# DOES ENGAGING WORKING MEMORY TASK DURING WALKING REDUCE KNEE ADDUCTION MOMENT? EXPLORATORY STUDY

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## INTRODUCTION

Alterations in knee adduction moment (KAM) has been suggested as a surrogate measure of medial compartment (1). It has two peaks; the first peak has been correlated with the progress of knee osteoarthritis (OA) that is more common in elderly population (2). Individuals with OA suffer to the limit of functional mobility including walking. Walking involves cognitive processes related to planning and performing actions. With advancing age, reduction in the cognitive functions related to walking has been noted (3). As OA is an age-related condition, it is therefore, necessary to consider OA gait assessment whilst individuals performing additional cognitively engaging tasks. There is, to the best of our knowledge, no published research examining the effects of concurrent cognitive tasks during walking on KAM. The aim of this study is to explore whether introducing cognitively engaging task during walking would affect the first peak of the KAM in healthy individuals.

## METHODS

Twenty-three healthy male subjects (age: 34.56 + 5.12 years) walked on a GRAIL system (Gait Real-time Analysis Interactive Lab, Motek Medical B.V.) at two days, separated by 5 ± 3 days. The GRAIL consists of an instrumented dual-belt treadmill and a 12-camera Vicon tracking system (Oxford Metrics, UK). Using the self-paced mode with virtual-endless scene, they walked under three conditions in random order: 1) Free walking (FR); 2) while performing one back auditory memory test (OB); and 3) while performing two-back auditory memory test (TB).

The average the first peak of KAM, range-of-motion (ROM) of KAM and foot progression, and walking speed across 100 consecutive gait cycles were calculated. A repeated measures ANOVA was used to explore the effect of memory tasks on these outcomes. The level of statistical significance was set at $p<0.05$.

## RESULTS

Descriptive statistics for KAM and its ROM, walking speed, and ROM of foot progression are presented in Table 1. The mean of KAM and foot progression of the 23 subjects for each walking condition is illustrated in Figure 1. There was no significant decrease (Figure 1) in these parameters while performing OB and TB tasks within a session and between days.

## DISCUSSION AND CONCLUSIONS

Although there was no significant effect of the working memory task on the reported gait parameters, participants walked slower ($p=0.068$) while performing OB and TB. In general terms, walking slower while performing another cognitive task is suggested in literature (3). Our findings show that the memory tasks caused participants to walk with only a slight reduction in both the first peak of the KAM and external foot progression (it can be used to reduce KAM (4)) (Figure 1). This is expected since control of gait requires minimal cognition; healthy subjects should therefore have sufficient residual cognitive capacity to maintain gait control even whilst performing additional cognitively engaging tasks (e.g. a working memory task). The results are based on much more strides compared to literature, therefore, learning effects might be reduced in our study. Future research should examine the effect of our concurrent paradigm on KAM and other gait parameters related to knee unloading in knee OA patients.

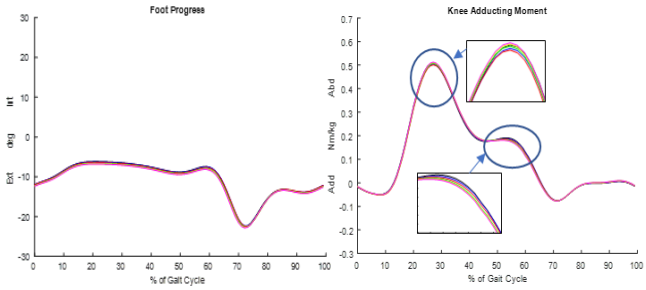


**Figure 1**: The mean KAM and foot progression curves of the 23 subjects throughout the gait cycle for all conditions at both days.

**Table 1:** Descriptive statistics (means and standard deviations (sd)) of gait parameters during three walking conditions: FR (single walking task); OB (walking while performing One-back task); and TB (walking while performing Two-back task). PKAM: First peak of the KAM; FP: foot progression; Bt Days: effects between days.

| | Day 1 | | | | Day 2 | | | | Bt Days |
|---|---|---|---|---|---|---|---|---|---|
| | FR (± sd) | OB (± sd) | TB (± sd) | P | FR (± sd) | OB (± sd) | TB (± sd) | p | p |
| PKAM (Nm/Kg) | 0.513 (0.13) | 0.504 (0.136) | 0.502 (0.127) | 0.307 | 0.531 (0.105) | 0.529 (0.102) | 0.528 (0.112) | 0.953 | 0.312 |
| KAM ROM (Nm/Kg) | 0.611 (0.123) | 0.603 (0.128) | 0.601 (0.125) | 0.597 | 0.634 (0.093) | 0.626 (0.092) | 0.629 (0.101) | 0.637 | 0.104 |
| Walking Speed (m/s) | 1.448(0.145) | 1.392 (0.145) | 1.384 (0.189) | 0.068 | 1.467 (0.171) | 1.444 (0.141) | 1.445 (0.156) | 0.232 | 0.268 |
| FP ROM (degree) | 22.277 (11.738) | 21.166 (10.718) | 21.00 (11.767) | 0.207 | 21.523 (10.925) | 21.622 (11.396) | 21.319(11.214) | 0.803 | 0.100 |

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