

GUEST EDITORIAL

Suppression Revisited

Merrill J. Allen, O.D., Ph.D.

Vision therapy is powerful and much needed. I congratulate those who do it and I hope to excite other ODs to give it a try. Once you understand how *simple and powerful vision therapy* is you will hardly be able to contain your enthusiasm.

This editorial is directed at understanding suppression. Suppression occurs in the occipital cortex at the point where both the left and right eye neurons compete as they try to send signals to the higher processing centers in the brain. Future topics could include amblyopia, strabismus, learning disabilities and clinical routine procedures.

By way of qualifications, I met Dr. Skeffington when I was a teenager about 60 years ago. He came to Corpus Christi, Texas, where people usually didn't dress in suits. He stepped off the train in a fancy suit, straw hat and spats! I was truly impressed. His visit was to provide continuing education for my father, Millard H. Allen. I helped do vision therapy on some of Dad's patients.

My optometry, 1940, M.Sc., 1941, and Ph.D., 1949, degrees came from the Ohio State University (OSU). Professor Samuel Renshaw at OSU and Skeffington were good buddies. Renshaw was on my Ph.D. Examining Committee. After teaching three years at Ohio State University, I came to Indiana University and ultimately became director of the vision therapy program. I have done clinical studies^{1,2} on the effectiveness of vision therapy on the full spectrum of vision problems.

As a result I have reached some very strong conclusions about the tremendous value and capability of vision therapy (VT) which I want to share with you. In brief summary: VT can be extremely effective in strabismus, amblyopia and visually-related learning disability. Properly applied, VT is fast, effective, enhances your prestige, is simple and is cost effective to patient and doctor. To have patients or parents stop you on the street

to say thanks for what your VT did for them or their child is truly worth the effort!

Did you know that anti-suppression training is the key to treating strabismus, anomalous retinal correspondence, poor stereopsis, amblyopia and eccentric fixation?

First, let me explain what suppression is. In 1963, Hubel and Weisel,³⁻⁵ who won the Nobel Prize for their work, reported that after prolonged deprivation of vision to one eye, the deprived eye's neurons could not send impulses to cortical neurons beyond layer IV in the occipital cortex. They also showed in these visually-deprived animals with blindness in one eye that the output of each eye was normal at the retina, the optic nerve, the lateral geniculate body and the optic radiations leading to layer IV of the occipital cortex. (This shows that the term "lazy eye" as applied to the amblyopic eye is not appropriate, the lazy eye is, in fact, perfectly normal.)

They showed that the left and right eye signals fuse or "fight" at layer IV of the occipital cortex. Fusing means that both the left and right eye inputs to the occipital cortex are able to drive simultaneously the same higher cortical neurons. Fighting means that while the dominant eye is sending impulses to the higher cortical neurons, it inhibits impulses from the other. Optometrists call this *suppression*. Neurologists call it *inhibition*.

Hubel and Weisel also reported that prolonged monocular deprivation starting at birth caused a *permanent* impairment (blindness) of the deprived eye. *Later Chow and Stewart⁶ demonstrated that the blindness was NOT permanent and that the vision could be brought back almost to normal through training!*

Bartley and Ball⁷ found that inhibition causes a reduction in brightness of normal objects that we see around us. They showed that by flashing the light entering the eye at nine cycles per second the perceived brightness would be four times greater. (With a 50% shutter,

half the light reaches the eye, yet the subject sees this light as twice as bright.) It has also been observed that visual acuity is impaired at nine cycles per second. This information supports the simultaneous contrast phenomena, both in color and black and white, which improves visual acuity and depends on adjacent photo-receptors inhibiting one another.

Clinically this means that at nine cycles per second of alternate eye stimulation, the inhibited neurons have a much better chance of delivering information to the brain because the good eye's inhibitory mechanism cannot operate normally at nine cycles per second! Once inhibition is rendered inactive, the suppressed eye's neuronal connections can reestablish themselves. Acuity, fusion, eccentric fixation, anomalous correspondence (ARC), etc. are all positively changed by alternately stimulating each eye at nine cycles per second. (Left eye on, right eye off; right eye on, left eye off, etc.)

Flash techniques have been used in optometry since I can remember (at least 65 years). Examples are Arneson's Rotating Patterned Wheel and Pierce's Rotating Peg Board Disk. These devices flash individual photoreceptors in peripheral vision. Keystone's and other stereo equipment could flash the left and right eyes independently or simultaneously. We have known the value of flashing but we did not know what the optimum flash rate was before Bartley and Ball's⁷ work.

Please note that occluding the better eye blocks its ability to suppress the weaker eye. Thus occlusion is a valuable and effective treatment procedure.

I did clinical studies^{1,2} in which ARC, eccentric fixation, amblyopia and strabismus were treated. The eyes were stimulated by light passing through the eyelids, hence no borders were visible to either eye. The lights alternately provided a uniform stimulation of each eye at about nine cycles per second. *The re-*



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sults indicate that anti-suppression therapy is essential to all abnormal binocular behavior.

I concluded that what was important was not the number of days or months of flashing light treatment but the number of hours. For example, I would say to patients who were taking flash equipment home: "I want you to treat your eyes for (let's say) 10 hours. You can do it in one day, one week or one month. Please return when you have completed the 10 hours." (The number of hours rarely went as high as 100. The usual number was about 15.)

At nine cycles per second the stimulated neurons can send impulses across synapses normally inhibited by the other eye. Ten hours at nine flashes per second is 324,000 simultaneous nerve impulses from the entire retina of the suppressed eye, which the brain cannot ignore. Such massive stimulation will reactivate the inherited normal binocular vision pathways that may have been inhibited for years.

ARC requires several collateral neurons to reroute the deviant eye's output so it can fuse with the output of the dominant eye. Flashing at nine cycles

per second is clearly too fast for these extra neurons and synapses to operate and be competitive, hence alternate flashing can quickly and easily eliminate ARC. Thus, within a few minutes or hours of treatment, ARC and eccentric fixation are usually by-passed because the normal, formerly suppressed pathways are once again able to operate.

Keep in mind that ARC and eccentric fixation are "learned" skills. If they should be needed in the future they will again become operational. ARC is like learning to ride a bicycle. Once learned, you never forget it. If the eyes go back to the old strabismus angle, the ARC will reappear.

Note that suppression is present even when each eye has good acuity, as in alternating strabismus. In this case each eye's fovea alternately suppresses the other. The nine cycles per second frequency assures that all suppression can be removed and that the normal neural pathways are again able to function. This major neurological change can be accomplished in but a few days or weeks by specifically treating the synaptic defect caused by neural inhibition by using nine cycles per second flashing lights.

In summary, it is important for each eye to be able to talk to the brain without interference from the other eye.

Treatment of suppression is basic and the first priority in instituting a vision therapy program. Once suppression is overcome the rest is greatly facilitated!

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