

INTRODUCTION

A limited number of previous studies have focused on the driving behavior of patients with frontotemporal dementia (FTD). Previous research (Ernst et al., 2010; Fugito et al., 2016) based on the information provided by caregivers, revealed that patients with FTD have increased driving difficulties as compared to patients with Alzheimer's dementia (AD).

According to the observed pattern of findings, patients with FTD appear to adopt an **aggressive and risky style** of driving behavior that is related to their frontal pathology (Ernst et al., 2010; Fugito et al., 2016; Turk & Dugan, 2014).

Data from a simulator experiment indicated that drivers with FTD have increased risk to commit various types of **driving errors** namely speed limit and stop sign violations as well as of-road crashes (de Simone et al., 2007).

Scope of the present research was to explore **the driving profile of patients with FTD** by focusing on two critical driving indexes, namely reaction time and accident risk. In contrast to previous research, the **subtype of FTD** namely **behavioral variant (bv-FTD)**, **Semantic Dementia (SD)** & **Primary Progressive Aphasia (PPA)** was taken under consideration in the analysis.

PATIENTS & METHODS

- Six patients (mean age=64.8±9.6) with FTD (bv-FTD=4, SD=1, PPA=1) were included in the study.
- Each participant was examined by a neurologist to verify the diagnosis of FTD according to the established criteria (Finger, 2016). In addition, a detailed **neuropsychological evaluation** was applied.
- The participants were assessed for their driving ability through a **driving simulator experiment** that measured the following driving indexes: **average speed, headway distance, reaction time, accident risk.**
- **Inclusion criteria** included: (a) a valid driver's license, (b) regular driving without any previous significant traffic accident, (c) absence of serious medical or psychiatric condition, (d) absence of dizziness or nausea while driving, (e) absence of any important vision disorder.
- For computing the **z-scores of the FTD patients** on the various driving indexes we used a reference group of healthy control drivers similar age and driving experience.

RESULTS

Table 1. Characteristics of patients with FTD

| Drivers (Diagnosis) | Age (years) | Education (years) | MMSE | FAB | CDR | Driving Exp. (years) |
|---------------------|-------------|-------------------|------|-----|-----|----------------------|
| Driver 1 (bv-FTD) | 63 | 6 | 21 | 6 | 0.5 | 40 |
| Driver 2 (bv-FTD) | 49 | 9 | 25 | 12 | 0.5 | 15 |
| Driver 3 (bv-FTD) | 66 | 17 | 25 | 7 | 1 | 38 |
| Driver 4 (bv-FTD) | 77 | 14 | 26 | 11 | 1 | 35 |
| Driver 5 (SD) | 63 | 6 | 22 | 12 | 1 | 40 |
| Driver 6 (PPA) | 72 | 6 | 8 | 4 | 0.5 | 50 |

MMSE: Mini Mental State Examination, FAB: Frontal Assessment Battery, CDR: Clinical Dementia Rating Scale, Driving Exp.: Driving Experience

Note. Driver 6 has profound low neuropsychological scores due to his specific language impairments

Figure 1: Driving landscape in the rural and the urban region



RESULTS

Figure 1. Driving performance of each participant on specific driving variables

| Driving Indexes | Driver 1 | Driver 2 | Driver 3 | Driver 4 | Driver 5 | Driver 6 |
|-----------------|---------------|---------------|----------------|---------------|----------------|----------------|
| Diagnosis | bv-FTD | bv-FTD | bv-FTD | bv-FTD | SD | PPA |
| Reaction Time | 2.3 SD | 1.1 SD | 5 SD | 1.1 SD | -0.2 SD | 2.3 SD |
| Average Speed | 1.6 SD | -0.2 SD | -1.6 SD | -0.3 SD | -2.2 SD | -2.5 SD |
| Accident Prob. | 50% | 25% | 100% | 0% | 0% | 0% |
| Headway Dist. | 0.6 SD | -0.4 SD | -0.6 SD | -0.8 SD | -0.1 SD | 0.7 SD |

Note: R.T.= Reaction Time, Av. Speed= Average Speed, Acc. Prob. = Accident Probability, Hway = Headway Distance, **z-scores are computed according to the mean-value and Standard Deviation of a control group of similar age and driving experience**

- Three bv-FTD had excessively high risk of being engaged in a car accident ($\geq 25\%$) compared to matched controls (8.8%).
- All four drivers with bv-FTD had a slow reaction time (at least 1SD greater than the average reaction time of the control group).
- The driver with SD managed to monitor effectively his reaction time and accident risk by utilizing a risk compensation strategy that was characterized by excessively slow driving speed and rather long headway distances.
- Finally, the driver with PPA had a slow reaction time ($z=2.2$) but attenuated accident risk and his overall driving profile was similar with the one of the driver with semantic dementia.

DISCUSSION/CONCLUSION

- The current findings indicate that the clinical variations of frontotemporal degeneration seem to affect driving behaviour in different ways. Thus, the sub-diagnosis of FTD should be carefully taken under account when evaluating the driving fitness of patients from this particular clinical group.
- In line of previous research, patients with bv-FTD adopt a risky driving behavior style that is characterized by a marked increase in accident risk and augmented reaction times on the appearance of unexpected incidents.
- On the other hand, driving profile of patients with SD & PPA appears to be less risky as it is characterized by a very low accident risk that does not surpass the corresponding index in the group of cognitively intact individuals of similar age and driving experience.
- Future studies are warranted in order to explore the driving behavior of patients with SD and PPA by utilizing larger and, therefore, more representative samples of drivers with the aforementioned clinical syndromes.

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