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EFFECTS OF MUSCLE ENERGY TECHNIQUE WITH AND WITHOUT SACROILIAC BELT ON PAIN, MUSCLE STRENGTH AND QUALITY OF LIFE IN PATIENTS WITH SACROILIAC JOINT DYSFUNCTION A RANDOMIZED CLINICAL TRIAL

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Abstract

Background:
Low back pain is reported to be the most common problem in the domain of musculoskeletal problems, although it's a common problem but its etiology is still not known in most of the cases which is eventually called as non-specific back pain and in almost near to half of the cases this back pain is arising from the sacroiliac joint giving it a name as sacroiliac joint dysfunction.

Objective(s):
To check the effects of muscle energy technique with and without sacroiliac belt on pain, muscle strength and quality of life in patients with sacroiliac joint dysfunction.

Methodology:
A Randomized clinical trial was conducted with sample size of 48 through convenient sampling technique. Participants were allocated into two groups i.e., Experimental and Control groups. Group A MET with SI Belt and Group B received only MET. SF-36, NPRS and MMT used for Quality of life, Pain and MMT for Muscle strength. Assessment was performed Pre and Post Treatment in both Group. Independent Sample T test and Repeated ANOVA tests were used to compare between group and within group differences with P value <0.05.

Results:
No significant difference was seen with p value >0.05 in between group and within comparison of both the groups pre and post treatment as per independent samples test but there was significant difference noted among between subject and within subject's comparison as per Repeated ANOVA with p value <0.05.

Conclusion:
The present study concluded that both the groups (Group A = MET with SI Belt) and (Group B= MET without SI Belt) showed significant difference in Quality of Life, Pain, and Muscle strength

INTRODUCTION

The sacroiliac (SI) joint is the largest joint in the body. The sacroiliac joint is often described as a large, ear-shaped, biarticular synovial joint. Only the third part of the connection between the sacru m and ilium is a true synovial joint; the remainder of the junction consists of a series of ti e links.

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With an absent or incomplete posterior capsule, the SI ligamentous structure is wi der dorsally and follows the connection between the sacrum and the ilium. The main func tion of this ligament system is to limit movement in all planes of motion.

The sacroiliac joints are also supported by muscles that help transmit local muscle tensio n to the pelvic bones. SI connectors are designed for stability. Their roles include changin g and influencing the body's load on the lower body, limiting x-
axis rotation and facilitating work. Sacroiliac joint dysfunction is a condition in which the re are mechanical changes or abnormalities, such as an increase or decrease in normal ran ge of motion. It is considered a painful condition of the sacroiliac joint caused by an incre ase or deviation of the ilium around the sacrum and irritation of the sacroiliac joint (skull, ligaments, or pain receptors in the joint)(Alkady et al., 2017)

Nerve supply of the SIJ is quite extensive and involves variations at different anatomical points which results in quite perplexed type of pain referral patterns. Traditionally the pain from SIJ usually comes as unilateral which is dull and involves the buttocks, the referral pattern usually includes pain in the posterior thigh, groin and anterior thigh. Occasionally the pain might be seen being referred or radiating to back or lateral part of calf, foot and toes(Gatterman, 1990).

Low back pain is reported to be the most common problem in the domain of musculoskeletal problems, although it's a common problem but its etiology is still not known in 85% of the cases which is eventually called as non-specific backpain and in almost 10-27% of the cases this backpain is arising from the sacroiliac joint giving it a name as sacroiliac joint dysfunction. Non-specific low back pain is not the only contributing factor , pain in sacroiliac joint dysfunction can also be accompanied with
lumbar disc herniation or spinal stenosis. Furthermore symptoms mimicking with facet joint syndrome and disc herniation makes it a challenging condition to diagnose. Other than SIJ block there is no other accepted diagnostic method or criteria to diagnose this problem. Pain provocation tests when applied on patients with SIJD , a combined approach to apply FABER or Patrick's Test and Thigh Thrust test yielded more successful results in the diagnosis of SIJD. Authors came to conclusion that the combination of special tests and data taken from patient's evaluation and assessment can better diagnose the condition despite having low clinical value of diagnostic tests(Nejati et al., 2020).

It is generally accepted that 13% of back pain is caused by abnormalities and positioning of the SI joint due to poor SI joint function. SI joint pain also affects the hips, pelvis, and lower extremities(Joshi et al., 2017b).

The prevalence of sacroiliac pain is at least 13% and usually 30% of patients treated for b ack pain and routine hip pain.The prevalence of joint dysfunction has confirmed its assess ment and study Sacroiliac joint dysfunction, sudden or It can be caused by repeated trau ma or an imbalance in the muscle environment.

Many methods have been used to treat sacroiliac joint dysfunction, but most have been u nsuccessful to date and no standard treatment for sacroiliac joint dysfunction has emerged (Vaseghnia et al., 2019).

The most common cause of back pain is sacroiliac joint dysfunction. The condition is tho ught to result from acquired mechanical instability resulting in stable subluxation or joint hypermobility with no history of serious injury(Sewani & Shinde, 2017).

Mechanical dysfunction can also be described by other terms such as hypokinesia, immo bility, malalignment, malrotation or joint and in case of unilateral hypokinesia a dynamic manual test such as standing flexion test, sitting flexion test and Gillet test will be used, t hese tests. measures the stability of the sacroiliac joint in a range of motion(Dreyfuss et al., 1994).The hypomobility of SIJ is often overlooked when treating patients with low back problem(Shokri et al., 2018).

According to the Handbook of Medical

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Terminology, joint dysfunction is defined as a rev ersible limitation of motion caused by reduced range of motion(Galm et al., 1998).Another way to use forced thrust technique is the to promote muscle's own energy (MET) or neuromuscular technique which is simple in concept, safe to perform and does not involve jerky thrusts. Muscle energy technique will restore muscle's range of motion to normal(Patel et al., 2015a). MET is a non-invasive, safe and cost- effective treatment that has been practiced by physiotherapists for the past two decades. Using muscle's own energy is an effective method which involves the patient actively to correct the joint motions that have been limited. In this technique the therapist ask the participant to do an active movement in the right direction with an intensity of 70% while the therapist resists this movement by applying an opposite force. The patient is asked to lay supine on her back while hanging the non-involved side of the leg over the edge of the bed and contracting the hip and knee muscles of the involved side. Now the patient's involved leg in a flexed position is placed on the shoulder of the therapist and the therapist moves it to the end range and ask the patient to push her leg against the shoulder of the therapist using the force which is of sub-maximal isometric contraction i.e. 70% of the total force with a hold for 7-10 seconds and after that the patient is asked to relax and right after that the patient is asked to raise his leg to check the ranged until the new barrier is achieved. TheMuscle technique (MET) and thrust manipulation technique are the techniq ues most frequently mentioned in many studies for the treatment of sacroiliac joint dysfu nction. MET improves body coordination by helping to correct imbalances through isome tric and isotonic contractions(García-Peñalver et al., 2020).MET has been used for years to treat muscular imbalance in the lumbar and the pelvic region such as asymmetry of the pelvis. The knowledge behind MET allows us to know the asymmetrical patterns in the pelvis by contracting the muscles behind the thigh or the muscles that extend the hip on the involved side and moving the sacro-coccygeal area in the pelvis to a corrected position(Shinde & Jagtap, 2018).As according to the guidelines of the international society for pain studies sacroiliac problems should preferably be managed without any surgery rather the use of pelvic belts can help reduce pain arising due to SIJ. These belts are quite affordable for the patient with limited side effects as compared to any surgery or medication however there is limited data available to support that clinical reliability of these belts and there are some controversies regarding its use in SIJD(Hammer, Moebius, et al., 2015). Pelvic belts are thought to improve form and force closure as well as neuromotor function. However, there is little proof that the SIJ mobility is decreased by the pelvic belts, and there aren't many patient-controlled studies that detail how they affect the pelvis. When the pelvic belt was put on with moderate strain, compared to the situation without a belt, the pain level changed somewhat but not significantly(Soisson et al., 2015). A pelvic belt helps reduce SIJ movement and ease severe SI pain. The use of a compressive belt has been demonstrated to enhance patient-reported outcomes in patients with SIJ discomfort by lowering the shear force across the joint as well as tension over the muscles surrounding the joint. To avoid dependence and muscular weakness brought on by overreliance and core muscle atrophy, rapid weaning from a belt is advised. Due to the potential limitations of medical therapy, fluoroscopy, and the use of injections in this situation, the pelvic belt may be useful in treating SIJ pain brought on by pregnancy(Schmidt et al., 2018).Some activities to be avoided include standing on a single leg e.g. skating, running , stair stepping has been proved to be beneficial to reduce SIJD related symptoms. As soon as possible, asymmetries in muscle length or stiffness should be corrected within pain-free ranges. METs have been proved to be helpful as it involves the activation of the muscle being involved so that its easy to detect the pain endurance(Prather, 2003).When it comes to the non-surgical treatment options during an acute phase the physical therapy has shown to be beneficial to improve muscle

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strength, flexibility and proprioception in patients suffering from SIJD (Schmidt et al., 2018).SIJ belts are used to create compressive forces across the sacroiliac joint which improves the force closure around the joint. This enhances the contraction or activation of gluteal muscles providing more strength to the joint and improving force closure of the joint. SIJ belt

According to Vleeming et al SIJ belt when applied on the cadaver showed reduction in rotation by 30% and when the influence of SIJ belt was checked on ligament loading , this computer model study showed that SIJ belt increased the motion in sagittal axis but decreased motion in transverse axis. Ligamentous strain was shown to be reduced with the application of SIJ belt. With the application of Sacroiliac belt it was observed that there is an improvement in the physical health patterns, improved scores of short form 36 questionnaire, pain reduction , there was reduced activity of the rectus femoris muscle with walking in 17patients suffering from Sacroiliac joint dysfunction as compared to 17 patients in the control group. The improvement in gait patterns and cadence was also noted in patients with SIJD as well as control group participants(Hammer, Moebius, et al., 2015). Most commonly Pain of Sacroiliac joint dysfunction tends to be evident around the gluteal region near posterior superior iliac spine as according to Fortin et.al while the other sites include groin, radiating pain in lower extremity with numbness, clicking or popping sound in the posterior part of the pelvis. Activities that tends to aggravate pain symptoms includes asymmetric loading by lower extremity or pelvis. Diagnosis of the SIJD is not that easy as it seems , other conditions which mimic SIJ pain includes radiculopathy in lumbar region , hip pathology of intra articular region which needs to be evaluated first. Further studies are needed to diagnose SIJ, hip and pelvis and still there is a lag for diagnostic gold standards to conclude or diagnose SIJD(Prather, 2003).Etiology of the SIJD is not that clearly identified however several contributing factors include degenerative disease of the spine, laxity of the joints and trauma. On the other hand degenerative cause of the SIJD is poorly evident in the literature(Zelle et al., 2005). As reported in the literature the prevalence of SIJD due to LBP is estimated as 15-30% which is increasing with both genders and races being effected(Gartenberg et al., 2021). Pathologies that effect the sacroiliac joint includes variety of conditions and it is very important to look into the cause of the disease before planning a treatment for the patient. SIJD is effected by many conditions in which traumatic causes include any fracture or dislocation , any stress fracture to the area, insufficient fractures, infectious diseases which include staphylococcal aureal, streptococcal, pseudomonas, cryptococcus neoformans, tuberculosis and brucellosis bacterial infections. Infectious diseases that affect the SIJD are Ankylosing spondylitis, psoriatic arthritis, Reiter's syndrome , Inflammatory bowel disease , Undifferentiated spondyloarthropathy , (Juvenile) rheumatoid arthritis , Systemic lupus erythematosus, Behcet's disease , Familial Mediterranean fever , SAPHO syndrome , Sjogren's syndrome , Sarcoidosis . Some metabolic diseases that affect the SIJ includes (Pseudo) gout, Paget's disease , Osteomalacia , Acromegaly , Hyperparathyroidism , Osteoporosis. Conditions which are tumorous include Lung, breast, kidney, and prostate metastases, Pigmented villonodular synovitis , Primary sacral tumors. Iatrogenic causes involves Complications after bone graft harvesting Sacroiliac joint syndrome Miscellaneous conditions , Osteitis condensans ilii , Peri-partum pelvic instability(Huijbregts, 2004).While performing special tests for the diagnosis of SIJD when the literature was reviewed there were 54 different special tests meant for the diagnosis of SIJD(Winkel, 1991). While assessing the patient for sacroiliac joint dysfunction the special tests for the diagnosis of Sacroiliac joint dysfunction have been divided into three categories, 1 positional palpation tests, 2 Motional palpation tests, 3 Provocation tests. While positional palpation tests checks for any asymmetry in the bony landmarks

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surrounding the Sacroiliac joint which involves ASIS (Anterior superior iliac spine), PSIS (Posterior superior iliac spine), Iliac crest, greater trochanter , sulcus of the sacrum(SS) and inferio-lateral angle of sacrum(ILA). Motion palpation tests attempts to diagnose if there is any abnormal movement of the bony landmarks of pelvis which are involved in sacroiliac joint or is there an abnormal resistance to a motion being induced. Some motion palpation tests include supine to sit and prone knee bend tests and lastly pain provocative tests tends to provoke the patient's pain by compressing the structures in or around sacroiliac joint(Huijbregts, 2004).Brief knowledge on how to wear Sacroiliac belts should be advised to the patients suffering from sacroiliac pain or discomfort , Sacroiliac joint belt must be advised to wear posteriorly across the base of the sacrum and anteriorly inferior to anterior superior iliac spine. When patient walks or stand it is recommended to keep this belt fastened. Furthermore patients having pain and weakness due to Sacroiliac joint dysfunction experienced reduction in their symptoms when worn during sedentary activities as well as during the time of sleep(Prather, 2003).When a sacroiliac joint dysfunction is discussed it is important to discuss the hypermobility of sacroiliac joint dysfunction which happens either due to biomechanical changes or laxity in the joint which causes the undue to stress on the joint and surrounding structures. Pain in the lumbopelvic region is often the result of increase laxity of the ligament having a congenital cause. Genetic causes include Marfan's and Ehler's Danlos Syndrome where there is destabilization of sacroiliac joint due to ligamentous hyperlaxity(Enix & Mayer, 2019).While talking about the radiological diagnostic measures to identify sacroiliac joint dysfunction . Computed tomography (CT) Scan provide more clear image of the bony structures of a joint whereas radionuclide imaging proves to be an inefficient tool but MRI (Magnetic Resonance imaging) has been proved to be 90% accurate in the identification of spondylarthritis but not that accurate in the identification of non-inflammatory condition of a joint. Injection technique using an image guidance has been proven to be the most effective and accurate method to identify SIJD till date. In this technique point the needle towards the inferior or the lower portion of the joint in which the joint is inflated using 1-2 ml of injection material(Raj et al., 2022).Spinopelvic mobility can be an important point in the development of sacroiliac joint related pain.

When the joint is hypomobile typically in the sagittal plane , this could indicate hypermobility of the joint is related to sacroiliac joint related pain. Spinopelvic mobility could be a valuable tool when diagnosing this joint for sacroiliac joint dysfunction(Tonosu et al., 2022).Diagnosis of this sacroiliac joint dysfunction has always been controversial among authors having different point of views regarding its accurate diagnosis , based on a study by steven etal. authors explained that while diagnosing the SIJD there are 3 criteria's , number 1 is relief of pain when a local intra-articular anesthetic is administered, number 2 is capsular tear on the ventral or anterior side being evident on Computed tomography (CT). number 3 is consistent painful sensation when a capsule is extended or elongated(Cohen, 2018). Although the cause of SIJD is not clearly identified in the literature but some factors play a causative in the development of this problem which includes minor injury to the area ,mechanism of injury includes fall on the buttocks, when a person slips during pushing a heavy object and the activities that include transfer of the body from one place to another contributes to the generation of pain in the area of the sacroiliac joint, such activities include getting up from a chair, getting out of a car and climbing stairs. Pain may also have a radiating nature which can radiate to the groin, buttock or the whole lower part of the limb. The most important thing to be noted is that if the pain is felt or referred above the fifth lumbar spine , it is the least chance that the pain is arising from Sacroiliac joint. Pain radiation pattern has been reported as extending 10 cm to the caudal and 3 cm to the lateral from the posterior superior iliac spine(Zelle et al.,

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2005).The model of Panjabi is considered when the concept behind the stability of sacroiliac joint is studied, this model tell us that there is an interaction between active, passive and a control system which provides stability. The passive system refers to the bone, joint and ligament related structures, active part consists of myofascial structures and controlling system consists of central and peripheral neural connections from the central and peripheral nervous system. Adding more it he further defined that there is a neutral zone which is called as the zone of motion, and it is the point of little displacement when the joint is in neutral position where there is small amount of resisting force by bony and ligamentous structures, this is the zone where there is more flexibility or laxity. Some studies have supported that this neutral point is more considerable or sensitive part than Range of motion when assessing the sacroiliac joint for sacroiliac joint dysfunction. So the stability is considered to be present when there is more laxity instead of movement. Although the assessment of the joint laxity in SIJ is difficult to measure , the method called Doppler imaging Vibrations have proven to be more reliable in the assessment of sacroiliac joint laxity along with tars metatarsal joint (TMTJ). In the same study the effect of pelvic belt application on sacroiliac joint laxity was assessed and it was observed that joint laxity was decreased due to the belt position rather than the belt tension. When the tension of 50 and 100 N were applied on the joint there was not much influence noted on the joint therefore laxity of SIJ with belt appeared to be different from the laxity of the joint without belt and application of the belt was more effective when applied below anterior superior iliac spine rather than the application at the level of symphysis(Damen et al., 2002).According to SORT key recommendations for SIJD and pain , apply 3-5 physical tests to elicit pain to aid in making diagnosis , patients must be treated conservatively first with modified activity guidance, NSAIDS ,physical therapy, or osteopathic manipulative techniques. If there is more pain originating from the source of discomfort other diagnostic evaluations are considered to be excluded and conservative approaches are considered to be unsuccessful and there must be an immediate referral to radiology and intra-articular injections guided by a radiologist must be considered(Poley & Borchers, 2008).

1.1: RATIONALE

Sacroiliac joint pain is the most common type of usually seen in patients suffering from Low back pain or the patients suffering from degenerative disc disease or trauma, the pain might be moderate to severe intensity depending upon the root cause. Muscle energy technique when applied with or without sacroiliac belt can play an important in pain reduction, muscle strength gains and quality of life improvement but there is no study available in the literature that compares the effects of muscle energy technique with and without sacroiliac belt thus the purpose of this study is to find out the effect of MET with and without sacroiliac belt to check whether which approach is better to reduce pain, to increase muscle strength and improve quality of life with sacroiliac joint dysfunction.

LITERATURE REVIEW

Urko José García-Peñalver et.al conducted a study on effectiveness of the muscle energy technique versus osteopathic manipulation in the treatment of sacroiliac joint dysfunction in athletes in Spain in 2020. It was observed while comparing the two techniques that the thrust technique was found better as compared to MET(García-Peñalver et al., 2020). Some techniques have comparable results while some have similar or same results that have many contributing factors. Sabah Mohammed Easa et al directed an examination on efficacy of mulligan mobilization versus muscle energy technique in chronic sacroiliac joint dysfunction in 2017. This study revealed that both Mulligan mobilization with movement and muscle energy technique had significant effect on decreasing anterior pelvic tilting angle and pain level in chronic sacroiliac joint dysfunction patients and no statistically significant difference was detected

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between both groups in anterior pelvic tilting angle and pain intensity level, while Mulligan mobilization with movement was superior to muscle energy technique in improving sacroiliac mobility. One can have an impression that mulligan mobilization with movement is more effective than muscle energy technique in managing patients with chronic sacroiliac joint dysfunction(García-Peñalver et al., 2020).

Aditya Vaidya et al conducted an examination on Comparison between Muscle Energy Technique and Mulligan's Mobilization with Movement in Patients with Anterior Innominate Iliosacral Dysfunction in 2019 and This study concluded that both Muscle Energy Technique and Mulligan's Mobilization with Movement is effective in both variables i.e. pain and functional ability status. But when both groups are compared with each other, the Muscle Energy Technique is effective than that of Mulligan's Mobilization with Movement.(Vaidya, Babu, & Mungikar, 2019)

Sabah Mohammed Easa Alkady et al directed an examination on effect of muscle energy technique in chronic sacroiliac joint dysfunction and the data obtained from this study revealed that MET has significant effect on decreasing anterior pelvic tilting angle and pain level in patients with chronic SIJ but it has no effect on sacroiliac stiffness(Alkady et al., 2019b)

Reema josh et al conducted a study on Effect of Muscle Energy Technique on Pain And Function in Patients With Sacroiliac Dysfunction in 2017 and concluded that MET can be use effectively in the management of sacroiliac dysfunction. However, younger patient respondent better than older patients(Joshi et al., 2017a)

Ashraf Vaseghnia et al conducted an examination on Effects of Muscle Energy Technique on Daily Activities and Lumbar Stiffness in Women With Sacroiliac Joint Dysfunction in 2018 and concluded that Muscle energy technique might be effective in decreasing the level of pain and disability index, but there are no significant differences in stiffness index after muscle energy technique 24 hours and one week after the intervention.(Shadmehr et al., 2019)

James M. Mielewski et al: Muscle energy technique following low back pain and SIJ dysfunction: case report;pty 768,May 2009.conducted the study on Muscle energy technique following low back pain and SIJ dysfunction and concluded that combined use of MET, therapeutic exercise, TENS, hot pack, cold packs and soft tissue mobilization appeared to reduce pain, increase strength, increase ROM and improve overall function following SIJD(Mielewski, 2009)

Mahesh Shinde et al;conducted a study on effect of muscle energy technique and mulligan mobilization in sacroiliac joint dysfunction and the he result of the study shows that combination of Muscle energy technique and Mulligan mobilization has extremely significant effect over application of muscle energy technique alone in management of sacroiliac joint dysfunction both statistically and clinically.(Shinde & Jagtap, 2018) Prakash Patel et al; conducted a study on Effectiveness of manipulation and muscle energy techniques in subjects with SI joint dysfunction This study concludes that manipulation along with SWD and spinal and pelvic muscles exercises gives a better outcome with respect to pain & functional disability(Patel et al., 2015b)

Manisha sarkar et al ; conducted a clinical trial comparing the effects of MET and KT in addition to conventional physiotherapy on improving pain and quality of life among patients with mechanical SIJD(Sarkar et al., 2020)Supreet Bindra et al; conducted a trial on A study on the Efficacy of Muscle Energy Technique as compared to Conventional Therapy on Lumbar Spine Range of Motion in Chronic Low Back Pain of Sacroiliac Origin in 2012 and it was concluded that It can be diagnosed on the basis of history and cluster of physical tests and can be successfully managed using MET along with Conventional Therapy. The study has also shown the relationship between lumbar spine ROM and SIJD which can be restored by using MET along with Conventional therapy (Bindra et al., 2012) Parinda R. Kansagara et al; conducted an

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examination on Muscle Energy Technique for Sacroiliac Joint Dysfunction– An Evidence Based Practice in 2019 and concluded that METalong with conventional or other physiotherapy treatment can be helpful in reducing pain and improving function in patients with sacroiliac joint dysfunction. However, effectiveness of MET in Sacroiliac joint dysfunction is still need to be identified with higher quality of research.(Kansagara & Patel, 2019)

Mullai Dhinkaran et al; conducted a study on Comparative Analysis of Muscle Energy Technique and Conventional Physiotherapy in Treatment of Sacroiliac Joint Dysfunction in 2011 and found that The results of the study showed that both the experimental group are significant in treating low back pain due to sacroiliac dysfunction but muscle energy techniques along with corrective 130 exercises is moderately significant over conventional physiotherapy like TENS along with corrective exercise.(Dhinkaran et al., 2011)

Praveen Kumar et al; conducted a study on Efficacy of Muscle Energy Technique and PNF Stretching Compared to Conventional Physiotherapy in Program of Hamstring Flexibility in Chronic Nonspecific Low Back Pain and The result of this study indicates that muscle energy technique , PNF stretching and static stretching produce a significant improvement in hamstring flexibility. Therefore it is concluded the MET, PNF and static stretching can be use as an effective therapeutic maneuver for decrease pain, improving ROM and increase flexibility of tight hamstring in chronic low back patient.(Kumar & Moitra, 2015) Srivastava, Saumya et al; Till date, no study has been done to see the effect of MET on upslip and inflare sacroiliac joint dysfunction. We suggest the use of MET in effectively treating this less frequent type of dysfunction.(Srivastava et al., 2017)

Kanchan Rana et al ; conducted a comparative study on Comparative analysis on the efficacy of G.D. Maitland s conee of mobilization & muscle energy technique in treating sacroiliac joint dysfunction and results showed that along with active exercises Muscle energy technique (MET) is moderately significant over the G.D.Maitland's technique of mobilization in improving functional ability and increasing the medial rotation of hip joint in mechanical chronic low back pain caused due to sacroiliac joint dysfunction, while both the experimental groups were highly significant in decreasing pain and improving functional ability.(Mobilization)Faryal Zaidi et al; conducted an examination on Effectiveness of muscle energy technique as compared to Maitland mobilization for the treatment of chronic sacroiliac joint dysfunction and results concluded that In the light of the current study, it was evident that MET and Maitland mobilizations were both effective in treating the chronic SIJD in terms of decreasing pain and disability when using lumbopelvic stability exercises as an adjunct therapy.(Zaidi & Ahmed)

Mara stoffel et al ; conducted a case report study on The implementation of Lumbar muscle energy techniques and dry needling for the treatment of patient with chronic lumbar pain and radiculopathy and concluded that the patient responded well to manual based therapies such as lumbar METs,TP release,soft and deep tissue mobilization with the implementation of core stabilization and postural education(Stoffel)Odette Soisson et al; conducted a study on Pelvic Belt Effects on Pelvic Morphometry, Muscle Activity and Body Balance in Patients with Sacroiliac Joint Dysfunction and according to results There was a lack of evidence that compressive forces were exerted on the SIJ or pelvis via pelvic belts. Muscle activity was largely unaltered in patients with SIJ dysfunction in one-leg stance. A majority of SIJ patients reported decreased pain intensity with a pelvic belt applied under moderate tension(Soisson et al., 2015)Niels Hammer et al; directed an examination on Pelvic Belt Effects on Health Outcomes and Functional Parameters of Patients with Sacroiliac Joint Pain Pelvic belts improve health-related quality of life and are potentially attributed to decreased SIJ-related pain. Belt effects include decreased rectus femoris activity in patients and improved postural

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steadiness during locomotion. Pelvic belts may therefore be considered as a cost-effective and low-risk treatment of SIJ pain.(Hammer, Möbius, et al., 2015)

The current literature is not enough for this practice and no one have done a comparison between these two groups. As the study yielded significant results so it is recommended to make further research on this topic to make it as a clinically practiced technique for the treatment of pain, muscle strength and quality of life in sacroiliac joint dysfunctionUse Evidence.

3.1 : OBJECTIVE(S)

To find the effects of muscle energy technique with sacroiliac belt on pain, muscle strength and quality of life in patients with sacroiliac joint dysfunction

To find the effects of muscle energy technique without sacroiliac belt on pain, muscle strength and quality of life in patients with sacroiliac joint dysfunction

3.2 : HYPOTHESIS

Null Hypothesis (H0).

There was no significant difference between the effects of met with and without sacroiliac belt on pain, muscle strength and quality of life in patients with sacroiliac joint dysfunction.

Alternate Hypothesis (H1).

There was a significant difference between the effects of met with and without sacroiliac belt on pain, muscle strength and quality of life in patients with sacroiliac joint dysfunction.

3.3 : OPERATIONAL DEFINITION(S)

PAIN

Pain is a physical or emotional discomfort or suffering that can be caused by a variety of factors, including injury, illness or trauma. Pain can be acute or chronic, mild, or severe and can affect different areas of the body or mind. It is an important signal that something is wrong and often requires medical attention or treatment.

Pain is a complex and subjective experience that is typically associated with physical or emotional discomfort. It is often described as an unpleasant sensation or feeling that alerts us to potential or actual damage to our body or emotional well-being. Pain can vary in intensity, duration, and location, and it can manifest in different ways for different individuals.

Physiologically, pain is a protective mechanism that helps us avoid harm and promotes healing. When tissues in the body are injured, specialized nerve endings called nociceptors detect the damage and send signals to the brain through the nervous system. The brain then processes these signals and generates the experience of pain.

MUSCLE STRENGTH

Muscle strength refers to the amount of force that a muscle or group of muscles can generate during contraction. It can be measured using various methods such as dynamic strength tests(e.g. bench press, squats) and isometric strength tests (e.g. handgrip strength).Muscle strength is important for many daily activities, such as carrying groceries, lifting normal or heavy objects and performing sports or exercises. Improving muscle strength through resistance training can also have benefits for overall health and function, including increased metabolism, improved bone density and reduced risk of falls and injuries.

Improvements in muscle strength can lead to various benefits, such as enhanced performance in sports and physical activities, increased metabolism and calorie burning,

improved posture and joint stability, and reduced risk of injuries. Moreover, maintaining muscle strength is crucial for everyday tasks, as it helps with tasks like lifting heavy objects, maintaining balance, and supporting proper posture.It's important to note that muscle strength is different from muscle endurance and muscle power. Muscle endurance refers to the ability of a muscle to sustain repeated contractions over an extended period. Muscle power, on the other hand, involves a combination of strength and speed, reflecting how quickly force can be generated.

To improve muscle strength, individuals often engage in resistance training programs that target specific muscle groups. These programs

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typically involve lifting weights, using resistance bands, or performing bodyweight exercises. It's important to follow proper techniques, progressively increase resistance, and allow for adequate rest and recovery to optimize strength gains while minimizing the risk of injury.

QUALITY OF LIFE

Quality of life refers to the overall well-being and satisfaction an individual experiences in various aspects of their life. It is a subjective measure that takes into account a person's physical health, mental and emotional well-being, social relationships, living conditions, and other factors that contribute to their overall happiness and fulfillment.

The concept of quality of life encompasses both objective and subjective elements. Objective factors include access to healthcare, education, employment opportunities, housing, and other resources that can directly impact a person's well-being. Subjective factors include personal satisfaction, happiness, sense of purpose, and fulfillment in relationships and activities.

Quality of life is a multifaceted concept and can vary from person to person, depending on their individual values, needs, and circumstances. For example, one person may prioritize a high income and career success, while another may value strong personal relationships and leisure time.

MATERIAL AND METHODS

4.1 : Study Design: Randomized Clinical Trial

4.2 : Settings: DHQ Layyah

4.3 : Duration of Study: 9 months after the approval of synopsis

4.4 : Sample Size: Total Sample size is 48 with 24 in each group

The calculated sample size using NPRS as outcome measure is 24 in each group after adding 20% dropout the sample size will be 24+6=30 in each group

Sample Size For Comparing Two Means

Input Data

Confidence Interval (2-sided)	95%
Power	90%
Ratio of sample size (Group 2/Group 1)	1

	Group 1	Group 2	Difference*
Mean	1.73	3.04	-1.31
Standard deviation	1.11	1.6	
Variance	1.2321	2.56	

Sample size of Group 1	24
Sample size of Group 2	24
Total sample size	48

$$n = \frac{2\sigma^2(z_{1-\alpha/2} + z_{1-\beta})^2}{(\mu_1 - \mu_2)^2}$$

Z1-α/2 Level of significance=95%

μ1 Expected mean change in NPRS in Group A= 1.73 μ2 Expected mean change in NPRS in Group B= 3.04 δ1 Expected standard deviation in group A=1.11

δ2 Expected standard deviation in group B=1.6

Z1-β power of the study= 90%

n Expected sample size in a group= 24

After adding 20% drop out 24+6=30 in each group.

4.5 : Sampling Technique: Convenient Purposive Technique

4.6 : Sample Selection: Subjects were assessed for eligibility according to following inclusion and exclusion criteria.

4.6.1: Inclusion Criteria:

- Both male and female patients
- Aging between 30 and 50 years

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- Respondents having pain in
- lower back,
- gluteal and groin area,
- lower extremity lasting for more than 4 weeks but less than 1 year
- Patients tested positive on pain provocation tests(write all pain provocation test that you will going to use in your study)

4.6.2: Exclusion Criteria:

- Pregnancy
- Patients with any medical conditions that would make exercise difficult i.e. SLE (Systemic Lupus Erythematosus, Multiple sclerosis, chronic fatigue syndrome
- Patients with osteoporosis affecting the pelvic and spine region
- Patients with inflammatory pathology i.e. Ankylosing Spondylitis, Osteoarthritis Hip Degenerative arthritis
- Patients with Hip fracture
- Any spinal surgery history

4.7 : Equipment(s):

- Numeric Pain Rating Scale
- Short form -36 Questionnaire
- Manual Muscle Testing
- Positive three out of five pain provocation tests for SIJD Robinson et al, (2007) suggested that the cluster of 3 out of 5 pain provocation tests (compression test, distraction test, posterior pelvic pain provocation test, faber's test, bilateral and unilateral internal rotation
of hip) were found to be reliable, so the cluster of tests should be validated for assessment of diagnostic power.

4.8 : ETHICAL CONSIDERATIONS

The rules and regulations set by the ethical committee of GCUF were followed while conducting the research and the rights of the research participants was respected.

- Written informed consent was taken from all the participants.

- All information and data collection was kept confidential.

- A participant was remain anonymous throughout the study.

- The subject was informed that there are no disadvantages or risks on the procedure of the study.
- They were also informed that they will be free to withdraw at any time during the process of the
study.
- There was no known risk associated with this research.
- We will do everything we can to protect your privacy. Your identity will not be revealed in any
publication resulting from this study.
- Your participation in this research study is voluntary. You may choose not to participate and you
may withdraw your consent to participate any time. You will not be penalized in any way should
you decide not you participate or to withdraw from this study.

4.9 : DATA COLLECTION PROCEDURE

Screening:

Patients were screened to meet inclusion criteria. Consent form was taken from patients then patients were randomly allocated 24 Patients in each group.

Randomization:

Patients fulfilling the inclusion criteria were randomly divided into experimental group and control group by using the lottery method.

Allocation:

Computer generated method.

Assignment:

Parallel

Blinding:

The study was single blinded. The assessor was unaware of the treatment given to both groups.

Assessment:

Baseline data was collected at base line and at 4th week and follow up at 8th week.

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Interventions:

Group A Group A was treated with Muscle Energy Technique with Sacroiliac belt

Muscle Energy Technique

MET was applied in three different muscle viz quadratus lumborum, erector spinae and piriformis.

For each muscle after positioning the patient was asked to apply 30% force against therapist force and hold that contraction for 7- 10seconds and after that relax for 5seconds and when patient exhale, therapist take muscle to new restriction barrier, hold this position for 10-60 seconds with 3-5 repetition.

METS on Quadratus Lumborum

Lewit technique was used for Quadratus Lumborum muscles where the therapist.

stands behind the side lying patient, at waist level. The patient has the uppermost arm extended over the head to firmly grasp the top of the table and on an inhalation adduct the uppermost leg until the practitioner palpates strong quadrates activity elevation of around 30 degrees usually. The patient holds the leg in this manner isometrically allowing gravity to provide resistance.

After 10 seconds of contraction the patient allows the leg to hang slightly behind him over the back of the table. The therapist straddle this and cradling the pelvis with both hands leans back to take out all the slack and to ease the pelvis away from the lower ribs during an exhalation. The stretch should be held for 30 seconds.

METS on Erector Spinae

For Erector Spinae the patient sits on a treatment table leg hanging over the side. The therapist stands behind the patient placing his one knee on the table close to the patient, at the side towards which side bending and rotation will be introduced. The therapist moves the patient into flexion, side bending and rotation over the therapist's knee. After taking the patient to a comfortable limit of flexion, he is asked to look towards the direction from which rotation has been made while holding the breath for 7-10 seconds.

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METS for Piriformis

The patient was in supine position, the leg to be treated was placed into flexion at the hip and knee so that the footrest on the table lateral to the contra lateral knee.

The angle of hip flexion did not exceed 600. The therapist placed one hand on the contralateral axis to prevent pelvis motion while the other hand placed against the laterally flexed knee as this was pushed into resisted.

abduction to contract piriformis for 7-10 seconds

Sacroiliac belt

Along with Muscle energy techniques mentioned above Group A individuals were received sacroiliac belt which was worn for the period of 2-4 weeks, 8-10 hours a day, The belt was removed during sleeping, bathing, and during exercise sessions.

Group B was treated with Muscle Energy Technique without Sacroiliac belt.

Muscle Energy Technique

MET was applied in three different muscles viz quadratus lumborum, erector spinae and piriformis.

For each muscle after positioning the patient was asked to apply 30% force against therapist force and hold that contraction for 7- 10seconds and after that relax for 5seconds and when patient exhale, therapist take muscle to new restriction barrier, hold this position for 10-60 seconds with 3-5 repetition.

METS on Quadratus Lumborum

Lewit technique was used for Quadratus Lumborum muscles where the therapist.

stands behind the side lying patient, at waist level. The patient has the uppermost arm extended over the head to firmly grasp the top of the table and on an inhalation adduct the uppermost leg until the practitioner palpates strong quadrates activity elevation of around 30 degrees usually. The patient holds the leg in this manner isometrically allowing gravity to provide resistance.

After 10 seconds of contraction the patient allows the leg to hang slightly behind him over the back of the table. The therapist straddle this and cradling the pelvis with both hands leans back to take out all the slack and to ease the pelvis away from the lower ribs during an exhalation. The stretch should be held for 30 seconds.

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METS on Erector Spinae

For Erector Spinae the patient sits on a treatment table leg hanging over the side. The therapist stands behind the patient placing his one knee on the table close to the patient, at the side towards which side bending and rotation was introduced. The therapist moves the patient into flexion, side bending and rotation over the therapist's knee. After taking the patient to a comfortable limit

of flexion he is asked to look towards the direction from which rotation has been made while holding the breath for 7-10 seconds.

METS for Piriformis

The patient was in supine position, the leg to be treated was placed into flexion at the hip and knee so that the footrest on the table lateral to the contra lateral knee.

The angle of hip flexion did not exceed 600.

The therapist placed one hand on the contralateral axis to prevent pelvis motion while the other hand placed against the laterally flexed knee as this was pushed into resisted.

abduction to contract piriformis for 7-10 seconds

Manual Muscle Testing Piriformis:

Position of patient: Short Siting with Trunk supported.

Position of Therapist: Kneels or sit beside the testing limb, Therapist grasps the ankle just above the malleoli to apply the resistance. The resistance is applied in a lateral pattern at the ankle.

The other hand where counter-pressure is applied is placed on the lateral aspect of the distal thigh just above the level of knee. Resistance is applied in a medial pattern on the knee, this is done in applied in opposite

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directions to generate rotatory motion.
Test: Patient is instructed to to do external rotation **Instruction:** Don't let me turn your leg outwards

Grading:
Grade5: Normal: Holds maximal resistance
Grade 4: Holds strong to moderate resistance.
Grade 3: Tolerates no resistance.

Quadratus Lumborum:
Position of patient: Prone lying or in Supine lying with extension on hip, patient grasps the table for stabilization when resistant will apply.
Therapist Position: Standing at the foot side of the table with therapist facing the patient. Both of the patient's limbs are grasped by the therapist just above the level of ankle to pull them in caudal position smoothly. Resistance is applied in a tractional manner.
Test:
A patient is seen hiking the hip/pelvis on one side, which approximates the rim of the pelvis to the lower margin of rib cage.
Instruction:
Patient is instructed to hike his/her pelvis to the level of Ribs, hold it and don't let me pull down your leg.

Erector Spinae (Spinalis thoracis)
Position of patient: Prone lying with both hands joined at the back of the head.
Position of Therapist: Standing to stabilize the lower extremities of the patient just above the level of ankles in case the patient has normal strength of hip.
Test: Ask the patient to perform extension at the lumbar spine until the entire thoracic region is raised from the table.
Instruction: Raise up your head, shoulder and chest as high as you can.

OUTCOME MEASURES
NPRS, Short form 36, Manual Muscle Testing

4.10 : DATA ANALYSIS PROCEDURE
Version 24 of the statistical package for social sciences (SPSS) was used to tabulate and analyze the data. The qualitative variables liked gender, were presented with frequency and percentages, bar charts were drawn. The quantitative variables age and numerical pain rating scale were presented with mean and standard deviation. After ensuring that the data are normal using the Kolmogorov-Smirnov and Shapiro-Wilk tests (parametric test) were applied. Independent samples T test was used for between group comparison and Repeated measures ANOVA was used for within group comparison of outcome measures. P value of less than and equal to 0.05 was considered as significant. Intension to Treat Analysis (ITT) applied to analyze the data of lost to follow-up participants.

4.11 CONSORT GUIDELINES
4.12 : GANTT CHART

Activity	Months (Divide the months according to your research duration)								
	01	02	03	04	05	06	07	08	09
Data collection									
Data analysis and interpretation									

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Thesis presentati on and submission									

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RESULTS

The tests of normality as per measured by Shapiro-Wilk test showed by significant p value (>0.05) that the data was normally distributed, therefore, the data is parametric. The results regarding descriptive statistics of age showed that mean and standard deviation found to be 39.38±6.114 for Group A (MET with SI belt) and 40.83±6.246 for Group B (MET without SI belt).

The histogram with normal curve regarding age showed that mean and standard deviation found to be 39.38±6.114 for Group A (MET with SI belt) while the curve was normally distributed. The histogram with normal curve regarding age showed that mean and standard deviation found to be 40.83±6.246 for Group B (MET without SI belt).while the curve was normally distributed. The results regarding gender of participant showed that there were 66.7% male and 33.3% females in group A and 70.8% males and 29.2% females in group B. Pain intensity on NPRS comparison between groups showed that mean and standard deviation were 7.038±1.7427 in Pre-Treatment Group A and 6.58±1.348 in Group B and In Post treatment Group A (MET with SI belt) as 2.125±1.191 and 2.625±1.134 in Group B (MET without belt)

The results regarding comparison of pain intensity in SF 36 before treatment at baseline showed that mean and standard deviation of pain score in SF 36 were found to be 67.33±18.384 and 67.79±21.197, in Group A (MET with SI belt) and 67.958±19.530 and 67.958±19.530 in Group B (MET without SI belt) while there was no statistically significant difference, p value 0.181 in Group A and 1.000 in Group B.

The results of mean and standard deviation regarding emotional well-being in Group A (MET with SI belt) was found as 65.04±19.284 Pre-treatment and 70.46 and 20.701 Post-treatment while 71.917±18.851 Pre Treatment and 65.79±16.089 Post-treatment respectively in Group B (MET without SI belt). The Results of social functioning in Group A(MET with SI belt) showed as 63.79±18.96 in Pre-treatment and 65.04±17.62 in Post treatment group whereas 68.54±17.70 and 68.54±17.70 in Group B (MET without SI belt) while P values were 0.636 and 1.000 respectively. Mean and standard deviation values of General health in Group A (MET with SI belt) were 67.38±17.915 and 67.96±20.681 and in Group B (MET without SI belt) as 67.625±19.65 and 67.625±19.65 with P values 0.229 in Group A (MET with SI belt) and 1.000 in Group B(MET without SI belt) . Results of Mean and Standard deviation in the domain of health change showed as 64.04±17.92 and 69.42 and 18.70 in Group A(MET with SI belt) and 65.45±19.06 and 65.45±19.06 in Group B and P values were 0.754 for Group A and 1.000 for Group B. The results of Mean and Standard deviation regarding Manual Muscle testing in Group A were 2.416±1.176 and 2.9160±0.880 and Group B (MET without SI belt) showed 3.166±1.049 and 3.875±0.850 with P values 0.050 in Group A and 0.560 in Group B.

Within subject's comparison regarding physical functioning domain showed the p value of 0.243 in Group A and 0.948 in Group B. The test of with in subject's comparison of the domain of physical role limitation showed the p values of 0.806 in Group A and 0.782 in Group B. Regarding Energy/fatigue, with in subject results p values were 0.367 in Group A and 0.174 in Group B. Emotional wellbeing in patients showed the p value of 0.252 in Group A and 0.360 in Group B. Social functioning related results showed the p values of 0.386 in Group A and 0.491 in Group B. Pre and Post pain comparison with in subjects showed the p values of 0.920 in Group A and 0.981 in Group B. The results of Health change factor of SF 36 showed the p values of 0.806 in Group A and 0.523 in Group B. NPRS comparison of with in subject's showed the p values of 0.00 in Group A and 0.00 in Group B. Manual muscle testing comparison of with in subjects showed the p value of 0.044 in Group A and 0.03 in Group B.

Between Subject's comparison regarding physical functioning domain of SF 36 showed the p value of 0.000 in group A and 0.000 in

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group B. Physical role limitation results showed the resultant p values of 0.00 in Group A and 0.00 in Group B. Energy/Fatigue related results of p values showed 0.000 in Group A and 0.000 in Group B. Emotional wellbeing related p values showed the values of 0.000 in Group A and 0.000 in Group B. The p value of social functioning domain showed the result of 0.000 in Group A and 0.000 in Group B. Pain related between subject's comparison showed p value of 0.000 in Group

A and 0.000 in Group B. Regarding General health the resultant p value showed as 0.000 in Group A and 0.000 in Group B. Health change domain p values showed as 0.000 in Group A and 0.000 in Group B respectively. NPRS p values between subject's comparison showed as 0.000 in Group A and 0.000 in Group B. MMT related p values showed as 0.000 in Group A and the same 0.000 in Group as well.

Repeated Measures ANOVA test and statistics regarding Physical functioning in SF 36 between groups A and B showed that there was no significant different in test of with in subjects comparisons and there was significant difference among between subject's comparisons of Group A and Group B. Test statistics of Physical role limitation showed that p value results of test with in subjects showed no significant difference and test of with in subjects groups showed significant difference. Test results regarding Energy/Fatigue among within subjects showed no significant difference and between subjects showed significant values. Resultant p values regarding emotional wellbeing showed no significant difference between within subject's comparison and no significant difference among between subject's comparisons. P values of with in subjects regarding social functioning showed no significant difference and p values of between subjects showed significant value. P value regarding Pain intensity in SF 36 showed no significant difference in with in subject's comparison and showed significant difference among between subject's comparison. Regarding General Health the resultant p value of with in subject comparison showed no significant difference and significant difference for between subject's comparison. Health change domain p values among within subject's comparison showed no significant difference and among between subjects showed significant difference. NPRS score and p values among within subject's comparison showed significant difference between groups and the same results of p values showed among between group's comparison. Regarding Manual Muscle Testing (MMT) the p values showed significant difference in Group A and Significant difference among between subject's comparison in Group B.

Tables and Figures

Table 1: Tests of Normality

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Group		Statistic	Df	Sig.	Statistic	Df	Sig.
Group A	**Pre-Physical functioning**	.130	24	.200*	.949	24	.261
	Post- physical functioning	.122	24	.200*	.928	24	.089
	Pre role limitation due to physical health	.139	24	.200*	.928	24	.088
	Post role limitation due to physical health	.122	24	.200*	.949	24	.264
	Pre role limitation due to emotional problem	.138	24	.200*	.939	24	.159

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	Post role limitation due to emotional problem	.140	24	.200*	.913	24	.041
	Pre energy/fatigue	.146	24	.200*	.935	24	.128
	Post energy/fatigue	.080	24	.200*	.961	24	.465
	Pre emotional wellbeing	.184	24	.034	.881	24	.009
	Post emotional well-being	.129	24	.200*	.948	24	.248
	Pre social functioning	.095	24	.200*	.955	24	.341
	Post social functioning	.102	24	.200*	.961	24	.453
	Pre pain in SF 36	.114	24	.200*	.939	24	.159
	Post pain in SF 36	.089	24	.200*	.958	24	.409
	Pre general health	.142	24	.200*	.949	24	.256
	Post general health	.103	24	.200*	.938	24	.148
	Pre health change	.107	24	.200*	.963	24	.498
	Post health change	.148	24	.184	.929	24	.091
	Pretreatment NPRS score	.191	24	.023	.882	24	.009
	Post treatment NPRS score	.292	24	.000	.805	24	.000
	Posttreatment MMT score	.180	24	.043	.848	24	.002
	Post treatment MMT score	.271	24	.000	.836	24	.001
Group B	Pre-Physical functioning	.119	24	.200*	.937	24	.140
	Post- physical functioning	.141	24	.200*	.908	24	.032
	Pre role limitation due to physical health	.167	24	.081	.955	24	.346
	Post role limitation due to physical health	.180	24	.042	.903	24	.024
	Pre role limitation due to emotional problem	.134	24	.200*	.919	24	.055
	Post role limitation due to emotional problem	.118	24	.200*	.913	24	.040
	Pre energy/fatigue	.123	24	.200*	.965	24	.545
	Post energy/fatigue	.111	24	.200*	.949	24	.255
	Pre emotional wellbeing	.136	24	.200*	.916	24	.048
	Post emotional well-being	.088	24	.200*	.974	24	.770
	Pre social functioning	.155	24	.139	.965	24	.541
	Post social functioning	.102	24	.200*	.961	24	.453
	Pre pain in SF 36	.163	24	.098	.906	24	.029
	Post pain in SF 36	.089	24	.200*	.958	24	.409

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	Pre general health	.141	24	.200*	.931	24	.103
	Post general health	.103	24	.200*	.938	24	.148
	Pre health change	.117	24	.200*	.952	24	.292
	Post health change	.148	24	.184	.929	24	.091
	Pretreatment NPRS score	.209	24	.008	.886	24	.011
	Post treatment NPRS score	.179	24	.046	.859	24	.003
	Pretreatment MMT score	.268	24	.000	.768	24	.000
	Post treatment MMT score	.265	24	.000	.780	24	.000

The tests of normality as measured by Kolmogorov-Smirnova and Shapiro-Wilk test showed by significant p value (<0.05) that the data was normally distributed, therefore, the data is parametric.

Table 2: Age of Participants

Statistics		
Age of Participant		
Group A (MET with SI Belt)	Mean	39.38
	Std. Deviation	6.114
	Range	20
Group B (MET without SI Belt)	Mean	40.83
	Std. Deviation	6.246
	Range	19

The results regarding descriptive statistics of age showed that mean and standard deviation was found to be 39.38±6.114 for Group A (MET with SI belt) and 40.83±6.246 for Group B (MET without SI belt).

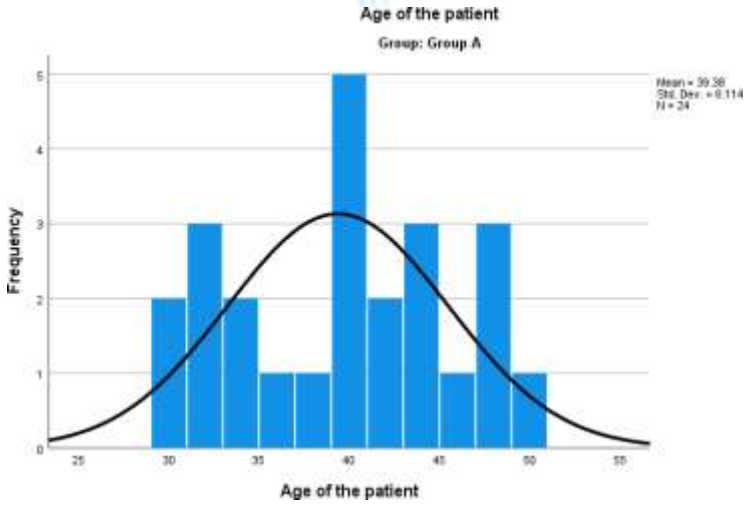

Figure 1: Age Group A MET with SI belt The histogram with normal curve regarding age showed that mean and standard deviation found to be 39.38±6.114 for Group A (MET with SI Belt) while the curve was normally distributed.

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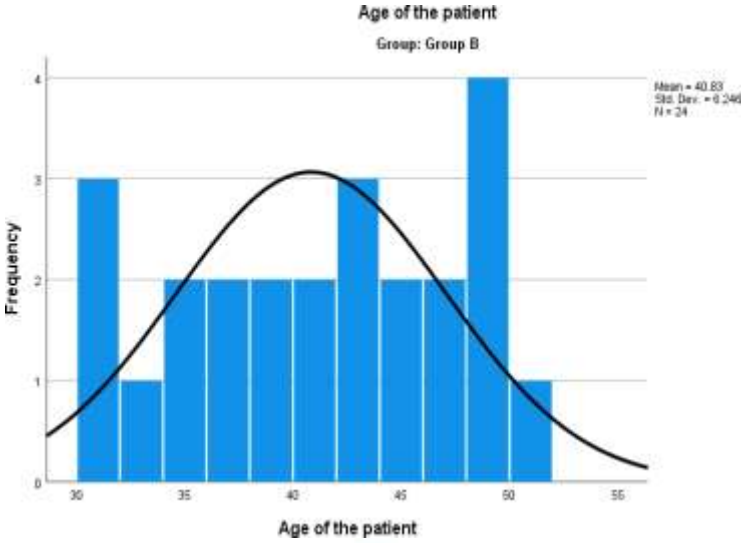

Figure 2: Age Group B MET

The histogram with normal curve regarding age showed that mean and standard deviation found to be 40.83±6.246 for Group B (MET without SI belt).while the curve was normally distributed.

Table 3: Gender of Participants

Gender of the participants

Group			Frequency	Percent	Valid Percent	Cumulative Percent
Group A	Valid	male	16	66.7	66.7	66.7
		female	8	33.3	33.3	100.0
		Total	24	100.0	100.0	
Group B	Valid	male	17	70.8	70.8	70.8
		female	7	29.2	29.2	100.0
		Total	24	100.0	100.0	

The results regarding gender of participant showed that there were 66.7% male and 33.3% females in group A and 70.8% males and 29.2% females in group B.

Table 4: Pre and Post Physical Function in Group A (MET with SI Belt) and Group B (MET without SI Belt)

		Group	N	Mean	Std. Deviation	P value
Pre physical functioning		Group A	24	61.21	20.547	0.624
		Group B	24	68.38	20.872	
Post physical functioning		Group A	24	67.0417	19.34465	0.339

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		Group B	24	68.7083	21.01858	

The results regarding pre and post physical functioning in in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was >0.05 in both the groups showing no significant difference among the participants.

Table 5: Pre and Post limitation due to physical health in Group A (MET with SI Belt) and Group B (MET without SI Belt

		Group	N	Mean	Std. Deviation	P value
Pre role limitation due to physical health		Group A	24	67.33	20.493	0.294
		Group B	24	66.42	16.914	
Post role limitation due to physical health		Group A	24	66.1250	18.73688	0.171
		Group B	24	64.7917	21.95644	

The results for pre and post limitation due to physical health in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was >0.05 in both the groups showing no significant difference among the participants.

Table 6: Pre and Post limitation due to emotional health in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre role limitation due to emotional problem	Group A	24	72.54	17.988	0.239
	Group B	24	67.50	20.747	
Post role limitation due to emotional problem	Group A	24	72.8750	19.85012	0.244
	Group B	24	75.0000	16.85488	

The results regarding pre and post limitation due to emotional health in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was >0.05 in both the groups A and B showing no significant difference among the participants.

Table 7: Pre and Post energy/fatigue in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre energy/fatigue	Group A	24	77.63	16.691	0.692
	Group B	24	61.75	17.598	
Post energy/fatigue	Group A	24	72.7500	17.06573	0.338
	Group B	24	68.8750	19.96369	

The results regarding pre and post energy/fatigue in Group A (MET with SI Belt) and Group B (MET

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without SI Belt) showed that the p value was >0.05 in both the groups A and B showing no significant difference among the groups.

Table 8: Pre and post emotional wellbeing in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre emotional wellbeing	Group A	24	65.04	19.284	0.748
	Group B	24	70.46	20.701	
Post emotional well-being	Group A	24	71.7917	18.85178	0.286
	Group B	24	65.04	19.284	0.748

The results regarding pre and post emotional well-being in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was >0.05 in both the groups A and B showing no significant difference among the groups.

Table 9: Pre and post social functioning in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre social functioning	Group A	24	63.79	18.969	0.636
	Group B	24	65.04	17.620	
Post social functioning	Group A	24	68.542	17.7053	1.000
	Group B	24	68.542	17.7053	

The results regarding pre and post emotional well-being in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was more than alpha i.e. (0.05) in both the groups A and B showing no significant difference among the groups.

Table 10: Pre and Post Pain in SF-36 in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre Pain in SF-36	Group A	24	67.33	18.384	0.181
	Group B	24	67.79	21.197	
Post Pain in SF-36	Group A	24	67.958	19.5303	1.000
	Group B	24	67.958	19.5303	

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The results regarding pre and post pain in short form 36 questionnaire in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was more than the value of alpha i.e. (0.05) in both the groups A and B showing no significant difference among the groups.

Table 11: Pre and Post General Health in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre-General Health	Group A	24	67.38	17.915	0.229
	Group B	24	67.96	20.681	
Post General Health	Group A	24	67.6250	19.65311	1.000
	Group B	24	67.6250	19.65311	

The results regarding pre and post general health status in short form 36 questionnaire in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was more than the value of alpha i.e. (0.05) in both the groups A and B showing no significant difference among the groups.

Table 12: Pre and Post Health Change in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre Health-Change	Group A	24	64.04	17.924	0.754
	Group B	24	69.42	18.701	
Post Health Change	Group A	24	65.4583	19.06506	1.000
	Group B	24	65.4583	19.06506	

The results regarding pre and post general health change status in short form 36 questionnaire in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was more than (0.05) in both the groups A and B therefore there is no significant difference among the groups.

Table 13: Pre and Post Pain intensity on NPRS in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre NPRS	Group A	24	7.0833	1.74248	0.193
	Group B	24	6.5833	1.34864	

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Post NPRS	Group A	24	2.1250	1.19100	0.493
	Group B	24	2.6250	1.13492	

The results regarding pain intensity on NPRS in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was more than (0.05) in both the groups A and B showing that there is no significant difference among both groups.

Table 14: Pre and Post Manual Muscle Testing (MMT) in Group A (MET with SI Belt) and Group B (MET without SI Belt

	Group	N	Mean	Std. Deviation	P value
Pre MMT	Group A	24	2.4167	1.17646	0.050
	Group B	24	2.9167	.88055	
Post MMT	Group A	24	3.1667	1.04950	0.560
	Group B	24	3.8750	.85019	

The results regarding muscle strength through manual muscle testing in Group A (MET with SI Belt) and Group B (MET without SI Belt) showed that the p value was more than (0.05) in both the groups A and B showing that there is no significant difference among both groups.

Table 15: Independent Samples Test and Statistics of Pre and Post Manual Muscle Testing (MMT) in Group A (MET with SI Belt) and Group B (MET without SI Belt

Independent Sample Test and Statistics					
	Group	Mean	Std. Deviation	DF	P value
Pre-Physical functioning	Group A	61.21	20.547	46	.624
	Group B	68.38	20.872	45.989	
Post physical functioning	Group A	67.0417	19.34465	46	.339
	Group B	68.7083	21.01858	45.687	
Pre role limitation due to physical health	Group A	67.33	20.493	46	.294
	Group B	66.42	16.914	44.403	
Post role limitation due to physical health	Group A	66.1250	18.73688	46	.171
	Group B	64.7917	21.95644	44.890	
Pre role limitation due to emotional problem	Group A	72.54	17.988	46	.239
	Group B	67.50	20.747	45.094	
Post role limitation due to emotional	Group A	72.8750	19.85012	46	.244

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problem	Group B	75.0000	16.85488	44.822	
Pre energy/fatigue	Group A	77.63	16.691	46	.692
	Group B	61.75	17.598	45.872	
Post energy/fatigue	Group A	72.7500	17.06573	46	.338
	Group B	68.8750	19.96369	44.913	
Pre emotional wellbeing	Group A	65.04	19.284	46	.748
	Group B	70.46	20.701	45.771	
Post emotional well-being	Group A	71.7917	18.85178	46	.286
	Group B	65.7917	16.08937	44.892	
Pre social functioning	Group A	63.79	18.969	46	.636
	Group B	65.04	17.620	45.752	
Post social functioning	Group A	68.542	17.7053	46	1.000
	Group B	68.542	17.7053	46.000	
Pre pain in SF 36	Group A	67.33	18.384	46	.181

Group B		67.79	21.197	45.098	
Post pain in SF 36	Group A	67.958	19.5303	46	1.000
	Group B	67.958	19.5303	46.000	.748
Pre emotional wellbeing	Group A	65.04	19.284	46	
	Group B	70.46	20.701	45.771	.286
Post emotional well-being	Group A	71.7917	18.85178	46	
	Group B	65.7917	16.08937	44.892	.636

Pre general health	Group A	67.38	17.915	46	.229
	Group B	67.96	20.681	45.083	
Post general health	Group A	67.6250	19.65311	46	1.000
	Group B	67.6250	19.65311	46.000	
Pre health change	Group A	64.04	17.924	46	.754
	Group B	69.42	18.701	45.917	
Post health change	Group A	65.4583	19.06506	46	1.000
	Group B	65.4583	19.06506	46.000	
Pre treatment NPRS score	Group A	7.0833	1.74248	46	.193
	Group B	6.5833	1.34864	43.279	
Post treatment NPRS score	Group A	2.1250	1.19100	46	.493
	Group B	2.6250	1.13492	45.893	
Pre treatment MMT score	Group A	2.4167	1.17646	46	.050
	Group B	2.9167	.88055	42.614	

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Post treatment MMT score	Group A	3.1667	1.04950	46	.560
	Group B	3.8750	.85019	44.100	

Independent samples test and statistics regarding the quality of life, pain and muscle strength Pre and Post Treatment between Group A (MET with SI Belt) and Group B (MET without SI Belt) showed the p value more than 0.05 therefore there is no significant difference between groups noted.

Table 16: Repeated Measures ANOVA Test and Statistics of Pre and Post Quality of life ,Pain intensity on NPRS and Manual Muscle Testing (MMT) in Group A (MET with SI Belt) and Group B (MET without SI Belt

Repeated Measures ANOVA Test and Statistics

	Group	Between group p value	Within group p value
Physical functioning	Group A	0.000	0.243
	Group B	0.000	0.948
Role limitation due to physical health	Group A	0.000	0.806
	Group B	0.000	0.782
Energy/fatigue	Group A	0.000	0.367
	Group B	0.000	0.174
Emotional wellbeing	Group A	0.000	0.252
Group B		0.000	0.360
Social functioning	Group A		0.386
Group B			0.491
Pain in SF 36	Group A	0.000	0.920
Group B		0.000	0.981

Emotional wellbeing	Group A	0.000	0.252
Group B		0.000	0.360

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General health	Group A	0.000	0.967
Group B		0.000	0.949
Health change	Group A	0.000	0.806
Group B		0.000	0.523
Pain Intensity on NPRS	Group A	0.000	0.000
Group B		0.000	0.000
Manual Muscle Testing (MMT)	Group A	0.000	0.044
Group B		0.000	0.03

Repeated measures Anova test and statistics showed no significant regarding the domains of short form 36 questionnaire with p value >0.05 but showed significant difference in pain intensity measured on NPRS and MMT with p values <0.05 among with in subjects comparison of both the groups (Group A and Group B) , Between groups comparison regarding all the domains of SF-36 showed significant difference , pain intensity on nprs showed significant difference and muscle strength measured through manual muscle testing also showed showed significant difference with p values <0.05.

DISCUSSION

As we go through the previous literatures on effect of muscle energy techniques and its efficacy and comparison with other techniques in patients with sacroiliac joint dysfunction , we come to know that this technique has proven to be beneficial for the patient with SIJD in terms of treating pain and disability but when it comes to its comparison with sacroiliac belt which is another stabilizing tool in treating patients with sacroiliac joint dysfunction and its effect on patients treated with muscle energy technique and only muscle energy technique without the use of SI belt , we have found limited evidence available on its comparison between the patients using SI belt and patients without SI belt and its effect on pain, muscle strength and quality of life in patients with sacroiliac joint dysfunction , So the main objective of this study was to check the effect of muscle energy technique with and without sacroiliac belt in patients with sacroiliac joint dysfunction.

The current study consists of 48 participants, out of which 24(50%) were in Group A (Patients treated with Muscle energy technique and with Sacroiliac belt) and 24(50%) in Group B (Patients treated with only muscle energy technique without the use of sacroiliac belt. On the whole there were (16) 66.7% male and (8) 33.3% females in group A(MET with SI Belt) and (17) 70.8% males and (7) 29.2% females in group B (MET without SI Belt). Participants of Group A (MET with SI Belt) had mean age of 39.38±6.114 years and 40.83±6.246 years in Group B (MET without SI Belt).

As the Data was normally distributed so the independent samples test and repeated measures anova was used to compare the Groups A and B,

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The statistics of independent samples test showed no significant difference in quality of life, pain and muscle strength between Groups A (MET with Belt and Group B (MET without Belt). Statistics of Repeated measures anova test showed non-significant value regarding quality of life among within group comparison but showed significant difference in pain, muscle strength and quality of life among between groups and within groups comparison, therefore we reject the null hypothesis which denotes that there was no significant among groups with sacroiliac belt and without sacroiliac belt and accept the alternative hypothesis which shows that there was significant difference among between groups in terms of Pain, muscle strength and quality of life but non-significant difference in quality of life and significant difference in pain and muscle strength among within group individuals.

A study was conducted in 2019 nu Aditya Vaidya et.al which compared the muscle energy technique and mulligan's mobilization with movement in patients with anterior innominate iliosacral dysfunction in which the age criteria of the participants was 18 years and over with no upper limit in age and the sample size was 30 in which the participants were randomly allocated into two groups (15) in each group (Vaidya, Babu, Mungikar, et al., 2019) but this study has selected the patients with age ranging between 30-50 years and the sample size was also comparatively large i.e. 48 with 24 in each group.

Another study was carried out in Iran in the year 2019 on the Effects of Muscle energy technique on daily activities and lumbar stiffness in women with sacroiliac joint dysfunction which was a randomized controlled clinical trial , with age ranging from 18-40(Vaseghnia et al., 2019) while this study included the participants ranging from 30 to 50 years as already mentioned but as this study was carried out only in women population , but the current study has included both the genders (male and female) , furthermore VAS (Visual Analogue Scale) was used as pain measuring tool in that study but the recent study has used the NPRS (Numeric pain rating scale) to measure the pain intensity of the participants.

Another study which was performed in the year 2015 in Germany with the title Pelvic Belt Effects on Health Outcomes and Functional Parameters of Patients with Sacroiliac Joint Pain Showed significant improvement regarding health related quality of life in patients with sacroiliac joint dysfunction(Hammer, Möbius, et al., 2015) whereas the current study showed non-significant value regarding quality of life among within group comparison but showed significant difference in pain, muscle strength and quality of life among between groups and within groups comparison. The limited data is present on the combined comparison of quality of life, pain and muscle strength on pain, muscle strength and quality of life therefore this current study emphasized on all these aspects for better understanding of these outcome variables.

An experimental study was done on the topic of EFFECT OF MUSCLE ENERGY TECHNIQUE IN CHRONIC SACROILIAC JOINT DYSFUNCTION in Cairo Egypt and the results showed that MET decreased the pain the intensity and anterior pelvic tilting in patients with chronic sacroiliac joint dysfunction,(Alkady et al., 2019a) but the current study has checked the EFFECT OF METS WITH AND WITHOUT SACROILIAC BELT IN PATIENTS WITH SACROILIAC JOINT DYSFUNCTION , therefore the current did not check the pelvic tilting separately but significant decrease in pain and increase in muscle strength was noted among Group A and B between and within subjects comparisons before and after the application of MET in patients with the SI Belt as well as without SI Belt.

In a study conducted on Effect of muscle energy technique on pain pressure threshold in sacroiliac joint dysfunction which included 72 individuals with age range from 20 to 65 years concluded that the MET has been proven to be safe and beneficial to decrease pain around PSIS due to SIJD whereas the current study included the patients of age 30-50 years and emphasized on role of MET on Sacroiliac joint as a whole and its relationship to quality of life, pain and

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muscle strength in patients wearing SI Belt and patients without SI Belt.

An examination was conducted on Comparative Analysis of Muscle Energy Technique and Conventional Physiotherapy in Treatment of Sacroiliac Joint Dysfunction in india in the year 2011 in which it was concluded that MET when applied with corrective type of exercises has showed more significant improvement in patients with SIJD as compared to the patients who were treated with TENS with corrective exercises in terms of treating pain and functional ability , the participants had age of 18-35 years and used NPRS for pain assessment , the present study has focused on muscle strength, pain and quality of life before and after the treatment of MET with Belt administered and without the administration of SI Belt and the results showed significant p values in terms of between and within group comparisons of short form 36 questionnaire , NPRS scores and MMT scores.

When we talk about the alteration of movement is Sacroiliac joint with the application of pelvic belt we came across an experimental computer model study which was conducted

in Germany using a finite element method in the year 2014 on the topic of Pelvic Belt Effects on Sacroiliac Joint Ligaments: A Computational Approach to Understand Therapeutic Effects of Pelvic Belts which included only one female with age of 29 years showed that the pelvic belt has been shown to alter the motion around the SI joint when applied and it was evident in the study that pelvic belt increases the sacroiliac joint motion in sagittal axis but decreases the motion in transverse axis also the strain on the ligaments around sacroiliac joint was relieved which shows that application of pelvic belt around SI joint has proven to be beneficial in terms of decreasing pain ,discomfort and minimizing the risk of injury(Sichting et al., 2014)Whereas on the basis of the knowledge that we get from such articles , we used sacroiliac belt which has a stabilizing effect in patients with SIJD and its relation to quality of life , pain and muscle strength , although the current study has not checked the amount of alteration in mobility around SI joint but it has compared the effects of MET with and without the application of SI Belt in the patients suffering from low back pain having the source of pain in SI joint.

Where the studies have supported the use of MET as treatment option when treating patients with SIJD , there is a study conducted in 2015 in India which has shown some different results in this context , the study included 30 individuals who were symptomatic with SIJ pain between the ages of 20-55 years , Although the study included the administration of electrotherapy related equipment i.e. SWD (Short wave Diathermy) in both groups A and B , Group A received manipulation along with SWD and Group B received MET with SWD , and the results supported the use of manipulation over MET with more improvements of symptoms in patients receiving manipulation as compared to MET(Patel et al., 2015a). But the current study has not compared the MET with any other physiotherapy specialized technique or SWD, but it has compared the effectiveness of MET with Sacroiliac belt which has shown significant results in pain reduction and improvement of muscle strength in both the groups receiving MET with SI and MET without SI Belt. A study was published in the year 2002 in Rotterdam Netherlands on the laxity of sacroiliac joint with and without the application of pelvic belt which included only females aged 18-30 with mean age of 25.4 , mean height of 171 cm and mean weight of 66 kg were included in the study which concluded that the effectiveness of pelvic depends upon its position of the body where it is administered , the belt was proven to be more

effective when worn at the level ASIS (Anterior superior iliac spine) rather than using it on the level of symphysis , The current study did not intended to determine the specific level of improved performance of the pelvic belt but only its presence and absence with the application of MET in patients with SIJD and it was noted that quality of life , pain and muscle strength were increased in patients among within groups comparison but quality of life did not

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show significant result among between subjects comparison but significant improvement in muscle strength and pain reduction was noted.

7.1 : CONCLUSION(S)

The present study concluded that both the groups (Group A = MET with SI Belt) and (Group B= MET without SI Belt) showed significant difference in Quality of Life , Pain and Muscle strength , The study further highlighted that Between Groups Comparison showed more significant results regarding Quality of life , pain and muscle strength as compared to within groups comparison which showed non-significant result regarding quality of life but showed significant difference in pain reduction and muscle strength among individuals.

7.2 : RECOMMENDATION(S)

- Further new research is encouraged to be done in future using the same outcome measures but with different muscle groups e.g. abdominal oblique, levator ani and coccygeus group as this muscle could be affected as a result of Sacroiliac joint Dysfunction
- Future research should be done with longer follow-up to create more generalized results.
- More outcome measures should be added to check for more variables.

7.3 : LIMITATION(S)

- One of the limitations of the study was the small sample size; further studies should be done with large samples to generate more accurate results.
- Another limitation of this study was the tool to check for muscle strength i.e., Handheld Dynamometer, which is an expensive instrument with more accuracy than Manual Muscle Testing and it could not be used due to limited finances

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