

Effect of Primal Reflex Release Technique on Pain Pressure Threshold and Ankle Dorsiflexion in Subjects with Plantar Fasciitis - A Single Blind Randomised Controlled Trial

Anila Peter Thekkudan^{1*}; Anumol C²; Remya N³; Manju Unnikrishnan⁴;
Chinchu Alwin⁵; Rejimol Jos Pulicken⁶; Rakhi Balagopal⁷;
Jisha Thampi⁸; Reeba Roy⁹

¹Postgraduate (Musculoskeletal and Sports), Department of Physiotherapy,
Little Flower Institute of Medical Science and Research, Angamaly, Kerala

²Assistant Professor, Department of Physiotherapy,
Little Flower Institute of Medical Science and Research, Angamaly, Kerala

³Professor and HOD, Department of Physiotherapy,
Little Flower Institute of Medical Science and Research, Angamaly, Kerala

⁴Professor, Department of Physiotherapy,
Little Flower Institute of Medical Science and Research, Angamaly, Kerala

^{5,6}Associate Professor, Department of Physiotherapy,
Little Flower Institute of Medical Science and Research, Angamaly, Kerala

^{7,8,9}Assistant Professor, Department of Physiotherapy,
Little Flower Institute of Medical Science and Research, Angamaly, Kerala

Corresponding Author: Anila Peter Thekkudan^{1*}

Publication Date: 2025/10/28

Abstract:

➤ *Background*

Plantar fasciitis is the common cause for heel pain affecting roughly 10% of the population, characterized by progressive pain with weight bearing and stiffness at ankle. Primal reflex release technique is a manual-therapy approach for musculoskeletal pain relief which produces an immediate effect and was proven effective over 80% of subjects. Therefore, this study is trying to find out the effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis.

➤ *Objective*

To determine the effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis.

➤ *Methods*

32 subjects diagnosed with plantar fasciitis were randomly allocated into 2 groups, conventional treatment group and interventional treatment group. Conventional treatment group received conventional treatment and interventional treatment group received primal reflex release technique along with conventional treatment. Treatment was given for 4 consecutive days. Pretreatment scores of pain pressure threshold and weight bearing lunge test were taken on the first day before treatment and post treatment scores were taken immediately after the treatment and on the fourth day after treatment. Home exercises were instructed and follow up scores were taken after two months.

➤ *Results and Discussion*

The post-test values of pain pressure threshold and weight bearing lunge test were analysed using independent t test and One way Analysis of variance. There were statistically significant improvements in pain pressure threshold and ankle dorsiflexion in interventional treatment group than conventional treatment group ($p < 0.05$). Primal reflex release technique aimed at down regulation of the nerves innervating the plantar fascia which helped in addressing the symptoms of up-regulation of autonomic nervous system and it produced an immediate and long-lasting effect.

➤ *Conclusion*

Primal reflex release technique is effective in improving pain pressure threshold and ankle dorsi flexion range of motion in subjects with plantar fasciitis.

Keywords: *Primal Reflex Release Technique; Pain Pressure Threshold; Ankle Dorsiflexion; Plantar Fasciitis.*

How to Cite: Anila Peter Thekkudan; Anumol C; Remya N; Manju Unnikrishnan; Chinchu Alwin; Rejimol Jos Pulicken; Rakhi Balagopal; Jisha Thampi; Reeba Roy (2025) Effect of Primal Reflex Release Technique on Pain Pressure Threshold and Ankle Dorsiflexion in Subjects with Plantar Fasciitis - A Single Blind Randomised Controlled Trial. *International Journal of Innovative Science and Research Technology*, 10(10), 1474-1484. <https://doi.org/10.38124/ijisrt/25oct771>

I. INTRODUCTION

Plantar fasciitis is defined as pain arising from the insertion of the plantar fascia, with or without a heel spur. It is often characterized by progressive pain with weight bearing, especially the first steps in the morning and stiffness at ankle.¹

Plantar fasciitis is the common cause for heel pain affecting roughly 10% of the population. It was found that approximately 1 in 10 people will be diagnosed with plantar fasciitis during their life time, with women aged 40-60 years most commonly affected. It is affected in people with sedentary lifestyle and athletic population due to chronic overload from lifestyle or exercises. Overuse due to prolonged weightbearing or unaccustomed activity and obesity have all been implicated as contributing factors for plantar fasciitis.^{2,3}

Ankle dorsiflexion limitation of at least 5 degrees was observed in 78% of patients with painful heel.⁴ 90% running athletes with plantar fasciitis had a lack of 5° dorsiflexion or more compared to the unaffected side.⁵ Calf muscle tightness and reduced ankle dorsiflexion are related to a number of lower limb disorders including Achilles tendinitis and plantar fasciitis.¹ A number of conservative treatments such as non-steroidal anti-inflammatory drugs, physical therapy, corticosteroid injections, and orthoses are available, but only few of these treatments provide an immediate and lingering effect.^{2,6}

Primal Reflex Release Technique (PRRT) is a manual-therapy approach for musculoskeletal pain relief which produces an immediate effect and proven effective over 80% of subjects.^{7,8} Therefore, this study is trying to find out the effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis.

II. MATERIALS AND METHODS

A single blinded randomized control trial was conducted with simple random sampling technique for a duration of six months to determine the effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis. After obtaining clearance from the Scientific Committee and Institutional Review Board, a total of 32 subjects with plantar fasciitis were selected according to the inclusion criteria. They were recruited for the study after obtaining informed consent and allocated into two groups, conventional treatment group and interventional treatment group. Conventional treatment group received conventional treatment and interventional treatment group received primal reflex release along with conventional treatment for 4 consecutive days. Pretreatment scores of pain pressure threshold using algometer and ankle dorsi flexion using weight bearing lunge test was taken on the first day and post treatment scores of pain pressure threshold and ankle dorsi flexion were taken immediately after the treatment and on the fourth day after treatment. Home exercises were instructed and follow up scores were taken after two months. Comparison of the post treatment scores of pain pressure threshold and ankle dorsi flexion were done between conventional treatment group and interventional treatment group.

➤ *Procedure*

Subjects with plantar fasciitis were selected and allocated into two groups, conventional treatment group and interventional treatment group. Conventional treatment group received conventional treatment and interventional treatment group received primal reflex release along with conventional treatment for 4 consecutive days. Pretreatment scores of pain pressure threshold using algometer and ankle dorsi flexion range of motion using weight bearing lunge test was taken on the first day and post treatment scores of pain pressure threshold and ankle dorsi flexion were taken immediately after the treatment and on the fourth day after treatment. Home exercises were instructed and follow up scores were taken after two months.

III. RESULTS

Leven's test was used for equality of variance. The post-test values of pain pressure threshold and weight bearing lunge test were analysed using independent t test and one way ANOVA.

In post pain pressure threshold scores on day one analysis, the table value is 1.69 and the calculated t value is 3.81 which is greater than table value ($p < 0.05$, DoF=30). So, rejecting the null hypothesis H_{01} and accepting the alternative hypothesis H_{A1} .

In post pain pressure threshold scores on day four analysis, the table value is 1.69 and the calculated t value is 4.38 which is greater than table value ($p < 0.05$, DoF=30). So, rejecting the null hypothesis H_{02} and accepting the alternative hypothesis H_{A2} .

In post pain pressure threshold scores on day sixty analysis, the table value is 1.69 and the calculated t value is 4.93 which is greater than table value ($p < 0.05$, DoF=30). So, rejecting the null hypothesis H_{03} and accepting the alternative hypothesis H_{A3} .

In post weightbearing lunge test scores on day one analysis, the table value is 1.69 and the calculated t value is 4.81 which is greater than table value ($p < 0.05$, DoF=30). So, rejecting the null hypothesis H_{04} and accepting the alternative hypothesis H_{A4} .

In post weightbearing lunge test scores on day four analysis, the table value is 1.69 and the calculated t value is 4.92 which is greater than table value ($p < 0.05$, DoF=30). So, rejecting the null hypothesis H_{05} and accepting the alternative hypothesis H_{A5} .

In post weightbearing lunge test score on long term that is on day sixty analysis, The table value is 1.69 and the calculated t value is 5.13 which is greater than table value ($p < 0.05$, DoF=30). So, rejecting the null hypothesis H_{06} and accepting the alternative hypothesis H_{A6} .

Thus, from the obtained results, it can be inferred that there is significant effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis.

Table 1 Descriptive Statistics of Conventional Treatment Group

	Mean	Median	Std. Deviation	Variance
PRE PAIN	1.55	1.50	0.17	0.03
PRE WBLT	6.12	6.10	0.97	0.95
POST PAIN (DAY 1)	1.90	1.70	0.60	0.36
POST WBLT (DAY 1)	6.60	6.70	0.96	0.92
POST PAIN (DAY 4)	2.20	2.10	0.77	0.59
POST WBLT (DAY 4)	7.30	7.00	1.20	1.20
POST PAIN (DAY 60)	2.20	2.10	0.73	0.53
POST WBLT (DAY 60)	7.30	7.00	1.30	1.20

Table 2 Descriptive Statistics of Interventional Treatment Group

	Mean	Median	Std. Deviation	Variance
PRE PAIN	1.50	1.50	0.24	0.06
PRE WBLT	6.50	6.80	1.19	1.40
POST PAIN (DAY 1)	2.80	2.80	3.80	0.69
POST WBLT (DAY 1)	8.10	8.00	0.74	0.55
POST PAIN (DAY 4)	3.30	3.20	0.69	0.48
POST WBLT (DAY 4)	8.80	8.90	0.28	0.08
POST PAIN (DAY 60)	3.40	3.30	0.68	0.46
POST WBLT (DAY 60)	8.80	8.90	0.28	0.08

Table 3 Distribution of Age in Conventional Treatment Group and Interventional Treatment Group

AGE	CONVENTIONAL TREATMENT GROUP		INTERVENTIONAL TREATMENT GROUP	
	Frequency	Percentage	Frequency	Percentage
40-50	9	56.25%	10	62.50%
51-60	7	43.75%	6	37.50%
TOTAL	16	100%	16	100%

CONVENTIONAL TREATMENT GROUP -AGE

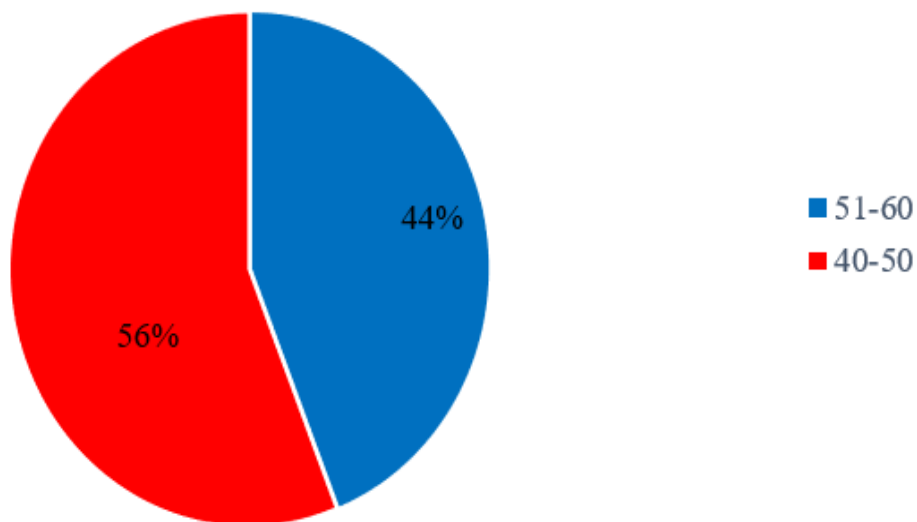


Fig 1 Demographical Representation of Age Distribution in Conventional Treatment Group

INTERVENTIONAL TREATMENT GROUP AGE

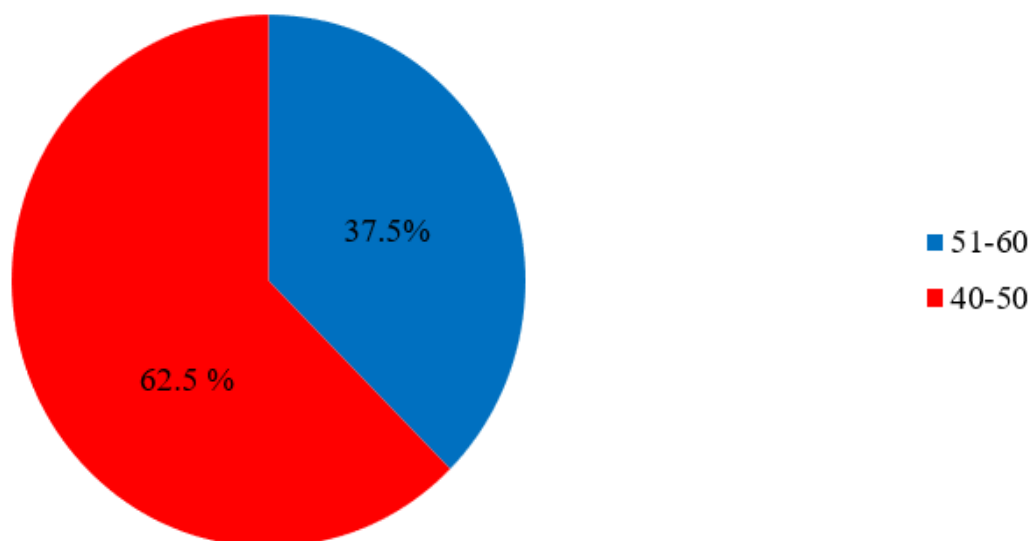


Fig 2 Demographic Representation of Age Distribution in Interventional Treatment Group

Table 4 Distribution of Gender in Conventional Treatment Group and Interventional Treatment Group

Gender	Conventional Treatment Group		Interventional Treatment Group	
	Frequency	Percentage	Frequency	Percentage
Male	4	25%	5	31%
Female	12	75%	11	69%
Total	16	100%	16	100%

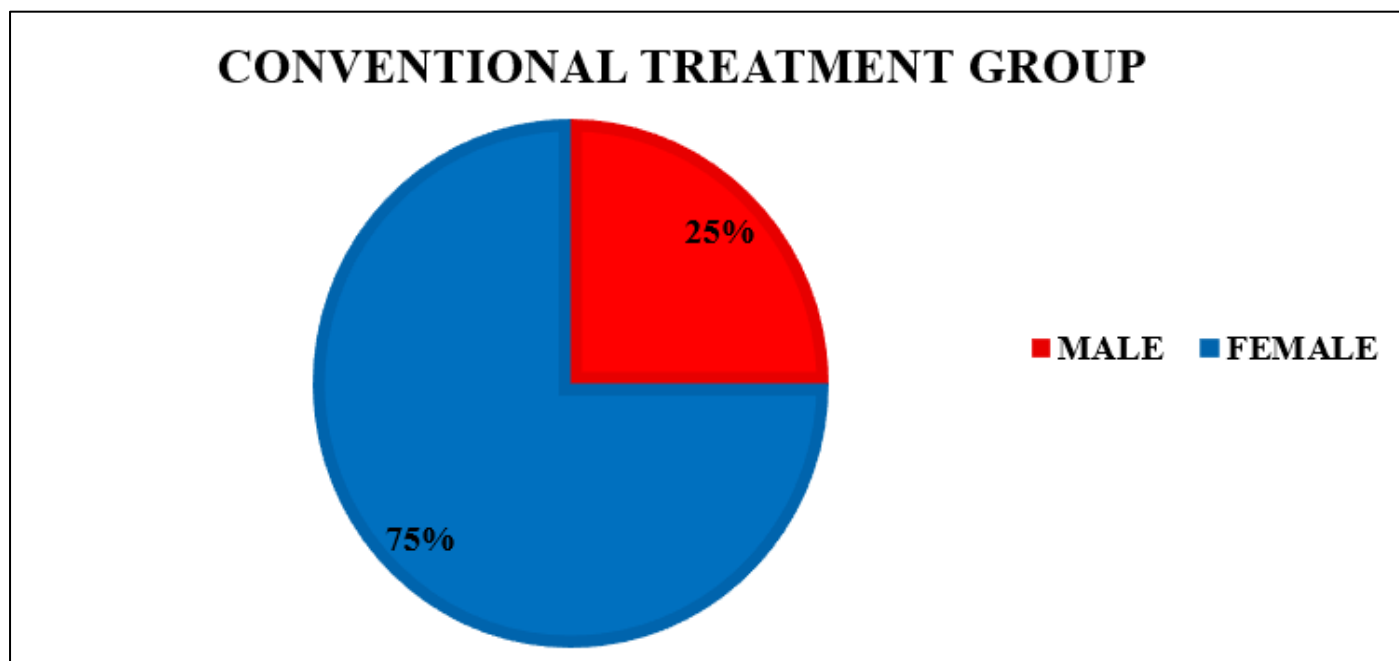


Fig 3 Demographical Representation of Gender in Conventional Treatment Group

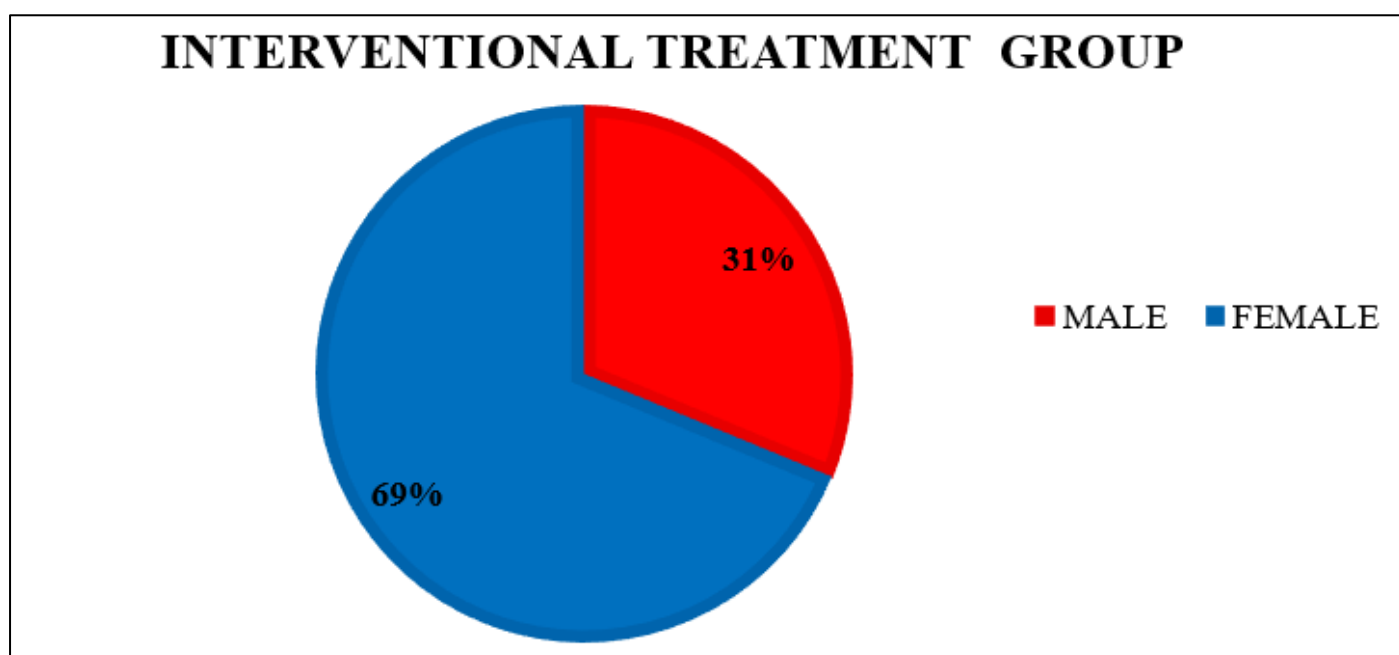
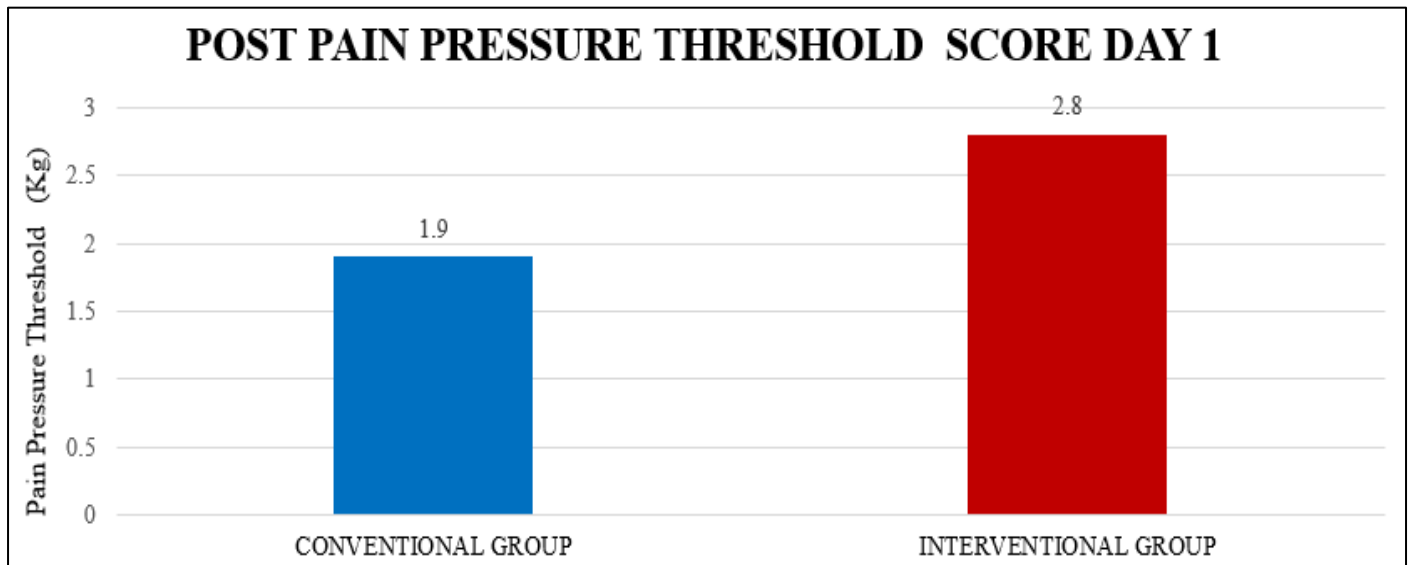


Fig 4 Demographical Representation of Gender in Interventional Treatment Group

Table 5 Independent T Test of Post Pain Score on First Day, Comparing the Variables Between Conventional Treatment Group and Interventional Treatment Group

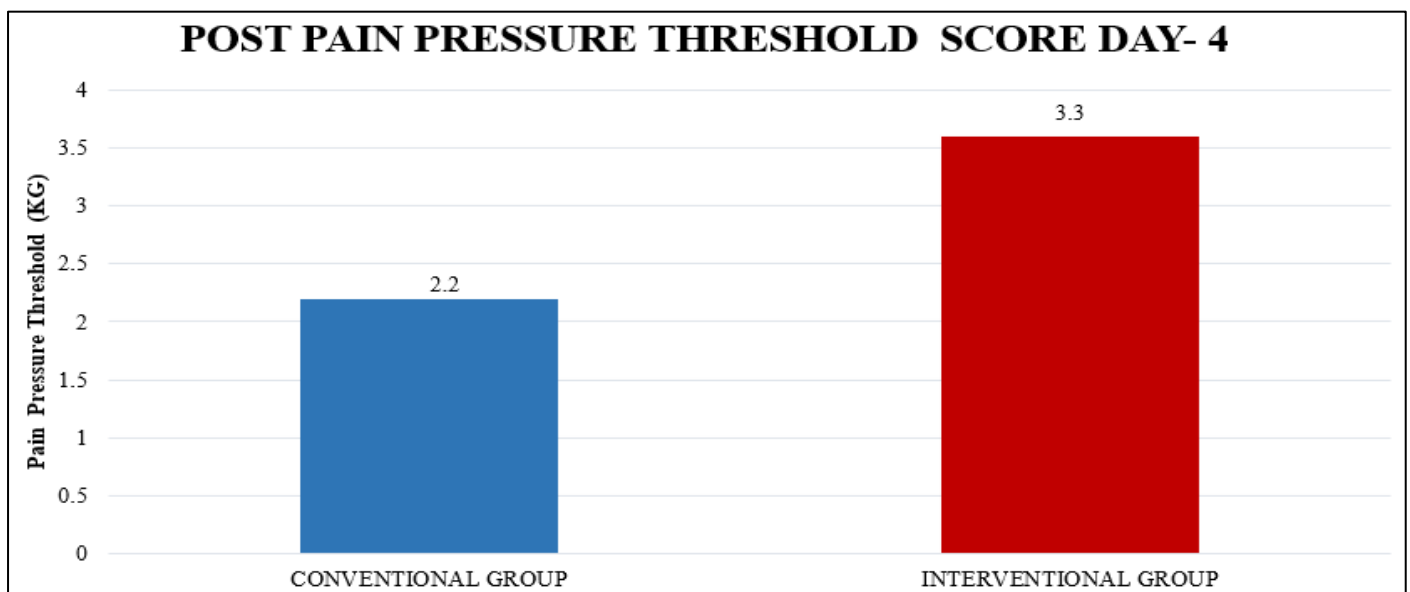
	Levene's Test for Equality of variance		t- test for equality of means		
	F	Sig	T	Df	Sig (2- tail) (p value)
Post Pain score (Day 1) Equal variances Assumed	0.04	0.83	3.81	30	0.001



Graph 1 Graphical Representation of Post Pain Pressure Threshold Score on Day One Between Conventional Treatment Group and Interventional Treatment Group

Table 6 Independent T Test of Post Pain Score on Fourth Day, Comparing the Variables Between Conventional Treatment Group and Interventional Treatment Group

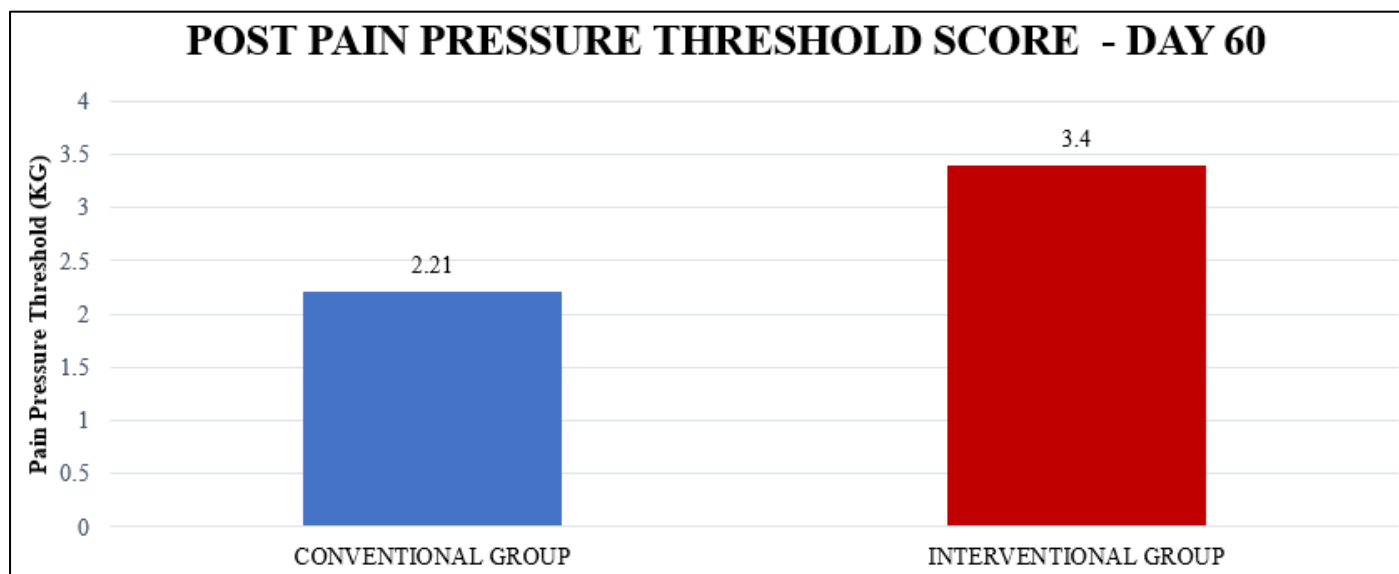
	Levene's Test for Equality of variance		t- test for equality of means		
	F	Sig	T	Df	Sig (2- tail) (p value)
Post Pain score (Day 4) Equal variances Assumed	0.89	0.35	4.38	30	0.00



Graph 2 Graphical Representation of Post Pain Pressure Threshold Score on Fourth Day Between Conventional Treatment Group and Interventional Treatment Group

Table 7 Independent T Test of Long-Term Post Pain Pressure Threshold Score (60th Day) Comparing the Variables Between Conventional Treatment Group and Interventional Treatment Group.

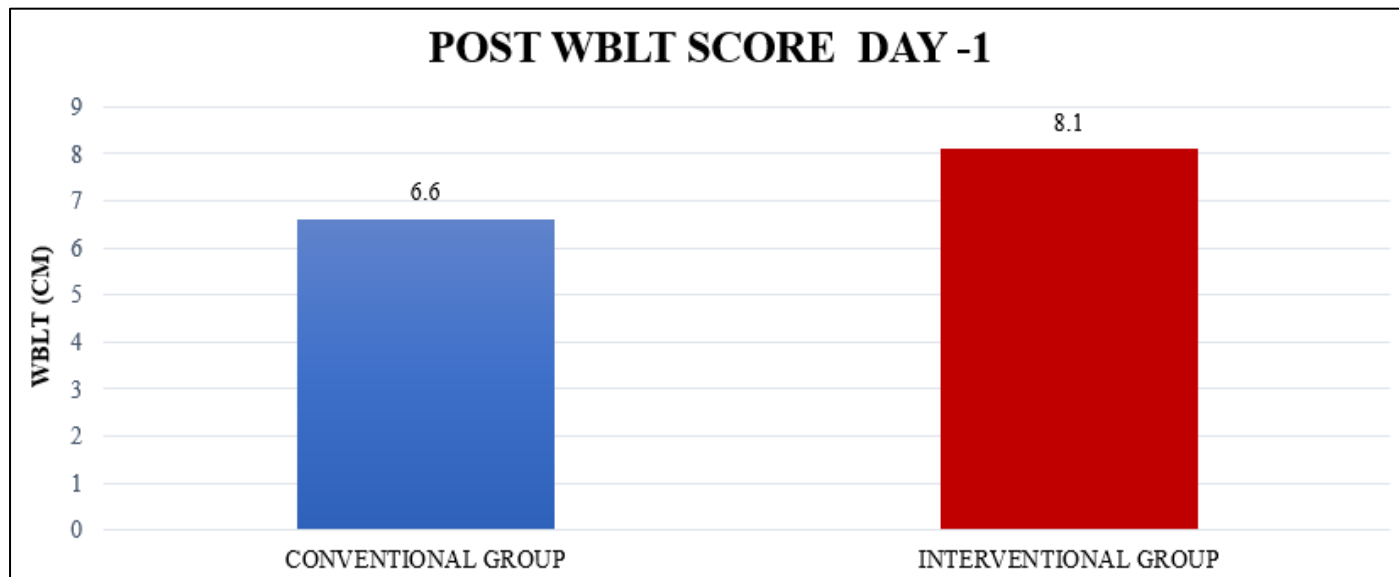
	Levene's Test for Equality of variance		t- test for equality of means		
	F	Sig	T	Df	Sig (2- tail) (p value)
Post Pain Score (Day 60) Equal variances Assumed	0.24	0.62	4.93	30	0.00



Graph 3 Graphical Representation of Long-Term Post Pain Pressure Threshold Score Between Conventional Treatment Group and Interventional Treatment Group

Table 8 Independent T Test of Post Weight Bearing Lunge Test Score on Day One Comparing the Variables Between Conventional Treatment Group and Interventional Treatment Group

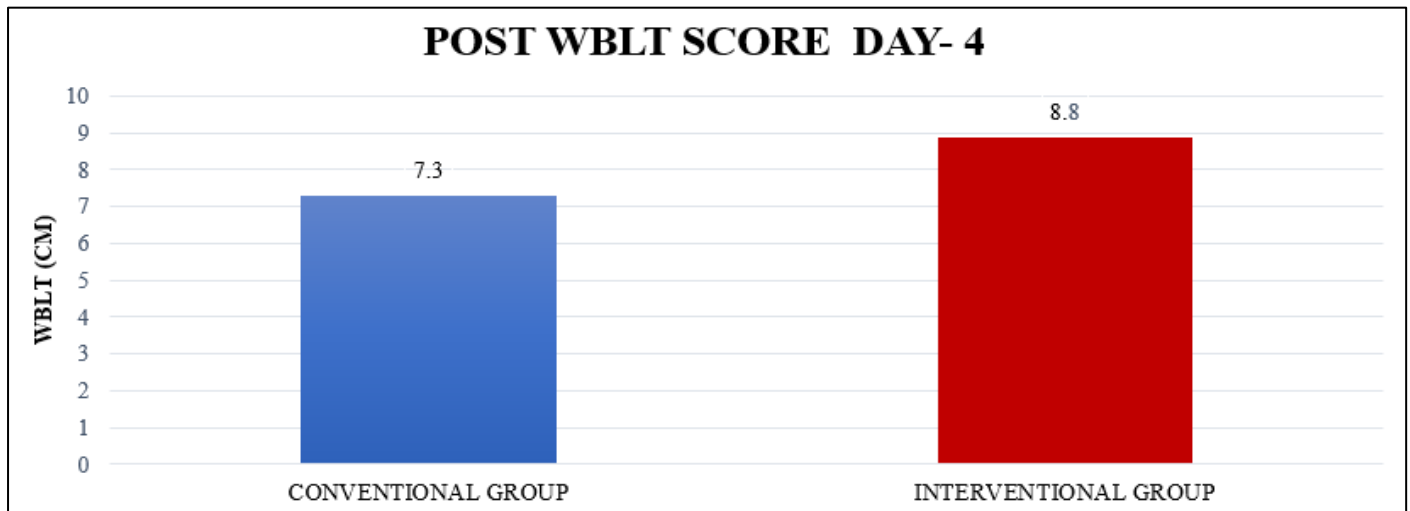
	Levene's Test for Equality of variance		t- test for equality of means		
	F	Sig	T	Df	Sig (2- tail) (p value)
Post WBLT Score (Day 1) Equal variances Assumed	0.98	0.32	4.81	30	0.00



Graph 4 Graphical Representation of Post Weight Bearing Lunge Test Score on Day One Between Conventional Treatment Group and Interventional Treatment Group

Table 9 Independent T Test of Post Weight Bearing Lunge Test Score on 4th Day Comparing the Variables Between Conventional Treatment Group and Interventional Treatment Group.

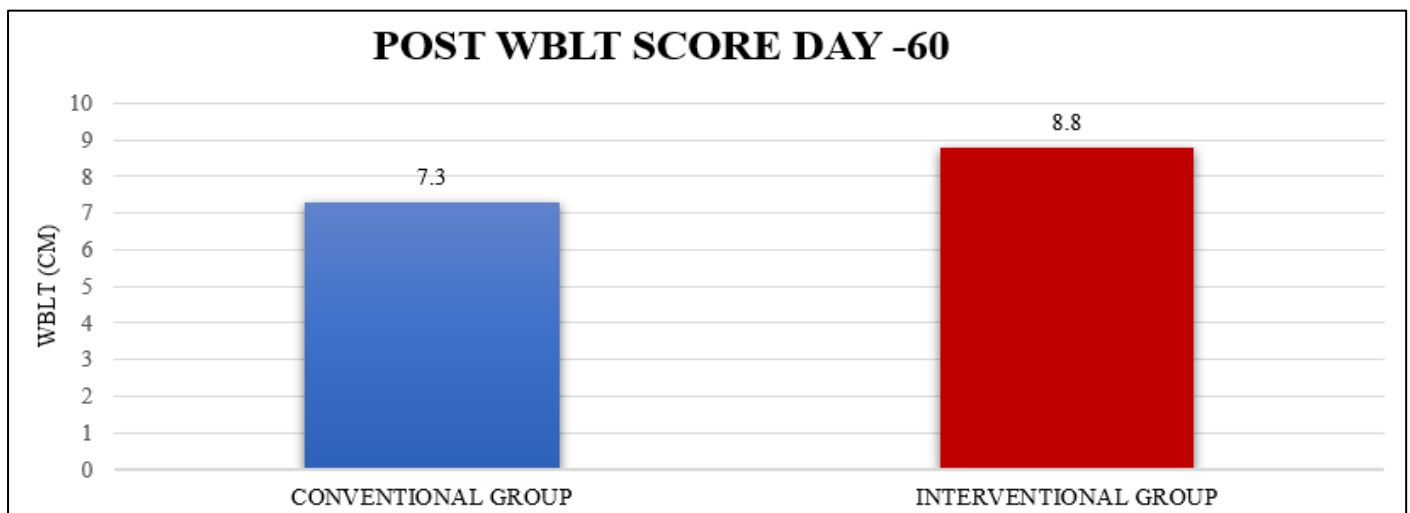
	Levene's Test for Equality of variance		t- test for equality of means		
	F	Sig	T	Df	Sig (2- tail) (p value)
Post WBLT score (Day 4) Equal variances not Assumed	17.36	0.000	4.92	30	0.00



Graph 5 Graphical Representation of Post Weight Bearing Lunge Test Score on Day Four Between Conventional Treatment Group and Interventional Treatment Group

Table 10 Independent T Test of Long Term Post Weight Bearing Lunge Test Score (on Day 60) Comparing the Variables Between Conventional Treatment Group and Interventional Treatment Group.

	Levene's Test for Equality of variance		t- test for equality of means		
	F	Sig	t	Df	Sig (2- tail) (p value)
Post WBLT Score (Day 60) Equal variances not Assumed	19.86	0.00	5.13	30	0.00



Graph 6 Graphical Representation of Post Weight Bearing Lunge Test Score on Long Term (Day 60) Between Conventional Treatment Group and Interventional Treatment Group

Table 11 Tabular Representation of One Way ANOVA Between Conventional Treatment Group and Interventional Treatment Group of Post Pain Score on 1st Day ,4th Day and 60th Day

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
POST PAIN (DAY 1) Between Groups	5.28	1	5.28	9.49	0.004
Within Groups	16.68	30	.55		
Total	21.96	31			
POST PAIN (DAY 4) Between Groups	8.00	1	8.00	12.30	0.001
Within Groups	19.50	30	.650		
Total	27.50	31			
POST PAIN (DAY 60) Between Groups	10.12	1	10.12	19.28	0.000
Within Groups	15.75	30	.52		
Total	25.87	31			

Table 12 Tabular Representation of One Way ANOVA Between Conventional Treatment Group and Interventional Treatment Group of Post Weight Bearing Lunge Test on 1st Day, 4th Day and 60th Day.

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
POST WBLT (DAY 1) Between Groups	19.53	1	19.53	26.11	0.00
Within Groups	22.43	30	0.74		
Total	41.96	31			
POST WBLT (DAY 4) Between Groups	19.53	1	19.53	25.00	0.00
Within Groups	23.43	30	0.78		
Total	42.96	31			
POST WBLT (DAY 60) Between Groups	18.00	1	18.00	27.17	0.00
Within Groups	19.87	30	.66		
Total	37.87	31			

IV. DISCUSSION

This study aimed to find the effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis. 32 diagnosed cases of plantar fasciitis who met the inclusion criteria were divided into 2 groups of 16 each, conventional treatment group and interventional treatment group. Both groups received ultra sound, stretching and strengthening exercise and was instructed to do home exercise program. Additionally, interventional treatment group received primal reflex release technique.

The outcome measures were pain pressure threshold and ankle dorsiflexion, which was assessed using algometer and weight bearing lunge test respectively. The pre test scores were taken on the first day before treatment. Post test scores were taken on the 1st day and 4th day. Follow up was taken after 2 months.

The baseline parameters we considered are age and gender. Age category ranges from 40-60 years in conventional treatment group 56% of the subjects were between 40-50 and 44% of the subjects were between 51-60. And in interventional treatment group 38% of subjects were between 51-60 and 62% of the subjects were between 40-50. Out of 16 subjects in conventional treatment group 75% of them were female and 25% were male. And in interventional treatment group 69% were female and 31% were male, which shows majority of the subjects were female in both groups.

Both groups showed improvement in all outcomes, but interventional treatment group have more improvement when compared with the conventional treatment group. It is statistically proven with $P < 0.05$. This result showed that there was significant immediate effect in interventional treatment group compared with conventional treatment group on the 1st day of treatment.

On 4th day after treatment, post test scores within the groups i.e., conventional treatment group and interventional treatment group were improved. But when comparing the outcome scores between the groups it showed that interventional treatment group have more reduction in pain and increased dorsiflexion which was statistically proven with $P < 0.05$.

Follow up scores was taken after 2 months showed that, same effect was carried out in conventional treatment group and interventional treatment group. So, it is evident that PRRT is effective in improving pain pressure threshold and ankle dorsiflexion ROM in subjects with plantar fasciitis.

Plantar fasciitis pain is due to 2 factors, musculoskeletal factor and the neural factor. The musculoskeletal factor includes calf muscle and plantar fascia tightness, and neural factor refers to the over activation of autonomic nervous system (ANS) and associated neural reflexes.^{9,10,11} Primal reflexes are triggered as protective defence mechanisms for the body.^{9,12} Following activation of primal reflexes, pain and muscle spasm may be produced through “up-regulation”- a sustained period of heightened arousal of the nervous system.^{5,9} ANS may remain in a heightened state of sensitivity in order to protect from further injury. PRRT aimed at down regulation of the nerves innervating the plantar fascia which helped in addressing the symptoms of up-regulation.^{13,14,15}

PRRT is a manual therapy approach for musculoskeletal pain relief which produces an immediate effect. The treatment is a regional approach in PRRT performed by lightly tapping the facilitated area's including the: medial knee tendons, peroneal tendons, triceps surae complex, hamstring musculature, and the toe flexors for approximately 12 seconds which in turn produces autogenic inhibition through golgi tendon organ and reciprocal inhibition by muscle spindle.

Bethany L et al⁹ states that the startle reflex activation and increased sympathetic nervous system response to an abnormal stimulus, causes a state of increased tension over the muscle and results in increasing pain. On the application of PRRT, there will be a re-evaluation and rebooting of the ANS by the brain which will reduce the pain and muscle tension by inhibiting the over activation of sympathetic nervous system. As the pain is reduced, there will be reduced muscle spasm and muscle guarding. Thus, painless ROM is achieved by the subject and that might be the reason for the improvement in ROM.⁹

ANS released messenger chemicals including acetylcholine and serotonin reinforces the protective spasm or trigger points. While giving PRRT this chemical release by ANS is also inhibited which in turn reduces the pain and reduced muscle spasm and thereby increase the ROM of the

ankle.⁸ Bethany L et al⁹ conducted a case series on PRRT in plantar fasciitis subjects and it was reported there was immediate and long term effect for PRRT in plantar fasciitis subjects on pain. Similar results were obtained in this study.

Conventional treatment given may also have been a possible reason for the improvement in the results of both groups. Conventional treatment aimed at addressing the musculoskeletal factor like calf muscle and plantar fascia tightness. Stretching given for plantar fascia and gastro soleus muscles had found to increase the ROM and mobility of the connective tissue.^{16,17,18} Strengthening exercise for intrinsic muscle can lead to an increase in muscle strength and power as a result of neuromuscular adaptations and alterations in connective tissue stiffness.¹⁹ A study conducted by Stefan et al²⁰ found that intense ultra sound therapy reduces the inflammation in plantar fasciitis.

V. LIMITATIONS

- Weight bearing lunge test was difficult to perform for obese population.
- Equal gender distribution was not obtained.

VI. SUGGESTIONS FOR THE FUTURE STUDY

- Strength of intrinsic muscles can be assessed.
- Further studies can be done in other vulnerable population like athletic population, prolonged standing individuals.
- Isolated effect of PRRT can be focused.

VII. CONCLUSION

Aim of the study was to find out the effect of primal reflex release technique on pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis. This study concluded that primal reflex release technique is effective in improving pain pressure threshold and ankle dorsiflexion in subjects with plantar fasciitis.

LIST OF ABBREVIATIONS

- ANS – Autonomic Nervous System
- HRV - Heart Rate Variability
- PF – Plantar Fasciitis
- PRRT – Primal Reflex Release Technique
- U.S – Ultra Sound
- VAS - Visual Analogue Scale
- WBLT – Weight Bearing Lunge Test

➤ Author Contributions

The author's confirm contribution to the paper as follows: Study conception and Design: Anila Peter Thekkudan and Anumol C; Data Collection: Anila Peter Thekkudan; Review and Editing: Rakhi Balagopal, Rejimol Jos Pulicken and Jisha Thampi; Analysis and Interpretation: Anila Peter Thekkudan, Remya N, Manju Unnikrishnan and; Draft manuscript: Anila Peter Thekkudan, Anumol C and Rakhi Balagopal. All the authors reviewed the results and approved the final version of the manuscript.

ACKNOWLEDGEMENT

Very great appreciation to all for the valuable suggestions and co-operations for the success of this research work.

- Competing Interests: The authors agree that there were no competing interests.
- Source of Funding: There was no external source of funding received for this research work.
- Ethical Approval: Approved

REFERENCES

- [1]. Young B, Walker MJ, Strunce J, Boyles R. A combined treatment approach emphasizing impairment-based manual physical therapy for plantar heel pain: a case series. *J Orthop Sports Phys Ther* . 2004;34(11):725–33.
- [2]. Arshad Z, Aslam A, Razzaq MA, Bhatia M. Gastrocnemius release in the management of chronic plantar fasciitis: A systematic review. *Foot Ankle Int* . 2022;43(4):568–75.
- [3]. Dabadghav R. Plantar fasciitis: A concise view on physiotherapy management. *Clin Res Foot Ankle* . 2016;04(04).
- [4]. Amis, J., Jennings, L., Graham, D., & Graham, C. E. (1988). Painful heel syndrome: radiographic and treatment assessment. *Foot & Ankle*, 1998(2), 91–95.
- [5]. Wb, K., Goldberg, & Tj, C.. Functional biomechanical deficits in running athletes with plantar fasciitis. *Clinical Journal of Sport Medicine: Official Journal of the Canadian Academy of Sport Medicine*.1991; 1(3), 213
- [6]. Alfaifi Y, Webb D. The effects of pain neuroscience education with conventional physical therapy on chronic plantar fasciitis: A case study. *Open J Ther Rehabil*. 2021;09(02):57–69.
- [7]. Iams john. Primal reflex release technique [Internet]. Primal Reflex Release Technique. 2008 [cited 2022 Aug 22]. <https://theprrt.com> (accessed 2022 Aug 22)
- [8]. Javed A, Riaz R, Khalid I, Khan N, Javed H, Tariq S, Rehman I. To find out the effects of myofascial release in the management of Plantar Fasciitis. *J Bashir Inst Health Sci*. 2021;2(2):85–92.
- [9]. Carter C. Treating coccydynia using primal reflex release technique TM case report. *APhOT* . 2020;3(1).
- [10]. Kinser AM, Sands WA, Stone MH. Reliability and validity of a pressure algometer. *J Strength Cond Res*. 2009;23(1):4–234.
- [11]. Iams J. When refl exes rule: a new paradigm in understanding why some patients don't get well. *Adv Phys Ther Rehab Med*. 2005;16(3):17-44.
- [12]. Fantazzi F, Snyder A, Snyder M.. Primal reflex release technique: welcome to a paradigm shift. *CyberPT* 2014; 7(5) 8-456.
- [13]. Chisholm MD, Birmingham TB, Brown J, Macdermid J, Chesworth BM. Reliability and validity of a weight-bearing measure of ankle dorsiflexion range of motion. *Physiother*. 2012 Autumn;64(4):55–375.

- [14]. Cameron MH. *Physical Agents in Rehabilitation: From Research to Practice*. St. St. Louis, MO: Elsevier Saunders; 2013. 104p
- [15]. Bialosky JE, Bishop MD, George SZ. Regional interdependence: a musculoskeletal examination model whose time has come. *J Orthop Sports Phys Ther*. 2008;38(3):60–330
- [16]. Brody LT. *Therapeutic exercise: Moving toward function*. 4rd ed. Saint Paul, MN: LWW; 2018.109 p
- [17]. Ford P, McChesney J. Duration of maintained hamstring ROM following termination of three stretching protocols. *J Sport Rehabil*. 2007;16(1):18–27.
- [18]. Altieri C. The effects of hamstring stretching on range of motion: A systematic literature review. *J Orthop Sports Phys Ther*. 2005; 5;2(3) 35-342
- [19]. David C. Hughes, Stian E.and Keith B. Adaptations to endurance and strength Training.C.Spring Har Lab Pre. 2017 Jun 1(11) 8-6
- [20]. Feldman S. Intense Ultrasound proven effective for chronic plantar fasciitis [Internet]. Foot and Ankle Blog. University Foot and Ankle Institute; 2021 [cited 2023 Jun 28]. www.footankleinstitute.com/blog/intense-ultrasound-effective-for-chronic-plantar-fasciitis/