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POSTERIOR CENTRE-OF-PRESSURE DISPLACEMENT AND PAIN INTENSITY IN NON-SPECIFIC HEEL PAIN: A SENSOR PLATE OBSERVATIONAL STUDY

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KEYWORDS

non-specific heel pain, centre of pressure, posterior COP shift, plantar pressure, postural loading, sensor plate, VAS, kinetic chain.

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Abstract

Background: Heel pain does not always come from one clearly identifiable structure. In some people, the way body weight is held and transferred may keep the centre of pressure too far back, placing extra stress on the heel. A sensor plate can show this pattern and help explain why pain continues even when routine examination does not reveal a definite local cause.
Aim: To study whether a backward shift of the centre of pressure is related to the intensity of heel pain in people with non-specific heel pain.
Methodology: This observational study involved 50 participants aged 20 to 70 years who had non-specific heel pain. Age, body measurements, duration and side of pain, and Visual Analogue Scale scores were recorded. Sensor plate assessment was used to measure posterior centre-of-pressure shift, forefoot and hindfoot loading, plantar pressure, and overall loading pattern. The relationship between these measurements and pain intensity was analysed statistically.
Results: The participants had a mean age of 39.28 ± 11.19 years, a mean BMI of 27.28 ± 3.63 kg/m², and a mean VAS score of 3.90 ± 1.13. A greater backward shift of the centre of pressure was associated with higher heel pain ($r = 0.645$, $p < 0.001$). Hindfoot loading also showed a strong positive relationship with pain ($r = 0.746$, $p < 0.001$). Participants with greater posterior loading generally reported more severe pain.
Conclusion: People with non-specific heel pain tended to show a backward weight-bearing pattern. The farther the centre of pressure moved toward the heel, the greater the reported pain. Sensor plate assessment may therefore help clinicians identify hidden loading problems and plan treatment beyond the painful area alone.

INTRODUCTION

Heel pain is a common problem that can make standing, walking, work and everyday activities difficult. In some patients, the source is easy to identify, such as plantar fascia irritation, heel-pad problems or nerve involvement. In many others, however, no single structure fully explains the symptoms. These cases are often described as non-specific heel pain.

The centre of pressure is the point under the feet where the combined ground reaction force is acting at a given moment. Its position changes with posture and movement and is influenced by the feet,

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ankles, knees, hips, pelvis and trunk. When this point stays farther back than expected, more body weight remains over the heels.

Keeping the centre of pressure too far back can expose the heel to repeated compression during standing and walking. It may also reduce the normal forward transfer of weight toward the forefoot. Over time, this pattern can irritate the heel pad, plantar fascia attachment and nearby tissues, especially in people who stand for long periods or have higher body weight.

Sensor plate testing allows this loading behaviour to be measured rather than guessed. It shows how weight is shared between the forefoot and hindfoot, where pressure is concentrated, and whether the centre of pressure is shifted backward. This information can help connect the patient's pain with the way the whole body is being loaded.

The heel should not be viewed as an isolated structure. The plantar fascia supports the arch and tightens during push-off through the windlass mechanism. If the foot does not move smoothly from heel contact toward the forefoot, the fascia may remain under stress for longer and the heel may receive repeated loading.

The calcaneus also forms a mechanical link between the Achilles tendon and the plantar fascia. Tightness or poor control in the calf muscles can limit forward movement of the shin over the foot. This may keep the body weight behind and increase pressure under the heel. For this reason, calf flexibility and ankle movement are important when assessing heel pain.

The same pattern may also be influenced by areas higher up the body. Stiff hamstrings, weak hip muscles, altered pelvic control or a backward trunk posture can all change how weight travels through the lower limb. These influences do not mean that every case of heel pain starts in the back or hip, but they may help explain why local treatment alone is sometimes not enough.

Possible whole-body contributors include reduced ankle dorsiflexion, calf and hamstring tightness, weak hip abductors or extensors, altered leg rotation, pelvic imbalance and a habit of leaning backward while standing. Each of these factors may encourage the centre of pressure to remain behind and increase stress on the heel.

Therefore, sensor plate findings should be combined with a full clinical examination. A backward centre-of-pressure shift tells the clinician how the patient is loading the body, while pressure values show where the load is concentrated. Together, these findings can guide a more complete treatment plan.

NEED OF THE STUDY

Heel pain is often treated with stretching, heel cushions, footwear advice and activity modification. These approaches may help, but they do not always explain why the heel continues to be overloaded. Measuring the centre of pressure may reveal whether the patient is habitually standing or walking with weight held too far back. Understanding this pattern can make treatment more specific and may help address both local symptoms and contributing movement problems.

AIM

To examine posterior centre-of-pressure displacement and its relationship with pain intensity in patients with non-specific heel pain using sensor plate evaluation.

OBJECTIVES

1. To quantify posterior centre-of-pressure displacement in patients with non-specific heel pain.

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2. To describe the accompanying forefoot-hindfoot load and plantar-pressure pattern.

3. To determine the correlation between posterior COP shift and VAS heel pain score.

4. To compare pain severity across sensor plate loading categories and evaluate whether regional hindfoot loading supports the COP-based interpretation.

MATERIALS AND METHODOLOGY

Study design: Observational study.

Study setting: Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan.

Sample size: 50 participants.

Sampling method: Purposive sampling method.

Study population: Male and female participants aged between 20 and 70 years with non-specific heel pain.

Outcome measures: Visual Analogue Scale for pain intensity and sensor plate variables including posterior COP shift, forefoot and hindfoot load, peak and mean plantar pressure, forefoot-hindfoot difference, hindfoot/forefoot ratio and loading category.

INCLUSION CRITERIA

1. Participants with non-specific heel pain.

2. Age between 20 and 70 years.

3. Participants willing to take part in the study.

4. Informed consent obtained.

EXCLUSION CRITERIA

1. Cancer.

2. Spinal trauma or amputation.

3. Systemic inflammatory disorder or progressive neurological condition.

4. Pregnancy or open wound.

5. Use of selected medications such as NSAIDs, anticoagulants or steroids.

6. Fracture, calcaneal spur or visible foot deformity.

PROCEDURE

Participants were selected according to the inclusion and exclusion criteria. After written consent was obtained, age, height, weight, BMI, duration of pain, affected side and VAS pain score were recorded. Each participant then stood on the sensor plate for assessment of centre-of-pressure position, forefoot and hindfoot loading, plantar pressure and loading category. The readings were recorded for statistical analysis.

STATISTICAL ANALYSIS

Mean and standard deviation were used for continuous data, while frequency and percentage were used for categorical data. Normality was checked with the Shapiro-Wilk test. Pearson correlation was used to examine the relationship between posterior centre-of-pressure shift, hindfoot load and VAS score. Paired and one-sample t-tests were used for loading comparisons, while one-way ANOVA and chi-square tests were used for group comparisons. A p-value below 0.05 was considered statistically significant.

RESULTS

The study included 50 participants with non-specific heel pain. Their mean age was 39.28 ± 11.19 years, and the largest age group was 31-40 years. There were 28 men and 22 women. The mean BMI was 27.28 ± 3.63 kg/m², showing an overall overweight tendency. The mean duration of pain was 10.84 ± 5.46 weeks, and the mean VAS score was 3.90 ± 1.13.

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Table 1: Age distribution

Age group	Frequency	Percentage
20-30	12	24.00
31-40	16	32.00
41-50	14	28.00
51-60	6	12.00
61-70	2	4.00
Total	50	100.00

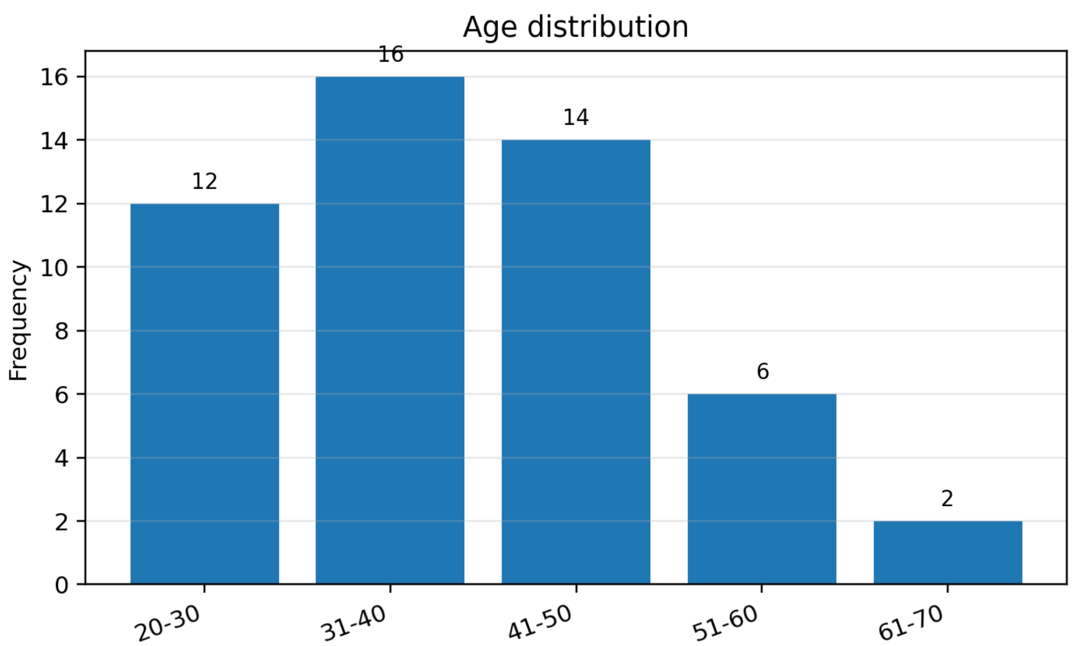

Figure 1: Age distribution of participants

Table 2: Sex distribution

Sex	Frequency	Percentage
Male	28	56.00
Female	22	44.00

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Total	50	100.00

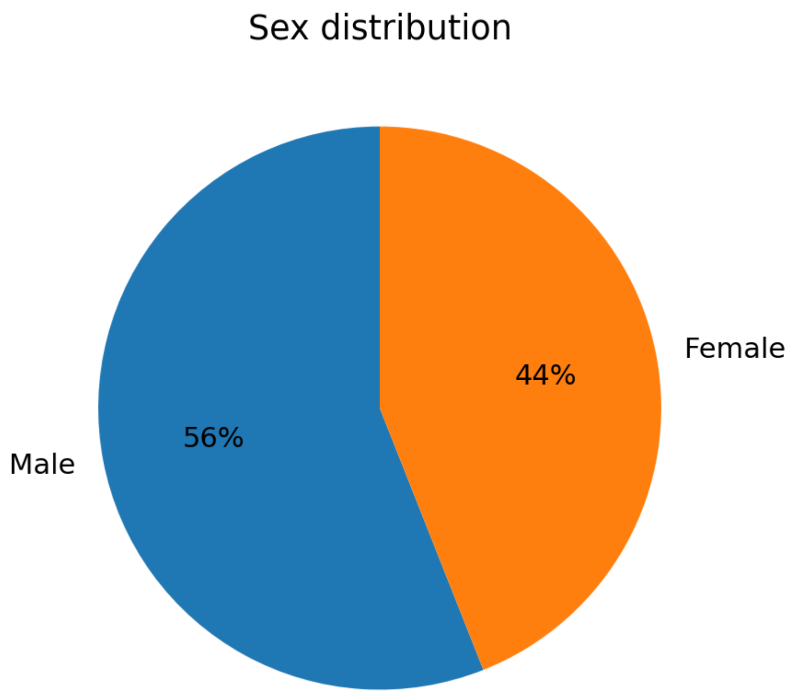

Figure 2: Sex distribution of participants

Table 3: Clinical and anthropometric profile

Variable	Mean	SD	Minimum	Maximum
Height (cm)	164.98	9.07	147.70	179.70
Weight (kg)	74.56	13.45	55.80	103.20
BMI (kg/m2)	27.28	3.63	20.20	36.00
Duration of heel pain (weeks)	10.84	5.46	3.10	30.00
VAS heel pain score (/10)	3.90	1.13	2.00	6.10

Table 4: Affected side distribution

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Affected side	Frequency	Percentage
Left	20	40.00
Right	19	38.00
Bilateral	11	22.00
Total	50	100.00

The sensor plate showed that most participants placed more weight on the heel than on the forefoot. Mean hindfoot load was 60.33 ± 7.08%, compared with 39.67 ± 7.08% over the forefoot. The average forefoot-hindfoot difference was 21.80 ± 12.31%, and the mean hindfoot-to-forefoot ratio was 1.60 ± 0.47. These findings describe the regional loading pattern that accompanied the backward centre-of-pressure position.

Table 5: Forefoot and hindfoot load distribution

Variable	Mean	SD	Minimum	Maximum
Forefoot load (%)	39.67	7.08	27.10	55.00
Hindfoot load (%)	60.33	7.08	45.00	72.90
Absolute F-H load difference (%)	21.80	12.31	0.20	45.90
Hindfoot/Forefoot ratio	1.60	0.47	0.82	2.70

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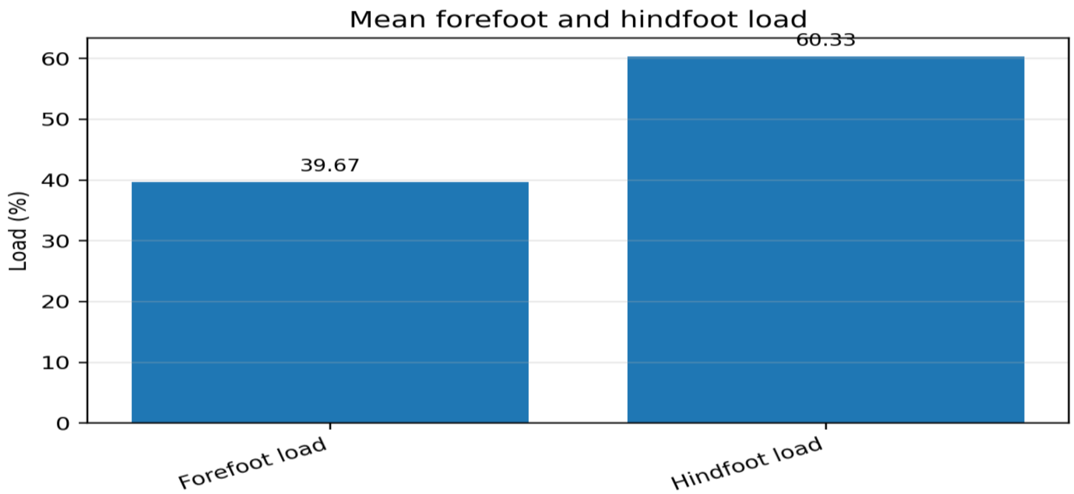

Figure 3: Mean forefoot and hindfoot load

Table 6: Sensor plate loading category

Sensor plate impression	**Frequency**	**Percentage**
Mild hindfoot loading	10	20.00
Moderate hindfoot loading	27	54.00
High hindfoot loading	13	26.00
Total	50	100.00

Table 7: Sensor plate pressure values

Variable	**Mean**	**SD**	**Minimum**	**Maximum**
Peak forefoot pressure (kPa)	330.15	39.34	260.00	427.00
Peak hindfoot pressure (kPa)	453.35	42.28	382.90	565.60
Mean forefoot pressure (kPa)	136.06	14.41	115.00	165.00
Mean hindfoot pressure (kPa)	176.17	19.54	135.90	220.40

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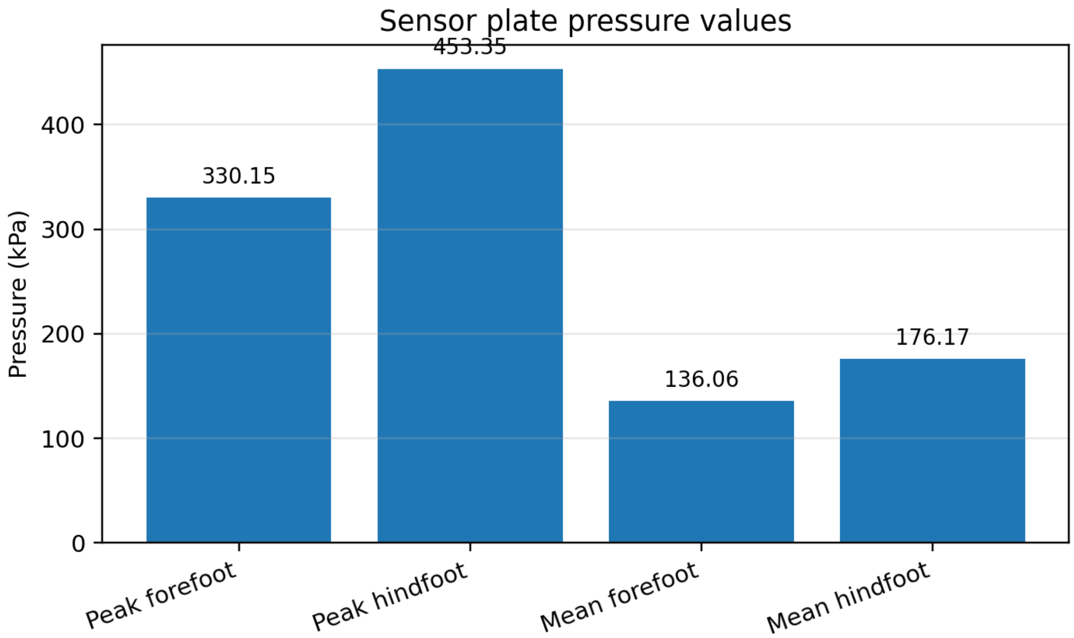

Figure 4: Sensor plate pressure values

Statistical testing confirmed that heel loading was clearly greater than forefoot loading. The mean difference was 20.66% ($t = 10.32$, $p < 0.001$), and average hindfoot load was also significantly above the neutral reference value of 50% ($p < 0.001$). This supports the presence of a posterior loading pattern in the sample.

Table 8: Inferential analysis of loading pattern

Test	Comparison	t value	p value	Interpretation
Paired t-test	Hindfoot load vs Forefoot load	10.32	<0.001	Significant
One-sample t-test	Hindfoot load against 50%	10.32	<0.001	Significant

The main analysis showed that a greater backward shift of the centre of pressure was linked with higher VAS pain scores ($r = 0.645$, $p < 0.001$). In practical terms, participants who kept their weight farther behind tended to report more heel pain. Hindfoot load also showed a strong positive relationship with pain ($r = 0.746$, $p < 0.001$), supporting the same mechanical pattern.

Table 9: Correlation of posterior COP shift and hindfoot load with heel pain intensity

Variables	**Pearson r**	**p value**	**Interpretation**
Hindfoot load (%) vs VAS heel pain	0.746	<0.001	Significant positive correlation
COP posterior shift (mm) vs VAS heel pain	0.645	<0.001	Significant positive correlation

Pain increased as the loading pattern became more posterior. The mean VAS score was 2.86 ± 0.87 in the mild hindfoot-loading group, 3.61 ± 0.71 in the moderate group and 5.29 ± 0.60 in the high-loading group. The difference between the groups was statistically significant ($F = 36.98$, $p < 0.001$).

Table 10: VAS according to hindfoot loading category

Sensor plate impression	**N**	**Mean VAS**	**SD**
Mild hindfoot loading	10	2.86	0.87
Moderate hindfoot loading	27	3.61	0.71
High hindfoot loading	13	5.29	0.60

Table 11: ANOVA for VAS across loading categories

Test	**F value**	**p value**	**Interpretation**
One-way ANOVA	36.98	<0.001	Significant difference across categories

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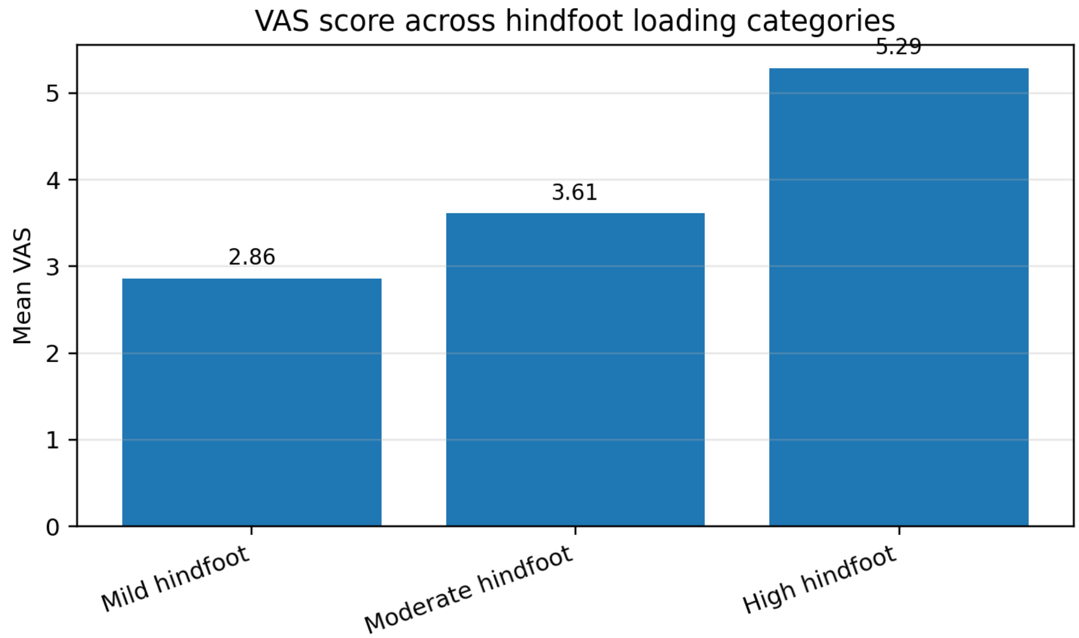

Figure 5: Pain intensity across progressive posterior-loading categories

Table 12: Association between sensor plate impression and pain category

Sensor plate impression	Mild pain	Moderate pain	Severe pain	Total
Mild hindfoot loading	6	4	0	10
Moderate hindfoot loading	4	23	0	27
High hindfoot loading	0	12	1	13
Total	10	39	1	50

Table 13: Chi-square association test

Test	Chi-square value	df	p value	Interpretation
Chi-square test	16.18	4	0.0028	Significant association

The chi-square test also showed a significant link between loading category and pain category ($\chi^2 = 16.18$, df = 4, $p = 0.0028$). Participants with higher posterior loading were more likely to fall into the higher pain groups. This finding supports the correlation results and shows that the relationship was present both in numerical values and in clinical categories.

DISCUSSION

This study looked at non-specific heel pain from a broader mechanical viewpoint. Instead of focusing only on how much pressure was present under the heel, the main question was whether the body's overall centre of pressure was being held too far back. The most important finding was that a greater posterior shift was associated with greater pain.

Centre-of-pressure position reflects the combined behaviour of many body regions. It is affected by foot contact, ankle movement, knee control, hip and pelvic stability, and trunk posture. For this reason, a backward shift may provide a useful picture of the patient's overall weight-bearing strategy rather than only one local pressure value.

The relationship between posterior centre-of-pressure shift and pain was statistically significant ($r = 0.645$, $p < 0.001$). This does not prove that the backward shift directly caused the pain, because the study was observational. However, it does show that the two were closely related and should be considered together during assessment.

Hindfoot load also had a strong relationship with VAS score ($r = 0.746$, $p < 0.001$). These two findings complement each other. The centre-of-pressure shift shows the direction of the whole-body loading strategy, while the hindfoot percentage shows how much of that load is concentrated over the heel.

The step-by-step rise in pain from mild to moderate and high loading groups suggests a clear clinical pattern. Participants with the greatest posterior loading reported the highest pain. This may help clinicians identify patients who need more attention to load redistribution rather than relying only on local pain-relieving treatment.

Several mechanical factors could contribute to this backward loading strategy. Limited ankle dorsiflexion may stop the shin from moving forward normally. Tight calf muscles can reinforce the same pattern.

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Reduced hip strength, poor pelvic control or a backward trunk position may also change the way weight passes through the leg and foot.

The plantar fascia, Achilles tendon and calf tissues are mechanically connected around the heel bone. When body weight stays behind, the heel may experience compression from below while the Achilles-plantar fascial system is under tension. This combination may help explain persistent symptoms in some patients even when no single local lesion is identified.

This changes the clinical focus from simply asking, 'Which tissue hurts?' to also asking, 'Why is the body keeping weight over the heel?' The answer may involve the foot itself, but it may also include calf stiffness, limited ankle movement, weakness at the hip, altered pelvic control or postural habits.

Treatment should therefore aim both to settle the painful tissues and to improve the way load moves through the body. Depending on the findings, this may include temporary heel cushioning, calf and plantar fascia stretching, ankle mobility work, foot strengthening, gait training, hip and pelvic strengthening, posture correction and gradual transfer of weight toward the forefoot.

The findings do not prove that every case of heel pain has a single global or fascial cause. Local conditions still need to be ruled out carefully. The value of this approach is that it helps explain how a local painful area may be influenced by movement and loading elsewhere in the body.

CONCLUSION

The study found that a backward shift of the centre of pressure was significantly related to greater pain in people with non-specific heel pain. This pattern was accompanied by higher hindfoot loading and greater pressure under the heel. Sensor plate assessment can therefore provide useful information about how a person is standing and loading the foot. When combined with a full biomechanical examination, it may help clinicians plan treatment that addresses both the painful heel and the wider movement factors contributing to it.

LIMITATIONS

1. The sample size was limited to 50 participants.

2. The study used purposive sampling, which may limit generalization.

3. The observational design can show association but not direct cause and effect.

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4. A healthy control group was not included.

5. Other biomechanical variables such as ankle range of motion, foot posture index and calf flexibility were not deeply analyzed.

6. Long-term follow-up was not performed.

RECOMMENDATIONS

1. Future studies should include a larger sample size.

2. Comparative studies with healthy controls should be conducted.

3. Future studies should prospectively evaluate ankle dorsiflexion, calf flexibility, hip strength, pelvic control and trunk posture as possible determinants of posterior COP displacement.

4. Interventional studies should investigate whether gait retraining, forward load-transfer exercises and proximal kinetic-chain rehabilitation reduce posterior COP shift and heel pain.

5. Longitudinal research should determine whether change in COP position predicts clinical improvement more accurately than regional pressure values alone.

REFERENCES

1. Thomas MJ, Whittle R, Menz HB, Rathod-Mistry T, Marshall M, Roddy E. Plantar heel pain in middle-aged and older adults: population prevalence, associations with health status and lifestyle factors, and frequency of healthcare use. BMC Musculoskelet Disord. 2019;20:337.

2. Lourdes RK, Ram GG. Incidence of calcaneal spur in Indian population with heel pain. Int J Res Orthop. 2016;2(3):174-176.

3. Liu P, Chen Q, Yang K, Cai F. Prevalence, characteristics, and associated risk factors of plantar heel pain in Americans: the cross-sectional NHANES study. J Orthop Surg Res. 2024;19:805.

4. Chatwin KE, Abbott CA, Boulton AJM, Bowling FL, Reeves ND. The role of foot pressure measurement in the prediction and prevention of diabetic foot ulceration: a comprehensive review. Diabetes Metab Res Rev. 2020;36(4):e3258.

5. Price C, Parker D, Nester C. Validity and repeatability of three in-shoe pressure measurement systems. Gait Posture. 2016;46:69-74.

6. Razak AHA, Zayegh A, Begg RK, Wahab Y. Foot plantar pressure measurement system: a review. Sensors. 2012;12(7):9884-9912.

7. Mazur F, Swoboda B, Carl HD, Lutter C, Engelhardt M, Hoppe MW, Hotfiel T, Grim C. Plantar pressure changes in hindfoot relief devices of different designs. J Exp Orthop. 2019;6(1):7.

8. McMillan AM, Landorf KB, Barrett JT, Menz HB, Bird AR. Diagnostic imaging for chronic plantar heel pain: a systematic review and meta-analysis. J Foot Ankle Res. 2009;2:32.

9. Chang AH, Rasmussen SZ, Jensen AE, Sorensen T, Rathleff MS. What do we actually know about a common cause of plantar heel pain? A scoping review of heel fat pad syndrome. J Foot Ankle Res. 2022;15(1):60.

10. Phillips A, McClinton S. Gait deviations associated with plantar heel pain: a systematic review. Clin Biomech. 2017;42:55-64.

11. Ribeiro AP, Trombini-Souza F, Tessutti VD, Rodrigues Lima F, Sacco ICN, Joao SMA. The effects of plantar fasciitis and pain on plantar pressure distribution of recreational runners. Clin Biomech. 2011;26(2):194-199.

12. Bedi HS, Love BR. Differences in impulse distribution in patients with plantar fasciitis. Foot Ankle Int. 1998;19(3):153-156.

13. Liddle D, Rome K, Howe T. Vertical ground reaction forces in patients with unilateral plantar heel pain: a pilot study. Gait Posture. 2000;11(1):62-66.

14. Rosenbaum D, Becker HP. Plantar pressure distribution measurements: technical background and clinical applications. Foot Ankle Surg. 1997;3(1):1-14.

15. Buldt AK, Allan JJ, Landorf KB, Menz HB. The relationship between foot posture and plantar pressure during walking in adults: a systematic review. Gait Posture. 2018;62:56-67.

16. Wearing SC, Smeathers JE, Urry SR, Hennig EM, Hills AP. The pathomechanics of plantar fasciitis. Sports Med. 2006;36(7):585-611.

17. Irving DB, Cook JL, Menz HB. Factors associated with chronic plantar heel pain: a systematic review. J Sci Med Sport. 2006;9(1-2):11-22.

18. Rano JA, Fallat LM, Savoy-Moore RT. Correlation of heel pain with body mass index and other characteristics of heel pain. J Foot Ankle Surg. 2001;40(6):351-356.

19. Van Lunen B, Cortes N, Andrus T, Walker M, Pasquale M, Onate J. Immediate effects of a heel-pain orthosis and

augmented low-dye taping on plantar pressures and pain in subjects with plantar fasciitis. Clin J Sport Med. 2011;21(6):474-479.

20. Cavanagh PR, Ulbrecht JS. Clinical plantar pressure measurement in diabetes: rationale and methodology. Foot. 1994;4(3):123-135.

21. Bolgla LA, Malone TR. Plantar fasciitis and the windlass mechanism: a biomechanical link to clinical practice. J Athl Train. 2004;39(1):77-82.

22. Stecco C, Corradin M, Macchi V, Morra A, Porzionato A, Biz C, et al. Plantar fascia anatomy and its relationship with Achilles tendon and paratenon. J Anat. 2013;223(6):665-676. doi:10.1111/joa.12111.

23. Singh A, Zwirner J, Templer F, Kieser D, Klima S, Hammer N. On the morphological relations of the Achilles tendon and plantar fascia via the calcaneus: a cadaveric study. Sci Rep. 2021;11(1):5986. doi:10.1038/s41598-021-85251-0.

24. Wilke J, Krause F, Vogt L, Banzer W. What is evidence-based about myofascial chains: a systematic review. Arch Phys Med Rehabil. 2016;97(3):454-461. doi:10.1016/j.apmr.2015.07.023.