

Effects of Active Release Technique on Hamstrings Flexibility in Patients having Chronic Low Back Pain

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Abstract: Background: Low back pain (LBP) is among the leading cause of occupational injury and disability in both developed and developing countries. Among all these factors the hamstring tightness was found to be one of the leading causes for development of LBP. Active Release Technique (ART) restores soft tissue structures that feel strained or inflexible to their original healthy condition. There are no studies done to find out the effect of ART on hamstrings flexibility and LBP. Hence there is a need for the study to find out the effectiveness of this technique on hamstrings flexibility in chronic LBP patients. METHODOLOGY: Ethics approval was obtained from the Institutional Review Board. 15 subjects were taken in the study. Measurement of the severity of pain by using VAS, degree of hamstrings tightness by active knee extension test and functional disability by modified Oswestry disability index was done. They all were given ART, isometric back exercises & hot pack to back. Results: The findings of the present study are 10 sessions of ART reduces the hamstrings tightness on right side ($t=2.560, p=0.023$), mean hamstrings tightness ($t=2.486, p=0.026$), pain at activity ($t=5.88, p<0.001$) & functional disability ($Z=-3.411, p<0.001$) Conclusion: Active Release Technique (ART) improves hamstrings flexibility and reduce LBP and disability over time.

Keywords: Chronic low back pain, Hamstrings flexibility, Active release technique

1. Introduction

Chronic low back pain (CLBP) is defined as back pain lasting more than 12 weeks [1]. A previous history of low back pain is often predictive of future back problems [2], and chronic cases represent a significant burden on the health care and compensation systems [3]. Low back pain is a significant public health problem in all industrial nations. It is associated with considerable disability, health problems and social cost [4].

There are several factors which are responsible for development of LBP. They include increased lumbar lordosis, reduced abdominal muscle length and strength, decreased back extensor muscle endurance, back extensor muscle flexibility, length of iliopsoas, hamstring muscle flexibility, body composition [5]-[8] etc. Controversies exist regarding association between various physical characteristics and the occurrence of LBP.

Nowadays there are many professions where prolonged sitting on chairs is essential like computer/ visual display unit users, bank clerks, accountants, stock exchange worker, industrial workers, architects, etc. Prolonged sitting in an inactive posture is a common feature among computer/visual display unit users as technology and its use is becoming more and more common [9].

In contextual concept of International Classification of Functioning (ICF) Model, both environmental and individual factors affect the development of low back pain. Lifestyle is a factor that could affect individual's health (WHO2001). Sedentary life style is associated with obesity as well as muscle shortening, which in turn is linked to chronic health problems [10]. Among all these factors the hamstring tightness was found to be one of the leading causes for development of LBP.

Leahy proposed a mechanism to explain increased tissue stiffness, or tension, called the "cumulative injury cycle". In this cycle, repetitive micro-injury in tight muscles leads to an increase in the friction and tension what is termed the "chronic cycle", or it leads to the "inflammation cycle" whereby a tear or crush injury ensues, followed by inflammation. Both of these cycles lead to the same result: an accumulation of adhesions and fibrosis within the tissue. This in turn increases the tightness of the tissue [11].

Hamstrings are the long and powerful group of muscles that span the back of the thigh [12]. As hamstrings muscles are the joining source between the lower back region and the posterior part of thigh, reduced hamstrings extensibility draws the pelvis into posterior rotation during normal daily postures. It develops alterations in the lumbar curve and changes the biomechanical line of pull of back and strains the back during usual day to day activity [13]. So thereby it causes compensatory movement patterns in the lumbar spine and subsequently increased stress on the lumbar spine and subsequently increased stress on spinal soft tissues and increased likelihood of injury to the spine [14]. Therefore, poor hamstring extensibility has been associated with thoracic kyphosis, spondylolysis, disc herniation, changes in lumbopelvic rhythm and low back pain [15].

Different stretching methods which are used to increase hamstrings flexibility are active stretching, passive stretching, ballistic stretching, static stretching, dynamic stretching, Muscle energy technique, Bowen technique, Dynamic soft tissue mobilization, massage therapy, walking exercise, bicycling, water therapy, active release technique (ART), and proprioceptive neuromuscular facilitation (PNF) [11],[15],[16].

ART is a type of treatment and management system that allows the practitioner to treat soft tissue injuries. The most

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common method of treatment is to initially feel for areas of soft tissue injury. Then, the tissue is taken from a shortened position to fully lengthened position with a specific hand contact on the soft tissue. This allows the contact to pass longitudinally along the soft tissue fibers and the lesion. The goal is to break up adhesions that may have formed from scarring within the soft tissue. In addition, ART also aims to restore soft tissue structures that feel strained or inflexible to their original healthy condition. The use of ART is becoming a commonality in the restoration of soft tissue injuries, especially in the world of competitive sports [11].

Although research and clinical experience has shown that treatment of hamstring flexibility is important, there is no widely acceptable form of treatment that is agreed upon to successfully improve flexibility of hamstrings which may indirectly affect the back region. Among the various stretching techniques ART is found to be effective treatment of choice for treatment of hamstrings flexibility [17],[18]. Besides this, there are no studies done to find out the effect of ART on hamstrings flexibility for patients having chronic low back pain and their effect on improvement of low back pain. Hence there is a need for the study to find out the effectiveness of this technique in improvement of hamstrings flexibility in chronic LBP patients.

2. Literature Survey

George JW et al (2006) [19] did a pilot study on the effects of active release technique on hamstring flexibility. There was a significant difference between the pre- and posttest groups. They concluded that a single ART treatment increased hamstring flexibility in a group of healthy, active male participants.

Kathy D et al (2007) [18] did a comparative study to find the effect of Active release technique (ART) and Proprioceptive neuromuscular facilitation (PNF) stretching to improve the hamstrings flexibility in asymptomatic individuals. Thus result of this investigation showed that both ART and PNF can significantly increase hamstrings flexibility and knee extension in asymptomatic participants.

Sarah B et al (2010) [20] did a study to measure the relationship between hamstring flexibility and pelvic rotation around the hip during forward bending in healthy individuals. They concluded that the hamstring muscles influence pelvic rotation during forward bending in healthy individuals and decreased flexibility of hamstrings was observed with limited rotation of pelvis.

Fritz JM et al (2001)[21] compared the Modified Oswestry low back pain disability questionnaire and the Quebec back pain disability scale. They concluded that the Modified Oswestry low back pain disability questionnaire showed higher level of test retest reliability and responsiveness compared with Quebec back pain disability index.

Norrissa CM et al (2005)[22] assessed inter-tester reliability of a self-monitored active knee extension test in the clinical setting. They concluded that the AKE test when used in conjunction with goniometry, accurate surface marking, and

manual monitoring of the test leg is a reliable measure of hamstring muscle length.

Boonstra AM et al (2008)[23] studied reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. The conclusion of the study was that the reliability and validity of the VAS for disability is moderate to good.

3. Methodology

Quasi Experimental Study was conducted with purposive sampling with random allocation using lottery method. Total 15 subjects were included in the study from department of physiotherapy of General hospital of Ahmedabad. 10 sessions of ART over a period of 6 months were given. Males and females, Age between 20 to 60 years, subjects having chronic low back pain (more than 3 months) of mild-moderate intensity and who are not involved in any flexibility exercise programme and having popliteal angle < 160 were included. Exclusion Criteria were, Medical history of injury to back, constant or persistent severe pain, Inflammatory conditions (rheumatoid arthritis, ankylosing spondylitis), Spinal infections (neuralgia, discitis, osteomyelitis, epidural abscess), hamstrings injury and strains, knee deformities and injuries, any impaired sensations and other neurological conditions, athletes, any previous surgery around the knee and hip, pregnancy, patients having radiating pain, venous thrombosis and arterial disease. Outcome measures were: Active Knee Extension Test, Modified Oswestry Disability Index (MODI), Visual Analogue Scale (VAS)

4. Procedure

Ethics approval was obtained from the Institutional Review Board. Patients with chronic low back pain with hamstrings tightness referred to physiotherapy department by orthopedic department of General Hospital were screened to find their suitability as per the inclusion and exclusion criteria. They were briefly stated about the nature of the study and intervention and written consent was taken from them. Demographic and baseline data were taken including history, occupation, duration of pain etc. Pain intensity was measured using visual analogue scale (VAS). Subjects were assessed for hamstring tightness using the active knee extension (AKE) test (popliteal angle). Functional disability was estimated by the Modified Oswestry Disability Index (MODI).

Each subjects were given Active Release Technique (ART) For that the patient was in a prone position on the treatment table with his feet hanging off the end of the table as shown in figure 1. The knee was then flexed to shorten the hamstrings. The therapist then evaluated the texture & tightness of the hamstrings by palpating and manually contacting the exterior skin to see where maximum tightness could be felt. The therapist then placed tension on the bellies of hamstrings longitudinally at a specific tension & asked the patient to extend his knee as per ART protocol. This cycle was repeated 5 more times on each patient [11]. The treatment was given for 10 sessions.



Figure 1: Active Release Technique

Associated with ART, the patients were also given isometric abdominal exercises, isometric extensor exercises and hot packs for low back region. Outcome measures were taken at the end of 10 sessions i.e after completion of the study duration which included VAS, MODI and Active knee extension test.

5. Result

Statistical analysis was done using SPSS version 16 and Microsoft excel 2007. Level of significance was kept at 5%. Within group analysis was done using outcome measures taken before the intervention and after 10 sessions of intervention. There were total 15 patients out of them 8 were females and 7 were males. Mean age of the patients were 41.33.

Table 1: Mean Active knee extension test scores pre & post treatment (Right, Left and Mean of right and left)

Outcome measures (Degrees)	Pre-treatment		Post-treatment		t-value	p-value
	Mean	SD	Mean	SD		
AKE (Rt)	141.51	6.70	145.21	8.22	2.560	0.023
AKE (Lt)	141.91	6.64	145.19	6.48	1.856	0.085
AKE(Mean)	141.71	6.14	145.20	7.07	2.486	0.026

Mean Active knee extension test (Rt,Lt and Mean) scores in degrees for pre and post intervention is shown in Table 1. For within group analysis paired t-test was used. For AKE (Rt) and AKE (Mean), $p < 0.05$. So statistically significant difference was found.

Table 2: Mean VAS scores pre & post treatment

Outcome measures	Pre-treatment		Post-treatment		t/Z-value	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
VAS (Rest)	2.57	2.31	1.70	1.89	Z=-2.371	0.18
VAS (Activity)	7.55	1.79	5.18	2.50	t=5.88	<0.001

Mean VAS (at rest and at activity) scores pre & post intervention is shown in Table 2. Within group analysis of difference in mean of pre and post was analysed using wilcoxon matched paired signed rank test. For VAS (Rest), $p > 0.05$ was not found to be statistically significant. But for

VAS (Activity), $p < 0.001$ was found to be statistically significant.

Table 3: MODI scores pre & post treatment

Outcome measures	Pre-treatment	Post-treatment	Z-value	p-value
	Median	Median		
MODI	33	23	-3.411	0.001

Within group analysis of difference in median scores of MODI was done using Wilcoxon matched paired signed rank test. $p = 0.001$ was found to be statistically significant.

6. Discussion

The present study was done to see the effect of Active release technique (ART) on hamstrings flexibility, pain and functional disability. Statistically significant improvement was found in mean hamstrings flexibility ($t = 2.486$, $p = 0.026$) from the baseline. This result is in accordance with the study by James WG et al(2006) [19]. The technique which was used by them differs from the present study as it involved ART treatment only to the right hamstrings muscle belly.

Vijay K et al (2014) [11] found that Active release technique group showed significant improvement in popliteal angle and sit and reach flexibility test than Mulligan Bent leg raise test post intervention. Jessica K et al (2011) [24] compared the effects of Active Release Technique and Graston on hamstring flexibility over a period of four weeks. Graston Technique reaches the scar tissue in a more efficient fashion and shows more consistent results than ART.

One of the causes for the development of the tissue tightness is the presence of adhesions and fibrosis within the tissue. The goal of ART, as with other soft tissue techniques is to remove these “adhesions” and thereby decreasing tissue tension, and thus stopping the cumulative injury cycle as the tissue is taken from a shortened position to a fully lengthened position while the contact hand holds tension longitudinally along the soft tissue fibers [11]. The effectiveness of this treatment method has been described in a variety of case reports and is utilized by many practitioners for the treatment of a variety of conditions involving soft tissue dysfunction[25]. However, as with any treatment method, effectiveness is subject to proper diagnosis as well as to anatomical and biomechanical considerations. It helps to improve flexibility and athletic performance, in addition to healing certain types of injuries more quickly. It removes the soft tissue adhesions by decreasing tissue tension and freeing the muscles to function more smoothly and efficiently. ART is used to restore uninhibited motion of soft tissues, release entrapped nerves, and restore optimal function of soft tissues[26].

By looking at the VAS Score, there is no statistically significant improvement in VAS at rest: $Z = -2.37$, $p = 0.18$ but significant improvement in VAS on activity, $t = 5.88$, $p < 0.001$ and MODI($Z = -3.411$, $p < 0.001$). To the author’s knowledge there are no studies which have demonstrated the effect of Active release technique in the chronic low back pain population. The result of the present study can be justified by looking at the association of hamstrings tightness and development of low back pain.

Diaz DA et al(2005)[27], Koley S et al in (2010)[8], Bellew et al (2010)[28], Esola et al (2006)[29] found that hamstrings tightness can be the cause for development of LBP. ART can effectively reduce the hamstrings tightness, which reduces the low back pain as well as functional disability.

According to Fritz & Irrgang[21], a difference of 6-13% point on the modified Oswestry represents a clinically meaningful change that exceeds the bounds of measurement error in subjects with CLBP. The present study observed > 9 % points for reduction in disability So there is also clinically meaningful improvement (CMI) in addition to being statistically significant.

7. Conclusion

Active Release Technique (ART) improves hamstrings Flexibility, reduce low back pain and there by also reduces the disability over time.

8. Future Scope

Further studies can be done with larger Population, by excluding the osteoarthritis knee patients and in particular age group subjects by taking long term follow-up to observe whether the effects are sustained for a longer period of time e.g. 3 months or 6 months. Further studies can be done with blinding and by using BMI as a criterion.

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