**PICO: Is Dynamic Balance Training More effective than conventional gait training in reducing falls in individuals with stroke over the age of 65?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Marigold et al, 2005, J Am Geriatr Soc,  *Exercise Leads to Faster Postural Reflexes, Improved Balance and Mobility, and Fewer Falls in Older Persons with Chronic Stroke* | To determine effect of an agility exercise program versus a weight-shift/stretching program on functional balance, postural reflexes, and falls in older adults with stroke; Randomized clinical trial | N=61—participants gathered from hospital databases, stroke support groups, and advertisements  IC=50+, single-stroke >12mos onset, walk min 10m w or w/o AD  Agility Exercise Group: n=30  Weight-shift/Stretching group: n=31  Participants blinded to differences in interventions | 1 hr sessions 3x/week  **Agility Group**: challenged dynamic balance, tandem standing, SLS, walking with various challenges (side-stepping, tandem walking, figure-8 walking, stepping over obstacles), S-S, rapid knee raise while standing, standing perturbations  **Weight-shift Group:** slow, low-impact movements with stretching and weight shifting, Tai Chi-like movements | TUG, Berg Balance Scale,  ABC Scale, Step Reaction Time, Nottingham Health Profile, Community falls follow-up  Measured 3x: pre-treatment, post-treatment, and 1-month after treatment | Significant improvements in favor of agility group in following areas:  BBS p<.001  TUG p<.001  SRT p<.005  ABC p<.001  NHP p<.001  Rectus femoris and gastroc postural reflex improvement p<.001 and p=.004 respectively  Agility group with less falls at follow up, but not statistically significant | This study favors dynamic balance/agility training over the conventional weight shift training that makes up an important component of typical gait training. In this study, dynamic balance training was a more effective treatment for preventing falls. The balance screening tests were significantly better in the agility group. | Supports dynamic balance/agility training for falls prevention and improvements on functional balance testing |
| Van Duijinhoven et al, 2012, Stroke Res Treat,  *Development and Process Evaluation of a 5-Week Exercise Program to Prevent Falls in People after Stroke: The FALLS Program* | To determine whether a specific exercise program (FALLS Program) is feasible and safe to implement for people with stroke.; cohort study | N=12 divided over 2 consecutive groups of 6 participants. All participants received the same treatment.  Ages 55-65 7male/5female, 4 hemorrhagic, 8 infarction  IC=Community-dwelling persons with stroke, stroke >6 mos prior, had received IP therapy within past 2 years, FAC ≥4 | 2x/week for 10 sessions  FALLS program: dynamic balance excercises including obstacle course, fall techniques, walking exercises, dual task training and an evaluation of the program. Easily replicatable with sufficient detail | Participant Satisfaction Surveys | Satisfaction with the program was very high with 100% of participants stating the program was pleasant, instructive and with good guidance. Time spent with fall technique and walking dropped to 73%  Not measured with statistical significance | Though this study does not convey the comparison of two treatments or the effectiveness of one, it does exhibit willingness of patients to participate, and a perceived benefit from patients. Once this program is fully developed, patients could benefit from it since it employs a number of different dynamic balance activities and trains patients in safe ways to fall if needed. This shows us how important it is to incorporate patient input when making decisions on the use of EBP. Feasibility and safety are important aspects to consider since the program cannot be completed if it is not feasible for the patient from a financial or time standpoint. | Supports the feasibility for patients to participate in dynamic balance program specifically designed to address falls prevention.  Needs to address effectiveness in additional studies.  Small sample size |
| Bonan et al, 2004, Arch Phys Med Rehabil, *Reliance on visual information after stroke. Part I: Balance on dynamic posturography* | To test the hypothesis that postural imbalance after stroke is a result of the inability to integrate somatosensory, visual, or vestibular information; cross sectional study | N=40 gathered via convenience sample (27 men, 13 women)  IC=hemiplegia after first and only stroke, >12mos since stroke, moderate degree of impairment, amb without supervision and keep balance on EquiTest without help  Subjects divided into 4 groups by sensation and motor control. | Sensory organization test conducted on each participant to determine which are is affecting postural balance problems. Scores were also taken from “normal” persons to compare samples to. | Sway angle center of gravity, equilibrium score (100 means no sway and 0 means sway beyond limits of stability), displacement of COG  Tested only one time | Normal scores for conditions 1-3 (fixed platform eyes open, fixed platform eyes closed, sway-referenced vision). SOT5 scores significantly lower than normal for R-hemisphere lesions (p=.003), Median SOT6 scores lower than normal (p=.0007) and sig lower in r-hemi lesions (p=.002) but not in L-hemi regiions | This information gives us the information that is linked to postural imbalance, which in turn leads to falls. The dynamic nature of the SOT testing shows our use in therapy of DBT as intervention. By knowing which area of sensory org is lacking we can train that area or come up with a compensation strategy. | Supports presence of sensory integration difficulty as a factor in impairments in postural stability and balance.  Study could indicate resolve of these issues could improve stability, but needs further study to confirm. |
| Cheng et al, 2001, Arch Phys Med Rehabil,  *Symmetrical body-weight distribution training in stroke patients and its effect on fall prevention* | To determine the role of symmetrical body-weight distribution training in preventing falls among patients with hemiplegic stroke; RCT | N=54  IC=hemiplegic stroke, stroke between 2-4 mos prior to study, stand up independently and walk with or w/o cane  Control n=24  Treatment n=30 | Intervention Group: typical post-stroke PT rehab + standing postural symmetry and repetitive sit-to-stand training through use of standing biofeedback trainer in lab (30 min/day)  Control: typical PT rehab | Sit>Stand performance test with force plate determining symmetry, falls  Outcomes measured pre-treatment, post-treatment and 6-month follow-up | Duration improved in training group p<.01, symmetrical weight shift p<.001, center of pressure in anteroposterior plane p<.005, statistical difference between control and training for falls in favor of training group p<.05 | Weight-shift and sit-to-stand training can be effective in reducing falls and improving postural symmetry in the post-stroke population. Blocked practice could be helpful in training in this area. | Supports weight shift training and sit-to-stand training as potential fall reduction.  Supports blocked practice for balance training  Does not address dynamic balance training specifically. |
| Tsaklis et al, 2012, Top Stroke Rehabil, *Effects of Weight-shift training on balance control and weight distribution in chronic stroke: a pilot study* | To determine the effects of weight-shifting training with visual feedback in standing, and gait training with wall support on functional balance tasks, weight distribution, and postural control mesures during standing and forward reaching tasks in subjects with chronic strokes; Cohort study | Convenience sample Stockholm, Sweden  N=9 males  Chronic stroke recruited from outpatient PT clinic in Stockholm  IC=stroke >3 years ago, had remaining gait difficulties, able to walk >20m, follow verbal and visual instructions | Static balance control: stood barefoot on posturographic digital platform. Standing as still as possible by using visual feedback from PC monitor for 30 seconds.  Dynamic Balance Control: barefoot quiet bipedal stance, then performed sequence of moving COP to 7 diff positions within BOS while keeping trunk still  Walking with Wall Support: walked with affected side closest to wall wearing regular shoes. Subjects walked back and forth 10 times in 3 sets | Pre and post-treatment measures taken:  Berg Balance Scale, Foot pressure and shift of COP during forward reaching tasks. | Significant improvements from basline in the following areas: [quiet standing tasks]: quiet bipedal stance COP sway(p=.01), quiet bipedal stance COP velocity (p=.01), [forward reach tasks shoulder level]: affected a/p COP displacement (p=.02), nonaffected a/p COP displacement (p=.02), nonaffected approach phase (p=.03), affected COP mean velocity (p=.04), nonaffected COP mean velocity (p=.02) [forward reach task knee level]: nonaffected a/p displacement (p=.01), nonaffected approach phase (p=.02), affected recovery phase (p=.01), and nonaffected COP mean velocity (p=.01). For the Berg Balance Scale there was a significant difference between baseline and 4 week testing with p<.01) | Weight-shift training may be a helpful intervention for improving functional balance scores, stability during quiet stance and postural control in forward reaching. This study shows the value and sometimes necessity of compensatory strategies for patient function (i.e. strengthening unaffected side) | Supports weight-shift and dynamic balance training to improve postural stability in static and functional movements. |
| Vearrier et al, 2004, Gait & Posture, *An intensive massed practice approach to retraining balance post-stroke* | To test the hypothesis that standard PT (task-oriented) in a massed practice program could improve balance function in patients with stroke; single subject design | N=10 subjects served as own control from baseline to post-treatment  Ages 16-80, 4 females, 6 males, IC=>1 year post-stroke, medically stable, negligible co-morbidities, cleared by physician and neurologist, 25/30 MMSE, 30/56 BBS, 2/3 Upright Motor Control test, amb >50 ft, not participating in other interventions | Intensive massed practice with 6-hr day of 1-on-1 training for 2 weeks. Functional mobility such as ambulation, various upright static and dynamic balance tasks, addressed underlying impairments such as ROM and strength. Tx different for each subject based on impairments | Pre and post intervention (BBS and ABC given at 3-month follow-up)  Berg Balance Scale, ABC scale, Time to Stabilization of COP, Lower Extremity Motor Activity Log | Subjects 1 and 2 improvements in TTS at maintenance phase while other saw at intervention phase. Subject 9 saw no change. BBS pre to post p<.006 and post to follow-up p<.038. ABC scale pre to post p<.003 and post to follow-up p<.002. TTS significance reported baseline to intervention p<.001 but not from intervention to maintenance p<.216.  BBS saw improvements from 0% to 12%, ABC scale saw improvements -5% to 21%, LE mal saw improvements -2% to 21% | Massed practice may be an effective means of conducting balance and gait training to prevent falls. While this study does not compare two treatments, it exhibits the value of massed practice and that neuroplasticity can take place long after stroke to improve function. I would not apply this principle to acute stroke patients on this study alone. | Supports massed practice for balance and gait training to prevent falls.  Does not discuss specifics of balance and gait training, but does indicate its presence in large quantities per day (6 hours/day) |
| Alptekin et al, 2008, Clin Rehabil, *Efficacy of treatment with a kinesthetic ability training device on mobility after stroke: a randomized controlled study* | To find out whether a kinesthetic ability training device will enhance the effect of a conventional rehabilitation program on balance and mobility in patients with hemiparesis after stroke, RCT-asssessor blinded, physician who performed Fugl-Meyer Stroke Assessment and FIM. Another physician who performed KAT measurements also blinded to use of balance training program | N=30  Random allocation  Mean age 57.4, mean time since stroke 545 days  IC=first episode unilateral CVA with hemiplegia, ability to understand and follow commands, amb before stroke, no med contraindications for exercise, ability to stand without assist >1 min | Control: conventional care with PT, OT, SLP, positioning, NDT, postural control, ROM, PRE, gait and endurance  Experimental: conventional care plus 4 week balance training program 5x/week for 4 wks 20 min/session. Moveable platform connected to monitor displaying cursor where patient was prompted to move to put cursor central. Static and dynamic preset patterns practiced. Little detail given about intervention. | Initial and final evaluation made 1-3 days before and after treatment  Fugl-Meyer Assessment, FIM motor and locomotion, KAT balance index (dynamic and static) | Experimental group had greater improvement in measures of balance including static balance (p=.045), dynamic balance (p=.001), Fugl-Meyer Stroke Assessment Balance Score (p=.001). No group differences were seen in lower extremity subscores or locomotor subsets (p=.217 and .744 respectively) | Visual feedback is an extremely helpful component of balance training to give patients awareness through more than one sensory integration method. This can be an effective asset in regaining dynamic balance and potentially decreasing falls through better postural reactions and control. | Supports visual feedback as a means of incorporating both static and dynamic balance training.  Applicable in the clinic with the Wii Fit tool to incorporate visual feedback for balance tasks. |
| Yavuzer et al, 2006, Clin Rehabil, *The effects of balance training on gait late after stroke: A randomized control trial* | To investigate the effects of balance training using platform biofeedback on gait characteristics on persons with hemiparesis rctlate after stroke, RCT, assessor blinded | N= 41 with hemiparesis after stroke  Mean age 60.9; 25 men and 16 women  IC=first episode of unilateral stroke with hemiparesis, in internal carotid artery, ability to understand and follow simple verbal instructions, amb before stroke, ability to stand with or without assistance and take >1 steps, no med contraindications to walking | Control: Conventional Stroke Rehab program🡪2-5 hr/day. Patient-specific consisting of NDT, PT, OT, SLP, positioning, ROM, PRE with endurance walking and ADLs.  Experimental: conventional program plus additional 15 min balance training 1x/day for 3 weeks. During balance training Nor-Am Target Balance Training System was used in standing stability mode. Forceplate detects pressure. Exercise tasks for weight shift to meet visual targets with COP | Pre and post-treatment values taken  Gait analysis via Oxford Metrics Limited Software: calculated joint angles, ground reaction force under each LE  Time and Distance parameters: walking velocity, cadence, step length, single support time  Kinematic and Kinetic Parameters: pelvic excursions, joint excursions in sagittal plane | Only two statistically significant results were in pelvic obliquity (p=.039) and vertical GRF first peak (p=.030). Experimental group saw larger gains in these two areas than control group. No other significant change for other outcome measures. | Improvements from this intervention are minimally significant, and we can’t take away large generalizations from study. Study with incomplete subset of parameters to address postural control. Wii Fit could be a useful tool to use in clinic to mimic this exercise. No true comparison of gait training and dynamic balance training, but the group who incorporated dynamic balance did make slight gains in GRF and pelvic excursion parameters. | Shows some support for visual feedback via forceplate use.  Wii Fit could be used in the clinic to mimic experimental group conditions. |

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| Mansfield A, Peters AL, Liu BA, Maki BE. 2010. Physical Therapy. Effect of a Perturbation-Based Balance Training Program on Compensatory Stepping and Grasping Reactions in Older Adults: A Randomized Controlled. Trial | Evaluate a perturbation based balance training program to target age-related impairments in compensatory stepping and grasping balance recovery; double blind RCT | 30 community-dwelling older adults with recent history of falls or perception of instability | Random assignment to either motion platform balance training (perturbation-based) program or control group with flexibility and relaxation training  Training period was 6 weeks. | | Multi-step reactions, extra lateral steps following A/P perturbations, foot collisions during lateral perturbations, time to complete grasping reactions  All were measured pre and post intervention period. | Statistical significance found with stepping reactions in A/P and M/L directions with surface translation, and with cable pull in grasp reactions | Many individuals with stroke are older adults who have pre-existing susceptibility to falls prior to stroke. These conditions are important to consider as they are a co-morbidity on top of chronic stroke | Further research needs to be conducted to determine how this affects older adults with disease-specific risk factors (i.e. stroke, TBI, TKA). |
| An M, Shaugnessy M. 2011 Journal of Neuroscience Nursing. The Effects of Exercise-Based Rehabilitation on Balance and Gait for Stroke Patients: A Systematic Review. | To review literature determining the effectiveness of exercise-based rehabilitation on gait and balance; systematic review | RCTs published in English language  IC: particpants living with stroke 18 years and older, one of outcomes focused on balance or gait functions | Aerobic, Comprehensive and Multisensory exercise interventions  Interventions varied from Tai Chi to BWSTT, to strength training, agility, gait training, and dual tasking. | BBS, Balance and Gait Measures | | Varying results, in many RCTs both control and training groups improved, though statistical significance was not noted between groups. Aerobic exercise, however is beneficial to improving balance post-stroke | Exercise training, especially aerobic training, is a helpful tool in attaining dynamic balance stability and thus should theoretically reduce falls in this population.  Timing plays a role in improving balance in stroke. Exercise during the acute recovery period shows greater improvements on the BBS during the first year after stroke. | Only observed RCTs published in English. Some studies also had small sample sizes |

**PICO: Is arm training more effective than specific balance training to reduce falls in indviduals with stroke over the age of 65?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Waller SM, Prettyman MG. 2012. Gait and Posture. Arm training in standing also improves postural control in participants with chronic stroke. | To determine if postural control improves with arm training in standing and not with specific balance control; case series | 9 subjects with chronic hemiparetic stroke gathered via convenience sample from another study  IC:chronic unilateral ischemic or hemorrhagic stroke, age 50-80, 6 months post stroke with completion of conventional therapy, ability to stand unsupported for 5 minutes with CGA of trainer | Training 1 hour 3x/wk for 6 wks: 5 UE tasks involving grasp, reach **and** release with Saeboflex hand training orthosis; 1. grasp, forward reach and release ball in target bucket, 2. grasp, reach forward through hoop and release ball in bucket, 3. grasp with pronated forearm and supinate to place hoop ball on horizontal pole 4.grasp with palmart grasp, flex and abduct arm to place hoop ball on horizontal pole 5. grasp peg ball with supinated wrist, reach forward and place peg in elevated peg board | Postural control testing: SOT, limits of stability, and rhythmic weight shift  Clinical Measures: BBS, ABC Scale  All measures were tested before and after treatment period of 6 weeks. | * Mean scores for SOT increased to post training (p<.05) * Limits of Stability: after training 6 of 9 subjects could reach all targets for COP movement directions * Rhythmic Weight Shift: directional control improved post training in M/L for all speeds and fast and moderate speeds for A/P shifts (p<.05) * BBS significant increases from pre to post (p<.01) * ABC scores improved significantly from pre to post (p<.05) | Though this UE training does involve the hemiparetic and non-hemiparetic UE, it incorporates much of the components of typical dynamic balance training. It is performed in standing, requires reaching and dual tasking, and requires control of the base of support and postural control. Reaching tasks are a helpful way to incorporate balance training in individuals with stroke. | Very small sample size, would require larger RCT to make any definitive conclusions.  Patients were in a previous study that involved postural control, so their awareness of postural control during activity was likely heightened. |

**PICO: Is the use of body-weight supported treadmill training more effective than no treatment in reducing risk for falls in individuals with stroke?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Combs SA et al. 2010. Arch Phys Med Rehabil. Balance, Balance Confidence, and Health Related Quality of Life in Persons With Chronic Stroke After Body Weight-Supported Treatdmill Training | To examine balance and balance confidence 6 months after BWSTT; prospective pre/post test study with 6 months retention | Convenience sample of 19 subjects at least 6 months post stroke, and able to ambulate 0.4-0.8 m/s | BWSTT administered for 20 minute sessions for 24 sessions over 8-week period. | BBS, ABC Scale, Stroke Impact Scale, Comfortable 10-meter walk test, and Fast 10-meter walk test | BBS significantly improved from pre-test to retention (p<.001)  ABC Scale significantly improved to retention (p<.05)  CWT and FWT significantly retained from pretest to retention (p<.05) | The use of BWSTT shows good retention in balance and balance confidence as well as walking speed with CWT and FWT.  Body weight supported treadmill training helps contribute to the factors that prevent falls including balance and balance confidence. | 6-months does represent a fairly significant retention rate, but perhaps an even further follow-up would be better suited (i.e. 1-2 years)  Lack of comparison group makes the findings less significant  Larger group and control group needed for further experimentation |

**PICO: Is the use of functional electrical stimulation more effective than no treatment in reducing falls in individuals with stroke?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Robertson JA, Eng JJ, Hung C. 2010. Physiotherapy Canada. The Effect of Functional Electrical Stimulation on Balance Function and Balance Confidence in Community-Dwelling Individuals with Stroke | Evaluate the change in balance function and confidence in adults with chronic stroke using FES for gait training; before-after study design | 15 community dwelling adults recruited through advertisements to support groups, stroke rehabilitation facilities and outpatient PTs working with persons with stroke | WalkAide2 FES was applied to each patient’s tibialis anterior muscle using biphasic waveform at 25 Hz during swing phase of gait--4 week period | ABC, BBS, TUG Test, Self-selected speed and fast speed trials | FES did produce an improved toe clearance during the swing phase of gait (p=.010 self paced and p=.005 fast paced)  BBS significant difference with and without FES  Decrease in ABC scores due to discomfort of FES device | FES can improve function of dorsiflexors, allowing more toe rise during the swing phase of gait to protect patient from tripping from toe drag at that phase. Could reduce falls during gait for this reason. | A training effect may have been in place due to the patient’s discomfort with the FES device. Perhaps not enough time was given for patients to practice with devices before training period began. |

**PICO: Does a Multifactorial Fall Prevention Program reduce risk for falls in individuals with stroke more than conventional stroke care?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Batchelor FA et al. 2012. Arch Phys Med Rehabil. Effects of a Multifactorial Falls Prevention Program for People With Stroke Returning Home After Rehabilitation: A Randomized Controlled Trial. | To determine the effectiveness of a multifactorial falls prevention program on reducing falls in those with stroke; single blind RCT | N=156 patients with stroke who were at high risk for recurrent falls upon returning home; assigned to intervention and control groups  Control (n=71)  Intervention (n=85) | **Control**: usual care consisting of outpatient PT and follow-up with physician  **Intervention**: individualized HEP based on Otago Exercise Programme, falls risk minimization strategies, education (written and verbal), injury risk minimization for those at high risk of fracture and received usual care similar to control group | Rate of falls, proportion of fallers, injurious falls, falls risk, participation, activity, leg strength, gait speed, balance, and falls efficacy | No significant differences in any outcome measures between control and intervention groups | A multifactorial program did not reduce risk for falls in this RCT trial.  The clinical judgement and patient values portions of EBP should dictate that this program may be important for individual patients, even though it did not have a widespread effect. | Researchers made no attempt to truly control the care that the control group received, likely due to ethical reasons. This could be a likely reason that there was no significant differences between groups |

**PICO: Will a biofeedback training program reduce risk for falls in individuals with stroke more so than conventional stroke training?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Cheng et al. 2001. Arch Phys Med and Rehabil. Symmetrical body-weight distribution in stroke patients and its effect on fall prevention. | To determine the role of symmetrical body-weight distribution training on reducing falls in stroke; prospective study | N=54  (30 in training group, 24 in control group)  All were inpatients with hemiplegic stroke, patients could stand up and walk independently without a cane | Control: Conventional stroke rehabilitation including facilitation techniques, FES, and therapeutic exercise  Training: conventional+symmetrical standing training with biofeedback trainer and repetitive sit-to-stand  5 days a week for 3 weeks | Occurrence of falls, sit-to-stand performance (body weight distribution, rate of rise in force, and COP sway)—initial and follow-up tests | Training group attained significant improvements from initial test in:  Duration (p<.001), %body weight (p<.005), rate in rise of force (p<.001), COP X (p<.01), COP Y(p<.05), the training group also had significantly reduced falls (p<.05) at six-month follow-up | Symmetrical body-weight distribution and sit-to-stand training with biofeedback can help reduce falls in individuals with stroke. | By using equal amounts of force through both lower extremities, the center of gravity is better controlled and is less likely to be outside of the base of support. Training people in body-weight distribution can help with function greatly, especially in balance during ADLs, and community participation. |
| Badke et al. 2011. Arch Phys Med Rehabil. Tongue-Based Biofeedback for Balance in Strok: Results of 8-week Pilot Study. | To determine if balance can be improved with a tongue electrotactile biofeedback training program; Prospective multicenter research | N=29 patients with chronic stroke, recruited by referral by rehabilitation clinics in the US | 1 week of in-clinic exercise, with 7 weeks of at-home exercise with tongue-based biofeedback balance device that detects changes in head position and stimulates the tongue accordingly in a spatially arranged pattern | BBS, TUG, ABC, DGI, SIS all performed before and after intervention | Stasticially and clinically significant improvements from pre🡪post training in BBS (p<.001), DGI(p<.001), TUG(p<.002), ABC Scale and partial SIS sections; 27 subjects improved greater than the MCID in at least one outcome | Tongue bio-feedback helped improve (at least) short-term balance improvements both clinically and statistically; promising home exercise program option if affordable; potentially good program for those with chronic stroke | No control group existed for comparison, future RCT recommended |

**PICO: Does Vitamin D supplementation reduce risk for falls in individuals with stroke more than no treatment?**

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| **Author, Year, Journal, Title** | **Purpose,**  **Design** | **Subjects** | **Intervention** | **Outcome Measures** | **Results** | **Application to PICO Question** | **General comments** |
| Sato Y, Iwamoto J, Kanoko T, Satoh K. 2005. Cerebrovascular Diseases. Low-Dose Vitamin D Prevents Muscular Atrophy and Reduces Falls and Hip Fractures in Women after Stroke: A Randomized Controlled Trial | To explore the effects of Vitamin D supplementation on falls in individuals with chronic stroke; RCT double blind | N=96 elderly women with post-stroke hemiplegia randomly assigned to two groups  (48 received vitamin D supplement and 48 received placebo) | Control: Placebo  Intervention: 1,000 UI ergocalciferol daily  Followed for 2 years | Strength and tissue ATPase of skeletal muscles on non-paretic side, falls assessed before and after study | Significant reduction in falls over two years, significant improvement of strength in the treatment group in non-paretic muscles (glut max and iliopsoas, vastus lateralis), no incidence of hip fracture s in treatment group and 4 hip fractures in placebo group. | Vitamin D treatment accounted for a 71% reduction in falls over the two year period as well as an increased muscle strength in the treatment group. Muscle strength’s correlation with falls is likely, so the increased strength and decreased falls provides an encouraging relationship between the treatment and result. | Good amount of time for follow-up, though a strong risk for attrition |

**Appropriate Frequency, Intensity and Duration of Gait Training to Improve Gait Quality and Reduce Risk for Falls:**

***Citation:*** Hornby TG, Straube DS, Kinnaird CR, Holleran CL, Echauz AJ, Rodriguez KS, Wagner EJ, Narducci EA. Importance of specificity, amount, and intensity of locomotor training to improve ambulatory function in patients poststroke. Top Stroke Rehabil. 2011 Jul-Aug;18(4):293-307

***Review Findings:***

* The largest improvements in lower extremity motor function are made in the first 3 months after stroke, with little improvements thereafter.
* Specificity: Task-specific training is achieved through practicing ambulation to improve ambulation skills. A typical gait progression is from body-weight supported ambulation to conventional ambulation. Training methods incorporate a fair amount of ambulation in a safe, controlled environment and progress conditions as the patient’s skill improves. Many studies support the beginning use of BWSTT for individuals with moderate to severe gait impairment.
* Amount of Task-Specific Exercise: large amounts of practice are encouraged for gait training (i.e. 1,000-2,000 steps per session). Essentially, the less steps, the less improvements are seen in step quality.
* Training Intensity: Higher intensities are preferred for a higher level of functioning. Higher treadmill speed requires more neuromuscular demand and more aerobic benefits. Higher intensity can also initiate neural excitability that is tied to better walking function.

***Clinical Application*:** Gait training is an important component of reducing falls in individuals with stroke. Because of specific gait impairments, base of support, balance, and center of gravity are all affected, increasing a patient’s risk for falls. By appropriately applying the optimal amount and type of gait training, we can work towards resolving one of the components that could lead to injurious falls. The availability for adequate training time is best seen in the inpatient rehabilitation setting, as usually an hour to 90 minutes is available for treatment. The utilization of this time is valuable, and the parameters of gait training should be considered.