

# An Historical Look at Amblyopia - from Patch to Patch.

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## Abstract

Amblyopia is one of the major areas of treatment in which the orthoptist is an active participant. As the understanding of the pathophysiology of amblyopia evolved so did the treatment attempt to respond. Reviewing the evolution of amblyopia treatment can help one to appreciate the present day treatment. Though it appears that the treatment has remained the same, ie: patching, this is not really the issue as our understanding of amblyopia increases.

**Purpose:** this paper reviews the evolution of theories about amblyopia and the treatment responses up to the present day.

## Amblyopia Review

Throughout the years, the main treatment of amblyopia has remained the same-patching. Though the treatment appears to have remained unchanged, many treatments have been advocated in response to increased understanding of the pathophysiology of amblyopia. Looking at the changes in thinking about amblyopia and the different treatments tried, allows us to appreciate how much we have progressed in our understanding of amblyopia as well as how much we still have to learn.

In the 1500s, straightening the deviated eye by covering the good eye was thought to correct a

squint. In order to straighten the eyes, treatment involved wearing nut shells, horned discs or a strabismus mask, one for esotropia and one for exotropia.<sup>1</sup> The problem became apparent that the covered eye was still turned. Amblyopia at this time was not understood to be associated with strabismus.

By the 1700s it was recognized that amblyopia was associated with strabismus. Strabismus was thought to be the single cause of a decrease in vision. The first treatment of amblyopia was credited to DeBuffon who had amblyopia and strabismus. He stressed the importance of full time occlusion as a treatment.<sup>2</sup> The problem was that only some vision deficits improved since this treatment was done on older patients.

In the late 1700s, amblyopia was regarded as a congenital and hereditary problem because improvement of vision with patching was not very successful. One of the earliest methods of partial occlusion was an oversized artificial nose that covered an eye.<sup>3</sup> It was also thought that since an imbalance of the extraocular muscles caused strabismus and decreased vision, treatment by manipulating the extraocular muscles with surgery might improve vision, even in patients with straight eyes.<sup>4</sup> Amblyopia obviously did not improve with surgery. Patching was not really advocated as a treatment at this time.

By the 1800s, amblyopia was recognized by some as a functional problem of binocular vision, and not residing in the eye and extraocular muscles.<sup>5</sup> In 1850, with the introduction of the Ophthalmoscope, the ability to see a normal retina in amblyopia supported the concept of a functional cause. At this time, Javal devised a treatment involving a series of exercises to train the eye and stressed the correction of refractive errors.<sup>6</sup> Donders established the importance of the correction of the refractive errors in the treatment of strabismus.<sup>7</sup> Again, the problem remained that amblyopia was not always cured and strabismus was still present after treatment.

During the 1800s, it became generally accepted that amblyopia was a functional problem residing in central areas of the nervous system.<sup>8</sup> Therefore treatment was directed toward activities other than patching in order to progress beyond the levels that patching was achieving. Treatment with pharmacological agents such as amyl nitrate inhalation, strychnine injections and even eye massages were advocated.<sup>9</sup> These treatments met with limited success.

During the 1800s, two different types of amblyopia were recognized, these being amblyopia of disuse and congenital amblyopia. Amblyopia of disuse occurred at the onset of the strabismus and was treatable. Congenital amblyopia was the remaining amblyopia and could not be improved with patching.<sup>10</sup> Patching was the accepted treatment at this time but no one could agree as to whether full time or part time was most effective. The problem was that there was no explanation for anisometropic amblyopia with straight eyes. There was also a limited understanding of suppression, and also of congenital amblyopia.

In the early 1900s, the concept of functional amblyopia was fully accepted. Worth emphasized that the age of onset of strabismus and of treatment was very important in improving amblyopia.<sup>10</sup> Chavasse named and described amblyopia of arrest as arrested development of vision at the onset of the strabismus.<sup>11</sup> Patching treatment saw the first adhesive patch. Full time occlusion was stressed even to the point of suturing the lids.<sup>12</sup> Worth was treating amblyopia by atropine and blurring the good eye through dilation.<sup>13</sup> Again, not all vision deficits improved. Organized treatment protocol was not fully accepted since some clinicians still claimed that patching did not help.

By the mid 1900s, it was recognized that organic and functional amblyopia coexisted in some patients. This explained why patching did not always succeed. Suppression, as an active inhibition of an image, was appreciated as more important than the concept of nonuse. Since active treatment was felt to be important, several unusual active treatments were tried. One treatment advocated but never successfully proven was the Master Korrektor, a type of rotating placido disc. This treatment was used to stimulate both eyes in special spatial orientations which would be a direct stimulation to the cortex.<sup>14</sup> There was still debate whether full or part time patching was the most effective.<sup>15</sup> Still the problem remained that not all vision deficits improved.

During the mid 1900s there grew an

increased interest directed toward amblyopia and its etiology. Burian stressed that amblyopia was an ongoing problem from misuse, not disuse.<sup>16</sup> Eccentric fixation was recognized as the main cause of poor visual results. The superiority of the fovea needed to be restored. Treatment with occlusion of the amblyopic eye called inverse occlusion was thought to break the abnormal fixation. A treatment regimen devised by Bangerter was named Pleoptics and consisted of actively dazzling the peripheral retina so the fovea would regain superiority. The pleoptophore was used to accomplish this dazzling.<sup>17</sup> The main problem was that this treatment could only be done with older patients, was costly, time consuming and had limited success.

By the 1950s the scientific method of organizing a treatment protocol was being used for amblyopia treatment. The concept of regaining foveal superiority for vision rehabilitation was accepted. Cuppers modified Bangerter's concept, adding his treatment method concentrating on regaining straight ahead localization of the fovea.<sup>18</sup> The problem was that even with this modification of treatment, eccentric fixation was not eliminated in many patients. It was most apparent that younger patients regained central fixation and improved vision just with direct occlusion of the non-amblyopic eye.

During the 1960s, early treatment was recognized as essential in the recovery from amblyopia. Costenbader stressed the need to treat patients as soon as the strabismus was apparent.<sup>19</sup> Regaining foveal superiority was still a problem in older patients. Since pleoptics was very time consuming, other methods were advocated to regain foveal fixation. One approach placed a red filter before the amblyopic eye while the good eye was occluded, the premise being that since the cones are more sensitive to red, the cones in the fovea would be forced to work.<sup>20</sup> Another treatment involved using prisms to either move the image to the fovea, the direct method, or away from the fovea, the indirect method.<sup>21</sup> Penalization treatment, using cycloplegia to force the patient to use one eye for distance and the other for near was suggested again. Though foveal fixation improved with these treatments, vision often did not.

By the 1970s, Hubel and Weisel had shown that early monocular deprivation during the sensitive period caused permanent visual loss in the cells of the central nervous system. The abnormal binocular interaction and spatial orientation of cells were the essential part of amblyopia.<sup>22</sup> Von Noorden's classification and description of different types of amblyopia

organized thinking about the treatment of amblyopia.<sup>23</sup> Current treatment stresses early intervention on younger patients and full time occlusion. Only a few suggested special approaches have recently been advocated. One is the CAM stimulator treatment that tried to incorporate the new information of spatial orientation into a stimulus for amblyopia treatment. Part time patching with stimulation of different spatial orientations of the amblyopic eye by a rotating disc was thought to lessen treatment time and improve vision.<sup>24</sup> Follow up studies failed to confirm the claimed results.<sup>25,26</sup> Also, a pharmacological agent Levodopa/carbidopa, is showing some short term effect on functional amblyopia but more investigation needs to be done.<sup>27</sup> An effective treatment is still being pursued so that all types of amblyopia can be improved.

Though patching is still and has been the treatment of choice for amblyopia, much has been learned about the necessity for early treatment, correction of refractive errors and the importance of binocular interaction in the treatment of amblyopia. Most treatments, though abandoned or of limited success, helped to move towards the direction and understanding we have of amblyopia. We still struggle with patients whose vision does not improve, but with new research, new treatments will come.

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