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# EFFECT OF SWISS BALL EXERCISES ON ABNORMAL SCAPULAR POSITION POST CLAVICLE FRACTURE: A CASE STUDY

Physiotherapy

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## ABSTRACT

Clavicle is a part of shoulder complex which connects scapula to the body. Clavicle fractures are common among young adults with mid-shaft clavicle fractures being most common type. The fracture site of clavicle being under various muscular influences undergoes changes in structure leading to alterations in scapula position. These changes are usually neglected during rehabilitation which leads to scapular dyskinesis as a possible complication. The purpose of this study was to observe the effect of Swiss ball exercises added to conventional protocol on abnormal scapular position post clavicle fracture. This case study showed improvements in shoulder range of motion, altered scapula position through Lateral Scapular Slide Test (LSST) and shoulder disability through Shoulder Pain and Disability Index (SPADI) with the addition of Swiss ball exercises to conventional protocol.

## KEYWORDS

Mid-shaft clavicle fracture, Swiss ball exercises, Lateral Scapular slide test, SPADI

## INTRODUCTION:

Clavicle fractures are common fractures with incidence rate of 2.4-4% in all types of fractures and are more common in younger and active individuals. [1] Fracture mid-shaft of clavicle is the most common type and accounts for about 80% of fractures of clavicle. [2] Fracture site of clavicle usually unites in malposition due to gravitational and muscular forces acting on the fractures fragments resulting in shortening of clavicle. A previous study conducted reveals that mid-shaft clavicle fractures involve anterior axial rotation of the distal fragment along with clavicle shortening. [3] Clavicle is a structure for shoulder complex which connects scapula to central portion of body. Studies performed earlier have reported that clavicle shortening decreases posterior tilting as well as internal rotation of scapula. [4] Decrease in posterior tilting of scapula can lead to various kinds of shoulder disorders. Also, anterior axial rotation of clavicle in conjunction with clavicle shortening leads to scapula dyskinesis. [5] Majority of studies conducted previously stating the rehabilitation of conservatively managed clavicle fracture have focused on immobilization phase which is followed by active range of motion exercises progressing towards strengthening protocol. [6] Exercises which focus on reduced scapular dyskinesis need to be added to the conventional protocol. Hence, this study is based on hypothesis that prophylactic physical therapy focusing on maintaining scapula position added to the conventional protocol can lead to reduction in complications associated with scapular dyskinesis in patients post conservatively managed mid-shaft clavicle fracture.

## CASE DESCRIPTION:

A 25 year old college student with no past medical or surgical history, met with a road traffic accident while riding his bike. He slipped from his motorcycle and fell on his lateral aspect of left shoulder. He started experiencing difficulty in moving his left shoulder. There was no loss of consciousness, chest pain or shortness of breath and he was able to move his fingers, wrist and elbow after the incident. On the next day, he went to the hospital where an X-ray was done which revealed left displaced mid-clavicle shaft fracture which was conservatively managed with a figure of 8 splint. He was advised to perform finger and elbow exercises. He started Physiotherapy treatment after 16 weeks with complain of restricted shoulder mobility, reduced strength and difficulty in performing activities of daily living. Initially, his shoulder range of motion was very limited hence for the first 4 weeks he was given active assisted exercises for shoulder joint to improve his shoulder range to ≥90degrees in sagittal and frontal plane. After 4 weeks, an assessment of his shoulder range of motion by universal goniometer, scapula position by Lateral scapular slide test (LSST) and functional status of shoulder by Shoulder pain and disability index (SPADI) was done. This was considered as initial assessment before beginning the protocol. The initial findings of ROM, LSST, and SPADI are mentioned in table 1. Based on the initial assessment, an intervention was planned for 6 days/week for 4 weeks where the scapular stabilization exercises on Swiss ball were added alternate days/week. Each session started with Shoulder rehabilitation exercises which included active-assisted exercises using a wand followed by scapular retraction exercises using a red theraband which was progressed to green theraband after 2 weeks. Along with this, strengthening exercises for scapular muscles was given (middle trapezius in prone lying, lower trapezius in prone lying and serratus anterior muscles in supine lying which was progressed to standing after 2 weeks). A set of 5 Scapular stabilization exercises on Swiss ball were added to the conventional protocol which were set in accordance to target the scapular dyskinesis. These exercises targeted on maintaining static scapular position and improving dynamic joint stability. The exercises, number of repetitions and progression are mentioned in table 2. Post-intervention after 4 weeks showed significant changes in scapula position, range of motion of shoulder and functional status. He was pleased with his ability to perform his activities of daily living with very minimal impairment.

**Table 1: Outcome values of study taken pre and post intervention.**

| | Outcomes | Pre-intervention | | | Post-intervention | | |
|---|---|---|---|---|---|---|---|
| Range of motion (ROM) | Shoulder Flexion | 0-120º | | | 0-173º | | |
| | Shoulder Abduction | 0-110 º | | | 0-170º | | |
| | Shoulder internal rotation | 0-70º | | | 0-80º | | |
| | Shoulder external rotation | 0-53º | | | 0-75º | | |
| Lateral scapular slide test (LSST) – distance inferior angle of scapula to correspondi ng spine (in cm) | Distance | Right | Left | Diff. | Right | Left | Diff. |
| | Hands on side (0º abduction) | 9cm | 11cm | 2cm | 9cm | 9.5cm | 0.5cm |
| | Hands on iliac crest (45° abduction) | 10.5 cm | 11.8 Cm | 1.3cm | 10.5 cm | 10.8cm | 0.3cm |
| | Shoulder at 90º abduction. | 11cm | 12.8 cm | 1.8cm | 11cm | 11.4cm | 0.4cm |
| Functional status | Shoulder pain and disability index (SPADI) (in %) | 39% disability | | | 11.53% disability | | |

**Table 2: Scapular stabilization protocol using Swiss ball**

| Exercise | No. of repetitions for 1st and 2nd week | No. of repetitions for 3rd and 4th week |
|---|---|---|
| Quadriped weight-bearing scapular retraction protraction on Swiss ball | 15 | 30 |
| Quadriped weight-bearing scapular retraction protraction on Swiss ball with shoulder flexed past 90º | 15 | 30 |
| Bilateral kneeling push-up movement on Swiss ball | 10 | 20 |
| Standing wall push-up exercise on Swiss ball | 10 | 20 |
| Side wall push-up exercise on Swiss ball | 10 | 20 |

## DISCUSSION:

The present study showed improvements in range, scapula position and functional status of shoulder joint with the use of Swiss ball combined with conventional protocol post mid-shaft clavicle fracture. Mid-shaft clavicle fractures usually causes anterior axial rotation as well as shortening of distal fragment of clavicle fracture. A traction force applied by the anterior portion of the deltoid muscle which is attached on the anterior surface on distal clavicle leads to the anterior axial rotation of clavicle.[3] Along with this the gravitational forces acting in conjunction with Pectoralis major and Latissimus dorsi muscle pull the distal fragment of fractured clavicle medially leading to shortening of clavicle. [7] This shortening and axial rotation of clavicle usually is associated with mal-union. Several studies have stated that severe clavicular malunion can cause scapular dyskinesis among which some mal-union cases can result in poor clinical outcomes. [8] Cadaveric studies performed earlier, have reported that clavicular shortening by as little as 10% is associated with reduced posterior tilting of scapula and result in less external rotation of glenohumeral joint. [9] Decreased scapular posterior tilting of about 5-7º can lead to increase in the sub-acromial stress which can further lead to various shoulder disorders.[3, 5] Clavicle fractures have been implicated in further development of scapular dyskinesis which is caused by the above factors. Over the past years many studies have been conducted in an attempt to elucidate optimal rehabilitation for complications resulted from displaced clavicle fractures. Swiss ball is a useful physiotherapeutic resource which has been proved to provide functional recovery. Also, Swiss ball exercises are capable in increasing shoulder muscle activity by improving the muscular demands which are required to maintain stability while performing exercises. [10] Additionally, scapular stabilization exercises on Swiss ball focus on facilitating neuromuscular co-activation efficiency in order to improve dynamic joint stability, coordination and maintaining static scapular position. These can be the possible reasons for improvement in shoulder range of motion and scapular position as Swiss ball exercises which help in maintaining muscle balance by promoting co-contraction of muscles which stabilize the scapula while performing exercises. Also, Swiss ball exercises for upper extremity are close chain exercises which provide greater stability when compared to open chain exercises. Further, improvement in range of motion and scapula position indirectly improves the functional status of shoulder which is seen in the above study.

## CONCLUSION:

The study concludes that Swiss ball exercises has an improved effect on shoulder ranges, scapula position, and functional status of shoulder joint when combined with traditional rehabilitation post conservatively managed displaced mid-shaft clavicle fracture.

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