

# In patients with Diabetic Peripheral Neuropathy does balance training vs. no intervention improve balance outcomes and reduce falls?



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## Abstract

**Background and Purpose:** People with Diabetic Peripheral Neuropathy (DPN) have altered balance and are typically at an increased risk of falling. Despite this, few studies have investigated the effect of balance training on fall rates. This case study and evidence-based analysis aims to determine if balance training is more effective than no intervention in improving balance and reducing falls in patients with Diabetic Peripheral Neuropathy (DPN).

**Case Description:** Patient is a 60 year-old male referred to physical therapy due to a recent history of falls. Secondary diagnoses are Diabetes Mellitus Type II (DM II), DPN, hypertension (HTN), Benign Prostatic Hyperplasia (BPH), osteopenia, tachycardia and arrhythmias. The physical therapy plan for this patient included balance and gait training, strengthening, endurance training and neuromuscular re-education.

**Outcomes:** A review of current literature revealed that balance training is effective at improving balance outcomes without increasing falls compared to no intervention. Integrating results into the case study was impossible secondary to patient only observed at evaluation.

**Discussion:** Overall, the majority of high quality studies fail to isolate DPN from peripheral neuropathy of other origins. However, there are several Randomized Controlled Trials (RCTs) that focus on DPN subjects. Seven out of the eight studies analyzed, demonstrated that balance training in subjects with DPN leads to improvements in balance outcomes.<sup>1-3, 5-8</sup> The only two studies that addressed falls as an outcome measure, identified no increase in number of falls.<sup>4, 6</sup> However, future studies need to specifically address reduction in fall rates and its long term effect.

## Introduction

The patient is a 60 year-old male full time architect, who was referred to outpatient physical therapy (PT) for balance training following a Diabetic Peripheral Neuropathy (DPN) diagnosis and a recent history of falls. Patient experienced two falls within the last 12 months with no significant injury associated. Patient reports concern of future falls especially at construction site due to high risk of injury.

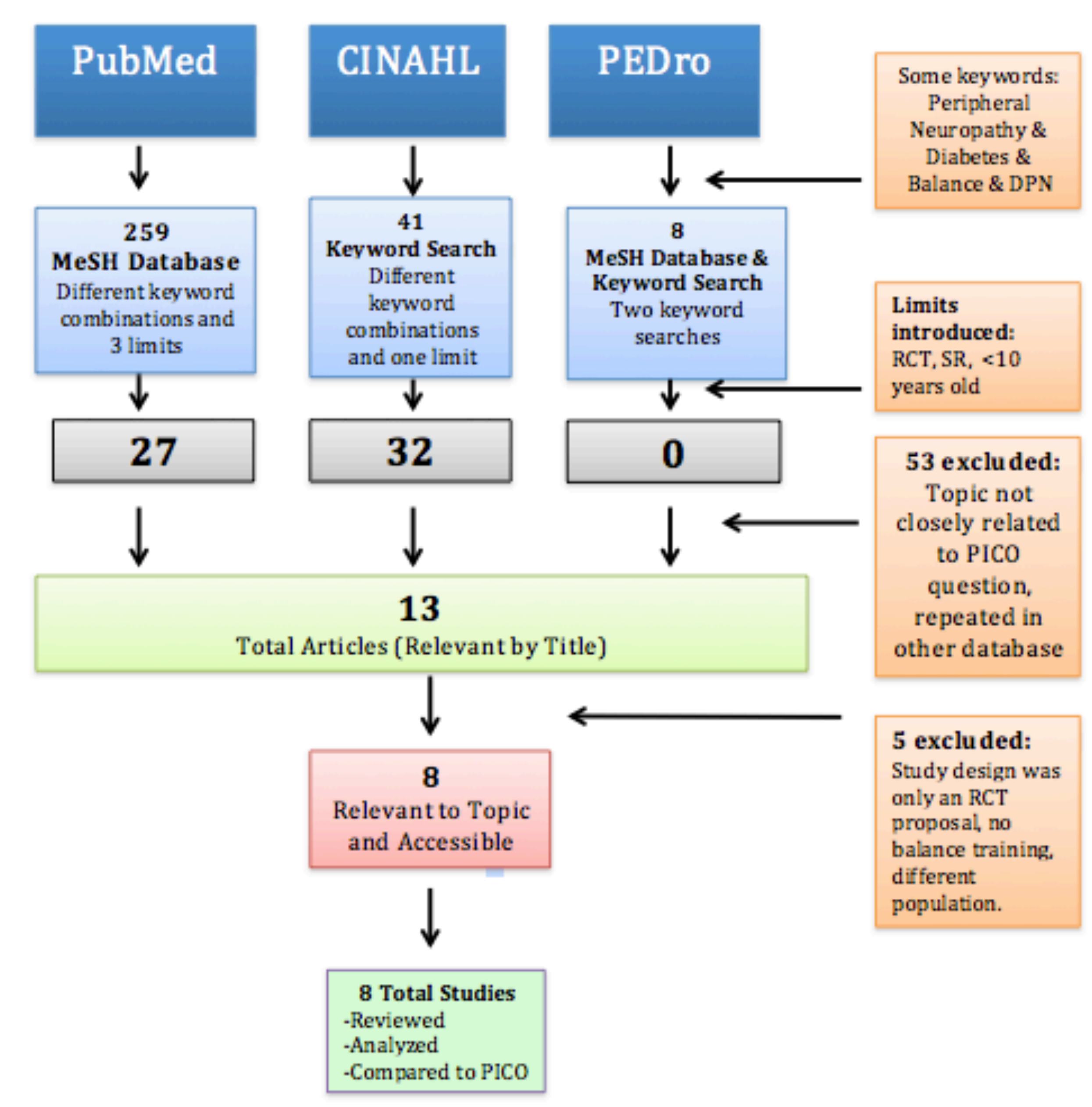
The sensory and motor loss associated with DPN contributes to impaired balance and gait, and increased susceptibility to lower extremity injury and amputation.<sup>12</sup> Sources of instability in patients with type 2 Diabetic Neuropathy (DN) include the loss or reduction of peripheral sensory information in the feet, the inability of the central nervous system to appropriately integrate available postural control information, and a switch from an ankle-based to a hip-based balance strategy.<sup>8</sup> Diabetic patients with peripheral neuropathy (PNP) have lower gait velocity, decreased cadence, shorter stride length, increased stance time and higher step to step variability compared with healthy controls.<sup>1</sup> Other identified impairments are postural instability, reduced ankle strength and mobility and fear of falling. In addition, an increase in the use of vestibular information and dependence on visual information alter the style of postural control in patients with DN.<sup>8</sup>

Impaired balance in the elderly with DPN is a chief cause of increasing falls and decreasing quality of life.<sup>2</sup> Therefore, balance improvement is a key aspect in decreasing falls in the DPN population.

## PICO Question

In patients with Diabetic Peripheral Neuropathy does balance training vs. no intervention improve balance outcomes and reduce falls?

## Methods



## Results

The majority of current evidence on the topic of balance in DPN subjects does not address its impact on fall frequency or fall risk.

Although there is a great deal of high level evidence on exercise and peripheral neuropathy, there is not enough high level evidence addressing balance intervention and its effects on number of falls and balance outcomes on DPN subjects.

Most of the studies reviewed showed statistically significant improvements in balance outcomes in patients with DPN. In addition, in the two studies that addressed falls, there was no increase in the number of falls reported; however the long-term effect in fall reduction is not addressed. Few studies addressed peripheral neuropathy scores, and while the patients were able to demonstrate improvement in balance outcome measures, there was no change on neuropathy scores.

## Analyzed Studies

#	Study & Origin	Oxford Level of Evidence	Pedro Score	Purpose	Helped answer PICO
1	Allet et al, 2010	2b (RCT)	8/10	To evaluate the effect of a specific training program on gait and balance of diabetic patients	Yes (did not address falls)
2	Song et al, 2011	2b (RCT)	5/10	To assess the effects of a balance exercise program on balance and trunk proprioception in older adults with diabetic neuropathies.	Yes (did not address falls)
3	Streckmann et al, 2014	2a (SR)	N/A	The purpose is to analyze exercise interventions for neuropathic patients in order to evaluate the possible benefits of exercise.	Yes (did not address falls)
4	Kruse et al, 2010	1b (RCT)	8/10	To increase LE strength and balance in patients with diabetic peripheral neuropathy without increasing falls.	Yes
5	Akbari et al, 2012	4 (CCT)	1/10	To investigate the effects of balance exercises on sway indices in diabetic patients with neuropathy.	Yes (did not address falls)
6	Morrison et al, 2010.	4 (CCT)	3/10	To assess the effects of balance/strength training on falls risk and posture in older individuals with type 2 diabetes.	Yes
7	Quigley et al, 2014.	2b (RCT)	6/10	To investigate the effects of exercise regimens on gait and balance in older patients with a distal symmetric polyneuropathy (DSP).	Yes (did not address falls)
8	Salsabili et al, 2011.	4 (quasi experimental time series)	4/10	The purpose is to determine if effective balance training should treat context-specific instabilities of postural control of patients with diabetic neuropathy (DN).	Yes (did not address falls)

## Conclusion

By participating in a balance intervention, subjects with DPN can improve their balance without an increase in falls. More research needs to be done to address number of falls as an outcome measure and address DPN subjects at a high risk of falling.

## References

- Allet L, Armand S, de Bie RA, et al. The gait and balance of patients with diabetes can be improved: a randomized controlled trial. *Diabetologia*. 2010;53(3):458-66. doi:10.1007/s00125-009-1592-4.
- Song CH, Petrofsky JS, Lee SW, et al. Effects of an exercise program on balance and trunk proprioception in older adults with diabetic neuropathies. *Diabet Technol Ther*. 2011;13(8):803-11. doi:10.1089/dia.2011.0036.
- Streckmann F, Zogl EM, Lehmann HC, et al. Exercise intervention studies in patients with peripheral neuropathy: a systematic review. *Sports Med*. 2014;44(9):1289-1304. doi:10.1007/s40279-014-0207-5.
- Kruse RL, Lemaster JW, Madsen RW. Fall and balance outcomes after an intervention to promote leg strength, balance, and walking in people with diabetic peripheral neuropathy: "feet first" randomized controlled trial. *Phys Ther*. 2010;90(11):1568-79. doi:10.2522/ptj.20090362.
- Akbari M, Jafari H, Moshshaghe A, et al. Do diabetic neuropathy patients benefit from balance training? *J Rehabil Res Dev*. 2012;49(2):333-38. doi:10.1682/JRRD.2010.10.0197.
- Morrison S, Colberg S, Mariano M, et al. Balance training reduces falls risk in older individuals with type 2 diabetes. *Diabetes Care*. 2010;33(4):748-750. doi:10.2337/dc09-1699.
- Quigley PA, Bulat T, Schulz B, et al. Exercise interventions, gait, and balance in older subjects with distal symmetric polyneuropathy: a three-group randomized clinical trial. *Am J Phys Med Rehabil*. 2014;93(1):1-12. doi:20.1097/PHM.0000000000000052.
- Salsabili H, Bahreymy F, Forough B, et al. Dynamic stability training improves standing balance control in neuropathic patients with type 2 diabetes. *J Rehabil Res Dev*. 2011;48(7):775-786. doi:10.1682/JRRD.2010.08.0160.

