44±0.820			

Comment: On Intragroup Comparison of pre and post NPRS Score of Group B we found that p value is <0.0001 which implies that Ischemic compression technique is effective for reducing levator scapulae muscle pain in helmet users.

Table 5: Intergroup comparison of post treatment of levator scapulae muscle pain of Mean difference (Group A) and Mean difference (Group B)

Group A-B				
NPRS	**Mean±Sd**	**t Value**	**p Value**	**Significance**
Post-treatment Group A	3.36±1.114	3.32	<0.0001	Extremely Significant
Post-treatment Group B	2.44±0.820			

Comment: On Intergroup Comparison of Group A and Group B we found that p value is <0.0001 which implies that Ischemic compression technique is more effective for reducing levator scapulae muscle pain in helmet users.

Discussion

The aim of this study was to compare the effectiveness of Static stretching and Ischemic compression technique in individuals experiencing levator scapulae muscle pain due to helmet use. A total of 50 participants were included, with 25 assigned to Group A and another 25 to Group B, all with a

mean age of 29. Within-group analysis revealed significant decreases in patient-reported pain scores when comparing pre- and post-intervention scores for both static stretching and ischemic compression technique.

1. Effect of Static Stretching on levator scapulae muscle pain

In Group A, the mean and standard deviation for pre-treatment and post-treatment pain scores were 5.32±1.282 and 3.36±1.114 respectively. For Group B, the corresponding values were 5.48±1.194 and 2.44±0.820 respectively. On post-treatment analysis, the mean and standard deviation for pain scores in Group A were 3.36±1.114, and for Group B, they were 2.44±0.820. These figures illustrate a notable decrease in pain scores for both groups following intervention, with Group B exhibiting a slightly lower post-treatment mean pain score compared to Group A.

On Intragroup Comparison of pre and post intervention NPRS scores of Group A we found that p value is <0.0001 which implies that Static Stretching is effective for reducing levator scapulae muscle pain in helmet users. The results are similar to the studies done on subacute mechanical neck pain in 2012 by richa Mahajan, chitra katariya *et al*.

The reduction in the pain following static stretching can be explained on the basis of inhibitory effects of GTO (which causes a dampening effect on the motor neuronal discharges, thereby causing relaxation of the musculotendinous unit by resetting its resting length) and Pacinian corpuscle modification. These reflexes will allow relaxation in musculotendinous unit tension and decreased pain perception Proposed mechanisms by which passive manual stretch facilitates the laying down of collagen and regain of muscle length are a direct decrease in muscle stiffness via passive viscoelastic changes or an indirect decrease because of reflex inhibition and consequent viscoelasticity changes from decreased actin myosin cross bridging [12].

2. Effect of ischemic compression technique on levator scapulae muscle pain

On Intragroup Comparison of pre and post NPRS Score of Group B we found that p value is <0.0001 which implies that Ischemic compression technique is effective for reducing levator scapulae muscle pain in helmet users which coincides with the results of study done on levator scapulae improving pain, ROM, disability at cervical level in 2023 by saornil, mila, chekroun *et al* [13].

Mechanism for pain relief Trigger points can be deactivated by temporarily occluding their blood supply and causing a reactive hyperaemia (Increase blood supply): effectively flushing out the muscle of inflammatory exudates and pain metabolites, breaking down scar tissue, and reducing muscle tone. The muscle is nourished by the extra – flow through of blood, nerve ending are desensitized and scar tissue is broken down so that the muscle fibre can move better. In this technique pressure is progressively over the trigger point area or Nodule or taut band in the muscle.

3. Comparative effect of static stretching and ischemic compression technique on levator scapulae muscle pain

On Intergroup Comparison of post intervention NPRS score of Group A and Group B we found that p value is <0.0001 with a mean difference of 3.36 and 2.44 respectively, which implies that Ischemic compression technique is more effective for reducing levator scapulae muscle pain in helmet users. Similarly users which coincides with the results of study done on managing the active trigger point of trapezius muscle in 2021 by Urooj Khan, Saeed Akhter *et al* [14].

Conclusion

In conclusion, both static stretching and ischemic compression technique are effective modalities for reducing levator scapulae muscle pain in helmet users. However, ischemic compression technique appears to be more efficacious in achieving pain relief compared to static stretching. These findings underscore the importance of considering alternative techniques for pain management in specific populations such as helmet users.

Limitations

1. **Short-Term Follow-Up:** The study only measured outcomes immediately after the interventions. Long-term follow-up would provide a more comprehensive understanding of the sustained effectiveness of the interventions.
2. **Subjective Outcome Measures:** The primary outcome measure, pain scores reported by the participants, is subjective and could be influenced by factors such as expectations, mood, or external influences, leading to potential bias.
3. **Lack of Blinding:** It's unclear whether participants, researchers, or assessors were blinded to the interventions, which could introduce bias into the results, especially n subjective outcome measures like pain scores.

Future Scope of Study

1. Longitudinal studies: Long-term follow-up assessments to evaluate the durability of pain reduction and functional improvements over time would be valuable in understanding the sustained effects of the interventions.
2. Patient-reported outcomes: Including measures of functional improvement, quality of life, and satisfaction with treatment would provide a comprehensive assessment of the interventions' impact on patients' lives

Clinical Implication

1. Choice of intervention: Clinicians treating levator scapulae muscle pain in helmet users can consider both static stretching and ischemic compression technique as effective treatment options based on the study findings.
2. Individualized approach: The study suggests that ischemic compression technique may be more effective than static stretching for reducing pain in this specific population. Clinicians can tailor treatment plans based on patient preferences, tolerances, and response to previous interventions.

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