Chiari malformation type I:
The impact of participation in Cogmed® working memory training (CWMT) on mood and self-perception

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STUDY OBJECTIVE

To explore the clinical utility and effects of a Cogmed® working memory training (CWMT; www.cogmed.com) on postoperative Chiari malformation type I (CM-I) patients' emotional functioning and self-perception of cognitive functioning through case series.

BACKGROUND

- Chiari malformation (CM) is a congenital, structural abnormality due to the potential for herniation of the cerebellar tonsils through the foramen magnum.
- Neurocognitive dysfunction in the CM population, mostly commonly reported being executive dysfunction[8], is possibly related to a diminution in the cerebello-cortico-cerebellar network, which underlies higher-order cognitive and emotional processing.
- Neurosurgical intervention entails decompression in an attempt to reduce pressure on the cerebellum.
- The neurocognitive sequelae of CM, both objective and perceived, are under-researched; however, extant literature states that the pathology itself and surgical intervention can impact cognitive and emotional functioning.[1,2]
- Neurocognitive profiles of CM individuals post-surgically are heterogeneous and largely dependent on pre-operative skills and abilities, ranging from clinically insignificant to decrements in various domains.[3]
- Cognitive rehabilitation (CR), specifically computerized CR, has the potential to enhance cognitive abilities as well as indirectly enhance mood, self-efficacy, and thereby perception of one's neurocognitive functioning.[4,5,6,7]
- Self-perceived neurocognitive changes can contribute to low mood and diminished self-efficacy; however, few studies exist assessing the efficacy of cognitive remediation of these constructs in the CM population.
- Through illustrative case series, the authors seek to establish proof of concept for computerized CR positively impacting self-perception and mood in post-surgical CM patients.

METHODS

- Three adult-diagnosed CM-I cases were enrolled in CWMT approximately three years post-operatively; each with self-reported decrements in neurocognitive functioning; moderate levels of self-reported mood dysfunction as measured by the Beck Depression Inventory-II (BDI-II) and decline in perceived pre-surgical neurocognitive functioning as measured by the Frontal Systems Behavior Scale (FrSBe).
- Comprehensive neuropsychological testing was completed pre- and post-treatment with Cogmed® computerized training containing 25 sessions of progressively challenging visual working memory exercises completed within 5-12 weeks.

RESULTS

Table 1: Participant Demographics

	Participant 1	Participant 2	Participant 3	Participant 4
Age	29	41	25	29
Gender	Female	Female	Female	Female
Race/Ethnicity	Hispanic	White	White	White
Years of Education	13-16	17-18	13-16	14-16
Time Since Surgery	40 months	29 months	50 Months	25 Months
Vocational Status	Yes	Yes	Yes	Yes
Psychiatric History	Depression/Anxiety	Depression/Anxiety	No	No

Figure 1: Comparison of Pre- and Post-Treatment Beck Depression Inventory-II (BDI-II) Scores

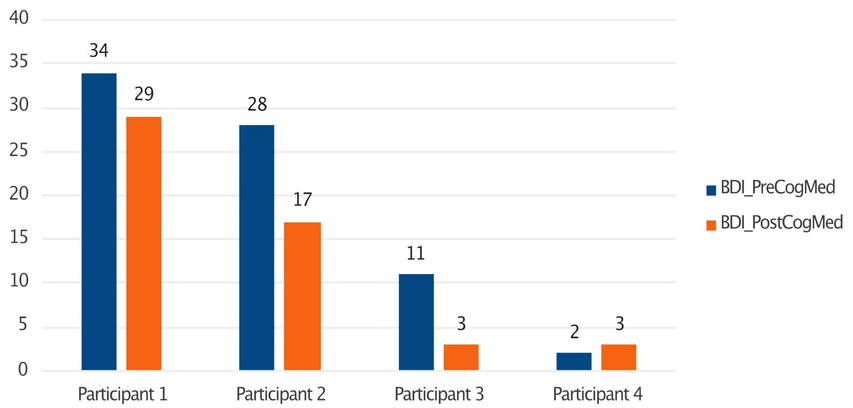


Table 2: Cogmed® Improvement Index and Frontal Systems Behavior Scale (FrSBe) Pre- and Post-CWMT

Participant	Cogmed® Improvement Index	Post-Surgical **Pre-Cogmed® Intervention** FrSBe Total	Post-Surgical **Post-Cogmed® Intervention** FrSBe Total	**Post-Cogmed® Intervention** FrSBe Δ Improvement
Participant 1	37*	152 (*T*=97)	127 (*T*=81)	25**
Participant 2	13	118 (*T*=81)	131 (*T*=90)	-13
Participant 3	34*	111 (*T*=71)	76 (*T*=49)	35**
Participant 4	23*	85 (*T*=54)	87 (*T*=56)	-2

* Successful progress is represented by an Improvement Index score of 17 or greater
** Participant 1 & Participant 3 had clinically significant improvement in their self-perception of executive functioning subsequent to completing the Cogmed® intervention.

DISCUSSION

- Consistent with neuropsychological literature on CM, diminished mood and self-perception of neurocognitive functioning following neurosurgical intervention were evidenced by the self-report measures in three out of the four participants in the case series.
- Qualitatively, findings of the current pilot study suggest that CWMT has the potential to elevate mood and self-perception of neurocognitive functioning in the CM population.
- A positive effect of participation in CWMT was found for mood; independent of actual improvement on the CWMT program.
- Self-perception improved in the two subjects who had the greatest objective improvement on CWMT.

FUTURE DIRECTIONS

- Results of these case examples indicate a potentially complex interplay between pre-CR intervention mood, self-perception of deficits, pre-existing psychiatric history, and the overall impact on engagement in computerized CR intervention.
- Given the impact of low mood and negative self-perception of neurocognitive functioning on return to functioning behavior and quality of life, it is essential to understand the specific benefits to the emotional factors of undergoing computerized CR treatment in this underserved neurosurgical population in order to enhance their recovery.
- Given the insufficiently met neurorehabilitation needs of the CM population, future studies may investigate this population's perception of the utility of CR and psychoeducation regarding the benefits.
- Exploring the impact of CWMT on CM across many demographic categories in future studies could offer additional context for understanding the efficacy of this program.
- Therefore, future directions for studying these complexities in this neurocognitively heterogenous CM population include a larger scale study focusing on deriving CR treatments that directly aim to enhance mood, self-perception of neurocognitive functioning as well as general neurocognitive functioning (i.e., bringing awareness to impact on mood and self-efficacy when an individual has cognitive success on items within any exercise in a computerized program).

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REFERENCES

Available on a separate sheet