International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 10; Issue 08 (C); August 2021; Page No.25069-25073
DOI: http://dx.doi.org/10.24327/ijcar.2021.25073.5003

Research Article

CORRELATION BETWEEN SCAPULAR DYSKINESIA AND GRIP STRENGTH IN AUTO RICKSHAW DRIVER

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A R T I C L E I N F O

Article History:
Received 4th May, 2021
Received in revised form 25th June, 2021
Accepted 18th July, 2021
Published online 28th August, 2021

Key words:

Scapular dyskinesia, grip strength, auto rickshaw drivers.

A B S T R A C T

Background: An auto rickshaw drivers tends to work for longer duration, shoulder muscles are always active as well as unsupported while driving and kept in fixed position for considerably longer duration, which leads to shoulder pain. The structure of auto rickshaw includes handle bar control causing continuous gripping activity and repetitive movements of wrists leading to wrist/hand pain. Scapular dyskinesia is an alteration in the normal position or motion of scapula during coupled Scapulo-humeral movement. Grip strength is a measure of muscular strength or maximum force/tension generated by one's forearm muscle

Objective: To correlate between scapular dyskinesia and grip strength in auto rickshaw drivers.

Method: Scapular dyskinesia was assessed using Kibbler's classification and scapular slide test and grip strength using Jammar hand-held dynamometer.

Result: Pearson coefficient of correlation was used to correlate between scapular distance and grip strength which shows negative correlation for dominant side for hand at side (r)=-0.4704, 45 degree (r)= -0.4817 and 90 degree (r) = -0.5329.Pearson coefficient of correlation was used to correlate between scapular distance and grip strength which shows negative correlation for dominant side for hand at side (r)= -0.5750, 45 degree (r)= -0.6118 and 90 degree (r) = -0.6670.scapular dyskinesia increases with scapular distance there is a positive correlation between scapular dyskinesia and grip strength.Unpaired t test was used to find out the difference between the grip strength of dominant and non-dominant side (p=0.0110) which is significant that suggest the dominant side has more grip strength compared to non-dominant side.

Conclusion: This study concludes that there is a significant correlation between scapular dyskinesia and grip strength which is more significant in the non-dominant side. So as per the study we can conclude that scapular dyskinesia does affect the grip strength.

INTRODUCTION

An auto rickshaw is a motorized development of the traditional pulled rickshaw or cycle rickshaw. Auto rickshaw is a common means of urban transportation. Drivers spend a considerable amount of time in an environment full of pollutant gases, noisy, continuous cacophony and whole-body vibration. Further harmful lifestyle is practised like irregularity of meals, no proper rest rooms, awful quality of sanitary toilets, bad posture while driving and stressful occupational conditions during their working hours. [(1)]Professional driving is associated with long hours in a single body posture, under exposure to vibration, vehicle exhaust, and noise. Mostly auto rickshaw drivers are affected worst on their health because of their workload and stress[(2)]

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It was found in a study that most of the auto rickshaw drivers suffer from musculoskeletal problem that includes low back pain (96.42 %), knee pain (88.09 %), wrist pain (71.43 %), shoulder pain (100 %) and body ache (88.10 %) [(4)]Whereas another study proved that 57% of the sample population has upper extremity disorders in the form of pain [(4)]. As auto rickshaw drivers tends to work for longer duration, shoulder muscles are always active as well as unsupported while driving and kept in fixed position for considerably longer duration, which leads to shoulder pain. The structure of auto rickshaw includes handle bar control causing continuous gripping activity and repetitive movements of wrists leading to wrist/hand pain. [(3)]Causes of Musculoskeletal Disorders among auto rickshaw drivers can be related to poor health habits like smoking, tobacco chewing, poor rest and health habits.[(1, 2)]They also have to undergo various mechanical pressure which leads to poor posture and repetitive awkward movement.[(1, 4, 5)]

Scapular dyskinesia is an alteration in the normal position or motion of scapula during coupled Scapulo-humeral movement. Typical movement of the scapula occurs in the sagittal, coronal, and transverse planes. The primary movements consist of two translations: superior/inferior, and protraction/ retraction, as well as three rotations: upward/downward, internal/external, and anterior/posterior. Upward rotation is primary and posterior tilt secondary during normal overhead upper extremity elevation with internal/external rotation being minimal until 100°. Scapular dyskinesia can lead to altered glenohumeral joint angulation, abnormal stress on shoulder ligament, altered sub acromial space, overload of acromio-clavicular joint, strain on scapular stabilizing muscle, altered muscle activation and modified arm position and motion. [(11)]

Grip strength is a measure of muscular strength or maximum force/tension generated by one's forearm muscle. Grip strength is measured using Jammar dynamometer [(12)] in shoulder in adducted and neutral position; elbow in 90-degree forearm neutral and wrist extended between 0-30 degrees. [(13)(14)]

Driving an auto requires constant use of hand and forearm muscle which may lead muscular fatigue over time and its overuse will ultimately lead to reduction in the strength of the muscles.

Scapula being extremely proximal and grip being the distal-most component is important. Even though they are not directly connected to each other it will be of clinical importance to study their correlation so as to design an effective treatment program. There are not many studies which highlight the importance of these two components in relation to each other and hence his study is being carried out.

MATERIALS AND METHODOLOGY

Male driver with age between 30 to 40 years having an experience of 5 years works for 5-10hrs were included in the study.Drivers with history of shoulder, upper limb or neck injury, Respiratory or cardiac condition, arthritic conditions of upper extremity, neurological condition, congenital deformities of scapula. Individuals who regularly undertake a structured exercise program were excluded. Materials used were Kibbler's classification for scapular dyskinesia, Jammar dynamometer to assess grip strength & measuring tape.

Procedure: The subject was selected according to the inclusion criteria, and who were willing to participate. The purpose and procedure of the study was explained to the subject prior to the assessment. A written informed consent was taken in the language best understood. Demographic data like name, age, BMI was noted.

To assess scapular dyskinesis using kibler classification: The subject was made to sit with scapula well exposed. Subjects medial border of scapula was observed while the subject is asked to sit with first hands on hip position then asked to perform active eccentric lowering from overhead then perform arm elevation. The subjects were then classified whether there is scapular dyskinesia or not i.e. yes/no. (Fig 1)

Fig 1 scapular dyskinesis using kibler classification

Scapular dyskinesia using lateral scapular slide test: Distance was measured from the base of spine of scapula to the T2 or T3 and from T7-T9 spinous process to inferior scapular angle. Then subjects were also tested holding two other positions**,** 45-degree abduction that is hands on waist, thumbs posteriorly and 90 degrees of shoulder abduction, full shoulder internal rotation. Each position the distance measured should not vary more than 1 to 1.5cm. (fig 2)

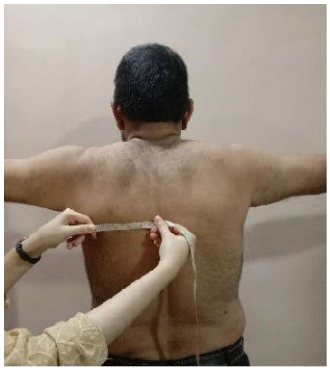


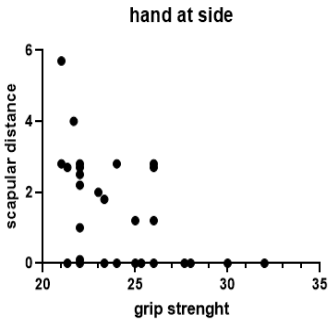
Fig 2 Scapular dyskinesia using lateral scapular slide test

To assess hand grip using jammar dynamometer: Hand position: The hand which was tested was kept with shoulder in neutral position, elbow in 90-degree forearm neutral and wrist extended between 0 to 30 degree. The handle of dynamometer was adjusted accordingly as the base should rest on first metacarpal while the handle should rest on middle of four fingers. The subject was instructed to squeeze the dynamometer with maximum effort which was maintained for five second the readings were noted. A mean of three readings was taken.

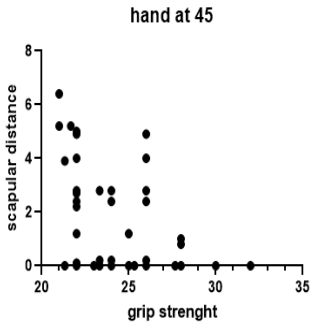
RESULTS

A total of 60 subjects were enrolled in this study with no drop outs. Data was collected on a data sheet and encoded for computerized analysis using SPSS Version 7 for windows. Tables were made using Microsoft word and figures were plotted using Microsoft excel windows 10.

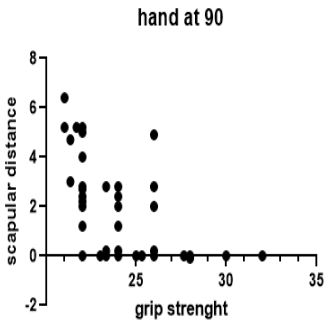
Dominant Side



(a)



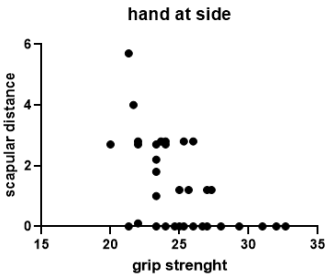
(b)



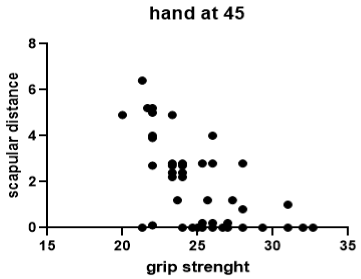
(c)

Chart 1 Correlation of Scapular Distance and Grip Strength (DOMINANT SIDE) with hand at side(a); hand at 45 degree (b) ;hand at 90 degree (c)

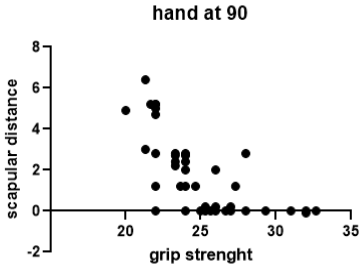
Interpretation: Pearson coefficient of correlation used to correlate between scapular distance and grip strength with hand at side, hand at 45 degree, hand 90 degree which shows negative correlation. Since, scapular dyskinesia increases with scapular distance there is a positive correlation between scapular dyskinesia and grip strength.



(a)



(b)



(c)

Chart 2 Correlation of Scapular Distance and Grip Strength (NON-DOMINANT SIDE) with hand at side(a); hand at 45 degree (b); hand at 90 degree (c)

Interpretation: Pearson coefficient of correlation used to correlate between scapular distance and grip strength with hand at side, hand at 45 degree, hand 90 degree which shows negative correlation.

Table 1 Correlation of Scapular Dyskinesia and Grip Strength between dominant side and non-dominant side

	Dominant Side			Non-Dominant Side		
Pearson r	Hand at side	Hand at 45	Hand at 90	Hand at side	Hand at 45	Hand at 90
r	-0.4704	-0.4817	-0.5329	-0.5750	-0.6118	-0.6670
95% confidence interval	-0.6470 to -0.2458	-0.6554 to -0.2595	-0.6930 to -0.3226	-0.7233 to -0.3759	-0.7493 to -0.4237	-0.7876 to -0.4973
R squared	0.2212	0.2320	0.2839	0.3306	0.3743	0.4449

Table 2 Grip Strength between Dominant and Non-Dominant Side

Unpaired t test	
P value	0.0110
Significantly different (P < 0.05)?	Yes
One- or two-tailed P value?	Two-tailed
t, df	t=2.584, df=118

Unpaired t test was used to find out the difference between the grip strength of dominant and non-dominant side (p=0.0110) which is significant that suggest the dominant side has more grip strength compared to non-dominant side.

DISCUSSION

In this study we aimed to correlate between scapular dyskinesia and grip strength in auto rickshaw drivers. The auto rickshaw drivers having an experience of 5 years; belonging in an age group of 30 to 40 years having a daily working hour between 5-10hrs were included. The sample consisted of 60 individuals. Kibbler's classification was used to find out scapular dyskinesia and was confirmed using a lateral slide test and Jammar's dynamometer was used to asses grip strength. Correlation was found using Pearson's correlation formula.

Kibler BW, McMullen J *et al* in their study found that there is correlation between shoulder pain and scapular dyskinesia. [7]Previous studies have shown that autorickshaw drivers have shoulder pain at various period of time. [1-4] Scapular dyskinesia most frequently occurs as a result of alteration of muscle activation or coordination. [11] Since, auto rickshaw driver tends to work for longer duration, they tend to maintain a fixed posture for a prolonged period of time. [2] Adopting hunched sitting position when driving can result in increased back and shoulder problems over time. A posture of excessive thoracic kyphosis and increased cervical lordosis can result in excessive protraction of scapula and depression of acromion.[7] A faulty scapular posture is associated with decrease flexibility in the pectoralis minor, levator scapulae and scalene muscles and weakness in the serratus anterior and trapezius muscles. The main stabilizers are the serratus anterior, rhomboid major and minor, levator scapulae, and trapezii. The glenohumeral "protectors" include the muscles of the rotator cuff: the supraspinatus, infraspinatus, teres minor, and subscapularis. Horsley I, Herrington L, *et al* study shows a significant correlation between rotator cuff muscle and grip strength. These muscle groups function through synergistic co-contraction to anchor the scapula and guide movement specifically. [9]The scapular stabilizing muscles are affected directly from direct-blow trauma; have micro trauma-induced strain in the muscles, leading to muscle weakness; become fatigued from repetitive tensile use; or are inhibited by painful conditions around the shoulder. [7]

The structure of auto rickshaw includes handle bar control which requires cylindrical grip. The most 'functional' type of grip within the 4 types of power grip is 'Cylindrical Grip'. It almost involves exclusive use of flexors to carry the fingers around and maintain a grasp on the object. The function in the fingers is performed largely by FDP (Flexor Digitorum Profundus) muscle especially in the dynamic closing of the fingers. In the static phase when the more powerful grip is required, the FDS (Flexor Digitorum Superficialis) assists. Along with FDP and FDS muscles, considerable interosseous muscle activity is also required. The interossei function primarily as MP (Metacarpophalangeal) joint flexors and abductors/adductors. The thumb usually comes around the object, then flexes and adducts to make a grip. The FPL and thenar muscles are also required. The activity of thenar muscles will change with a width of the web space and with the more pressure or resistance. The cylindrical grip is typically performed with the wrist in neutral /extension and slight ulnar deviation. The intrinsic muscles of hand along with the thenar and hypothenar muscles are not the only muscles responsible for proper functioning of hand. The proximal muscles like flexors and extensors of wrist and fingers as well as the proximal joints- Elbow (Humero-ulnar and Humero-radial), all 3 Radioulnar joints and all joints of shoulder girdle i.e. Gleno-humeral, Acromio-clavicular, Scapulo-thoracic, and Sterno-clavicular are responsible for hand functions. [9]

The hand being the distal component, a good grip might require adequate shoulder stability which will be dependent upon its musculature.

A study done by J.Snehal, *et al* showed that Trapezius muscles, Rhomboids, and Serratus anterior has a significant correlation to grip strength, [9] which supports the purpose of this study for scapular dyskinesia is caused by dysfunction of scapular muscle.

Grip strength is affected from many conditions and some studies had been designed to identify these factors. Muscle strength is one of these factors. The synergistic action of flexor and extensor muscles and the interplay of muscle groups is an important factor in the strength of resulting grip.[17] A study done by NA Incel, *et.al*, showed that the dominant hand is significantly stronger in right-handed subjects but no such significant difference between sides could be documented for left-handed people.[17]

This suggest that when scapular position is affected one must assess for grip strength or when grip strength is affected one of the causes can be scapular position.

CONCLUSION

This study concludes that there is a significant correlation between scapular dyskinesia and grip strength which is more significant in the non-dominant side. So as per the study we can conclude that scapular dyskinesia does affect the grip strength

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How to cite this article:

Sidrah A Kharbe *et al* (2021) 'Correlation Between Scapular Dyskinesia And Grip Strength In Auto Rickshaw Driver', *International Journal of Current Advanced Research,* 10(08), pp. 25069-25073.
DOI: http://dx.doi.org/10.24327/ijcar.2021.25073.5003

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