ORIGINAL ARTICLE

IJPHY

EVALUATING THE TARGET, EFFECT, ACTION INTERACTION (TEA MODEL) OF SPINAL MANIPULATION THERAPY ON SACROILIAC JOINT DYSFUNCTION

[1]Muhammad Salman Bashir
[*2]Mohammad Reza Hadian
[3]Gholamreza Olyaei
[4]Saeed Talebian
[5]Rabiya Noor
[6]Syed Asadullah Arslan

ABSTRACT

Background: In physical therapy, usually the effects of treatment on any condition will be evaluated based on the mode of action on the target tissue. Some treatments will have direct and indirect effects. Due to indirect effects, there may be changes in other tissues or systems in and around the target tissue. The interaction between target, effect, and action was studied under TEA model. In sacroiliac joint dysfunction, Muscle Energy Technique (MET) and Spinal Manipulation Therapy (SMT) were proved as useful treatment approaches but one is targeted on muscles (MET) the other targets on joint (SMT). The indirect effects of both the approaches can't be neglected. This study focused on evaluating indirect effects of SMT.

Methods: A pilot study was conducted to see the effect of Spinal Manipulation Therapy on muscles (Transverse Abdominus, Internal Oblique) when applied in patients with sacroiliac joint dysfunction. 44 subjects diagnosed with sacroiliac joint dysfunction were recruited in the study. Resting thickness was measured by ultrasound before and after Spinal Manipulation Therapy. SPSS version 17 was used for statistical analysis. Paired t-test compared pre and post test results.

Results: After conducting Pilot study revealed that Pre resting thickness of Transverse Abdominus and Internal Oblique is (3.5±0.10) and (5.47± 0.15) Post resting Thickness of TrA (Transverse Abdominus) and Internal Oblique (IO) is (3.90±0.12) and (7.63±0.80) Results are significant as P-Value 0.000 that is <0.05.

Conclusion: Here is concluded that SMT is a useful method to treat muscles through its direct action is on the Sacroiliac joint in Sacroiliac joint dysfunction. So we can use it for treating muscles by applying on joints (Indirect method).

Keywords: Spinal Manipulation, Sacroiliac Joint, Muscle, Pain, Low backache, Ultrasonography.

Received 27th March 2017, revised 20th July 2017, accepted 06th August 2017

10.15621/ijphy/2017/v4i4/154723

www.ijphy.org

[1]Ph.D. Physiotherapy Student, School of Rehabilitation Tehran University of Medical Sciences - International Campus (IC-TUMS)
[3]Professor, School of Rehabilitation, Tehran University of Medical Sciences - International Campus (IC-TUMS)
[4]Professor, School of Rehabilitation, Tehran University of Medical Sciences - International Campus (IC-TUMS)
[5]Ph.D. Physiotherapy Student, School of Rehabilitation Tehran University of Medical Sciences - International Campus (IC-TUMS)
[6]Ph.D. Physiotherapy Student, School of Rehabilitation Tehran University of Medical Sciences - International Campus (IC-TUMS)

CORRESPONDING AUTHOR

[*2]Mohammad Reza Hadian

Professor, School of Rehabilitation, Brain & Spinal Injury Research Center, Vice Dean for Research Affairs Tehran University of Medical Sciences - International Campus (IC-TUMS)
Email: hadianrasan@gmail.com; hadian_ras@yahoo.com; hadianrs@sina.tums.ac.ir

INTRODUCTION

Sacroiliac joint dysfunction may cause a low backache [1] prevalence of Sacroiliac joint dysfunction among chronic lower back ache is 10% to 27% [2]. Some muscles increased compressive forces on sacroiliac joint such as Transverse abdominous, Gluteus maximus, multifidus, external oblique, Internal oblique and Latissimus dorsi, etc..[3]. Pain arises from sacroiliac joint anatomical vicinity as described by international association for the study of pain. While applying provocation tests, pain reproduced and diminished by using local anesthesia. Researchers are exploring the sacroiliac joint pain areas that are felt at the posterior aspect of joint, and radiating to the buttock, groin and lower limbs[4]. The physical therapist believes that there is considerable movement in this joint. Sacroiliac joint dysfunction can be isolated by evaluating critically. Sacroiliac joint dysfunction variously termed as forward and backward torsions and iliosacral such as up slip and down slip. Different tests assess sacroiliac joint dysfunctions, palpation of bony landmarks with or without measurements and pain provocation tests [5].

By addressing, the effect of Muscle Energy Technique (MET) and Spinal Manipulation Therapy (SMT) on Sacroiliac Joint in different ways either treating Muscle or Joint. Previously MET was commonly used for treating muscles and Manipulation were used for Joints. Sacroiliac Joint dysfunction is an imbalance between muscles and Ligaments that causes compression on this joint. So, it's unique joint in the body either to treat directly joint/ muscles or indirectly/vice versa. Sacroiliac joint pain is affecting 15%-25% of patients are affecting by, but there is no typical treatment. History demonstrates that physical and radiological investigations are deficient in identifying sacroiliac joint problems. To diagnose sacroiliac joint pain, a common method used, was pain generators with small capacity local anesthetic blocks [6]. The pain of sacroiliac joint arises from its anatomical area as described by international association for the study of pain. It should be regenerated when pain provocation tests are applied. There are many pain provocation test described diagnose sacroiliac joint pain, but some of them have the descriptive power to diagnose. Differentiation between Intra-articular and extra-articular structure can be difficult for untrained physicians [4].

(Miyamoto,2008) Identified low back pain in taxi drivers in 2002. The numbers of participants were 1334. Low back Prevalence was 20.5% among taxi drivers [5]. A survey was objected to find out the occurrence of lower back pain among urban bus drivers and to assess the relationship between low back pain and psychosocial and biomechanical risk factors. Information was taken from male bus drivers on regular physical activities, ergonomic and psychosocial stress factors (Alperovitch-Najenson,2010) [7]. A cohort study by (O'Shea and Boyle, 2010) identified prevalence of sacroiliac joint disease and its medical features that might precisely expect radiographic alterations in sacroiliac joint and spine revealed that degenerative sacroiliac joint disease might be an under-recognized medical entity and distinct to worsening variations in the lumbar spine was toughly affected by sex [8]. Results showed, the incidence of low back pain and sacroiliac dysfunction and their relationship in students with good physical fitness, low back pain was 26.5% and 19.3% for sacroiliac dysfunction, and low back pain had no relationship (Gemmell and Jacobson,1990) [9]. (Ayanniyi, 2008) studied about asymptomatic sacroiliac joint dysfunction, leg length discrepancy and their significant association [10].

A study was conducted by Madani et.al in 2013 to get relative incidence of sacroiliac problems in a patient with image proven lumbar disc herniation, resulted, sacroiliac joint dysfunction might be considered in clinical decision making, irrespective of intervertebral disc problems [11].

E. Vlaanderen, 2005 objected to validate the concept of ultrasound for the measurement of bone vibration and concluded that use of ultrasound waves could develop a new dimension find the relation of sacroiliac joints and low back pain [12]. Thomas T. Simopoulos, 2012 wrote a systemic review to evaluate the accuracy of diagnostic interventions for sacroiliac dysfunction, explained, sacroiliac joint injections had good diagnostic accuracy, fair for Special pain provocation maneuvers, and limited for imaging [13]. A cross-sectional study by (Noda and Malhotra,2015) on drivers of three wheeler disclosed that drivers had low back pain commonly and was associated with long work hours and two-stroke engines [14]. Banerjee in 2015 studied on rickshaw puller; the study was aimed to assess posture of a rickshaw puller, analyze of work condition, determined possible hazards in pulling a rickshaw and concluded rickshaw design must be changed due to biomechanical error injuries [15].

Trunk muscle function may be affected by SMT as its effects depend upon neurophysiolic mechanism [16,17] (Bialosky JE,2009) (Evans DW,2002). Although muscles of the trunk has been affected by Spinal Manipulation Therapy, the consistency and potential relevance of these effects to clinical improvement remains discussionable [18]. (Lehman GJ,2001) More centralized research on the effects of muscles by SMT has examined the superficial erector spine muscles. In patients with LBP, after immediate application of SMT erector spinae muscle activity at rest has been found to increase in electromyography (EMG) , followed by a reduction to a level similar with asymptomatic persons [19] (DeVocht JW,2005).

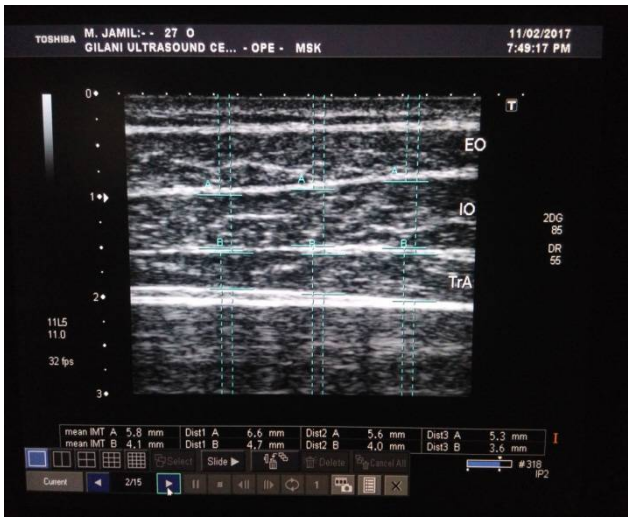
The aim of this study is to see the effect of Spinal Manipulation Therapy on muscles (Transverse Abdominus, Internal Oblique) when applied in patients with sacroiliac joint dysfunction and to evaluate the target, effect, action interaction (tea model) of spinal manipulation therapy on sacroiliac joint dysfunction.

METHODOLOGY

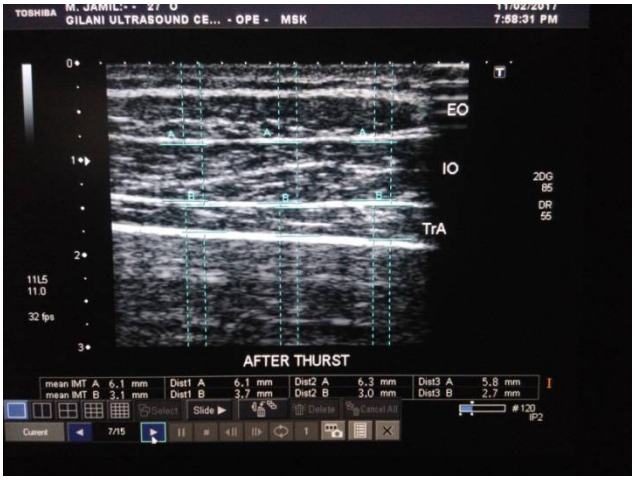
A pilot study (Quasi-Experimental Study design) had been conducted to find Spinal manipulation effect on muscles through the joint. 18 to 45 years old male participants with Sacroiliac Joint Dysfunction were included in this study af-

ter positive three or more provocative test [20] (Laslett et al.,2005). Ankylosing Spondylitis and Disc Pathology cases were excluded. A sample of 50 patients by assuming 5 % margin of error with 95% confidence Interval were recruited by using convenient sampling technique after taking informed consent.

After recruiting 50 patients of Lower Backache five provocative tests was applied to diagnose Sacroiliac Joint Dysfunction, among which 44 were diagnosed as SIJD (30 Right,14Left). Then Resting thickness(in mm) of Transverse abdominus muscle and Internal Oblique was measured before treatment and after SMT with ultrasonography with B-mode and site of measuring is same in all patients that are 36.2 mm from linea alba, so that is a valid and reliable tool to measure the thickness of muscle. The average of the three trials was used for further analysis. Measurements were obtained at the midline of the muscle belly, and 1 cm to each side of midline The mean vertical distance of the three lines represented the muscle thickness value. Session of Spinal Manipulation Therapy was twice a week for one month. SPSS was used for analysis. Paired Sample T-test was applied to find the effect of SMT after pre and post mean resting thickness of Internal oblique and Transverse Abdominus.



Picture 1: Resting Thickness of IO and TrA by taking three values from 1 cm away to each other



Picture 2: Resting Thickness of IO and TrA by taking three values from 1 cm away to each other after SMT.

RESULTS

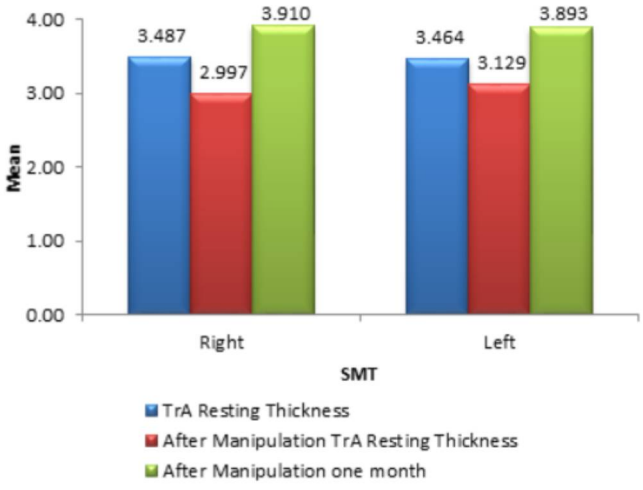
After conducting Pilot study it was revealed that Pre resting thickness of TrA (Transverse Abdominus) and Internal Oblique (IO) is (3.5+0.10)& (5.47+.15) Post resting Thickness of TrA (Transverse Abdominus) and Internal Oblique (IO) is (3.90+.12) & (7.63+0.80) Results are significant as P-Value 0.000 that is <0.05

		Mean	N	Std. Deviation	Std. Error Mean	Sig.
Pair 1	TrA Resting Thickness	3.4795	44	.10248	.01545	
	After Manipulation one month	3.9045	44	.12567	.01895	.000
Pair 2	Internal Oblique Resting Thickness	5.4705	44	.15489	.02335	
	After Manipulation IO Resting Thickness	7.6341	44	.80202	.12091	.000

Table 1: Resting Thickness (Mean ±S.D) of TrA, IO before and After SMT

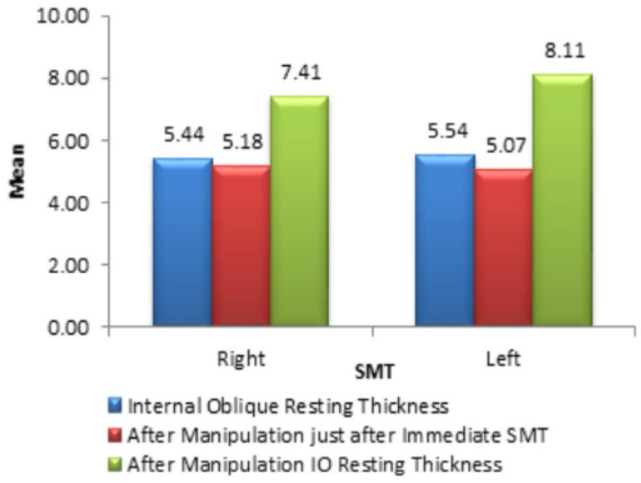
		Paired Differences for (TrA Resting Thickness - After Manipulation one month) (Internal Oblique Resting Thickness - After Manipulation IO Resting Thickness)					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	TrA Resting Thickness - After Manipulation one month	-.42500	.16999	.02563	-.47668	-.37332	-16.584	43	.000
Pair 2	Internal Oblique Resting Thickness - After Manipulation IO Resting Thickness	-2.16364	.73202	.11036	-2.38619	-1.94108	-19.606	43	.000

Table 2: Paired differences (TrA Resting Thickness - After Manipulation one month) (Internal Oblique Resting Thickness - After Manipulation IO Resting Thickness)



Graph 1: Resting Thickness of Transverse abdominus before, after immediate and one month SMT

The graph showed Resting Thickness of Transverse abdominus before and after immediate and after one month SMT 3.48, 2.99 and 3.91 among Right SIJD and 3.46,3.13 and 3.89 respectively among Left SIJD.



Graph 2: Resting Thickness of Internal oblique before and after Immediate, one month SMT

The graph showed Resting Thickness of Internal oblique before and after immediate, after one month SMT 5.4, 5.18 and 7.41 among Right SIJD and 5.54,5.07 and 8.11 respectively among Left SIJD.

DISCUSSION

Spinal manipulative therapy (SMT) is used to treat ache and most suitable treatment for low back ache now a day [21,22]. Conflicting results have produced about SMT after conducting trials, by showing benefits in clinical aspects from SMT and others showing small effects or no benefit[22,23].

Further, one school of thought supports that back ache patients responded well or very little effects by Spinal Manipulation Therapy [24]. Researcher supported that muscular effect of Manipulation such as erector spinae through electromyography in backache patients. Its activity enhanced just after SMT then following consistent reduction with asymptomatic participant [19] Result of this study also in support of the previous study by (Herbert and Moseley,2002) [25] that showed the activity of muscles is increased close to normative value after SMT by muscle thickness measured by ultrasonography. Initially, the size of both internal oblique and transverse abdominus decreased just after the first immediate session but after one-month size became normal. Here we mentioned Limitation of the study while interpreting results. First, researcher used ultrasound measures of muscle thickness as a surrogate for Electromyography measures of muscle activity, as change in thickness depends not only on the muscle activity change however, there are number of factors involved such as muscular length, contraction type ,angle of pen nation and forces of tissues in surrounding.

The high-velocity manipulation was selected specifically by Herzog as it has shown that reflex electromyography activation seen after high-velocity manipulations as compared with lower-velocity mobilizations.(Herzog and Conway,1995) [26] Just like reflex electromyography activation, neurophysiological effects of spinal manipulation has also been investigated by Haavik and Murphy in 2012 [27].

Similar to our results with a previous study (Koppenhaver et al,2011) just after immediate effect of SMT both thicknesses was reduced, but these changes were transient [22] but after one month sessions thickness of IO in our study i.e. (7.63±.80) near to normative value as cited in previous study (10.4±0.23) male and (7.5±0.14) female [28] (Teyhen et al, 2012) significant decreases in both contracted TrA and IO muscle thickness were observed immediately following SMT [22]. Correlation coefficients between MVC and muscle thicknesses of the distinct muscles of musculus quadriceps were strong and significant, indicating that a higher MVC was associated with a higher muscle thickness in the young and the old patient group [29] (Strasser et al.,2013).

TEA Model	Action (A)	Effect (E)	Target (T)
SMT	J	M	J
	J	J	M
	J	J	J
MET	M	M	M
	M	J	J
	M	M	J

Table 3: TEA Model for SMT and MET

TEA MODEL:

AET – named as TEA MODEL

J: Joint **M**: Muscle

T: Target

E: Effect

A: Action

SMT acted on joint showed effect directly on the Sacroiliac joint. According to TEA model, it was revealed that in the case of SI joint, there are two major ways to treat the joint with different combinations.

1. Direct method
2. Indirect method.

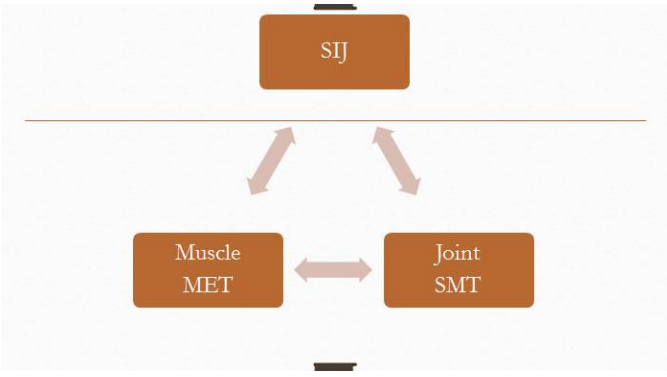


Figure 1: Triangle SIJ via Muscle and Joint

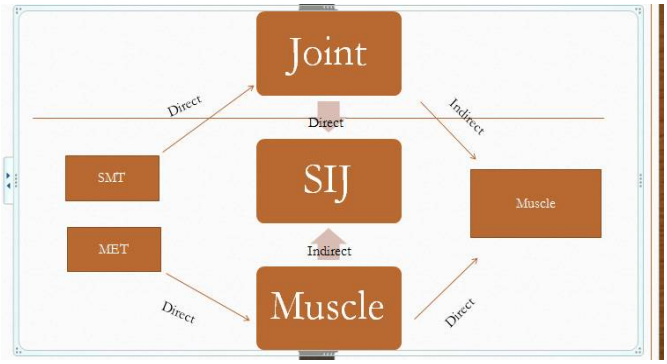


Figure 2: Direct and Indirect method approaching SIJ

SMT:

1. Combination J-M-J showed That Manipulation acted on Joint effect on Muscle and target is Joint.

   Example: If we want to treat sacroiliac Joint (target) we will apply manipulation on SIJ, and musculoskeletal ultrasonography can measure its effect through Muscle (IO, TrA).

2. Combination J-J-M showed That Manipulation acted on Joint will affect on Joint and target is Muscle.

   Example: If we want to treat Muscle (target e.g. IO, TrA) we will apply manipulation on Joint (SIJ, Action) and its effect through Joint (Effect).

3. Combination J-J-J showed That Manipulation acted on Joint will affect on Joint and target is Joint.(Previously Practicing)

MET:

1. Combination M-M-M showed that MET acted on Muscle will affect on Muscle and target is Muscle.(Previously Practicing)
2. Combination M-J-J showed that MET acted on Muscle will affect on Joint and target is Joint.

   Example: If we want to treat sacroiliac Joint (target) we will apply MET on Muscle (Action) and its effect through Joint (Effect)

3. Combination M-M-J showed that MET acted on Muscle will affect on Muscle and target is Joint.

Example: If we want to treat sacroiliac Joint (target) we will apply MET on Muscle (Action) and its effect on Muscle (Effect)

Hence after the pilot study, it was revealed we might use SMT for treating muscles as well. This study supported following combination J-M-J, J-J-M of Tea Model. The result of our study also in support of the previous study, resting thickness of Transverse abdominus and Internal oblique among Sacroilliac joint dysfunction were reduced [30] (Leonard H. Joseph,2014) compared to normative value or matched control [28,30] (Teyhen et al.,2012) (Leonard H. Joseph, 2014).Thickness reduced because of delay recruitment of muscular activity of muscles among Sacroiliac joint dysfunction. Although muscles of the trunk has been affected by Spinal Manipulation Therapy, the consistency and potential relevance of these effects to clinical improvement remains discussionable [18] (Lehman GJ,2001).

CONCLUSION

Combination J-M-J showed That Manipulation acted on Joint effect on Muscle and target is Joint. Combination J-J-M showed that Manipulation acted on joint will affect on Joint and target is Muscle. Here is concluded SMT was already using for joints with the same findings in the Sacroiliac joint but we can use it for treating muscles by applying on joints (Indirect method).

Hence after the pilot study, it was revealed we might use SMT for treating muscles as well because SMT showed the effect on muscles through Joint. This study supported following combination of Tea Model. J-M-J, J-J-M. However, trunk muscle function may be affected by SMT as its effects depend upon neurophysiolgic mechanism

List of abbreviation:

SIJ	Sacroiliac Joint
SMT	Spinal Manipulation Therapy
MET	Muscle Energy Technique
TEA	Target Effect Action
EMG	Electromyography

Limitation

These findings and TEA model are tested for a Sacroiliac joint but its application on all other joints still required Evidence with extensive work and research is in the process for all other joints.

Recommendation

For Justification M-J-J, M-M-J. A study can be conducted by using Muscle Energy Technique on Sacroiliac joint Dysfunction in future.

Acknowledgements

The authors with to thank to (IC-TUMS) for support in research.

REFERENCES

[1] DonTigny RL. Mechanics and treatment of the sacroiliac joint. Journal of Manual & Manipulative Therapy. 1993;1(1):3-12.

[2] Visser L, Nijssen P, Tijssen C, van Middendorp J, Schieving J. Sciatica-like symptoms and the sacroiliac joint: clinical features and differential diagnosis. European Spine Journal. 2013;22(7):1657-64.

[3] Jung H-S, Jeon H-S, Oh D-W, Kwon O-Y. Effect of the pelvic compression belt on the hip extensor activation patterns of sacroiliac joint pain patients during one-leg standing: a pilot study. Manual therapy. 2013;18(2):143-8.

[4] Van Leeuwen R, Szadek K, de Vet H, Zuurmond W, Perez R. Pain pressure threshold in the region of the sacroiliac joint in patients diagnosed with sacroiliac joint pain. Pain Physician. 2016;19(3):147-54.

[5] Miyamoto M, Konno S, Gembun Y, Liu X, Minami K, Ito H. Epidemiological study of low back pain and occupational risk factors among taxi

drivers. INDUSTRIAL HEALTH-KAWASAKI-. 2008;46(2):112.
[6] Cohen SP, Chen Y, Neufeld NJ. Sacroiliac joint pain: a comprehensive review of epidemiology, diagnosis and treatment. Expert review of neurotherapeutics. 2013;13(1):99-116.
[7] Alperovitch-Najenson D, Santo Y, Masharawi Y, Katz-Leurer M, Ushvaev D, Kalichman L. Low back pain among professional bus drivers: ergonomic and occupational-psychosocial risk factors. IMAJ-Israel Medical Association Journal. 2010;12(1):26-31.
[8] O'Shea F, Boyle E, Salonen D, Ammendolia C, Peterson C, Hsu W, et al. Inflammatory and degenerative sacroiliac joint disease in a primary back pain cohort. Arthritis care & research. 2010;62(4):447-54.
[9] Gemmell H, Jacobson B. Incidence of sacroiliac joint dysfunction and low back pain in fit college students. Journal of manipulative and physiological therapeutics. 1990;13(2):63-7.
[10] Ayanniyi O, Raji F, Adegoke B. Prevalence of asymptomatic sacroiliac joint dysfunction and its association with leg length discrepancies in male students in selected junior secondary schools in Ibadan. African journal of medicine and medical sciences. 2008;37(1):37-42.
[11] Madani SP, Dadian M, Firouznia K, Alalawi S. Sacroiliac joint dysfunction in patients with herniated lumbar disc: A cross-sectional study. Journal of back and musculoskeletal rehabilitation. 2013;26(3):273-8.
[12] Vlaanderen E, Conza N, Snijders C, Bouakaz A, De Jong N. Low back pain, the stiffness of the sacroiliac joint: a new method using ultrasound. Ultrasound in medicine & biology. 2005;31(1):39-44.
[13] Thomas T. Simopoulos, Sanjeeva Gupta M, Haroon Hameed M, Sudhir Diwan M. A systematic evaluation of prevalence and diagnostic accuracy of sacroiliac joint interventions. Pain Physician. 2012;15:E305-E344.
[14] Noda M, Malhotra R, DeSilva V, Sapukotana P, DeSilva A, Kirkorowicz J, et al. Occupational risk factors for low back pain among drivers of three-wheelers in Sri Lanka. International journal of occupational and environmental health. 2015;21(3):216-24.
[15] Nandi S, Bhattacharyya O, Banerjee D. Analysis of Posture of Rickshaw Pullers Using REBA and Suggestion for Change in Design. 2015. Department of Human Physiology with Community Health, Vidyasagar University, Midnapore, West Bengal.
[16] Bialosky JE, Bishop MD, Price DD, Robinson ME, George SZ. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. Manual therapy. 2009;14(5):531-8.
[17] Evans DW. Mechanisms and effects of spinal high-velocity, low-amplitude thrust manipulation: previous theories. Journal of manipulative and physiological therapeutics. 2002;25(4):251-62.
[18] Lehman GJ, McGill SM. Spinal manipulation causes variable spine kinematic and trunk muscle electromyographic responses. Clinical Biomechanics. 2001;16(4):293-9.
[19] DeVocht JW, Pickar JG, Wilder DG. Spinal manipulation alters electromyographic activity of paraspinal muscles: a descriptive study. Journal of manipulative and physiological therapeutics. 2005;28(7):465-71.
[20] Laslett M, Aprill CN, McDonald B. Provocation sacroiliac joint tests have validity in the diagnosis of sacroiliac joint pain. Archives of physical medicine and rehabilitation. 2006;87(6):874.
[21] Feuerstein M, Marcus SC, Huang GD. National trends in nonoperative care for nonspecific back pain. Spine J. 2004 Jan-Feb;4(1):56-63.
[22] Koppenhaver SL, Fritz JM, Hebert JJ, Kawchuk GN, Childs JD, Parent EC, et al. Association between changes in abdominal and lumbar multifidus muscle thickness and clinical improvement after spinal manipulation. journal of orthopaedic & sports physical therapy. 2011;41(6):389-99.
[23] Ernst E, Canter PH. A systematic review of systematic reviews of spinal manipulation. Journal of the Royal Society of Medicine. 2006;99(4):192-6.
[24] Fritz JM, Childs JD, Flynn TW. Pragmatic application of a clinical prediction rule in primary care to identify patients with low back pain with a good prognosis following a brief spinal manipulation intervention. BMC family practice. 2005;6(1):29.
[25] Herbert R, Moseley A, Butler J, Gandevia S. Change in length of relaxed muscle fascicles and tendons with knee and ankle movement in humans. The Journal of physiology. 2002;539(pt2):637-45.
[26] Herzog W, Conway P, Zhang Y, Gal J, Guimaraes A. Reflex responses associated with manipulative treatments on the thoracic spine: a pilot study. Journal of manipulative and physiological therapeutics. 1995;18(4):233-6.
[27] Haavik H, Murphy B. The role of spinal manipulation in addressing disordered sensorimotor integration and altered motor control. Journal of Electromyography and Kinesiology. 2012;22(5):768-76.
[28] Teyhen DS, Childs JD, Stokes MJ, Wright AC, Dugan JL, George SZ. Abdominal and lumbar multifidus muscle size and symmetry at rest and during contracted states. Journal of Ultrasound in Medicine. 2012;31(7):1099-110.
[29] Strasser EM, Draskovits T, Praschak M, Quittan M, Graf A. Association between ultrasound measurements of muscle thickness, pennation angle, echogenicity and skeletal muscle strength in the elderly. Age. 2013;35(6):2377-88.
[30] Joseph LH, Hussain RI, Naicker AS, Htwe O, Pirunsan U, Paungmali A. Pattern of changes in local and global muscle thickness among individuals with sacroiliac joint dysfunction. Hong Kong Physiotherapy Journal. 2015;33(1):28-33.

Citation
Bashir, M. S., Hadian, M. R., Olyaei, G., Talebian, S., Noor, R., & Arslan, S. A. (2017). EVALUATING THE TARGET, EFFECT, ACTION INTERACTION (TEA MODEL) OF SPINAL MANIPULATION THERAPY ON SACROILIAC JOINT DYSFUNCTION. *International Journal of Physiotherapy,* 4(4), 246-252.