Auditory training – a natural way to affect impaired tone matching in dyslexia

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Background

Introduction and Intervention

- Deficient auditory processing is often reported in dyslexia [1,2].
- Impairment in tone matching is quite permanent and in most cases stays unchangeable even in adulthood [3].

IADT ® (Individual Auditory Discrimination Training) has it's background in the theory of Tomatis [4]. The auditory perceptual profile (both monaural and dichotic testing in tones and words) is used as a starting point for the intervention to increase sensitivity for the central frequencies of the speech. IADT® is based on synthesized music that is moulded individually according the hyper- and hypoactive features when compared with the optimum hearing reference curve by Tomatis. In many individuals suffering from sensory problems, atypical auditory sensations and primitive reflexes are related to each other, so the auditory intervention is often combined with sensomotor training.

- SynAmps, Scan (NeuroScan), 1000Hz sampling rate, on-line band-pass 0,05-200 Hz, off-line band-pass 0,5-20 Hz, reference: linked mastoids, artifacts rejected if +/- 150 µV

Subjects and Stimuli

Young adult dyslexics, N = 10, mean 18,6 years (range 17-20 yrs)
Typically developed, age matched controls, N = 10

The oddball paradigm was used to declare:
1) if the brain activation can be normalised by intensive auditory training
2) if simultaneous changes can be seen in behavioural skills: technical and comprehensive reading, naming (Table 1.), and profiles of adaptive and maladaptive behaviour (ASEBA [5]).

Intervention 6 months (15 minutes per day) in controlled conditions
Auditory ERPs recordings: at the beginning of the study; after 6 months training; after 3 months follow-up

ERP conditions: sine tones 1800/2000/2200 Hz and 3600/4000/4400 Hz, 100 ms; syllables AMA/ANA/ALA, 400 ms (each deviant p=.10)

Results and Conclusions

Baseline: In dyslexics the ERP pattern was atypical for adults. The latency of N1 was long, showing immature response and primary deficits in auditory orienting.
After training: Latencies of N1 decreased statistically (1800/2000/2200 Hz, p=.009; 3600/4000/4400 Hz, p=.017) especially over the LH (Fig. 1). The intervention activated auditory potentials (both for standards and deviants), and after the follow-up also the discriminative component MMN was growing in amplitude, Fz p=.003 (Fig. 2). The lateralization for verbal stimuli was normalized to the LH, and the amplitude of MMN was increasing, Cz p=.013 (Fig. 3.). Our results show that adult brains have plasticity for auditory training and that dyslexic learning difficulties can be relieved with individually planned and intensive intervention.

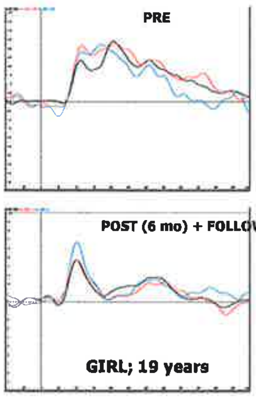
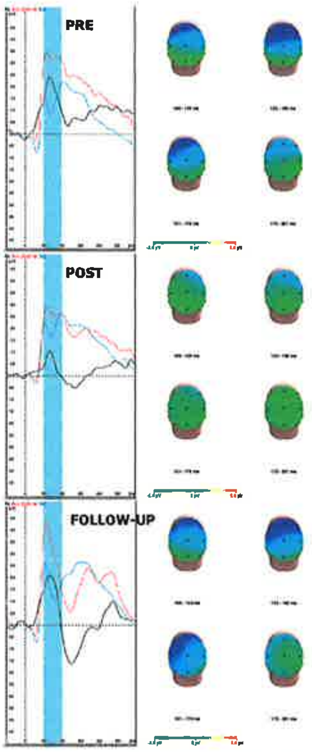


Fig. 1. N1 elicited by 1800/2000/2200 Hz.
Black: standard 1800 Hz. Red: deviant 2000 Hz.
Blue: deviant 2200 Hz.

Testing	Reading age in ALLU yrs; mo	Spelling (subtest in technical reading)	Boston Naming Test
PRE	8;9	18,5	45,6
POST + FOLLOW-UP	9;8	29,4 ** P = .006	48,2

Table 1. Changes in behavioral skills.
Mean values (N=10).



GA ERPs N = 10

Fig 2. Non-verbal 1800/2200 Hz (dev 10 %).

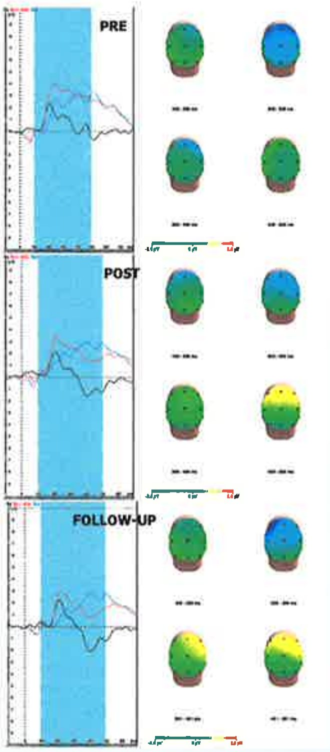


Fig 3. Verbal AMA/ANA (dev. 10 %).

Panels on the left: standard, deviant, MMN.
Maps: MMN distribution over the scalp.
Top: before training. Middle: after intervention (6 mo). Bottom: follow-up (3 mo).

Literature & Framework

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IADT ® (Individual Auditory Discrimination Training); Modified and further developed by H. Hätinen (www.pekuoy.fi) from the method of K. Johansen, Baltic Dyslexia Research Lab ApS.

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