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EFFECT OF MULLIGAN SUSTAINED NATURAL APOPHYSEAL GLIDES ON THORACIC COBB ANGLEIN SUBJECTS WITH THORACIC KYPHOSIS

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Key Wards: Mulligan, thoracic kyphosis, Cobb Angle , digital x-ray.

ABSTRACT

Objective: This study was conducted to investigate the effect of mulligan SNAGS on thoracic cobb angle in subjects with thoracic kyphosis. **Methods**: A total of 40 subjects participated in this study aged from 18 to 28 year underwent 12sessions of a combination of Mulligan techniques and traditional treatment (experimental group, n 20) or traditional treatment only (control group, n 20). They were evaluated before the treatment, and after 4 weeks, using digital x-ray. **Results:** Mixed MANOVA revealed significant decrease of thoracic cobb angle post treatment compared to pre treatmentfor both expermintal and control group also it revealed significant decrease of thoracic cobb angle post treatment in experimental group compared to control group. **Conclusion**:Thoracic MWM improves thoracic kyphosis (decrease kyphotic cobbs angle)

INTRODUCTION

The thoracic kyphosis is the primary curve of the vertebral column which is consists of 12 vertebrae (**Standring, 2005)**. The thoracic kyphosis angle increases with age and the increase is greater in females than in males **(Nishiwaki et al.,2007).**Normal values for the thoracic kyphosis are between 20˚and 40˚ of angulations, When the curve of the thoracic spine exceeds this, it is described as either a postural kyphosis or Scheuermann's kyphosis **(Shelton, 2007).**

kyphosis can be found in all age groups 30% in teenagers(**Eslami and Hemati,2013)**, 35% in adults (**Seidi et al.,2014)**, and 40% in the elderly**(Kado et al.,2007).**Changes in lifestyles currently are prompting people to reduce their levels of physical activity and spend a considerable

amount of their time sitting with an extreme flexion posture. Such changes may raise the development of kyphosis in early age groups. As kyphosis angle increases, physical performance and quality of life often decrease, making early intervention for hyperkyphosis is a priority (**Katzman et al.,2007).**

Physical therapy usually use posture correction exercise, which include strengthening and stretching exercises and positioning to treat subjects with thoracic kyphosis. However, quality of evidence that supports effective therapeutic exercise for this postural abnormality is lacking **(Morris and Bui.,2005).**Bracing as conservative treatment is effective in decreasing pain and fatigue until skeletal maturity is reached in adolescent. But not sufficient for correction of hyperkyphosis so combined treatment is recommended for best improvement **(Trevor et al.,2015).**

Mulligan mobilization technique can used to improve extension range of motion in the thoracic spine using SNAGS. Mulligan SNAGS provide immediate improvement in range of motion(ROM) as it corrects the positional fault in facet joint **(Mulligan,2004).** As in mulligan combination of mobilization in weight bearing position and active movement of subject has good effect in correction of malalignment between articular surfaces **(Hing et al., 2014).**

So the aim of this study was to investigate the immediate effects of the Mulligan SNAG on kyphotic angle in subjects with thoracic kyphosis

MATERIALS AND METHODS:

Design, setting, methods, and population

The current randomized single-blinded placebo-controlled trial was performed in a private physical therapy clinic in the period between February 2019 and September 2019. The design of the study was approved by the local ethical committee board (P.T.REC/012/002219) and was registered on the Pan African Clinical Trial Registration (PACTR201907852069410).

Forty subjects diagnosed with postural thoracic kyphosis (cobb angle $\geq 40°$) and referred to receive physical therapy interventions were included in this study. Subjects from both genders ranged from18 to 25 years old, and having a Cobb angle $\geq 40°$ were included in this study.

Pregnant females, obese persons (more than $30kg/m^2$), fixed spinal or thoracic deformities, combined scoliokyphosis were excluded. The recruitment process was summarized in the flow chart (figure1)

Sample size

The sample size was estimated using the G*power 3.0.10 software (Heinrich Heine University Düsseldorf, Düsseldorf, Germany). The sample size was calculated based on a prior pilot study consisted of 10 subjects received the same interventions. F test-repeated measurements, between factors α=0.05, β=0.2, and effect size=0.4 revealed that 40 (20 subjects per group) were the appropriate sample size.

Interventions

Group A(Experimental group): participants in this group underwent thoracic SNAG manipulative therapy on thoracic region. The participants were given mulligan mobilization 3 sets with 10 repetition using SNAG technique to level affected of thoracic spine. 12 mobilization session were given to the subjects over a period of 4 weeks, 3 session a week. ***Position of the participant*** was seated , with both hands behind the neck to protract the scapula and make the therapist make hand contact with mid thoracic spine. ***Position of the therapist*** stand astride beside the subject. With one arm of the therapist around the participant and guide the motion. The other hand ulnar border has been placed on spinous process on the level which would be mobilized and apply gliding force along the facet plane while the patient extend his thoracic spine (figure 1). some strength required to support the subject extension movement as well as providing facet glide**(Mulligan ,2010).**

Figure1:Thoracic extension SNAG with spinous process application point

Posture correction exercises : The exercise programme consisted of 5 basic exercises, were performed under the supervision of the physical therapist, who provided guidelines (verbal and/or written) to the participants so that they could also perform the exercises alone (at home) to have best result of the exercises .The exercise programme comprised a daily session of 15–20 min(under the supervision of the therapist or alone at hom **(Bautmans et al.,2010)**

The exercises consisted of :

1-Seated, lifting both hands together above the head (3 series of 10–15 movements, using a dumbbell if necessary).

2- Seated or standing with the back against a wall, straightening the back as far as possible (3 series of 10–15 repetitions, maintaining the upright position for 3–10 sec).

3- seated on a chair with both hands on the neck or crossed over the thorax on the shoulders, lifting the arms and extending the upper back without compensation in the hips or lumbar spine (3 series of 10–15 repetitions, maintaining the upright position for 3–10 sec).

4- Standing in front of a wall, scrolling with both hands as high as possible over the wall (3 series of 10–15 repetitions, maintaining the upright position for 3–10 sec).

5-lying on the back, knees and hips flexed and feet resting on the ground, a small rolled-up towel under the 5th to 7th thoracic vertebrae (perpendicular to the spinal processes), stretching the thoracic spine for 30–180 sec(depending on the patient's capacities, without compensation of the lumbar spine or eliciting back pain)

Group (B) control group: were received postural correction exercise only. FVC,FEV1,MVV,andkyphotic angle were measured for all participants before and after treatments.

Outcomes measures:

Kyphotic angle were measured by digital X-ray. participants were filmed for lateral spinal radiography over the area of the thoracic spine [the first thoracic vertebral (T1) to the 12th thoracic vertebral (T12)] in an upright standing position. The Cobb angle was subsequently analyzed by four raters using the software .To achieve a Cobb angle, a digital X-ray file was uploaded to the prima console programme. Then, a straight line was drawn that passed the upper border of the T4 vertebra, and another line that passed the inferior border of the T12vertebra. Then, two other lines were drawn perpendicularly with the first two lines, and the intersection of these two lines produced the Cobb angle (**Briggs et al.,2007 andKatzman et al.,2007)**

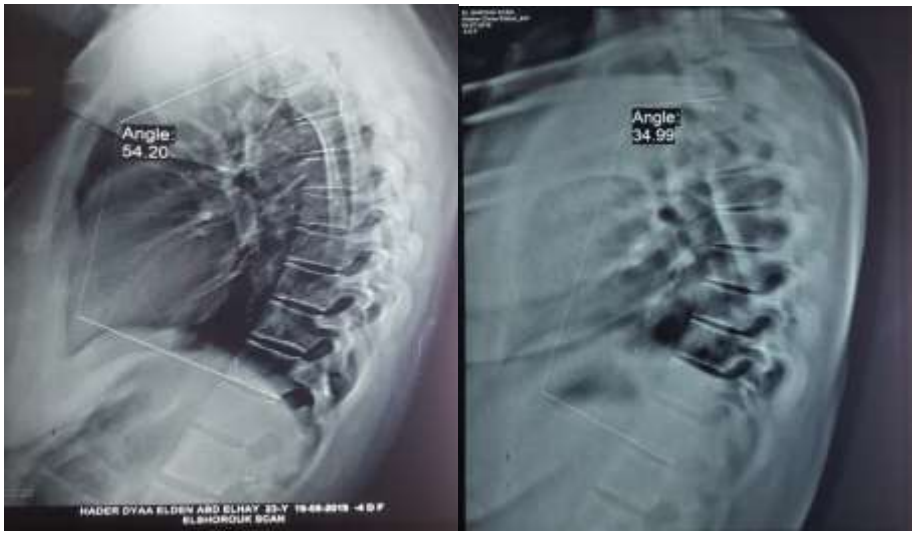

Fig (2): (a) before treatment (b) after treatment

Statistical analysis

- Descriptive statistics and t-test was conducted for comparison of the subject characteristics between both groups. Chi squared test were conducted for comparison of sex distribution between both groups. Mixed MANOVA was conducted to compare the effect of time (pre versus post) and the effect of treatment (between groups), as well as the interaction between time and treatment on mean valueof kyphotic angle. The level of significance for all statistical tests was set at $p < 0.05$. Statistical analysis was performed through the statistical package for social studies (SPSS) version 25 for windows.

Table 1.Participant characteristics..

		Group A	Group B	p-value
		mean ± SD	mean ± SD	
Age (years)		2.42 ±24.25	23.85± 2.56	0.61
Weight (kg)		74.25 ± 8.75	75.45± 6.84	0.63
Height (cm)		168.25 ± 5.44	169.65 ± 3.81	0.35
BMI(kg/m2)		26.23±2.88	26.22±2.28	
Sex	Boys	8 (40%)	7 (35%)	0.73
	Girls	12 (60%)	13 (65%)	

SD, Standard deviation; p-value, Level of significance

Overall effect of treatment on FVC, FEV1, FEV1/FVC ratio, MVV and kyphotic angle :

Mixed MANOVA was conducted to investigate the effect of treatment on kyphotic angle. There was a significant interaction effect of treatment and time ($p = 0.0001$). There was a significant main effect of treatment ($p = 0.002$). There was a significant main effect time($p = 0.0001$).

Within group comparison

Within-group comparison between the before treatment and after treatment revealed a significant increase in Kyphotic angle, in the group A and B ($p < 0.001$), (table 2).

Table (2): within-group comparisons in both experimental and control groups.

Variable	Experimental group				Control group			
	mean ± SD		MD	P	mean ± SD		MD	P
	Pre-treatment	Post treatment			Pre-treatment	Post treatment		
Kyphotic angle (°)	46.29 ± 5.32	39.46 ± 3.78	6.83	0.0001	45.95 ± 3.12	42.15 ± 4.19	3.80	0.0001

SD, standard deviation; MD,mean difference; P, level of significance

Between group comparison

There was no significant difference in the kyphotic anglepre treatment between the study and control groups ($p = 0.8$). However, there was a significant decrease in the mean values of kyphoticangleof the study group post treatment compared with that of control group ($p = 0.03$).,(table 3).

Table(3): between groups comparisons for both real MWM and sham MWM groups.

Variable	Between groups pairwise comparison (Bonferroni correction)							
	Pre-treatment				Post – treatment			
	Mean± SD		MD	P	Mean± SD		MD	P
	Experimental	Control	MD	P- value	Experimental	Control	MD	P- value
Kyphotic angle (°)	46.29 ± 5.32	45.95 ± 3.12	0.34	0.80	39.46 ± 3.78	42.15 ± 4.19	2.69	0.03

DISCUSSION

The current study revealed statistical significant decreasing in thoracic cobb angle after Mulligan mobilization the possible explantions for decreasing thoracic kyphotic angle are**:**

The first is that mulligan technique is given in sitting position facing the challenge of the gravity effect on the thoracic vertebrae when performing the mobilization maneuver and this enhance the corrective effect of mobilization on kyphosis. It is important to give manual therapy in weight bearing position when dealing with spinal deformity **(Lawrence and Bakkum,2000).**

The second, the impairment in thoracic kyphosis not only in joints, cartilage and ligaments but also there is impairment in muscle balance, sense, postural awareness**(Knight,2003).** Mulligan SNAGS combine between joint glide which improve the dysfunction in vertebral joints and active movement of subject which improve muscle balance, postural awareness and sense of movement **(Hing et al., 2014)**

The third explanation, kyphosis is considered compensated incongruent posture. Congruency is important for maintainance of posture upright, and the degree to which someones posture is congruent will influence body mass distribution and biomechanical environment of spine. Applying SNAG on thoracic vertebrae restore the normal congruence and weight distribution over vertebral body **(Hing et al.,2014).**

The forth explanation is that postural kyphosis is accompanied with incongruence of zygapophyseal joint that limit the range of rotation movement. As the T8 vertebrae is coupled into left rotation, this would enhance the widening of the T8/9. The advantage of the sustained distraction glide is facilitation of the correct physiological motion in weight bearing **(Edmondston & Singer, 1997).**

Additionally mulligan SNAG is effective in improve positional fault, to explain the effect of Mulligan technique on proprioception,Accessory gliding by SNAGS mobilizationcause Stimulation of mechanoreceptors,also,increase thesensitivityof muscle spindle within the muscle gammamotor neurons, lead to proprioceptive facilitation **(Sterling et al.,2001).**

Further explanation **Nagai** et al.,2016, who concluded from his studyconsiders the human fascia, whichhad mechanoreceptor nerve endings. As active ROM increasesmovement from near mid-ROM to end-ROM, it islikely that more mechanoreceptors are stimulated due toan increase in tissue stretch surrounding the cervical spine.This increase in afferent information near end-ROM mayultimately result in higher precision in position sense than near mid-ROM **(Nagai et al.,2016).**

Accessory movement associated with mulligan technique gives more explanation forpatient improvement as it applied to the spinous process of cervical vertebra, enhances the circulation and nutrition to the joint, leading to washing out of nociceptive metabolitesand better heals of minor injuries of the soft tissue,thus bringing out smooth and pain free physiological movements **(Mulligan,2004).**

Limitations:

The mean age of the study sample was relatively young. Consequently, the results will be applicable only to this age group. The lack of follow-up limits the ability to investigate the length of time these changes could be persisting with the patients.

CONCLUSION:

Thoracic MWM improves thoracic kyphosis (decreasekyphoticcobbs angle)

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Disclosure statement
The authors declare no conflict of interest.
Conflict of interest:
There was no conflict of interest.

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تأثير التحريك الطبيعي المستمر للمفاصل المسطحة لموليجان علي زاوية الحداب الصدري في الاشخاص ذات التحديب الصدري

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****أستاذ مساعد الأشعة التشخيصية والتداخلية بكلية الطب جامعة المنصورة

خلفيه: الهدف: أجريت هذه الدراسة لمعرفة تأثير موليجان على زاوية التحديب الصدري في الأشخاص المصابين بحداب الصدر. الطريقة: ما مجموعه 40 شخصًا شاركوا في هذه الدراسة تتراوح أعمارهم بين 18 و 28 عامًا خضعوا لـ 12 جلسة من مزيج من تقنيات موليجان والعلاج التقليدي (المجموعة التجريبية 20شخصا) أو العلاج التقليدي فقط في (مجموعة التحكم

شخصا20). تم تقييمهم قبل العلاج وبعد 4 أسابيع باستخدام الأشعة السينية الرقمية. النتائج: أظهرت النتائج انخفاضًا معنويًا في علاج ما بعد العلاج بزاوية التحديب الصدري مقارنة بالمعالجة المسبقة لكل من المجموعة التجريبية والمجموعة الضابطة ، كما أظهرت انخفاضًا ملحوظًا في زاوية كوب الصدر بعد العلاج في المجموعة التجريبية مقارنة بالمجموعة الضابطة. الاستنتاج: التحريك الطبيعي المستمر للمفاصل المسطحه لموليجان لمنطقه الصدر يحسن ويقلل من التحديب الصدري.

الكلمات الداله: موليجان ، حداب صدري ، زاوية كوب ، أشعة سينية رقمية.