**Proprioceptive Neuromuscular Facilitation Training Effects on Hemiparetic Gait after Stroke**

**Clinical Bottom Line:** There was a significant improvement in clinical measures of functional ambulation with Proprioceptive Neuromuscular Facilitation (PNF) compared to other physical therapy interventions in patients with hemiparesis following stroke within one year. Efficacy of PNF techniques such as gait, pelvic, and lower extremity patterns depends on patient population, chronicity of neurological injury, duration, intensity, and functional context of PNF intervention.

**Clinical Scenario:** For patients that develop hemiparetic gait dysfunction secondary to stroke within one year, a main goal of physical therapy is to increase functional independence. However, there is no consensus among researchers or clinicians on whether PNF is the most appropriate treatment for gait dysfunction as compared to other forms of physical therapy in this population.

**Clinical Question:** In adult patients with hemiparesis due to stroke within the past year, does PNF improve scores on clinical outcome measures specific to gait compared to other forms of physical therapy?

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<tr>
<th>Databases</th>
<th>Search Terms</th>
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<tbody>
<tr>
<td>PubMed</td>
<td>hemiplegia and gait and rehabilitation and physical therapy and proprioceptive neuromuscular facilitation; hemiplegia and gait and rehabilitation and physical therapy and stroke and pilot; gait and stroke and rehabilitation and PNF</td>
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<td>CINAHL</td>
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**Summary of Studies:** Of the ten articles reviewed, more consideration on determining the clinical bottom line and relevance to our PICO question were given to articles with higher PEDro scores, level of evidence, and number of components addressed in the PICO question. Khanal and Seo constituted two of the top studies and concluded PNF was more effective than control treatments and significantly improved gait parameters. These were randomized clinical trials (RCTs) with evidence level 2b, addressed all components of PICO, and had PEDro scores of 6/10. Additional consistencies included similar sample size (n=30; n=40), intervention duration (30 minutes, 5 days/week for 4 weeks), and pre- and post-tests were administered without follow-up. However, neither study addressed whether researchers were blinded. Inconsistencies between the key studies pertained to the control groups and differences in the independent and dependent variables (IVs and DVs). Seo used ramp training with PNF and without PNF (control group). Khanal used conventional physical therapy (PT) for the control group. The Seo subjects received lower extremity patterns, whereas the Khanal subjects received pelvic patterns. Seo measured spatial and temporal parameters of gait with the
GAITRite system and force plate. Khanal\(^6\) measured trunk function, ROM, and gait changes with Tinetti. Inclusion and exclusion criteria were more extensive in the Khanal\(^6\) study.

Other RCTs of good quality were Kyochul\(^4\) and Stephenson,\(^7\) both with level 2b evidence,\(^11\) and PEDro\(^12\) scores of 7/10. However, neither study addressed whether patients had stroke within one year of trial initiation. Kyochul\(^4\) study compared PNF in two different contexts (PNF ground gait vs. PNF stair training). Stephenson\(^7\) compared PNF, body-weight treadmill training (BWTT), and no intervention (control group). Kyochul\(^4\) found the PNF stair training group had significantly greater gains, than other groups, as measured by the Timed Up and Go. Stephenson\(^7\) had more gait related DVs (velocity, cadence and the Wisconsin Gait Scale) and concluded PNF yielded significant differences in all outcome measures in the experimental group compared to the control group, but not compared to BWTT.

Remaining studies\(^1,3,5,9,10\) were quasi-experimental and ranged from evidence levels 2b\(^11\) with PEDro\(^12\) of 5/10, to 2c\(^11\) with PEDro\(^12\) of 3/10.\(^5,10\) Consensus from these articles was PNF improved hemiparetic gait deviations as gauged by various clinical outcome measures. Dickstein\(^3\) measured improvements in ADLs and not gait. Kyochul\(^4\) and Trueblood\(^5\) found ground gait PNF patterns\(^4\) and supine pelvic patterns\(^5\) did not improve gait significantly on level ground. The Trueblood\(^5\) findings were weighed down due to one treatment session, whereas the next fewest number of sessions in the other studies was twelve.\(^3\)

Overall, our original PICO was not definitively answered. Four studies\(^1,3,4,9\) did not include participants with stroke within one year of the experiment. Five studies\(^1,4,5,9,10\) did not offer a comparison treatment. According to 80% of the literature reviewed in this CAT, PNF improved gait parameters in subjects who experienced a stroke and showed statistically significant differences (p<0.05)\(^3,4,6,7,10\) in a variety of outcome measures. Furthermore, PNF was more beneficial than a variety of comparison treatments (BWTT,\(^3,7\) ramp training,\(^8\) and conventional PT\(^2\)).

**Comments**: The PICO question was affirmed by two key studies\(^6,8\) with high levels of evidence,\(^11\) internal validity, and designs that closely matched the PICO question construct. These results may be generalized when patient characteristics and PNF treatments are similar to those used (muscle strengthening\(^6\) and non-PNF gait\(^8\)). Generalizability is limited due to the relatively small number of studies which affirmed the PICO question (only two\(^6,8\) of ten studies). The remaining studies\(^1,5,7,9,10\) drew alternative conclusions, although these had lower levels of evidence\(^11\) and/or did not make direct comparisons between PNF and other forms of PT.\(^1,4,5,9,10\) Increased confidence in the conclusion of this CAT might be possible if more studies closely matched the clinical question construct. The research on the use of PNF, with the dosages described,\(^6,8\) has been shown to be valid in the acute stroke population. In summary, clinicians should use PNF in this population but consider how dosage and functional context affects significance of change in clinical outcome scores.

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**Appraisal date**: August 05, 2015

**Peer-review provided by**: Phil Alonzo, Patrick Harris, Rebecca Marino, Robert Meier, Inge Tagliareni.
References: