AUGMENTED REALITY MIRROR THERAPY FOR ENHANCING UPPER LIMB FUNCTION IN A CHILD WITH UNILATERAL HEMIPLEGIA : A CASE REPORT

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Summary

Augmented Reality Mirror Therapy (ARMT), using a smartphone and AR technology, simulates the movement of the affected hand by projecting the movement of the unaffected hand. This study aimed to explore the potential of ARMT in enhancing upper limb movement in a child with unilateral hemiplegia. An 8-year-old girl with hypoxic-ischemic encephalopathy received ARMT twice weekly for 6 weeks. Outcome measures included the Fugl-Meyer Assessment - Upper Extremity (FMA-UE) and the Box and Block Test (BBT). Results showed a 9-point improvement in FMA-UE post-intervention, particularly in wrist and hand movements. Three months later, the FMA-UE score remained stable. ARMT demonstrated long-term benefits for upper limb recovery and offers portability, making it a promising therapy for children. Larger studies are needed to confirm its efficacy.

Introduction

Mirror therapy can promote the recovery of upper limb movement and function on the affected side in patients with unilateral hemiplegia, such as those with cerebrovascular accidents (CVA), stroke [1], or children with cerebral palsy [2]. By using a mirror to reflect the movement of the unaffected hand, patients can observe the movements in the mirror, thereby activating mirror neurons. However, mirror therapy typically requires a large mirror, which can be inconvenient to carry. Using augmented reality (AR) and a smartphone as a medium, the movement of the unaffected hand is projected and synchronized to simulate the movement of the affected hand, which is called Augmented Reality Mirror Therapy (ARMT).

Methods

The case was an 8-year-old female child with hypoxic-ischemic encephalopathy (HIE) and unilateral hemiplegia. She received ARMT twice a week for 30 minutes per session over 6 weeks, totaling 12 sessions.

ARMT includes the following 6 movements: 1) Forearm supination/pronation 2) Wrist extension/flexion 3) Finger extension/flexion 4) Thumb opposition with little finger 5) Thumb extension/flexion 6) Tendon-gliding exercises. Each movement should be repeated 50 times.

The outcome measures included the Fugl-Meyer Assessment - Upper Extremity (FMA-UE) and the Box and Block Test (BBT), with measurements taken one month before the intervention (T1), pre-intervention (T2), post-intervention (T3), and three months post-intervention (T4).

Results and Discussion

The difference in FMA-UE scores between the one month before the intervention and pre-intervention was stable. After the intervention, the FMA-UE score improved by 9 points, particularly in wrist and hand movements, which improved by 3 and 2 points, respectively. Three months after the intervention, the FMA-UE score was only 1 point lower than the post-intervention score (Table 1). However, there was no significant change in the BBT results after the intervention (Table 1).

Conclusions

In this case report, ARMT was found to promote upper limb recovery in a pediatric patient, particularly in wrist and hand movements, with long-term effects. ARMT offers the advantage of portability and can motivate children to engage in therapy, effectively facilitating the recovery of upper limb movement. Future studies with larger sample sizes are needed to further explore its therapeutic efficacy.

References

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Table 1: Summary of FMA-UE and BBT scores before and after the intervention.

	Upper extremity	Wrist	Hand	Coordination / speed	FMA -Motor	Sensation	Passive joint motion	Joint pain	BBT
T1	24	4	4	0	32	12	24	24	6
T2	24	4	3	0	31	12	24	24	3
T3	27	7	5	1	40	12	24	24	3
T4	26	7	5	1	39	12	24	24	4