Implementing reading performance measures in the clinical practice: reading aloud or silent?

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Introduction: Many activities of daily living rely on reading, thus, standardized reading texts have been developed to evaluate sustained reading performance. However, a significant inter- and intra-individual variation in reading performance exists, as a result of the high influence of cognitive factors. Here we present a new method based on eye movement analysis that can improve variability in silent reading.

Methods: Twenty volunteers with an average age of 30 years (range: 22 to 36 yrs) participated in the study. Reading performance was evaluated using two IReST texts of similar linguistic difficulty of about 140 words each and 0.4 logMAR print size at 40 cm distance in two conditions. First, participants were instructed to read the texts <u>aloud</u> as fast as they could, trying not to correct any possible mistakes. Second, participants read the texts <u>silently</u> while their eye movements were monitored using an infrared eyetracker (Eye-Link II, SR Research Ltd). A reading comprehension questionnaire was performed to secure a high level of attention. Data analysis included computation of reading speed (in wpm), number of fixations per word (in fpw), fixation duration, and percentage of regressions.

Results: Average (SD) reading speed was found to be 204 ($\pm$17) and 229 ($\pm$45) wpm for the aloud and the silent reading, respectively with the difference being statistically significant (p=0.012). The repeatability coefficient (2*SD) was better in the aloud (27 wpm) compared to the silent (47 wpm) condition. In the silent condition, average number of fixations among participants was 1.00 ($\pm$0.13) fpw, and the repeatability of coefficient 0.14 fpw. Average fixation duration was 200 ($\pm$20) with the repeatability coefficient being 20 ms. Average percentage of regressions was 14.0% ($\pm$6.1) and the repeatability coefficient 6.9%. Reading speed in the silent condition was statistically correlated with the number of fixations (r=-0.83) and with fixation duration (r=-0.72).

Conclusions: Most of the variability in silent reading speed derives from the number of fixations, which is known to depend on cognitive factors. Repeatability can be improved using fixation duration which better characterises pre-retinal processing. Evaluating reading performance using eye movement analysis can result in a more reliable outcome of reading behaviour.