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Original Research Article

Efficacy of Kinesio-Taping on Pain, Range of Motion and Functional Disability in Chronic Mechanical Low Back Pain: A Randomized Clinical Trial

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ABSTRACT

Background and purpose: Chronic Mechanical low back pain is one of the most common health problems. Core stabilization exercise has an important role in Chronic low back pain treatment as well as prevention. Extensive literature review revealed little evidence on Kinesio taping with standardized exercise program and standardized exercise program alone for the management of chronic mechanical low back pain. So, the purpose of this study was to compare the effectiveness of Kinesio taping with standardized exercise program Vs standardized exercise program alone and find out the efficacy of Kinesio Taping in subjects with Chronic Mechanical Low Back Pain.

Study design: Randomised clinical trial.

Subjects and methods: Thirty (30) subjects with Chronic Mechanical low back pain were randomly assigned into two groups. Group –A (n=15, 14 Male, 1 Female) received Kinesio Taping (2 session/week for 4 weeks) with standardized exercise program (3sittings per week for 4 weeks) and Group-B (n=15, 9 Male, 6 Female) received standardized exercise program alone (3sittings per week for 4 weeks). Pain intensity was measured by Visual Analogue Scale (VAS), lumbar spine range of motion was evaluated by Modified Schober's test (MST) and Functional disability was evaluated by Oswestry Disability Index (ODI) at Baseline, after second week and after 4th week of intervention.

Results: Both groups showed statistical significant improvement after 4 weeks of intervention in respect to pain intensity, range of motion and functional disability. Group-A showed significant improvement than Group-B in respect to Pain intensity (p value <0.05) and functional disability (p value <0.05), however, there was insignificant changes found between the groups for lumbar spine range of motion (p value >0.05) after 4 weeks of treatment.

Conclusion: The results of this study suggested that Kinesio taping with standardized exercise has a significant effect in improving pain and function in subjects with Chronic Mechanical low back pain.

Keywords: Chronic Mechanical low back pain, Kinesio taping, Visual analogue scale, Oswestry disability index.

INTRODUCTION

Low back pain is an extremely common health problem and most of the subjects experience it at some point of their life. [1] It is the leading cause of activity limitation, work absenteeism and has a significant impact on subject's physical, psychological and social functioning. [2]

The yearly prevalence of low back pain ranges from 5% to as high as 65%, the lifetime prevalence can range up to 84% and the monthly prevalence has been placed between 35% and 37%. [3,4]

Nachemson (1976) defined low back pain as an acute, sub-acute or chronic episode, which is characterised either by a slowly or a suddenly occurring rather sharp pain with or without radiation over the buttocks or slightly down the leg, with concomitant restriction of motion, when subsiding to the chronic type, the pain will be a little less severe and continue for more than two months. 80-90% of low back pain is of mechanical origin and the source of the pain is the spine or its supporting structures. [5]

Mechanical low back pain (MLBP) varies with physical activity (e.g. prolonged sitting, forward bending) and with time. In most of the cases pain is usually cyclic in nature and it commences when subject start moving in any direction (e.g. pain on forward flexion and often also on returning to the erect position). Pain is often produced or aggravated by extension, side flexion, rotation, standing, walking, sitting and exercise in general. Generally Pain is located between T12 and gluteal fold and it becomes worse over the course of the day. Pain is relieved by a change of positions like lying down, especially in foetal position.

In India, approximately 35% of subjects suffer from chronic low back pain. [6] The transition from acute to chronic episode may occur due to various individual factors (Obesity, low educational level, high levels of pain and disability), psychosocial factors (Distress, depressive mood) and occupation related factors (Job dissatisfaction, heavy duty, job requiring repetitive lifting). [7,8]

Several treatment options available for subjects with chronic low back pain which include: educational programs, medication, electro-physical agents, manual therapy, exercises etc. [9,10] These treatments at best provide, a moderate effect; thus, more effective treatments are still needed for low back pain subjects. Conventional back care exercises decrease the pain and increase the strength of involved muscles, but results in frequent recurrence rates because of their short lasting effectiveness of up to one year and subjects are left out with some residual pain and disability. [11]

Core stability training is a form of training that challenges the stability of the spine while training motor activity patterns and postures that enhance optimal stability without unnecessarily overloading spine. [12] Optimal functioning of the Core muscle system is required to enhance protection against the stress of harmful forces that were commonly applied to spine during the functional movement. [13] Many studies available in the literature that has shown that core stability exercise is an important component of LBP management. [14]

Kinesio Taping is a relatively new rehabilitative technique that is being used to facilitate the body's natural healing process that provide support and stability, without providing restriction in their range of motion. [15,16] Taping technique developed by a Japanese chiropractor, Dr. Kenso Kase, in the 1970s has theorized that it has several functions such as (1) restoring correct muscle function by supporting weakened muscles, (2) reducing congestion by improving the flow of blood and lymphatic fluid, (3) decreasing pain by stimulating neurological system and (4) correcting misaligned joints by retrieving muscle spasm.

Extensive literature searches revealed limited evidence where Kinesio taping with standardized exercise has been compared with standardized exercise alone for management of chronic mechanical low back pain. Therefore, this study aimed to investigate the additional efficacy of Kinesio Taping along with standardized exercise program on pain, range of motion and functional disability in subjects with chronic mechanical low back pain.

METHODOLOGY

Prior approval of the Institutional Ethical Committee (IEC) for this study was taken. 48 subjects (Age between 20-40 years) with chronic low back pain intensity of 3-8 on Visual Analogue Scale [17] and duration of at least 3 months were approached with the proposal of the study.

Subjects were excluded (n=10) if they had spinal pathologies like fractures, tumour, inflammatory pathologies such as ankylosing spondylitis, nerve root compromise (disc herniation and spondylolisthesis with neurological compromise, spinal stenosis etc), prediagnosed cardio respiratory diseases, Red flag sign includes thoracic pain, previous history of carcinoma, steroid injection, previous history of spinal surgery, pregnancy, contraindications to the use of Kinesio Taping (allergy or intolerance), Rheumatoid arthritis, lower limb and spinal deformity, degenerative conditions of spine, psychiatric problem.

Subjects were excluded due to not meeting the inclusion criteria (n=6) and unable to attend for the procedure (n=4). Informed consent was taken from all subjects who agreed to participate and demographic data, baseline pain intensity after activity on VAS scale, lumbar flexion and extension range of motion measured by Modified Schober's test & ODI score was taken at pre intervention. Randomization of the subject was done using a computer number generator and the Subjects (n=38) were allocated in Group-A (n=19, Kinesio Taping + standardized Exercise), and Group-B (n=19, standardized exercise alone). Total eight subjects were dropped out from both groups within one week of intervention due to other health related issues (n=6) and personal reasons (n=2). Post intervention data was collected after two weeks of treatment and on the final day of intervention at 4th week.

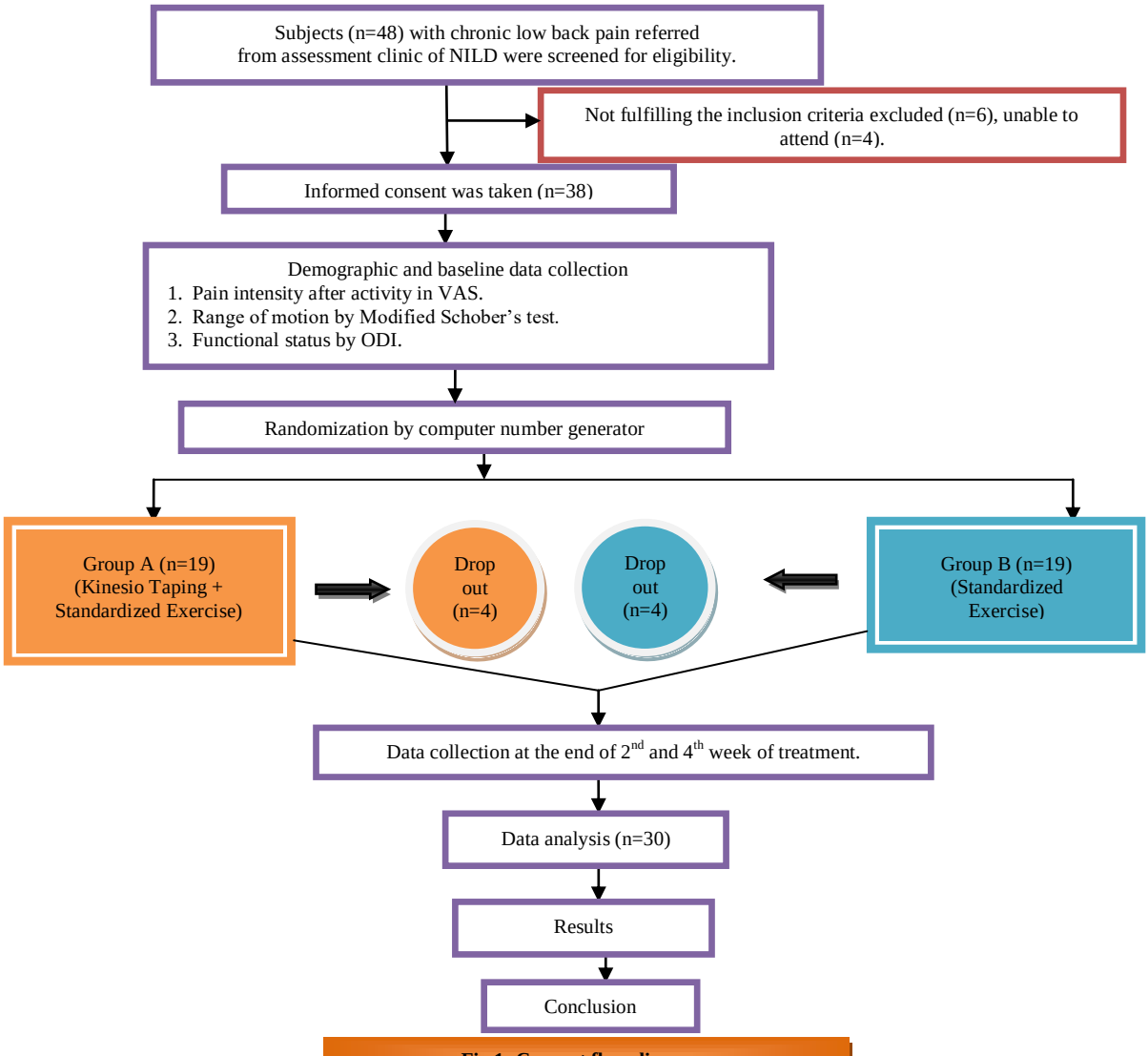

Fig 1: Consort flow diagram.

Interventions:

Subjects in the Group- A (n=19) were treated with two 'I' shaped Kinesio Tape which was applied over the erector spinae muscle (bilaterally) parallel to the spinous process of the lumbar vertebrae. Before the tape application treated area were cleaned and made oil and hair free. The distal base of the tape was applied 2 inches (5 cm) below the posterior superior iliac spine without any tension. Subsequently, for each 'I' strip application, the subjects were asked to move the lumbar spine into flexion to position the erector spinae muscle in a stretched position. Then the tape was applied over the skin with "paper-off" tension. Consequently, the tape application was finished by placing the proximal base of the 'I' strip approximately 2 inches (5 cm) above the T8 vertebra with 0% of tension and then the therapist rubbed the 'I' strip to initiate the glue adhesion. The tape was applied two times per week for four consecutive weeks (8 sessions). [15]

All Subjects in both the groups had received standardized exercises program under the physical therapist supervision which included core stabilization exercise and stretching exercises for back muscles, hamstring and iliopsoas muscles using standard methods. These exercises were performed 10 repetitions X 3 sets with 30 sec hold & 30 sec rest between each repetition. Further rest of 30 sec were given between the sets and it was performed 3 sessions per week for 4 weeks. At the same time all subjects in both the groups were explained about postural and back care advice.

Core stabilization exercises were performed in two stages. Stage-I exercises includes Drawing-in Manoeuvre (Abdominal Hollowing Exercise), abdominal "tuck in" in high sitting position, Bird dog exercise in quadruped position, bridging on the floor without leg extension. After 2 weeks once the subjects were mastered in transverse abdominis activation then progression was made to stage-2 exercises which includes abdominal "tuck in" in quadruped position, abdominal crunches on floor (hands behind head), back bridging on swiss ball without leg rise, wall squat with swiss ball. All these exercises were performed 10 repetitions per set X 3 sets per session X 3 sessions per weeks. Each static contraction was hold for 10 sec (using 30-40 % of maximal voluntary contraction).

DATA ANALYSIS

R programming version 3.2.5 and Microsoft Excel 2010 was used for analysis of the gathered data. Baseline and demographic data of the groups were analysed using "Independent sample t test". ANOVA for repeated measures was used to compare within group VAS, MST, and ODI at three different time point of the study. "Independent sample t test" was used to analyse the between group variables for VAS, MST, ODI. The p value was set at <0.05.

RESULTS

Data were analysed for thirty subjects (n=30) participated in this study. The mean age of subjects were 31.66 (±6.00) years in Group–A (n=15) and 32.33 (±6.06) in Group–B (n=15). Independent sample t test analysis revealed no significant between groups difference for demographic and baseline data for the outcome measures including VAS score, MST and ODI score (Table-1).

TABLE -1: DEMOGRAPHIC AND BASELINE DATA.

	Group-A (n=15) (Mean, SD)	Group-B (n=15) (Mean, SD)	Independent t test	
			t-value	**p value**
Age	31.66± 6.00	32.33± 6.06	-0.3024	0.7646
Male	14	09		
Female	01	06		
VAS_0	6.18 ±1.17	6.12 ±1.04	0.1478	0.8836
$M_{ST}(F)_0$	5.43±0.72	6.39±0.91	-3.1972	0.0035
$M_{ST}(EX)_0$	1.81±0.43	1.85±0.48	-0.2106	0.8348
ODI_0	34.66±6.35	34.00±4.14	0.3404	0.736

TABLE - 02: WITHIN GROUP CHANGES IN OUTCOME VARIABLES.

GROUP	Variables	Mean, SD	Wilks' lambda Value	p-Value
Group- A	VAS_0 - VAS_1	6.18 ±1.17 - 4.02±1.57	0.080	0.000
	VAS_1 - VAS_2	4.02±1.57 - 2.23 ±1.37	0.080	0.000
	VAS_0 - VAS_2	6.18 ±1.17 - 2.23 ±1.37	0.080	0.000
	$M_{ST}(F)_0$ to $M_{ST}(F)_1$	5.43±0.72 to 6.44±0.74	0.076	0.000
	$M_{ST}(EX)_0$ to $M_{ST}(EX)_1$	1.81±0.43 to 1.96±0.35	0.330	0.001
	$M_{ST}(F)_1$ to $M_{ST}(F)_2$	6.44±0.74 to 7.08±0.82	0.076	0.000
	$M_{ST}(EX)_1$ to $M_{ST}(EX)_2$	1.96±0.35 to 2.20±0.37	0.330	0.001
	$M_{ST}(F)_0$ to $M_{ST}(F)_2$	5.43±0.72 to 7.08±0.82	0.076	0.000
	$M_{ST}(EX)_0$ to $M_{ST}(EX)_2$	1.81±0.43 to 2.20±0.37	0.330	0.001
	ODI_0 - ODI_1	34.66±6.35-24.53±7.72	0.078	0.000
	ODI_1 - ODI_2	24.53±7.72-13.46±6.06	0.078	0.000
	ODI_0 - ODI_2	34.66±6.35-13.46±6.06	0.078	0.000
Group- B	VAS_0 - VAS_1	6.12 ±1.04 - 5.40±1.28	0.377	0.002
	VAS_1 - VAS_2	5.40±1.28 - 4.90 ±1.49	0.377	0.002
	VAS_0 - VAS_2	6.12 ±1.04 - 4.90 ±1.49	0.377	0.002
	$M_{ST}(F)_0$ to $M_{ST}(F)_1$	6.39±0.91 to 6.74±0.78	0.346	0.001
	$M_{ST}(EX)_0$ to $M_{ST}(EX)_1$	1.85±0.48 to 2.02±0.45	0.389	0.002
	$M_{ST}(F)_1$ to $M_{ST}(F)_2$	6.74±0.78 to 7.17±0.68	0.346	0.001
	$M_{ST}(EX)_1$ to $M_{ST}(EX)_2$	2.02±0.45 to 2.16±0.41	0.389	0.002
	$M_{ST}(F)_0$ to $M_{ST}(F)_2$	6.39±0.91 to 7.17±0.68	0.346	0.001
	$M_{ST}(EX)_0$ to $M_{ST}(EX)_2$	1.85±0.48 to 2.16±0.41	0.389	0.002
	ODI_0 - ODI_1	34.00±4.14-30.80±3.76	0.221	0.000
	ODI_1 - ODI_2	30.80±3.76-26.26±5.79	0.221	0.000
	ODI_0 - ODI_2	34.00±4.14-26.26±5.79	0.221	0.000

As can be seen from repeated measure ANOVA analysis a significant difference exist among both groups at 2nd week post and 4th week post intervention for all outcome variables including mean value of VAS, MST and ODI score at a p-value less than 0.05 (Table -2).

TABLE-03: Between group comparisons of outcome variables

Variables	Group-A (Mean, SD)	Group-B (Mean, SD)	t-values	p-value
VAS_0	6.18 ±1.17	6.12 ±1.04	0.1478	0.8836
VAS_1	4.02± 1.57	5.40± 1.28	-2.638	0.0137
VAS_2	2.23 ±1.37	4.90± 1.49	-5.0991	0.00002
$M_{ST}(F)_0$	5.43±0.72	6.39±0.91	-3.1972	0.0035
$M_{ST}(Ex)_0$	1.81±0.43	1.85±0.48	-0.2106	0.8348
$M_{ST}(F)_1$	6.44±0.74	6.74±0.78	-1.0741	0.292
$M_{ST}(EX)_1$	1.96±0.35	2.02±0.45	-0.4084	0.6863
$M_{ST}(F)_2$	7.08± 0.82	7.17±0.68	-0.3435	0.7338
$M_{ST}(EX)_2$	2.20±0.37	2.16±0.41	0.2609	0.7961
ODI_0	34.66±6.35	34±4.14	0.3404	0.736
ODI_1	24.53±7.72	30.80±3.76	-2.824	0.01
ODI_2	13.46±6.06	26.26±5.79	-5.905	0.00

As can also be seen from the result, no significant difference exist among Group-A and Group-B at baseline, but a significant difference exist among Group A and B on 2nd week post and 4th week post of VAS and ODI score at a p-value less than 0.05. An insignificant difference exist between Group-A and Group-B on 2nd week post and 4th week post for MST score with a p-value more than 0.05

DISCUSSION

The present study investigated a homogenous subject group using specific inclusion criteria and found significant difference in VAS and ODI score in Group-A subjects who received Kinesio Taping with standardized exercises as compared with Group- B subjects who received standardized exercises only. Significant changes was noted between the groups in VAS score (pain intensity) and ODI score from second week onward of the study, however insignificant difference was noticed between the groups in lumbar flexion and extension range as measured by MST at second and fourth week post intervention.

The result of this study indicates that Group-A subjects has better improvement in pain perception as compared to Group-B subjects and this improvement was statistically significant. Exact mechanism by which KT works on musculoskeletal pain is not yet clear. Mcglone F (2010) hypothesized that sensory modalities operate within interconnecting, intermodal and cross modal network. Lumpkin EA and Denda M (2007) suggested that keratinocytes may represent the non neuronal primary transducer of mechanical stimuli probably through signal transduction

cascade mechanisms such as intracellular Ca^{2+} fluxes to evoke a response in adjacent C-fibres. [18,19] Kenzo Kase (2003) suggested that application of KT alleviates pain, facilitates lymphatic drainage by microscopically lifting the skin. KT creates a convolution in the skin that increases interstitial space. The results are that pressure and irritation are gradually taken off the neural and sensory receptors that help to alleviate pain. Pressure on the lymphatic system is also taken off so it allows draining more freely. [20] Another possible mechanism suggested by Kase et al (2003) that KT induce these changes which may be due to neural feedback received by the subjects, which may improve their ability to reduce the mechanical irritation of soft tissues when moving the lumbar spine. [21] Application of KT for 4 weeks in situ gave the subjects a greater awareness of the low back while moving, thus preventing movements that were detrimental to the healing of the affected lumbar tissues, it also enhance a greater confidence in the subjects to remain active despite their pain. [22] The application of kinesio tape is also theorized to stimulate cutaneous mechanoreceptors. [23] Cutaneous mechanoreceptors activate nerve impulses when mechanical loads create deformation. The activation of cutaneous mechanoreceptors by an adequate stimulus causes local depolarisation that triggers nerve impulses along the afferent fibre travelling toward the central nervous system. [24] The application of KT may apply pressure to the skin or stretch the skin and this external load may stimulate cutaneous mechanoreceptors causing physiological changes in the taped area. So it can be concluded from previous literature that KT might have worked in the same way to reduce pain as theorized by several authors.

Between group analysis revealed statistical insignificant difference between the groups for lumbar spine Flexion and Extension range of motion. Literature review suggests that Free-ending unmyelinated nerve fibres are abundant around joint capsules, ligaments and the outer parts of the intra articular menisci. They mediate pain when a joint is strained and operate in excitatory reflex to protect the capsule. Kinesio Tape can improve joint function by stimulating the proprioceptors within the joint by application over the ligaments and biomechanically supporting the joint. The proprioceptors in the ligaments and joint capsules provide information to the nervous system that allows the musculoskeletal system to provide the appropriate perception of support and movement to the injured joint and provide feedback into the tissues joints they heal. In the present study no added advantage of KT for improving ROM was found. Stimulation of the GTO by direct pressure has been well documented by Rood (1950) to inhibit muscle over activation. Research has shown that the GTO is responsible for controlling the muscle spindle activity throughout movement. It modulates and modifies tension of the muscle in direct responses from feedback about the antagonist muscle to create controlled coordinated motion. It is thought that the skilled application of KT can immediately influence muscle balance and contraction. Finding of the present study revealed that this effect is not strong enough to improve ROM of lumbar spine in CMLBP subjects. [20]

Pain is the main factor that leads to disability in subjects with CLBP. Rationale behind improvement in disability might be due to ease in pain that leads to less suffering in daily activities i,e sitting, standing, lifting heavy weight. As the subject's pain decreased it leads to an improvement in ODI scores. Castro-Sanchez et al (2012) observed that individuals with chronic non-specific low back pain experienced statistically significant improvements immediately after the application of Kinesio taping in disability, pain perception. They suggested that KT provide greater awareness of the low back while moving, thus preventing movements that were detrimental to the

healing of the affected lumbar tissues. It also enhances a greater confidence in the subjects to remain active despite their pain. [22] Findings of the present study was also agreed with that of AlBahel F et al. (2014) who hypothesized that the reduction of VAS and ODI score was thought to occur due to lifting of skin because of the flexibility of the tape, creating a wider space between the skin and the muscle, that leads to improvement of blood circulation and drainage of lymphatic fluids in the taped area, thereby dramatically decreasing pain and functional disability. The improvement of functional disability in the present study following KT application in conjunction with standardized exercise may be due to decrease in pain and re-appearance of flexion-relaxation phenomenon which may result in normalization of lumbar muscle function by providing correct sensory feedback, resulting in decrease in fear of movement and thus improving lumbar muscle function. [25,26]

According to Panjabi's hypotheses core stabilization exercises have positive effects over chronic low back pain. In this study we used core stabilization exercise for subjects with CMLBP to strengthen the deep spinal muscles that enhance trunk stabilization which reduce pressure on the lumbar spine so it leads to back pain reduction. [27] Improvement in pain perception could be as a result of re establishment of the normal control of the deep spinal muscles that reducing the activity of the more superficial muscles. [28] Wells et al (2015) suggested that core stabilization exercise has an ability to mobilize and stabilize the body, it activate specific muscles in a functional sequence at controlled speed thus emphasize quality, precision and control of movement. [29] Park and Kim (2012) suggested that increase in muscle strength and balance in lumbar spine leads to relief of pain could be achieved by core stabilizing exercise. [30]

CONCLUSION

The result of this study showed that Kinesio taping have an added advantage in improving pain, disability in chronic mechanical low back pain from second week onwards . However KT does not give any advantage in improving ROM.

LIMITATIONS AND SUGGESTIONS

This single centre study was conducted with a small sample size, without any follow up period. Only the assessor was blinded and no absolute control group was taken. Future double blind multicentre studies may be conducted with more number of subjects and long follow up period to find out long term efficacy.

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