

# Cornell Vision Center

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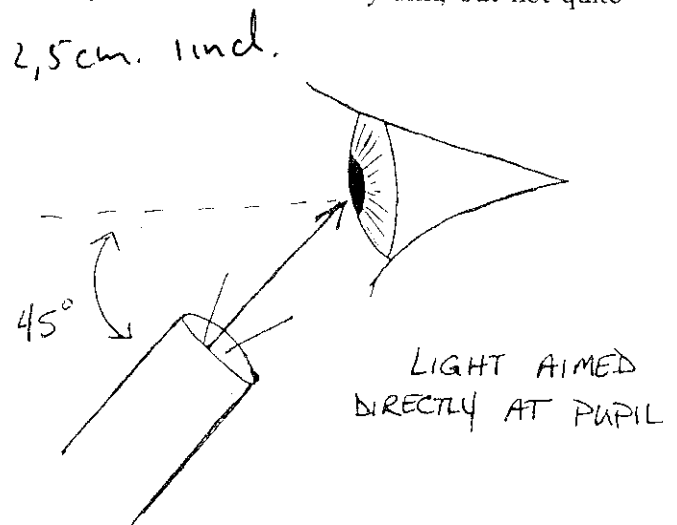
Diana Ludlam, certified vision therapist  
Debbie Mish, office manager

## Direct Pupil Stimulation

The pupil is the black spot (actually a hole, like a window) in the middle of the colored part of your eye. It changes size according to the light level: In the dark, it's very big, to let as much light as possible into your eye. In bright light, it is very small, to protect you from the glare. The tiny muscles that make the pupil work are also connected (by nerve pathways in the brain) to the muscles that make your eye focus and aim correctly. So if we exercise the pupil, we are indirectly exercising the focusing and aiming systems, too.

**How to do direct pupil stimulation (instructions written for therapy partner):** This exercise can be very visually stressful, so it is often best to do it right before your child goes to sleep at night, after he's already lying down. (Older children and adults can do this exercise alone by watching themselves in the bathroom mirror.) Make the room very dim, but not quite dark.

Hold the "flashlight" about 2 inches from your child's face, pointed directly at the eye from below, at an angle of about 45 degrees. (See sketch.) Turn the flashlight on by pressing the silver clip against the main body of the light. Hold the light on for about 2 seconds, then release the clip to turn it off. The light should be aimed exactly at the child's pupil, and you should see it constrict (shrink) when the light comes on. Ideally, it should stay small the whole time the light is on, but often it will "release," or get a little bigger again while still stimulated by the light.



Rotate the flashlight so that it is aimed at the child's eye from the side, still at about 45 degrees. Turn the light on for another 2 seconds, watch the pupil, then turn it off. Rotate the light so it shines from above the child's eye and repeat the stimulation for another 2 seconds. Also repeat from the other side of the eye, and finally from straight in front of the eye. These 5 stimulations make up ONE cycle.

Switch to the other eye and do all 5 positions again. Alternate between the two eyes, and try to complete 5 cycles on each eye.

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## Rapid Fixations (or Saccades)

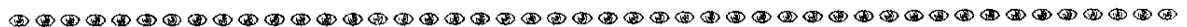
This procedure helps the muscles that control eye movements to make small accurate jumps. These small voluntary eye movements are the means by which visually presented material is sent to the processing centers in the brain. It is one of the major tools necessary for building efficient, rapid reading ability and developing visual memory.

**How to do rapid fixations:** If glasses for near visual work have been prescribed these should be in place. An electronic or pendulum metronome is set at about 60 (largo-adagio) and two pencil-top type targets are held at the eye level of the child or adult 14 inches from the face. The instructions are to move the eyes from one target to the other WITH the click of the metronome. Once this is established and the eyes are moving easily back and forth, begin asking for information processing and verbal output. This could be counting forward and backward, counting by two's, practicing spelling words for the week, etc. Always pay attention to the regular shift of fixation between the two horizontal objects, and to maintaining the rhythm. Pauses in verbal output are more acceptable than pauses in the eye movement pattern.

The demand of this exercise can be increased by moving the targets further apart, or by placing one lower and the other higher creating a diagonal movement, then reversing the heights.

Remind the viewer to see the detail as they shift from one to the other. This should be done without interruption for at least 2 minutes.

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## Tracking (or “Smooth Pursuits”)

This exercise will help you to gain better control of the muscles that move your eyes. This is very important to lots of things in life – like trying to watch a fly ball so you can catch it when it comes down – and it’s especially important in reading. In order to read a story, you have to aim your eyes at a word, focus on the letters, figure out what it says, and then *move your eyes* to the next word and start again. At the end of a line, your eyes need to jump all the way back across the page, and try to keep your place!

**How to do tracking exercises:** Wear your near-point glasses. Your therapy partner (mom or dad or sister, brother, grandma, uncle, etc.) holds an interesting target about 16 inches away from you. Watch it very closely as your partner moves the target in all different directions – up, down, sideways, diagonal – in a random pattern. The movements should all be in one plane (not moving closer or farther away) and cover an area about the size of an open book. Your partner will help remind you to keep your eyes right on the target at all times.

Do this for a short time without any distractions (to “warm up”), then your partner will ask you to do some spelling for 1 minute (it’s a great way to review for a spelling test!), then some math problems for 1 minute, and then some general conversation for 1 minute, all while you are keeping your eyes right on the moving target! This helps to separate your eye movements from conscious thought, so later you can concentrate on the story instead of on making your eyes move from word to word.

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## “Pencil Push-Ups” or Near Point of Convergence (NPC)

When you look at something far away, your eyes are approximately parallel, both pointing straight ahead. When you look at something close to you, though, your eyes need to turn in, toward your nose, so they can both aim at the near target. If you have trouble turning your eyes in (crossing your eyes), it can make it difficult to concentrate on near targets, like reading material.

**How to do push-up exercises:** Find a small, interesting near-point target (a sticker on the end of a popsicle stick, or a pencil-topper, etc.), and have your therapy partner (mom, dad, grandma, brother, etc.) hold it straight in front of you and about 16 inches away from your nose. Make sure it is in-focus and single (not doubled up) when you look at it. Tell your partner when the target looks good, and they should bring the target slowly toward your nose. Keep both eyes open, and make sure the target is clear and single all the time. When it gets too close, so that it looks blurry or doubled up and you can't fix it (or if your partner notices one of your eyes suddenly turn out to the side), stop. Back it up a tiny bit, so that it becomes clear and single, but still makes you feel kind of cross-eyed. Look at it for a couple of seconds, then relax for a few seconds and start over.

**Push-up exercises with “cover/uncover”:** After you have practiced a couple of times, you can try some “cover/uncover” exercises, too. When the target is about halfway to your nose, cover (or have your partner cover) your right eye with your hand. (Keep both eyes open.) After you've looked at the target for a couple of seconds, take your hand away. Does the target become single right away, or does it look like it's double at first? Can you make it be single? Now move the target to a different position (nearer or farther) and repeat this exercise, this time covering the left eye. Keep trying different positions (mix them up) and alternating eyes.

*Both with and  
without glasses*

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## Yoked Prism

Prisms change the way we see the world, by shifting the image of the object you're looking at to a new location. Optometrists can use prisms in full-time glasses to permanently alter perception (for example, if someone who'd been in an accident had a "blind spot," the prism can help them to look and work around it), or we can use prisms as training tools. When we put prisms on for a short period of time, then remove or change them, then change them again, it keeps the mind and body "shaken up," making it very alert to visual input. This can be a good way to "loosen up" the visual system, or help break it of bad habits, to make room for more efficient ways of seeing.

**How to use yoked prisms:** "Yoked" means that both prisms are of equal power and are pointed in the same direction. This is important, because it means that the image that goes to the right eye is shifted by the same amount and in the same direction as the image to the left eye, so the eyes can still work together as a team. We call the fat part of the prism lens the "base," and we use it as our reference point. For example, "base up" means the lenses are oriented with the fat part on top; "base right" means the fat part is on the patient's (NOT the doctor's or the assistant's) right side.

When you use the yoked prism glasses, first loosen the thumbscrews that allow the lenses to twist in the frames. Now orient the lenses so that the base (fat part) is straight \_\_\_\_\_ (both lenses the same). Re-tighten the thumbscrews. Put the prism glasses on OVER your regular distance glasses.

You will need to wear the glasses this way for \_\_\_\_\_ minutes. It's important that you move around and do activities while you wear the glasses, so your body can get used to the way the world looks through them. Walk around, touch things. Are objects where you think they are when you reach for them, or are they shifted to the left or right? Up or down? Closer or farther? Keep moving around. You could help empty the dishwasher or fold laundry or set the table. Try to avoid sitting down; standing and walking help you "feel" the glasses better. Do NOT count TV time as a prism activity.

After your prescribed time with the glasses in this position, remove them, loosen the screws, and twist the lenses to a new position (both sides the same). Continue to be active and move around for the following schedule:

Base \_\_\_\_\_ for \_\_\_\_\_ minutes.

Base \_\_\_\_\_ for \_\_\_\_\_ minutes.

Base \_\_\_\_\_ for \_\_\_\_\_ minutes.

Base \_\_\_\_\_ for \_\_\_\_\_ minutes.

Sometimes, the prism glasses can be used to help with convergence (eyes aiming in, like for reading). For this exercise, turn both lenses so their base (fat side) is on the outside. When you put the glasses on, you may see double, or you may feel very cross-eyed. Try to touch something. Is it where you thought it should be? Closer? Farther? To the left or right? After you've worn the glasses like this for \_\_\_\_\_ minutes, take them off and try touching things again. Now is the shift in the opposite direction?

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## Near-Point Glasses

It is very important that you wear your “reading glasses” for all near-point work, including reading, writing, coloring, model building, sewing, etc. . . even computer work and GameBoy! Anything that you are working on within arms’ reach is close enough that you should be using your glasses. You do NOT have to wear them for recess, P.E., after-school sports, playing outdoors with friends, etc. They aren’t necessary for these activities, and may get damaged.

We understand that you can see things clearly, even up close, and so it may be hard to remember to wear your glasses at first. Don’t be upset if your parents or teachers remind you to put them on for near work. The lenses in your glasses are not necessarily designed to make things look clearer, but to relax your focusing system, so that it can work better with the system that makes your eyes aim at near things. If you have any questions about this, just ask, and we will try to explain it better.



# Visual training, the alpha activation cycle and reading

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O.D.

**ABSTRACT** — *Inability to suppress the occipital alpha rhythm during attempts at visual processing has been shown in the literature to relate to academic reading and learning problems. This paper presents the case histories of two such grammar school children who both exhibit: (1) visual problems (2) reading difficulties and (3) the inability to suppress occipital alpha during visual processing. Visual therapy programs are carried out which normalize the optometric findings and simultaneously are accompanied by improved reading performance and the ability of the student to attenuate his occipital alpha rhythm. No other therapy directed at alleviating the reading problem was carried out during the two to six month visual training period. No direct training of the alpha activation cycle by biofeedback or other means was attempted.*

**KEY WORDS** — *alpha rhythm, amplitude, attenuation, visual processing, reading and learning problems, academic performance, optometric visual training*

## Introduction

Over the past 50 years, Berger,<sup>1</sup> Adrian,<sup>2</sup> Adrian and Matthews,<sup>3</sup> Grey-Walter,<sup>4</sup> and Mulholland<sup>5</sup> (among others) have found a relationship between the amplitude of the occipital alpha rhythm and visual processing. Lippold,<sup>6</sup> on the other hand, hypothesizes a direct relationship between alpha amplitude and fine eye movements. The alpha rhythm, the first discovered, and the largest amplitude of the EEG rhythms is generally a 10 cycle/second undulating rhythm which is largest in the occipital cortex. In most people the amplitude is largest during the least visual processing,

i.e., eyes closed, no mental visualization activity and is minimal, i.e., attenuated and desynchronized with eyes open, clear, fused, macular visual imagery.

Grey-Walter<sup>4</sup> reported that although 2/3 of a large population sample he measured acted as described above, fully 1/6 showed what he termed "persistent alpha rhythm," i.e., a lack of attenuation or desynchronization of the alpha rhythm despite attempts to visually process. He characterized this group as having poor academic and reading skills, low socio-economic level, *inability to sustain attention, etc.*<sup>(6)</sup> Grey-Walter called attention to the differences in perceptual style and personality of these groups and apparently concluded that these

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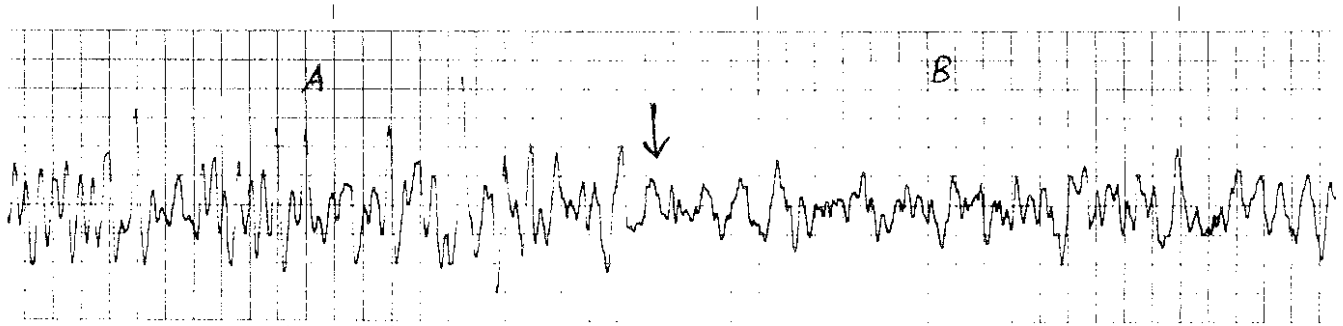
were immutable categories since he cautioned against intermarriage of couples with different alpha activation cycle typings. A more complete coverage of the literature can be found in Ludlam.<sup>7</sup> Reading Grey-Walter's description of the behavior and personality of the alpha persistent adults reminded the present author of the many children he was dealing

with clinically, who had been labelled "learning or reading disabled" and whom reading glasses and visual skills helped to a status of improved attention, ability to sustain effort while reading, less loss of place, increased comprehension and speed while reading, increased enjoyment of reading and improved test scores on standardized reading tests. A typical case history has been reported in Ludlam, Twarowski and Ludlam.<sup>8</sup> After ten years of clinical experience by the author with the interrelationship of alpha activation cycle, optometric findings, and academic performance during the course of and after completion of successful visual training, a direct relationship between these factors has been noted. When alpha rhythm is monitored at various stages of visual training, a change in control of the alpha rhythm activation cycle is noted with changes in the optometric findings and improvements in reading and academic performance. The change in control of alpha activation in these cases is a result of optometric visual training and not from conditioning or direct biofeedback control of alpha as had been accomplished by Brown<sup>9</sup> or Mulholland.<sup>10</sup> The optometric changes most closely associated with the improved control over alpha activation have been improved fixation and accommodative facility, elimination of intermittent blur, improved blur and break-points in ductions and motor fusion measurements at near point generally accompanying the use of moderate power (+0.75 to +2.25) plus reading lenses at near. The remainder of this report



TIM K 7/7/77

Figure 1. Alpha activation monitoring, patient Tim K. 7/7/77. At left of arrow (A) patient had had eyes closed for approximately 30 second and opened them for reading to the right of arrow (B). Inspection of the trace shows no attenuation. Chart speed 20 mm/sec. Amplitude of alpha is  $4\mu\text{v}$  per mm. in vertical dimension. Alpha can thus be seen to range from 30 to  $100\mu\text{v}$  in this trace.



TIM K 11/15/77

Figure 2. Alpha activation monitoring, patient Tim K. 11/15/77. At left of arrow (A) patient had eyes closed for 25 seconds, opened at arrow for reading to right of arrow (B). Inspection of trace shows reduction and partial desynchronization of alpha so that amplitude while reading is roughly half of the amplitude for eyes closed. Chart speed 20 mm/sec. Amplitude of alpha is  $4\mu\text{v}$  per mm. in vertical dimension. Alpha to left of arrow can thus be seen to range from 30 to  $100\mu\text{v}$  and to the right of the arrow from 10 to  $50\mu\text{v}$ .

will relate two case histories of typical patients treated by the author which relate alpha attenuation, visual training and reading performance.

**Case History #1** Master Tim K., age 6 years 9 months, completed first grade, first seen 7/7/77. Had problems learning reading and writing, in first grade, still doesn't know letters and can't seem to learn letters on sight. Reverses when copies or tries to write letters from memory. Left handed. Has been labelled hyperactive and hyperkinetic by teachers, remedial specialist and school psychologist. Present teacher felt that he could not "focus" on close work with his eyes. Does not make eye contact when speaking to another or while being spoken to. Teacher says he is disruptive in class, can't pay attention and wants him on a behavior modification drug. Suggested putting him back in kindergarten because of "immature

behavior." Tim still likes school despite these problems. History of club feet corrected by surgery, night bar and corrective shoes. Allergy to sugar — increased by hyperactivity. Past three to four months severe curtailment of sweets with only minor behavioral changes. Allergic reaction to penicillin. General health otherwise good. Never had an eye examination before. *Visual Examination:* DVA, R. 20/30, L 20/30. Both 20/25 on Illit E test. Necessary to isolate individual E's to elicit response to test. NVA on Illit E chart, R. 10"/24", L. 10/24. Individual E's had to be pointed to with pencil to get a response. Ophthalmoscopy and external exam were negative. Great difficulty maintaining fixation for two seconds was experienced. Was unable to fixate or track a light, finger, pen or examiner's face in predictable horizontal trajectory. Made sporadic head movements in the direction of ob-

ject when informed of this tracking error. Did not know where he was aiming his eyes at any given moment. Confused about right and left in his own internal body schema and had no concept of directionality or laterality when projected or externalized. Near point of convergence, 10-12". Cover test at distance, 2-3Δ esophoria, at 16", 5-6Δ esophoria. Distance refraction +0.75 O.U., 20/20-1, 1Δ esophoria. Near refraction, add +1.00, 14"/17", 1Δ esophoria. Poor quality and amplitude of fusion was demonstrated on several tests. Use of +1.00 spheres at near improved quality of amplitude and duration of fusion. Alpha attenuation was absent for eyes open, eyes closed, fixation or pursuit movements.<sup>b</sup> (See Figure 1.)

Tim was started on a program of daily home training, prescription of +1.25 D sph for constant wear and office visits once every three weeks. Home training was

directed to pursuit movements, pushup and jump convergence, improving ocular fixation and eye contact when speaking, improvement of fusion and accommodative facility. One half hour daily home training sessions were assigned. Office visits were on 8/18/77, 9/1/77, and 9/29/77, during which period gradual improvements in visual skills took place. Improvements in attention and school behavior and in academic performance were also noted. Alpha activation was next measured on 11/15/77. At this time Tim and his mother both stated that there had been much improvement in visual skills and overall behavior. Several commendation notes had been sent home by teacher. Tim had learned all of his letters and numbers to recognize on sight and to spell 25 words. His attention was much improved and he no longer touched everything with his hands. He regularly made eye contact at this point & accommodative facility & fusion ranges were improving, +1.50/-1.50 binocularly was able to be cleared quickly and easily while reading. His fusion and stereo ranges were 20 B.O. to 12 B.I. in instruments. Pursuit movements were much better and eye movements were now made independently of head movements even for unpredictable target trajectories. Alpha activation now showed the ability to attenuate alpha during fixation, pursuits and reading for

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10 to 15 seconds duration. (See Figure 2.)

Further home visual therapy was assigned of a similar nature to that described earlier and office visits were made on 12/1/77 and 12/27/77. On 1/26/78, alpha activation was again measured. At this time he liked reading very much, reports from school were that he was now one of the best readers in his class, that he was much better coordinated (he could hop on either foot, skip and ride his bicycle whereas previously he could not). His signs of hyperactivity were gone. His fusion ranges had increased to 30 B.O. to 20 B.I., binocular accommodative rock was now easily accomplished through

+2.00/-2.00, for a sustained period of time. His alpha activation assessment revealed that he could now suppress or block alpha for 20 minutes and more at a time with eyes open, and could also attenuate alpha while doing mental arithmetic and visualizing scenes which were described to him with his eyes closed. (See Figure 3.)

After cessation of all home visual training, Tim was seen on 3/9/78, and 6/15/78, with slightly further improved behavior, academic skills and essentially normal optometric findings.

**Case History #2.** Master Michael P., first seen 7/20/76, age 8 years, 8 months, completed 3rd grade. Has had problems learning to read and now reading to learn. In 1st grade and 2nd grade had letter and word reversals and loss of place. Now major problem is comprehension and getting meaning from reading. Learns very well auditorially. Phonics good, knows words, does well in math and oral practice. Has had 9 months of 4 times weekly remedial reading. Tested at completion he was still 6 months behind chronological age in reading. Becomes very tired while reading, reading distance decreases after about 5 to 6 minutes of reading to 8-9" from original distance of 14". No blur or diplopia. Avoids reading if at all possible. General health good. Never had an eye examination other than school Snel-

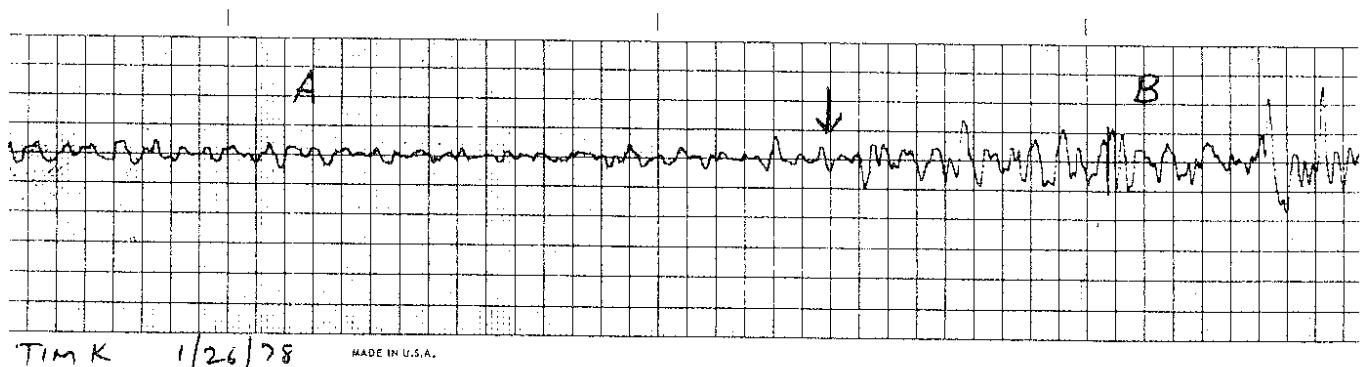


Figure 3. Alpha activation monitoring, patient Tim K. 1/26/78. Patient had been reading for 5 minutes with attenuated alpha, the trace of which was essentially the same as at (A). To the right of the arrow, Tim had more difficulty reading and began to subvocalize, head scan and re-read each line. Inspection of the trace at (B) shows the decrease in alpha attenuation which accompanied the loss of comprehension while reading. Chart speed 20 mm/sec. Alpha amplitude in vertical dimension  $4\mu\text{V}$  per mm. Alpha while attenuated to left of arrow ranges from 6 to 20  $\mu\text{V}$ . To the right of the arrow it slowly increases to 100  $\mu\text{V}$  as meaning is lost while reading.

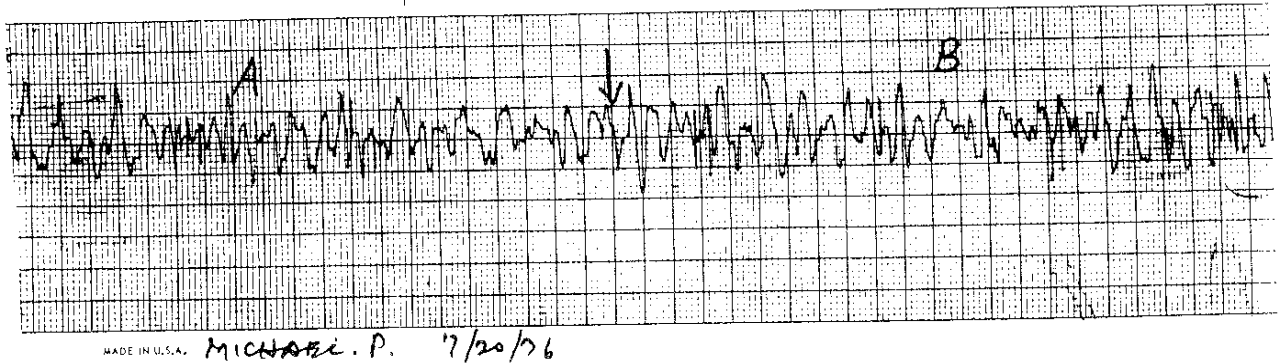


Figure 4. Alpha activation monitoring, patient Michael P. 7/20/76. To left of arrow (A) patient had been reading, at arrow he was instructed to close his eyes and relax for trace (B). Note very slight increase in alpha amplitude to right of arrow (B). Chart speed 20 mm/sec. Alpha amplitude (vertical dimension) is  $4\mu\text{V}$  per mm. Alpha to left of arrow can be seen to range from 16 to  $60\mu\text{V}$  and to the right of the arrow from 20 to  $68\mu\text{V}$ .

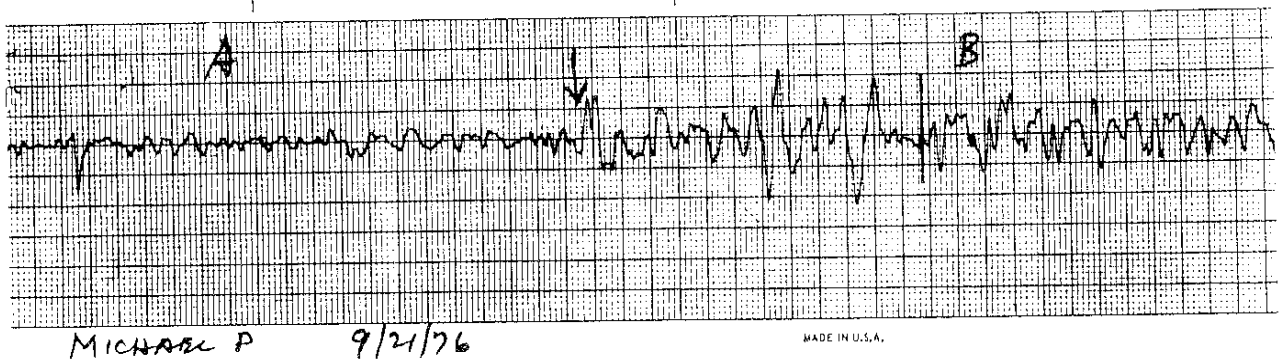


Figure 5. Alpha activation monitoring, patient Michael P. 9/21/76. To left of arrow (A) Michael had been reading for several minutes and at arrow was asked to close his eyes and relax (B). Inspection of the trace shows immediate increase in alpha amplitude to right of the arrow. Chart speed 20 mm/sec. Amplitude of alpha (vertical dimension) is  $4\mu\text{V}$  per mm. Alpha activity to the left of the arrow can be seen to range from 5 to  $20\mu\text{V}$  and to the right of the arrow from 20 to  $100\mu\text{V}$ .

len screenings which were normal. No glasses. *Visual Examination Findings:* DVA, R. 20/15, L. 20/15, Both 20/15. NVA, R. 10"/21", L. 10"/21", Both 10/21. Scans reading with his head. Ophthalmoscopy and external were negative. Cover test: distance, 2-3  $\Delta$  esophoria, near, 5  $\Delta$  esophoria. Refraction,  $\Delta$  O.U. +0.75, 20/15, 3  $\Delta$  esophoria, dynamic cross cylinder, add +0.50, 14/14, 1 esophoria, NRA +1.50, PRA -1.75 (blur out). Fusion ranges were, 10  $\Delta$  B.O. to 4  $\Delta$  B.I. with blur and intermittent suppression. Accommodative facility with +1.00/-1.00 rock was found to be sluggish binocularly. Alpha monitoring showed no attenuation or blocking eyes open or closed, during pursuits, convergence or accommodative rock. (See figure 4.)

Reading glasses of O.U. +1.00 were prescribed and a combined home-office visual training pro-

gram was initiated with three week intervals for office visits. The focus of the daily home training procedures assigned was directed at increasing quality, range and facility of fusion, accommodation, and convergence and increasing stamina during reading so that processing for meaning could be sustained. Further office visits were made on 8/1/76 and 8/31/76, and alpha activation control again assessed on 9/21/76. At that time Michael was reading much more, liked reading, was reading more quickly with better comprehension and minimal fatigue for half hour periods. He was wearing his glasses for all near work activity and was reported as completing his home visual training assignments daily. On my observation while reading there was no head scanning movement and the 14" reading distance was maintained for 10 pages of reading of 4th grade

material. Accommodative rock +1.50/-2.00 binocularly over reading glasses was accomplished easily and sustained for 5 minutes. Base-out, base-in prism rock was quickly and easily carried out with 10 for reading while maintaining good comprehension. Stereoscope tromboning for both wide and narrow separation and jump duction cards was found to be fatiguing after several minutes. Tachistoscopic presentations of letters were 6 letters in 1/10 second up from 2 at earlier sessions. Fusion ranges were 20  $\Delta$  B.O. to 10  $\Delta$  B.I. repeated without blur. Alpha activation monitoring now showed good attenuation with eyes open, while reading, during pursuits and convergence. (See Figure 5.)

This was followed by 4 succeeding office visits with decreasing home training assigned. School grades at the most recent visit, 6/12/78, were all A's and B's. Mi-

chael now loves school, reads for pleasure with none of the fatigue reported initially. Six months progress checks are still being made.

### Discussion

Glass<sup>11</sup> and Fuller<sup>12</sup> have demonstrated the deficient alpha suppression characteristics in poorer students in mental arithmetic and reading performance respectively. Mulholland<sup>10</sup> has also shown that the alpha activation cycle can be conditioned directly by biofeedback closed loop systems which have a direct and observable improvement on visual attention. It still remains to be demonstrated whether reading performance can be improved by direct conditioning of alpha especially in the presence of visual anomalies such as faulty eye movements and accommodative-convergence problems. The type of patients, histories, optometric findings, methods and results of treatment cited in this paper are not new with the present author but have been developed over the past 50 years by Brock, Skeffington, Crow, Woolf, Jacques, Schrock, Flax, Solan and Murrroughs among others.<sup>6</sup>

What is novel in the present paper is the demonstration on two patients of a relationship of changed electrophysiological measurement and improved reading performance which circumstantially coincide with normalized optometric findings during and after a program of visual training. This occurred while no other remedial educational, psychological, pharmacological or other therapy was in progress.

This change in the alpha activation cycle demonstrated on two patients in this paper may be the physical mechanism accounting for the vast behavior changes and improvements in academic skills which have been brought about inadvertently and fortuitously by many optometrists in their therapy programs for learning and reading disabled children.

Although the author has observed this improvement in alpha suppression effect in other training patients as well, it is not clear what proportion of the total learning disabled population or

the visually related learning disabled population manifests a difficulty or absence of alpha suppression which is remediable by visual therapy. Once this is known the full impact of the demonstration in this paper will become apparent. The author is presently undertaking such a study.

### Summary

Two patients with visual problems and reading difficulties originally unable to suppress alpha have been shown to demonstrate alpha rhythm attenuation during the course of and after a program of visual training with simultaneous improvement in reading performance. No direct training of alpha attenuation was engaged in.

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*"It still remains to be demonstrated whether reading performance can be improved by direct conditioning of alpha especially in the presence of visual anomalies such as faulty eye movements and accommodative-convergence problems."*

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No other therapy directed toward solution of the patients reading or behavior problems was attempted during the course of visual training. It is concluded that the change in alpha activation and the improvement in reading were both brought about by the combined visual therapy and reading glasses.

Further research concerning the number and proportion in the population of learning disabled who respond similarly to the cited cases is presently being undertaken by the author. **AOA**

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### FOOTNOTES

a. Grey-Walter found still a third alpha activation cycle type which does not warrant our attention at the moment, that type manifested minimal alpha both while visually

processing and while visually at rest.

- b. The instrumentation used in these studies was the Optometric Electrophysiological Unit IV, single channel strip chart, available from Electronic Circuits and Systems, 35 Glenside Road, South Orange, NJ 07079. Electrode hookup was single Beckman scalp electrode, 2.5 cm above theinion along the midline referenced to paired Mediacraft ear clip electrodes.
- c. References available upon request from author.

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