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

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Introduction: Many activities of daily living rely on reading, while reading difficulty forms the most common complaint among individuals with visual deficits. Thus, standardized reading texts have been developed to evaluate sustained reading performance. Although these tests are thoroughly standardized, a significant inter- and intra- individual variation in reading performance (ie reading speed) exists, especially in comprehensive reading, as a result of the high influence of cognitive factors. Here we present a new method based on eye movement analysis that can improve reading speed variability in silent reading.

Methods: Twenty young volunteers (native Greek speakers) with an average age of 30 years (range: 22 to 36 yrs) and healthy vision participated in the study. Reading performance was evaluated with subjects reading two IReST texts of similar linguistic difficulty of about 140 words each and 0.4 logMAR print size at 40 cm distance. Reading was evaluated in two conditions: first, participants were instructed to read the texts aloud as fast as they could, trying not to correct any possible mistakes, especially not to go back in the text. Second, participants read the texts silently 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 during the experimental procedure. 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 205 ($\pm$21) and 225 ($\pm$47) wpm for the aloud and the silent reading, respectively with the difference being statistically significant ($p<0.017$). The repeatability coefficient (2*SD) was better in the aloud (24 wpm) compared to the silent (45 wpm) condition. In the silent condition, average number of fixations among participants was 1.00 ($\pm$0.17) fpw, while the repeatability of coefficient was 0.19 fpw. Average fixation duration was 208 ($\pm$19) with the repeatability coefficient being 20 ms. Average percentage of regressions was 14.2% ($\pm$6.1) with the repeatability coefficient being 7.0%. Reading speed in the silent condition was statistically correlated with the number of fixations ($r=-0.82$) and then with fixation duration ($r=-0.55$).

Conclusions: Most of the variability in silent reading speed derives from the number of fixations, which is known to depend on cognitive factors. Repeatability in reading performance 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.