

LONG-TERM MAINTENANCE OF DICHOTIC LISTENING SKILLS FOLLOWING TRAINING USING CAPDOTS™-Integrated

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Introduction

Dichotic listening training (DLT) has been found to be effective as a treatment process for CAPD after relatively short periods of intervention (Lau, 2012; Weihing & Musiek, 2014). Using CAPDOTS-Integrated (CI), Lau (2012) reported significant improvements in performance of the weaker ear on dichotic listening tests, and associated improvements in listening behaviour, verbal comprehension and academic performance.

The goal of any auditory training program is to effect changes to the neuronal substrate of the auditory system through auditory plasticity and, specifically, learning-related plasticity. Musiek et.al. (2014) suggest that repeated exposure to stimuli, as in auditory training, should result in a change in synaptic activity and long-term potentiation.

The question, then, remains whether these changes to the auditory system can be maintained over the long term once DLT has been completed. If such changes are maintained, then it can be deduced that there have been changes to the neural substrate and that neuroplastic changes have taken place.

Methods

This paper describes 3 subjects who were diagnosed with CAPD with specific deficits related to binaural integration (auditory divided attention) as measured by 2 dichotic measures: (1) SCAN-3 Revised Competing Words-Free Recall (SCAN-CW) and (2) Dichotic Digits Test (DDT).

Each subject subsequently completed a DLT program, CI over 14 weeks. CI utilises a staggered time lead-lag paradigm to train dichotic listening skills. The training protocol consisted of 20min per day, 5 days per week for an average total of 23 hours of DLT. The training was completed at home with a parent as an assistant with remote monitoring and telephone appointments with the clinician every week.

The subjects then returned for re-testing following auditory training completion. All 3 subjects were subsequently discharged from auditory training as their post-therapy scores fell within the normal range with typical interaural symmetries on dichotic listening tests. The subjects were also referred for testing with a developmental optometrist and a sensory processing occupational therapist to screen for any visual or sensory processing deficits that may require intervention.

The subjects were then retested 2 years or more after discharge to determine whether their skills had been maintained or deteriorated.

Results - See reverse of page

Discussion

An overview of the results indicates that the 3 subjects maintained their scores within the normal range despite being discharged from auditory training for 2 years or more. On the SCAN-3 CW, all the subjects tested with scaled scores and ear advantages within the normal and typical range respectively. On the DDT, all subjects scored within the normal range for both right and left ear. This suggests that not only were their skills maintained, but that their skills continued to improve commensurate with their chronological age and that allowed the subjects to continue to remain within the normal range for their ages.

This maintenance was viewed in both children doing the Junior version aged 6 yrs (Subject 3) and also the Adolescent version aged 12yrs (Subject 1) and 8yrs (Subject 2) respectively. Each child rigorously complied with the prescribed treatment protocol as recommended for CI.

There may be several factors which could have influenced the longevity of the CI training results:

- Singular and intense focus on a single skill – dichotic integration listening skills
- Appropriate application of CI to subjects who presented with binaural integration deficit only. These subjects did not present with auditory closure or temporal processing deficits for which CI would not have been appropriate.
- Inherent design of CI including the time lead-lag (staggered) presentation of the stimuli simulated increased speed of processing auditory information
- Correct implementation ensured through thorough training of the parent along with close monitoring by an experienced clinician.
- Exercises were run for an average of 12 weeks, with a total of 30 hours auditory training completed 4 to 5 days per week.
- All 3 subjects were school-aged, elementary school children at the time of initial intervention.
- Care that the subjects were not discharged from auditory training unless post-CI scores fell within the normal range. (No additional auditory therapy was incorporated in any of these subjects either before, after or during CI therapy).
- Investigation and treatment of comorbid disorders such as visual and sensory processing disorders could have contributed to the findings, especially in view of the possible interaction between different sensory systems via the somatosensory pathways.

To isolate which of these factors contributed to the robustness and longevity of post-CI findings, would require further extensive researching isolating each parameter with multiple permutations. However, initial findings are encouraging and as implemented, suggests that auditory training outcomes are sustained over several years.

Results (Cont'd)

Subject1: MB

MB, a 12.8yr old male at the time of initial CAPD diagnosis. He was diagnosed with Autism Spectrum Disorder and referred to our clinic by his occupational therapist. Diagnostic testing revealed difficulties related to dichotic listening with atypical interaural symmetries. He completed the CI program (Adolescent Version) over a period of 3 months at home, with his mother as an assistant. Telephone consultations were scheduled weekly to monitor participation, scoring, and performance. Post-training assessment was administered and he was discharged as he obtained scores within normal range and typical interaural symmetry on the dichotic listening tests. He also returned for a recheck in July 2015 at the age of 15.8yrs and test results indicate that the dichotic skills were successful maintained with the normal range.

Subject2: KP

KP, a 6.5yr old male referred by his teacher due to classroom distraction and a tendency to tune out when he was first seen at our clinic. He was meeting academic expectations and his parents were not concerned about any hearing or listening difficulties. KP was diagnosed with CAPD with difficulties related to binaural integration.

He completed CI (Junior Version) over 4 months with his mother as his assistant and then returned for re-testing. Scores revealed significant improvements to within normal range and he was discharged from our clinic.

At the age of 8.2yrs, he was retested. SCAN-3 Competing Words and Dichotic Digits Test revealed that scores had continued to remain within the normal range.

Subject3: LB

LB, an 8.2yr old female when she was referred by her teacher for CAPD testing. LB was found to be easily distracted during listening activities and frequently asked others to be quiet while working, reading or playing piano. She was diagnosed with CAPD with specific difficulty with binaural integration. While her SCAN-Competing Words scores fell within the normal range, there was an atypical interaural asymmetry on the Dichotic Digits Test as well as failure on the label version of the Frequency Pattern Test.

She completed CI (Adolescent Version) at the age of 10yrs, doing the work at home with her mother as assistant. She was discharged from auditory training post-CI when the results of her DDT fell within the normal range.

LB returned for a recheck at age 13.1yrs and the results of the SCAN-3 CW and DDT continued to fall within the normal range.

Table 1
COMPARISON OF SCAN-3 COMPETING WORDS SCALED SCORES AND EAR ADVANTAGE

	SCALED SCORE	PERCENTILE RANK	EAR ADVANTAGE
PRE-CI (12.8 YRS)	3	1	-6
POST-CI (13.0 YRS)	7	16	1
RECHECK (15.8 YRS)	9	37	-2

Table 2
COMPARISON OF SCAN-3 COMPETING WORDS SCALED SCORES AND EAR ADVANTAGE

	SCALED SCORE	PERCENTILE RANK	EAR ADVANTAGE
PRE-CI (6.5 YRS)	9	37	-8
POST-CI (6.10 YRS)	12	75	-1
RECHECK (8.2 YRS)	9	37	5

Table 3
COMPARISON OF SCAN-3 COMPETING WORDS SCALED SCORES AND EAR ADVANTAGE

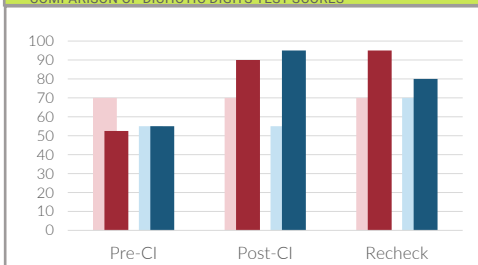
	SCALED SCORE	PERCENTILE RANK	EAR ADVANTAGE
PRE-CI (8.2 YRS)	8	25	-3
POST-CI (10.0 YRS)	10	50	0
RECHECK (13.1 YRS)	9	57	0

■ Normal/Typical ■ Below Normal/Atypical

Figure 1
COMPARISON OF DICHOTIC DIGITS TEST SCORES



Figure 2
COMPARISON OF DICHOTIC DIGITS TEST SCORES



■ Normal Range (R) ■ Normal Range (L)
■ Test Score (R) ■ Test Score (L)

Figure 3
COMPARISON OF DICHOTIC DIGITS TEST SCORES



Conclusion

These 3 case studies suggest that DLT using CAPDOTS-Integrated produces results which can be sustainable and lasting over several years. It provides support that DLT and specifically CI can effect neuroplastic changes in the Central Auditory Nervous System. While the number of subjects is small, continued use and research into the efficacy and effectiveness of CI is highly encouraging. The return-on-investment of time, effort and finance is high and suggests that the use of CI is indeed, worthwhile.

Reference

Lau, Carol A. (2014), Maximizing Auditory Training Effectiveness – A Clinical Perspective, <http://hearinghealthmatters.org/pathways/2014/maximizing-auditory-training-effectiveness-clinical-perspective/>
 Lau, Carol A., (2012), Clinical Findings of a Web-Based Application (Integrated Werks to train Dichotic Listening Skills, First Global Conference on CAPD, Audiology NOW, AAA March 30 – 31, Boston.
 Musiek, F.E., Chermak, G.D. & Weihing, J. (2014), Chapter 7: Auditory Training in Handbook of Central Auditory Processing Disorder, Vol 2 by G.D. Chermak & F.E. Musiek (eds), Plural Publishing: San Diego.
 Musiek, F.E., Weihing, J.A. & Lau, C. (2008), Dichotic Interaural Intensity Difference (DIID) Training : A Review of Existing Research and Future Directions, JARA, 41:51-65.
 Weihing, J. & Musiek F.E. (2014), Chapter 9: Dichotic Interaural Intensity Difference (DIID) Training in Handbook of Central Auditory Processing Disorder, Vol 2 by G.D. Chermak & F.E. Musiek (eds), Plural Publishing: San Diego.