

Correlation Between Grip Strength and Scapular Muscles Strength Among Goldsmith Workers in Pune: A Correlational Study

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ABSTRACT

Introduction: Gold ornament making industries are small scale widespread industries. Goldsmith workers make use of tools like cables, screw drivers, clippers, burr set, pliers at workplace which involve in doing different gripping activities. Due to these repetitive motions at workplace grip strength is affected in goldsmith workers which is one of the musculoskeletal disorders among them. Grip strength affection is related to scapular muscle strength because hand is the most distal component and shoulder is the most proximal component. They both are connected to each other via upper limb kinetic chain.

Inclusion of shoulder rehab in plan of treatment for reduced grip strength would be more effective and if treated from proximal most component the maintenance of functional

Method: 110 samples were collected, they were approached and consented for the assessment. Scapular muscles testing assessment was done by individual muscle testing, and grip strength assessment was done by hand dynamometer.

Result: Purposive sampling method was used in which results were calculated by Spearman's rank correlation coefficient. The Spearman's rho value is 0.543 for right side which indicates that there is moderate correlation according to grading standards of Spearman's correlation between scapular muscle strength and grip strength. And for left side the value is 0.567 that is also moderate correlation according to grading standards of Spearman's correlation between scapular muscle strength and grip strength. The rank associated with these two values is +1 hence there is significant positive correlation within these two.

Conclusion: It was concluded that there is a significant positive correlation observed between scapular muscle strength and grip strength.

Hence, we accept our alternative hypothesis H1 which stated that - there will be correlation between scapular muscles strength and grip strength.

Keywords: Goldsmith workers, grip strength, scapular muscles strength, prehension activities, power grip

INTRODUCTION

Gold ornament making industries are one of the small scale industries in India which are widespread. These industries belong to unorganized sector of the state. Most of the

goldsmith workers are working there at semi confined workstations. Tools like pliers, cables, screw drivers, clippers, burr set etc. are used by them. (2) This may lead to the development of different kind of

musculoskeletal disorders among them. (2) Our human hand is designed to perform various kinds of skilled movements in the daily activities. Such activities are termed as 'Prehension Activities'. (1). The prehension activities of our human hand involves grasp objects between any two surfaces of our hand, the thumb of human hand participates in almost every activity performed by hand. These activities can be categorized as either power grip or precision handling (1). Power grip is also called as full hand prehension and precision handling is also called as finger thumb prehension. Power grip is a forceful act which leads to flexion at all finger joints. The thumb acts as a stabilizer for the object held in hand and fingers. (1) Power grip is divided in 4 sub-types: Cylindrical grip, Spherical grip, Hook grip, Lateral prehension. (1) Thumb is generally abducted and rotated from the palm. (1) The fingers in in a power grip function all together to hold onto an object. (1) The position and degree of finger flexion changes every time as per the size, shape, and weight of an object. (1) The most commonly used functionally more effective type of grip within the 4 types of power grip is 'Cylindrical Grip. (1) It almost involves exclusive use of flexors to carry the fingers around and maintain a grasp on the object. (1) The cylindrical grip is typically performed with the wrist in neutral /extension and slight ulnar deviation. (1) The hand is most the distal component of upper extremity a good grip might require adequate shoulder stability which will be dependent upon its muscle strength. (1) All activities of hands require scapular mobility and stability. (1) This scapular mobility and stability are obtained by muscles attached to the scapula and strength of those muscles also play a major role. (1) Scapular stability is important for normal shoulder function and to maintain the scapula in normal alignment. (1) While gripping redistribution of forces happen all over limb. (1) Infraspinatus activity is increased in gripping. (1) There is co-activation of proximal and distal muscles while gripping activity. (1)

MATERIALS & METHODS

This study was a correlational study conducted on 110 goldsmith workers in Pune by purposive sampling within 6 months. The individuals selected were both males and females between age group 25 to 35 among them 73 individuals of age between 25 to 30 and 37 individuals of age between 31 to 35. Individuals working in this industry since 3 years, who work 7 to 8 hours per day, 6 days per week and have a scapular muscle strength of 3, 3+, 3-.

Workers with recent upper limb injuries, fractures, open wounds, De Quervain's tenosynovitis were excluded from this study

PROCEDURE

The study started with synopsis presentation and ethical clearance from the ethical committee.

Participants were selected according to the inclusion and exclusion criteria of the study. The study was explained and then the consent was taken for assessment of both components.

Grip strength assessment

Participant seated in chair, elbow at 90-degree flexion dynamometer placed in hand and participant instructed to press on the dynamometer in cylindrical grip. 3 readings were taken for both right and left hand. Individual muscle testing for following scapular muscles

Lower trapezius

Action – Depression of scapula, stabilizes adduction of scapula

Test – Adduct and elevate scapula, medially rotate inferior angle. Patients' elbow should be flexed, humerus is adducted toward the side of the body in slight extension and slight lateral rotation. Examiner applies pressure with one hand against patients arm in direction of abducting scapula and rotating inferior angle laterally and patients' shoulder with other hand in the direction of depression.

Rhomboids

Action – Adduct and elevate scapula, and rotate it so that the glenoid cavity faces caudally.

Test – Adduction of scapula with upward rotation and without elevation of shoulder girdle. Test position obtained by placing shoulder in 90-degree abduction and in lateral rotation. Pressure is given against in a downward direction towards the table

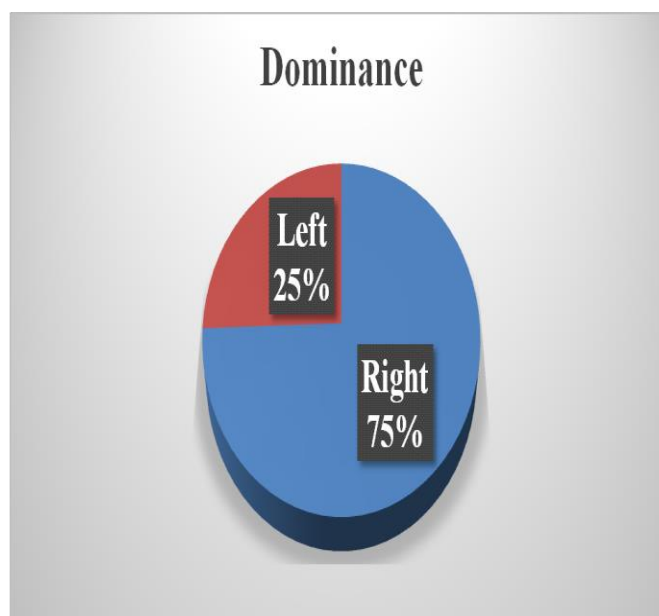
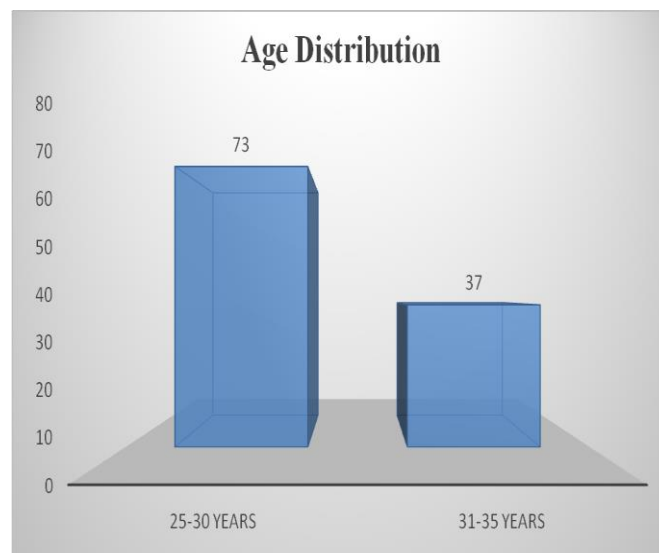
Serratus Anterior

Action - Abducts the scapula, rotates inferior angle laterally and glenoid cavity cranially

and holds medial border of scapula firmly against rib cage. In addition, lower fibres depress scapula and upper fibres elevate it slightly.

Test- Abduction of scapula, projecting upper extremity anteriorly upward from table. Firm surface of table supports the scapula. Pressure is applied against subject's fist transmitting the pressure downwards through the extremity to the scapula in the direction of adducting the scapula. Slight pressure may be applied against lateral border of scapula as well as against fist.

STATISTICAL ANALYSIS



RESULT

Correlations				
			Grip strength (Right)	Grip Strength (Left)
Spearman's rho	Trapezius	Correlation Coefficient	0.543	0.567
		P-Value	0.000	0.000
		N	110	110
			Grip strength (Right)	Grip Strength (Left)
Spearman's rho	Rhomboids	Correlation Coefficient	0.543	0.567
		P-Value	0.000	0.000
		N	110	110
			Grip strength (Right)	Grip Strength (Left)
Spearman's rho	Serratus anterior	Correlation Coefficient	0.543	0.567
		P-Value	0.000	0.000
		N	110	110

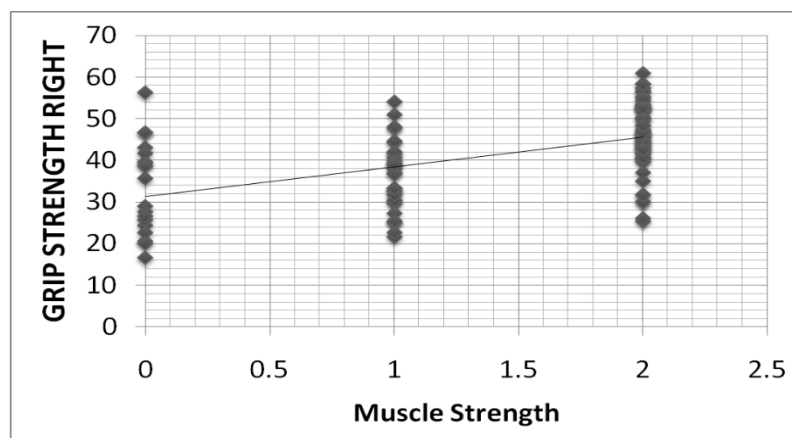
Spearman's rank correlation coefficient is used to test correlation between scapular muscle and grip strength.

From above table, we can observe that, there is significant positive correlation observed between scapular muscle strength and grip strength.

As the spearman's rho value is 0.543 that is moderate correlation according to grading

standards of spearman's correlation, for right side and 0.567 that is moderate correlation according to grading standards of spearman's correlation, for left side. It indicates that the rank associated with this value is +1, hence there is significant positive correlation within these two.

CORRELATION OF RIGHT SCAPULAR MUSCLES STRENGTH WITH RIGHT GRIP STRENGTH

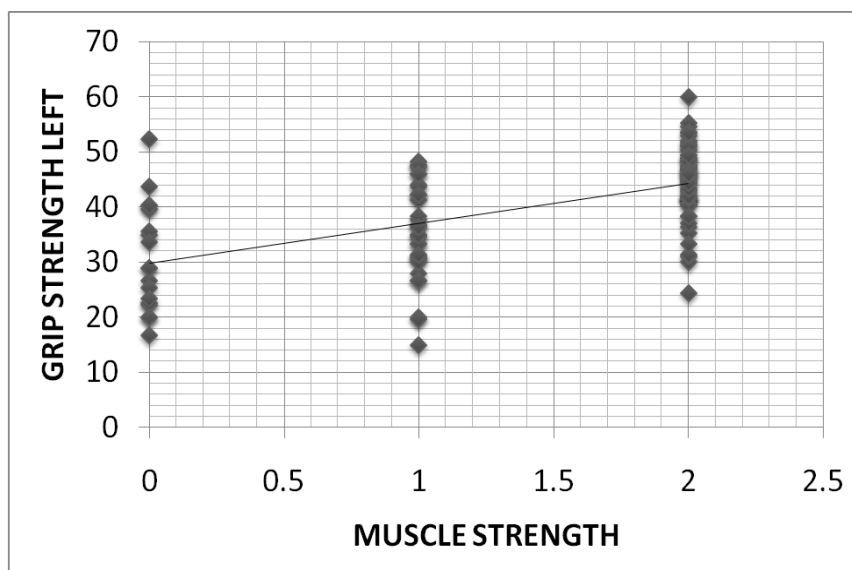


Above graph represents correlation of right scapular muscles strength with right hand grip strength.

In this graph x-axis shows muscle strength for scapular muscles. (0 represents 3-, 1 represents 3, 2 represents 3+).

Maximum participants have 3+ grip strength. In this graph y-axis shows grip strength for right hand which ranges from 15kg to 65kg.

CORRELATION OF LEFT GRIP STRENGTH WITH LEFT SCAPULAR MUSCLES STRENGTH



Above graph represents correlation of left scapular muscles strength with left hand grip strength.

In this graph x-axis shows muscle strength for scapular muscles. (0 represents 3- , 1 represents 3, 2 represents 3+.

Maximum participants have 3+ grip strength In this graph y-axis shows grip strength for right hand which ranges from 15kg to 60kg. There is no role of dominant side on good or poor grip strength. Participants also have good grip strength on non dominant side too and in some participants, it was reduced on both sides too.

This study is not focusing on grip strength vs dominant and non dominant side whether as it is only focusing on correlation of right grip strength to right scapular muscles strength and left grip strength to left scapular muscles strength.

DISCUSSION

The purpose of present study was to find out correlation between grip strength and scapular muscles strength in goldsmith workers. The main result of study showed that there is significant positive correlation between grip strength and scapular muscles strength in goldsmith workers. Numerous studies have focused on finding correlation

between grip strength and scapular muscle strength. Park MC reported that reaching movement was more efficient after passive pre positioning of scapula and noted that hand function is influenced by alignment of scapula. The result of previous studies shows that positioning of scapula improves upper extremity function. The muscle activation of muscles surrounding the scapula and upper extremity also increase after active scapular protractors. The muscle activation of serratus anterior muscle, trapezius. These results show that positioning the scapula in ideal position can improve muscle activation of distal end of upper extremity. Cho MA studied that positioning the scapula in an ideal position through passive protraction affected the function of the upper extremity and ADLs of chronic stroke patients. Her results showed that upper extremity function and ADL of the group that had scapular setting improved more than those of group did not receive scapular setting. When scapula is placed in its ideal position upper limb function improves and works better when scapular stability is secured. Study of grip testing in goldsmith workers we find that grip strength is significantly associated with strength of scapular muscles – trapezius, serratus anterior, rhomboids. Proper

positioning of scapula during assessment is very important. Poor grip strength may be associated with weakness of scapular muscles, which was found in some individuals during this study. Age plays a relatively major role in poor grip strength and good grip strength. This is also seen in previous studies. Individuals with good grip strength had good scapular muscles strength either due to proper work place ergonomics, proper way of using of tools used in their occupation. And also following proper rest breaks. Reduced grip strength and reduced scapular muscles strength was reported in a study which was done in breast cancer survivors and she also stated that gripping exercises should be added in protocol for strengthening of scapular muscles. The reason for reduced grip strength and scapular muscles strength is overuse of muscles due to daily workplace motions associated to work of goldsmith workers. So many studies have shown a positive correlation between hand gripping activity and rotator cuff muscle activity. Kwasniewski compared bilateral rotator cuff strength in patients with a unilateral hand or wrist disorder using a hand-held dynamometer and he reported decrease in elevated external rotation strength. Kwasniewski stated that it was unclear whether there is a causal relationship. Similarly, Budoff found an increased prevalence of associated upper limb weakness with associated hand or wrist injuries. Alterations in muscle activity patterns have been seen in the presence of shoulder dysfunction. (1) Muscle strength and endurance in the proximal aspect that is rotator cuff of the upper extremities influence hand, grip functions, and individuals with reduced strength and endurance at rotator cuff are more prone to developing work-related musculoskeletal disorders. Good grip endurance is been influenced by the stability provided by shoulder muscles. (16) This concept of the kinetic chain regarding human anatomy has been around since 1955 when Dr. Arthur Steindler on the basis of the theory of Franz Reuleaux, a mechanical engineer. Reuleaux proposed that a series of

overlapping segments are connected through a pin joint, and these interlocking joints create a system which allows movement of one joint which affects the movement of another joint within the kinetic chain link. Dr. Steindler stated that the human body can be viewed the same way, as a mechanical system of rigid and overlapping segments connected to each other by a series of joints, collectively called as the kinetic chain. (11-15) The upper limb kinetic chain consists of the fingers, wrists, forearms, elbows, upper arms, shoulders, shoulder blades, and spinal column. (11-15) A large number of goldsmiths work for prolonged period in crossed sitting posture at workstation. (2) Ghosh T. in 2010 analyzed and it revealed that musculoskeletal disorders were the major problem of the goldsmiths. The activities done by the goldsmiths are all highly repetitive. Twisting, bending, and over-reaching are the resultant of poorly designed 32 workstation. These actions force them to be into a non-neutral position and that position increases the overall discomfort to their body and creates pain at the lower back, neck, and shoulders. Hence there is a significant positive correlation between grip strength and scapular muscle strength in goldsmith workers between age 25 to 35 years Most of the individuals over 30 years of age have a reduced grip strength and scapular muscles strength, thus while assessment of any distal component proximal component must be assessed for accurate diagnosis and proper rehabilitation.

CONCLUSION

Based on this study, it was concluded that there is a significant positive correlation observed between scapular muscle strength and grip strength

Hence, we accept our alternative hypothesis H1 which stated that - there will be correlation between scapular muscles strength and grip strength

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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