

Introduction

Individuals who experience blindness early in life (early blind, prior to age 16) have been shown to incorporate cross modal sensory mechanisms to enhance cortical reprocessing as an adaptation for vision loss. These individuals develop cortical reprocessing essential for integrating alternative sensory cues in learning and cognitive processing. Interestingly, there appears to be a finite period of brain plasticity allowing for cross modal cortical reprocessing. Individuals who experience blindness after the mid-teenage years (late blind) appear to be much less likely to fully develop cross modal cortical integration vs. early blind individuals as demonstrated by fMRI studies.

Development of cross modal cortical reprocessing appears to play a key role in enhancing non-visual sensory perception thereby facilitating skills in braille and other non-visual learning modalities. It is unclear however if the full benefit of cross modal reprocessing noted in those early blind individuals imparts advantages in cognition in old age compared to those who experience blindness later in life as young adults or in middle age.

It is further hypothesized that cross modal reprocessing skill negates suggestions by the sensory deprivation theory linking vision loss to reduced cognitive function. Rather, it is posited that modifying effects of personality such as neuroticism, depression, and anxiety likely have more of an impact on cognition and perceptual skill among early or late blind older adults than sensory acuity loss.

Objectives

The purpose of this study therefore is to test the following hypotheses:

1. The advantage of early blindness in terms of exploitation of cross modal sensory adaptation translates to greater preservation of perceptual and cognitive skill in old age.
2. Personality traits typified by harm avoidance, notably, anxiety, depression and neuroticism negatively impact perceptual skill and cognition among both early late blind older adults.

Methods

The study is designed as a cross-sectional assessment of individuals 55 years of age or older who have experienced legal blindness during their life beginning before the age of 45. Because little data exists on cognitive function in long-term blind populations, a convenience sample of twelve subjects will be examined stratified by age. Following acknowledgment of the consent, subjects will undergo collection of demographic data (age, highest level of completed year of school, gender, ethnicity, handedness - right, left or non-familial left); medical, drug, ocular, social and psychological history. In addition, each patient's visual acuity and visual field will be determined. The following cognitive tests will be administered:

1. Premorbid IQ: Vocabulary subtest of the WAIS
2. Working Memory: Digit Forward, Digit Backward Digit Ordering
3. Episodic Memory: Logical Memory I and II, California Verbal Learning Test
4. Semantic Memory: Category fluency, animals and vegetables
5. Personality: NEO Five Factor Inventory
6. Mood: Geriatric Depression Scale, and
7. Personality (Assessment of neuroticism): NEO Five Factor Inventory.

Two age groups were used for this particular study, individuals blind at birth (early or congenitally blind) and those blind in adolescence or older (late or adventitiously blind)

Raw scores on each test were converted to appropriate standardized t scores for ease in comparative and analytic purposes.

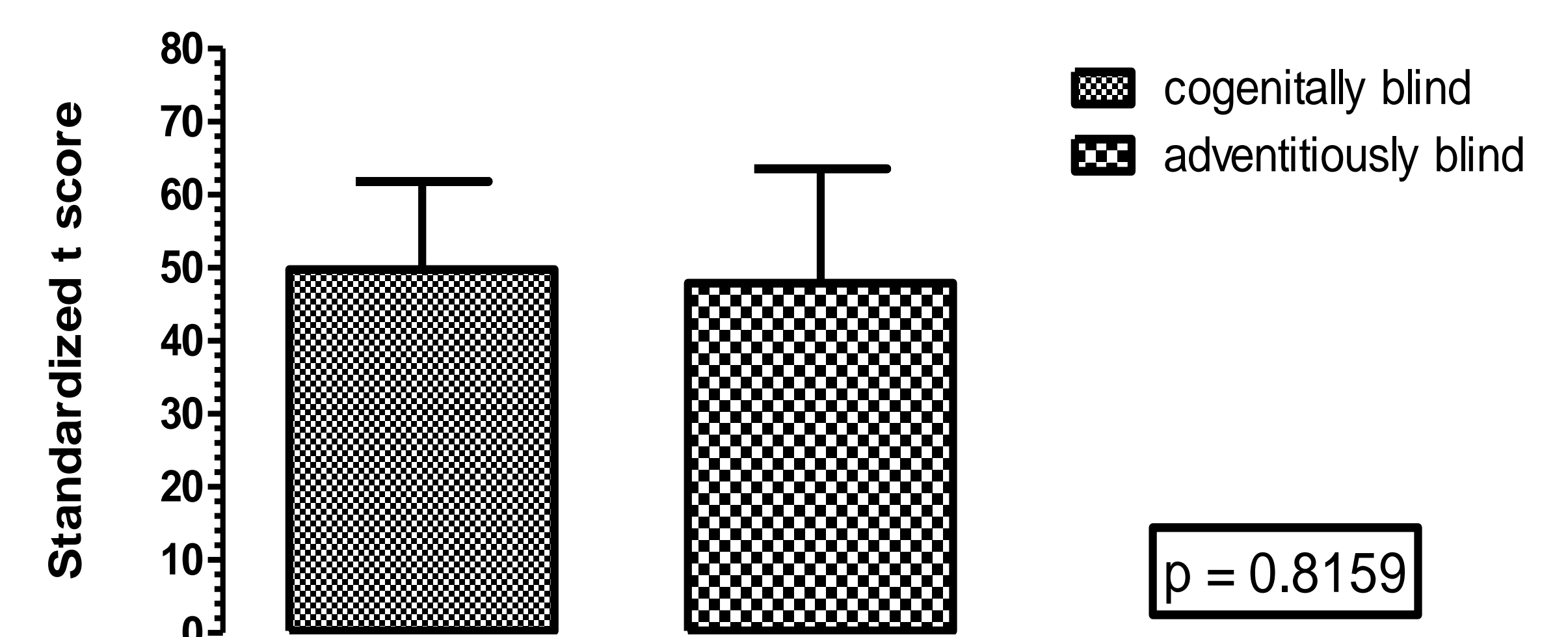
Results

Interim analysis involved assessment of the California Verbal Learning Test (episodic memory) and the Geriatric Depression scale (mood). Standardized t scores for the CVLT were based on historical controls among a normally sighted elder population. Descriptive data for the CVLT and GDS as well as subject age among all study participants is noted in Table 1.

	Age	Depression score	CVLT t score
Number of values	12	12	12
Minimum	57.00	1.000	24.71
25% Percentile	61.25	1.000	39.25
Median	64.50	3.000	48.38
75% Percentile	70.00	6.000	60.52
Maximum	81.00	8.000	67.40
Mean	65.83	3.417	48.99
Std. Deviation	6.726	2.712	13.02
Std. Error	1.942	0.7829	3.759
Lower 95% CI of mean	61.56	1.693	40.71
Upper 95% CI of mean	70.11	5.140	57.26
Coefficient of variation	10.22%	79.38%	26.58%

Figure 1 demonstrates the difference in CVLT score between the study groups:

CVLT- total words trials 1-5 between older adults with congenial vs adventitious blindness



Conclusion

Results of this study do not support the hypothesis that early blind individuals demonstrate advantages in terms of verbal intelligence as older adults compared to late adventitiously blind subjects. No subject demonstrated clinical depression as noted by the GDS subtest (normal < 9). Analysis of the additional test batteries outlined in the methods section of this study may provide additional data that support or refute our initial findings. Further, internal study validity is hampered by the small sample size utilized for interim analyses.

Bibliography

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