Case Study

Scapular Pull up – The Assessment and Management of Unilateral Interscapular Pain with Functional Scoliosis in An Olympic Weightlifter – A Case Study

[1]J. Elisha (MPT – MSK and Sports)

[1]Physiotherapist of the Indian Weightlifting Team (IWLF)

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Abstract

Introduction: Interscapular pain is a familiar condition in athletes with overhead load activity. The usual location of pain is along the medial border of the scapula close to the midline. Functional scoliosis is a type of scoliosis with temporary curvature of the spine which is reversible in nature and absence of rotation of the vertebrae. This case studies the scapular pull up exercise as assessment to view compensations and treatment variation to solve the root cause of unilateral interscapular pain.

Method: The pronated grip hanging scapular pull up exercise was performed by the athlete which showed overactivity of the retractors and depressors of scapula with curvature of spine appearing at thoracolumbar level, convexity on same side. As a treatment plan for functional scoliosis and overactivity the same exercise was performed but with lateral flexion of spine towards the same side of convexity. The exercise was performed for 10 repetitions of 4 sets for 2 sessions across 2 days for a total of 4 sessions of treatment.

Results: Numerical pain rating scale was taken pre and post treatment at rest, in movements and training overhead at same weights. Post treatment there was clinically significant reduction in pain and the scapular pull up lateral trunk bending exercise changed the temporary curvature of spine (functional scoliosis) to normal on observation.

Conclusion: This single case study shows an important assessment exercise to find the compensation, the root cause and the treatment exercise for unilateral interscapular pain with functional scoliosis in overhead training athlete.

Keywords: *Interscapular pain, scapular pull up, functional scoliosis.*

Introduction

Interscapular pain is a common condition caused by cervical disc herniation, upper thoracic facet joint problems, low cervical spondylosis and myofascial pain syndrome.[1] Overactivity of scapular retractors and depressors namely rhomboids, middle and lower trapezius leading to muscular trigger points is one of the major cause for unilateral interscapular pain.[2] There is also a non specific diagnostic cause for this condition.[2]Pain intensity is higher in movements of shoulder flexion, adduction and side lying on affected side.[3]

Corresponding Author: J. Elisha (MPT – MSK and Sports), H/no 52/1 Gandhi wada, Gadag road, Hubli, KARNATAKA – 580020

E-mail: elishjeedi@gmail.com

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Functional scoliosis is a form of scoliosis that is marked by a temporary curvature of the spine, which does not involve the rotation of the vertebrae. This type of scoliosis most of the times is due to asymmetrical loading with altered mechanical forces acting on spine and usually reversible in nature with targeted exercise protocol.[4]

Weightlifting is one of the Olympic sports. Olympic weightlifting has 2 major lifts that is snatch and clean and jerk. Both of these techniques require tremendous amount of symmetry in overhead positions. The sport demands various attributes such as strength, balance, speed, coordination and technical skill.[5]

Pull ups in pronated forearm from the hang position is one of the upper extremity pulling strength test in athletes.[6] Scapular pull up is the initial active phase of pull up in which there is scapular retraction and depression from full hang position to initial active hang engaging the scapular muscles. In this position we can observe the recruitment of the upper back muscles. In this active position we can also observe the difference in recruitment, any compensations and deviations in the spine.

Numerical pain rating scale (NPRS) is one of the easy understandable methods to assess pain levels in numeric value. This scale also provides the difference in score to clinical importance and it also predicts disability.[7]

This brainstorm development of different assessment led to finding the root cause and the single exercise that reduced the pain at rest, active movements and overhead weight training. Also the scapular pull up lateral trunk bending exercise showed change of functional scoliosis to normal.

There is scarcity of literature about unilateral interscapular pain especially in athletes. A literature gap is evident about assessment and cause of interscapular pain in Olympic weightlifters and overhead weight training athletes. So a strong need arises to find the cause of unilateral interscapular pain, especially in Olympic weightlifters.

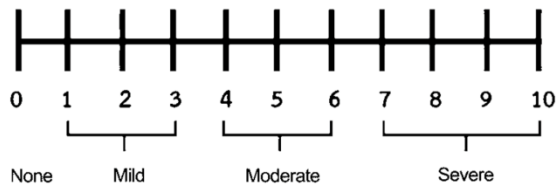
Case Description

A 19 year old elite weightlifter presented with pain in the upper back region on the right side. The pain gradually increased with his overhead training of snatch and clean and jerk at 70-80 percent of his training load. This also created the discomfort in overhead lifts and also the feeling of not stable in overhead lifts. The week of gradual increase of pain also had incomplete or failed lifts in training. He continued the release with this tennis ball on his own along the medial border of the scapula on the right side which reduced the pain minimally but the pain reappeared in training, post training, lying down on same side. This cycle of events occurred for a week. He presented himself to the physiotherapist and the assessment was done.

Assessment

PAIN

Numerical Pain Rating Scale



1. Pain at rest along the lower medial border of the scapula on the right side – NPRS – 6.
2. Pain at same site in right shoulder flexion and adduction movement – NPRS – 7.
3. Pain in overhead training snatch and clean and jerk – NPRS – 8.

The NPRS scale was shown and explained to the athlete about the scoring. The athlete mentioned the number accordingly.

In standing position there was no deviation of the spine. In Bar clean position also there was no deviation of spine (Figure 1).

There was tightness and overactivity of the scapular retractors and depressors namely the middle trapezius, lower trapezius and rhomboids (Figure 2). To confirm the overactivity the athlete was told to

perform a scapular pull up which clearly showed the overactive medial scapular muscles with deviation of the spine at thoracolumbar level (Figure 2). There was also no leg length discrepancy.

(Figure 1)

(Figure 2)

Methods:

After the assessment the athlete was told to perform the pronated scapular pull up with lateral flexion of trunk to the right side (lower limbs pointing to lower right diagonal) (Figure 3).

This exercise was performed for 4 sets of 10 repetitions, 2 sessions a day across 2 days without any rest day in between for a total of 4 sessions.

Outcome measures: NPRS was taken pre treatment and post treatment at rest, active movements of shoulder flexion and adduction, overhead training of snatch and clean and jerk at same weights.

The same scapular pull up exercise test was done to see the muscular recruitment difference and spine deviation changes through observational analysis (video and images) (Figure 4).

(Figure 3)

(Figure 4)

Results

There was significant lower rating of pain level on NPRS after 4 sessions of treatment (Table 1). The pre and post scapular pull up exercise test shows equal recruitment of medial scapular muscles and corrected deviation of spine at thoarcolumbar region (Figure 5).

Table 1. Pre and Post NPRS scores at rest, in movements and post training.

NPRS	At Rest	In Movements	Post Training
Pre	6	7	8
Post	0	1	1

(Figure 5)

Discussion

Interscapular pain is common presentation of pain along the medial border of the scapula, although there are various causes but mostly it is due to myofascial pain or trigger point in the muscle due to overactivity. The roll and pinch test elicits pain on the area of feeling of tightness which is along the medial border of scapula (interscapular point).[1] The elite weightlifter has immense demand of overhead shoulder stability and the scapular muscles play a key role in Olympic weightlifting techniques.

Functional scoliosis is a type of scoliosis which has a nature of reversibility of the temporary curvature of the spine. This postural deformity is caused by asymmetrical loading, difference in biomechanical forces side to side and gravitational forces that act along the spinal column.[8] In Olympic weightlifting techniques, the snatch and clean and jerk have overhead finish phase where the demand of symmetry and forces acting along the spinal column is crucial for balance to complete the lifts with massive weight.

Pull up exercise is one of the most practiced exercises for athletes as well as in general to gain upper limb and back strength. According to the literature of the regard of this case study the initial phase of pull up has activation of middle trapezius, lower trapezius and rhomboids whereas at the full phase there is more activation of latissimus dorsi and external oblique.[9, 10] Pronated wide grip pull up exercise has a lot of stability demand on the retractors and depressors of the scapula.

Numerical pain rating scale is 11 point pain rating scale ranging from 0 – 10 with 0 depicting no pain and 10 depicting worst imaginable pain. This scale has shown to have concurrent validity and validity for pain intensity measure. The use of this scale is feasible, easily understandable and shows good responsiveness to measure pain intensity in clinical and research settings. A minimum of 2 point change on NPRS represents a clinically meaningful change.[11]

The scapular pull up exercise is an initiation active phase of the pull up where the scapular retractors and depressors are active and enhances scapular movement control. In this particular case study this was used as an assessment to see the overactivity of the medial scapular muscle group and during this exercise test there was a curvature of the spine seen at thoracolumbar level. The tennis ball release was done by self which did not give any change to the athlete. The scapular pull up through brainstorm was done to see the difference of muscle engagement of medial

scapular group. The right side through observation showed clear overactivity at lower medial scapular group (Figure 2).

Latissimus dorsi is fan shaped muscle covering a significant portion of the back. It has widespread attachments with the origins from the iliac crest, thoracolumbar aponeurosis, spinous processes of T7 – L5, inferior angle of the scapula and the fibers wind around the teres major muscle and inserts as a tendon on the floor of bicipital groove of the humerus.[12]

The overactivity of the right lower medial scapular group could be because of the reduced shared activity of the latissimus dorsi at the scapula as one of its functions is to retract and depress the scapula. This assumption is based on the compensation that occurred at its spinal level where the weakness of latissimus dorsi shows deviation of spine. This has been assumed as the root cause of unilateral interscapular pain.

As a treatment protocol the same exercise of scapular pull up with the lateral bending of the trunk with both lower limbs to right lower diagonal position was administered for 10 repetitions of 4 sets, 2 sessions a day across 2 days for a total of 4 sessions. This exercise was done to enhance the recruitment of the latissimus dorsi. The insertion component of the latissimus dorsi is fixed and only the origin component of the muscle is concentrically working.

The pain reduction post treatment may be due to

1. Post isometric relaxation.

   This is one type of muscle energy technique in which there is brief period of submaximal isometric contraction of a muscle against a counter force which results in decrease in muscle tone of same single or group muscle isometrically worked. This works on the principle of autogenic inhibition where the Golgi tendon organ (GTO), the musculotendinous proprioceptor is activated responding by reflex inhibition.[13] In this case the isometric contraction is for the scapular retractors and depressors and the counterforce is the body weight.

2. Exercise Induced Hypoalgesia (EIH).

   The theory behind relief of pain by exercise can be considered as EIH (exercise induced hypoalgesia), which states that there is release of endogenous opioids and serotoninat various sites like central, spinal and peripheral levels which helps in modulating the pain. The other mechanism of exercise which helps in relieving the pain maybe by release of cannabinoid receptors in brain and spinal cord. There will be release of chemicals such as N-arachidonylethanolamine, endocannabinoids and 2-archidonoylglycerol which will help in controlling CNS by activating cannabinoid receptors, which will further produce anti nociception. These two theories are proved to cause pain modulation by release of endogenous opioid peptides and endocannabinoids which will increase the circulation post exercise and produceanalgesia.[14]

3. Effective shared muscle activity for scapular control.

   The scapular pull up lateral trunk bending to right exercise could have increased the recruitment of latissimus dorsi as the action of latissimus dorsi at the scapular level is the retract and depress the scapula. The muscle assists in holding the scapula against the thorax during upper limb movements. The attachment of the muscle to the inferior angle of the scapula allows this. The lateral trunk bending could have massively increased the recruitment because the large area of attachments produces lateral flexion of the trunk.

The change in the curvature compensation of the spine at the thoracolumbar level could be due to the gain in the strength and neuromuscular control of the latissimus dorsi. According to the literature the peak activation during the pull up are maximum for latissimus dorsi and external oblique muscles.[15] Another study showed that ipsilateral lateral flexion has increase in activation of latissimus dorsi muscle.[16]

This exercise could be termed by the principle of reverses of muscle action or reversal of insertion action

to origin action of the muscle where the insertion component of the muscle is fixed which in this case is the maintained position of the scapular pull up and the origin action of the muscle is targeted with lateral trunk bending to the right. So this way of fixing the insertion and movement at origin attachment is assumed to have corrected the temporary curvature (functional scoliosis).

Conclusion

The scapular pull up exercise could be used as an aseessment for unilateral interscapular pain to observe difference in recruitment and compensations that can lead to the root cause of the overactivity of medial scapular muscle group. The scapular pull up with lateral trunk bending exercise showed change the temporary curvature of spine to normal on observation. There was clinical significant change in pain at rest, in movements and in training rated on NPRS after 4 sessions of treatment. On observation there is also equal recruitment of medial scapular muscle groups on both sides.

Scapular pull up exercise could be used as an assessment for unilateral interscapular pain and the scapular pull up lateral trunk bending exercise could be used as a therapeutic exercise for functional scoliosis.

Implications

1. The assessment with scapular pull up in athletes may give an indication of cause of unilateral interscapular pain and the compensations.
2. Overactivity of the particular medial scapular group of muscles and the inadequate shared muscle activity can be judged.
3. This study motivates to find a functional assessment pattern.
4. The study implies on specific exercise targets in athletes, different attachment action of muscles which can be studied for different conditions.
5. The reduction in pain in unilateral interscapular pain emphasizes the importance of having equal recruitment of muscles for similar action.

Limitations

1. Unifactorial pain scale.
2. Functional scoliosis measured is by observation.
3. No objective measure for muscle recruitments involved.
4. This assessment was possible because of the strength of upper body that athlete possesses.
5. Single case.

Future scope

1. Multifactorial pain scale can be used.
2. Objective measures (cobb's angle) could be used to see definite changes of spine.
3. EMG analysis can be done as objective measurement for overactivity of muscles and for the muscles that are assumed to have changed the functional scoliosis to normal.
4. Case series or RCT can be done to see the effectiveness. Control group or comparative studies can be done further.
5. Comparison between origin action and insertion action could be done to see the recruitment levels through EMG studies.
6. For non sportspersons or with less upper body strength a variation of scapular pull up sitting on Swiss ball and lateral trunk bending can be an alternative for functional scoliosis. A study could be done with EMG analysis of back and core muscles.

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Conflicts of Interest: NIL

Ethical Clearance: There was no need of ethical approval as it was studied in sports setup. An informed consent was taken from the athlete for publication.

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