EFFECT OF DIFFERENT SCAPULAR POSITIONS ON ISOMETRIC SHOULDER ELEVATOR STRENGTH IN YOUNG NORMAL HEALTHY INDIVIDUALS

Shikha Jain¹, Suroshree Mitra², Rachana Dabadghav³, Nilima Bedekar⁴, Ashok Shyam⁵, Parag Sancheti⁶

1. BPTh, Sancheti Institute College of Physiotherapy.
2. Assistant Professor, Sancheti Institute College of Physiotherapy.
3. Lecturer and Research coordinator, Sancheti Institute College of Physiotherapy.
4. Principal, Sancheti Institute College of Physiotherapy.
6. MS Ortho, Chairman, Sancheti Institute of Orthopaedic and Rehabilitation.

ABSTRACT
Objective: To find effect of isometric shoulder elevator strength in three different scapular position (protraction, neutral, and retraction) with FET3 dynamometer.
Methodology: Sample of 500 were included in this study, with the mean age of 21±2.08 ranging from 18-25 years, strength of shoulder elevator (upper trapezius) was tested in three positions with FET3 dynamometer in young healthy individuals with age group of 18 to 25 years. Participants were made to sit on a chair without arm rest with back erect, arm in neutral position and head flexed to contra-lateral side to be tested. 3 readings of 3 different scapular positions were noted and the mean of all 3 positions were calculated and the best was selected.
Results: The average of protraction was 6.99N, average of neutral was 7.73N, average of retraction was 5.87N. So amongst the 3 positions average of neutral position was maximum.
Conclusion: This study shows that neutral position has maximum isometric shoulder elevator strength as compared to other two positions

KEYWORDS: isometric shoulder elevator strength; 3 scapular position; FET3 dynamometer; length tension relationship

INTRODUCTION
The shoulder joint or glenohumeral joint is an incongruous, ball and socket, triaxial joint with a lax capsule, supported by the tendons of the rotator cuff and the glenohumeral (superior, middle, inferior) and coracohumeral ligaments. Strength testing is one of the cornerstones of physical examination and an increase in strength is the aim of many rehabilitation programs. Various factors must be taken into account when testing muscles including test standardization, appropriate positioning, observation of how the patient performs the test and avoidance of pain or discomfort which may inhibit the participant from performing a maximal contraction.

There are two methods of improving strength of the muscle namely static and dynamic: Static includes isometric muscle contraction whereas dynamic includes resistance with movement. But earlier studies state that isometric resistance training became popular as an alternative to dynamic resistance exercise and initially was thought to be more effective and efficient method of muscle strengthening, which raised us to a question to check isometric shoulder elevators strength.

The rationale and indications for isometric strength are (1) to prevent or minimize muscle atrophy when joint movement is not possible owing to external immobilization (2) to activate muscles to begin to re-establish neuromuscular control but protect healing tissues when joint movement is not advisable after soft tissue injury or surgery (3) to develop static muscle strength at particular points in the ROM consistent with specific task related needs.

Isometric shoulder elevator strength is needed in daily activities and so we are checking, mainly the trapezius, it is a flat triangular muscle. The right and left trapezius muscles form a shape that looks like a trapezium, hence the name trapezius. The trapezius muscle is a strong elevator of the shoulder and it turns and elevates the shoulder, simultaneously.

This isometric shoulder strength was measured with Hogaan micro FET3 dynamometer. The wireless micro FET3 muscle testing dynamometer is an accurate, portable force evaluation testing (FET) device. It is designed specifically for taking accurate, objective muscle testing and range of motion...
measurements. The microFET3 is the latest development in the field of diagnostic medicine and provides fast and reliable results. The isokinetic machine is considered the gold standard in muscle testing with validity and reliability well documented. Dynamometers offer an alternative to the isokinetic machine as they are a portable, time-efficient and relatively inexpensive method of measuring isometric contractions and have also been shown to be valid and reliable when compared to the isokinetic machine. Also, with the publication of normative Data, HHs offer a simple alternative in clinical practice and provide a more quantitative objective measure than MMT5-7.

As shoulder injuries are very common, shoulder rehabilitation is practiced on a large scale so which shoulder position to be maintained to gain maximum strength as early as possible during rehabilitation, and hence this study compares all the three positions and finds which position has maximum strength.

METHODOLOGY

In this cross sectional, observational type of study 500 participants were included with 255 males and 245 females with mean age of 21 with SD+2.08 ranging in the age group of 18 to 25 years. Purposive sampling was done with the help of micro FET3 dynamometer. The inclusion criteria was young healthy individuals, both males and females in age group of 18 to 25 years. The exclusion criteria was participants having history of fracture or any trauma to shoulder and neck, participants having congenital deformity or any neurological disorder.

Isometric shoulder elevator strength was measured with micro FET3 dynamometer. Before starting the procedure written informed consent was taken then participants were explained about the procedure and a demo was given they were made to sit on a chair without arm rest with back erect, arm in neutral position and head flexed to contra-lateral side to be tested. Lateral flexion of neck was chosen because study done by Dale Edgar, Gwendolen Jull and Susan Sutton state that the tests for the movement and the length of the upper trapezius muscle and neural tissue of the upper quadran share common components. These are shoulder girdle depression and cervical contra-lateral lateral flexion which maintains the upper trapezius length8.

Therapist was standing in front of the participants with one hand on the shoulder and the other hand holding FET3 dynamometer on the bulk of the muscle to be tested (upper trapezius). Different scapular positions (protraction, neutral, retraction) were tested. Participants were asked to elevate the shoulder in the above mentioned positions while the therapist was resisting the elevation. 3 readings of 3 different scapular positions were noted and the mean of all 3 positions were calculated and the highest was selected. Subjects having any discomfort or pain during the procedure were discontinued from the study.

RESULTS

Sample of 500 were included in this study, with the mean age of 21 ranging from 18-25 years. The average of all three was calculated, average of protraction was 6.99N, average of neutral was 7.73N, average of retraction was 5.87N. So amongst the 3 positions average of neutral position was maximum.

DISCUSSION

In the previous study done by Smith J, Kotajarvi BR et al. on effect of scapular protraction and retraction on isometric shoulder elevation strength measured in sagittal plane with manual muscle testing concludes that strength is significantly reduced in protraction and retraction position as compared to neutral9. Another study done by Paul A. Matthews and Martin Scott on altering scapular position reduces isometric shoulder strength concludes that self-selected neutral position is stronger than protraction, retraction, posterior tilt10. Another study done by on isometric strength reference values in physically active collegiate males and females with hand held dynamometer concludes that strength is significantly reduced in dominant and non-dominant side for internal rotation, abduction and prone flexion11.

As the above studies were done with manual muscle testing and hand held dynamometer this study aimed to find the effect of isometric shoulder elevators strength in three different scapular positions (protraction, neutral, and retraction) and to find in which scapular position the strength was maximum. Five hundred young healthy subjects of the age group 18-25 years were included in the study. Subjects fulfilling the above mentioned inclusion criteria were
recruited. Then the mean of all 3 positions were calculated and the highest reading was noted. Out of the 3 scapular positions “neutral” position had maximum strength. Cynthia C Norkin and Pamela K. Levangie state that neutral position is the best because of isometric “length-tension relationship” which means direct relationship between isometric tension development in a muscle fiber and the length of the sarcomeres in a muscle fiber. Muscle fibers develop maximal isometric tension at optimal sarcomere length because the thick and thin filaments are positioned so that the maximum number of cross-bridges within the sarcomere can be formed. If the muscle fiber is lengthened or shortened beyond optimal length, the amount of active tension that the muscle fiber is able to generate when stimulated decreases. Hence, isometric tension decreases as the muscle is lengthened because fewer cross-bridges are able to form and tension decreases as the muscle is shortened because of interdigitation of the thin filaments. So in neutral position the length of upper trapezius is maintained. Hence, neutral position should be advised during the rehabilitation of shoulder patients and for postural corrections.

CONCLUSION

This study shows that neutral position has maximum isometric shoulder elevator strength as compared to other two positions.

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CLINICAL APPLICATION:

Neutral position can be used for shoulder rehabilitation patients.

Isometric strengthening of shoulder musculature is beneficial in shoulder injury patients.

SCOPE OF FURTHER STUDY

Along with strength range of motion could also be compared.

REFERENCES

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