**ONLINE SUPPLEMENTARY MATERIALS – Currently listed as appendices**

**APPENDIX A: PubMed Search, July 2015**

1: “mild cognitive impairment”[MeSH]

2: “mild cognitive impairment”[tiab]

3: “mild cognitive impairement”[tiab]

4: MCI[tiab]

5: “age-associated memory impairment”[tiab]

6: “age-associated cognitive decline”[tiab]

7: “benign senescent forgetfulness”[tiab]

8: “cognitive impairment no dementia”[tiab]

9: CIND[tiab]

10: 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9

11: Gait[MeSH]

12: “Gait Disorders, Neurologic”[MeSH]

13: walking[MeSH]

14: Gait\*[tiab]

15: walk\*[tiab]

16: “dual task”[tiab]

17: “dual tasking”[tiab]

18: step-time[tiab]

19: step-length[tiab]

20: step[tiab]

21: stepping[tiab]

22: “single support”[tiab]

23: “double support”[tiab]

24: “double limb”[tiab]

25: stride\*[tiab]

26: cadence\*[tiab]

27: “swing time”[tiab]

28: “stance time”[tiab]

29: 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28

30: sway\*[tiab]

31: “postural balance”[MeSH]

32: postur\*[tiab]

33: “center of pressure”[tiab]

34: “center of mass”[tiab]

35: “balance”[tiab]

36: proprioception[tiab]

37: 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36

38: 10 AND (29 OR 37)

**APPENDIX B: Assessment of Methodological Quality**

Methodological quality was assessed using appropriate domains (i.e. blinding of personnel, participants, and outcomes; incomplete outcome data; selective outcome reporting), of the Cochrane Collaboration’s tool for assessing the risk of bias. For each study, the risk was categorized as “low”, “high”, or “unclear”.

|  |  |  |  |
| --- | --- | --- | --- |
| **Study** | **Domain** | | |
| **Blinding of Personnel, and Outcome Assessors** | **Incomplete Outcome Data** | **Selective Outcome Reporting** |
| Beauchet et al., 2011 | Unclear | Low | Low |
| Beauchet et al., 2013 | Unclear | Unclear | Unclear |
| Boripuntakul et al., 2014 | Unclear | Low | Low |
| Choi et al., 2011 | Unclear | Low | Low |
| Deschamps et al., 2014 | Low | Low | Low |
| Gillain et al., 2009 | Unclear | Low | Low |
| Leandri et al., 2009 | Unclear | Low | Unclear |
| Mignardot et al., 2014 | Low | Unclear | Unclear |
| Montero-Odasso et al., 2012 | Unclear | Low | Low |
| Montero-Odasso et al., 2014 | Unclear | Low | Unclear |
| Muir et al., 2012 | Unclear | Low | Low |
| Nascimbeni et al., 2015 | Unclear | Low | Low |
| Tarnanas et al., 2015 | Unclear | Low | Unclear |
| Verghese et al., 2008 | Low | Low | Low |
| **Summary** | **Low: 3**  **Unclear: 11**  **High: 0** | **Low: 12**  **Unclear: 2**  **High: 0** | **Low: 9**  **Unclear: 5**  **High: 0** |

In summary, for blinding of personnel and outcomes; three studies were identified to have a low risk of bias, and 11 studies did not provide enough detail to determine whether a blinding procedure was used. For incomplete outcome data, 12 studies had a low risk of bias, and 2 may have reported incomplete outcome data. For selective outcome reporting, 9 papers had a low risk of bias, and 5 may have reporting selective outcome data.

**APPENDIX C: Funnel Plots for Assessment of Publication Bias**

For most parameters, there were not enough studies to assess publication bias using funnel plot or other advanced methods. Gait velocity for single task, which had the largest sample size, was used as representative for the overall publication bias in the included studies. From the asymmetry of the funnel plot, there is clear evidence of publication bias in the included studies.

Online Supplmentary Figure 1

**APPENDIX D: Gait Parameters and Qualitative Brain Changes in MCI**

Our qualitative analysis additionally identified five studies[[1-5](#_ENREF_1)] that focused on mechanisms explaining the MCI related decline in gait. Since these studies did not report values which could be included in meta-analysis, they were not included in the article text. From the four papers that focused on brain atrophy or brain chemistry in MCI subjects, it was found that brain atrophy was inversely related to gait velocity [[6](#_ENREF_6)] and associated with increased falls in subjects [[4](#_ENREF_4)]. In particular, atrophy of the primary motor cortex and alterations of biochemical balances in the brain identified through magnetic resonance spectroscopy lead to decreased gait velocity and increased stride time variability[[3](#_ENREF_3)]. Verbal fluency[[1](#_ENREF_1)] and visuospatial working memory[[5](#_ENREF_5)] were additionally found to be impaired and linked to the brain atrophy.

Consistently, authors reported that MCI had significant impact on gait performance, which appears to be resulting from brain atrophy and associated biochemical changes in the motor pathways[[3](#_ENREF_3)]. Global brain atrophy decreases a person’s cognitive abilities for motor planning and navigation[[6](#_ENREF_6)] and can be assessed through ventricle volume[[2](#_ENREF_2)]. This atrophy may contribute to decreased gait velocity[[6](#_ENREF_6)] because of impairment of sequential thinking[[7](#_ENREF_7)] required during motor planning and execution. Past work has also identified the primary motor cortex as critical in the latter half of locomotive execution[[8](#_ENREF_8)] for both successful gait and adaptability to external perturbations. When atrophy of the motor cortex is examined in dual task performance as compared to single task, the deterioration of gait performance (e.g. gait velocity, stride time variability[[3](#_ENREF_3)]) seems to indicate that the primary motor cortex is important to gait quality and performs a supportive role in that capacity. Further, primary motor cortex is involved execution of motor commands and loss of neurons in this structure changes both the chemical interactions and resulting motor function[[3](#_ENREF_3)]. Additionally, this region of the brain has been implicated in maintenance of patterns, and it has been shown that gait patterns rely heavily on neuron networks through transcranial magnetic stimulation[[9](#_ENREF_9)]. This loss of function in the primary motor cortex may be the cause of increased stride time variability, as the internal model for generating the even gait is no longer functioning optimally.

**References**

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