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# Review of the literature on the subject of the control of myopia by the use of plus lenses

## Abstract

The purpose of this work is to review studies of the effect of plus lenses on the progression of myopia.

## Degree Type

Thesis

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Master of Science in Vision Science

## Committee Chair

D.T. Jans

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REVIEW OF THE LITERATURE ON THE  
SUBJECT OF THE CONTROL OF MYOPIA  
BY THE USE OF PLUS LENSES

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A Fifth Year  
Research Project

By  
A. T. Rasmussen  
May, 1964

## ACKNOWLEDGMENT

I would like to express my appreciation to Dr. D. T. Jans, Professor of Optometry, for his guidance and interest in my project and to Dr. William Baldwin, Dean of the College of Optometry, for the assistance he gave me in gathering my material.

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## PURPOSE

~~The purpose of this work is to review stud-~~  
ies of the effect of plus lenses on the progression  
of myopia.

REVIEW OF THE LITERATURE

The earliest mention of this subject that I  
 could find was in a book written by Herman Cohn  
 in 1886, Hygiene of The Eye In Schools. This pub-  
 lication was the first systematic, statistical  
 approach to the problem of school children's vision,  
 particularly that of nearsightedness. He proposes  
 what he considers are the proper hygienic procedures  
 to enable the child to develop a normal and adequate  
 visual system.

Although no studies or statistics with respect  
 to the effect of plus lenses on myopia were given,  
 I am going to give some of the material presented in  
 the interest of presenting some of the earliest  
 recorded thoughts on this subject.

Mention was made that Javal had recently ordered  
 convex glasses for school children with commencing  
 myopia, in order to enable them to read without exert-  
 ing their accommodation, which in his opinion is the  
 chief factor that promotes myopia.

Then Cohn mentions that: "It is true, with  
 Donder's already having mentioned this fact, that  
 myopia is rare among watchmakers because they use  
 the magnifying glass instead of their accommodation.  
 In Breslau, among 71 watchmakers from 19 to 71



years old, only 7-9% of them were myopic. Of these were 4 that had become near-sighted in the course of their trade"<sup>1</sup>. But a reminder is made that watchmakers only look with one eye, that they sit at the window and in very good light and that in Germany they don't begin their work before their 15th year. "Among the Swiss watchmakers Emmert found 12% myopia probably because the trade is learned in Switzerland at an earlier age. Just follows Javal's advice and now orders all commencing myopes for whom the ophthalmometer gives emmetropia or hyperopia up to 1.5 diopters to wear convex glasses when at work. The results, however, have not been made known."<sup>2</sup> Cohn says that it seems to him that the increased forward stooping caused by the use of convex glasses outweighs the benefits derived.

Another relatively ancient work in this field was done by M. Straub, a Dutchman, who worked in a government study and dealt with fully and under-corrected myopes. He revealed his results in a publication, Concerning the Etiology of Myopia and

<sup>1</sup>Herman Cohn, Hygiene of The Eye In School (1886), p. 213

<sup>2</sup>Ibid.

The Cause of Emmetropization, which was published in 1909.

It has only recently been translated and I was not able to obtain it in its entirety so therefore I don't know the type of experiment he conducted or the number of subjects utilized.

His apparent conclusions were that (1) some fully corrected myopes from 7 to 13 years progress at about the same rate as undercorrected myopes, (2) fully corrected myopes above 14 years level off while the undercorrected continue to progress, and (3) 7-13 years appear to be the age of greatest progression of myopia.

Edward Forbes Tait, a prominent ophthalmologist, while offering no documented statistics, does say that he has used bifocals in some cases with children and because he is considered an authority in the field of refraction, his opinions will be presented.

He states that "in progressive myopia, my experience suggests that a full lens correction when used for both far and near vision is undesirable, because the progression tends to continue at the same or even at an increased rate. The only effective optical procedure in the treatment of such cases seems

to be in the use of bifocals, regardless of the amount of myopia or the amplitude of accommodation. I have followed this practice consistently during the last 20 years and during that time have observed, in a considerable number of cases, an apparent tendency for the progress to stop or the rate of progress to lessen when bifocals were used."<sup>3</sup>

"In a number of individual cases of children, observed for some years, the prescription of bifocals was promptly followed by a decrease in the rate of the progression, but when the bifocal additions were removed for a time the former rate was resumed. Other patients showed no response, but certainly were not adversely affected by the bifocals; with a full concave lens correction for distance and an arbitrary addition of plus 1.00 or 1.50, in all myopic cases in which there is real evidence of untoward progression. In this way, the patient can have clear distance vision and comfortable near vision with a lessened strain on the ciliary muscle."<sup>4</sup>

<sup>3</sup>Edwin Forbes Tait, Textbook of Refraction, Philadelphia, (1951), p. 61.

<sup>4</sup>Ibid.

Paul W. Miles, an ophthalmologist, conducted a series of experiments in his practice fitting bifocals to children but restricting them to those who were increasing in myopia one or more diopters per year. All the adds were either plus .75 or 1.00 diopter and the segs were decentered in an excess of 2 millimeters to create slight base-in prism.

As a control group, 50 children were used who had been followed through the last 20 years in the Washington University Eye Clinic.

"Average rates of myopization were determined over a period of years by studies of clinic cases. The final degree of myopia depended on the age of onset and the rate. It was shown that the rate of myopization is fairly stable, diminishing gradually until about age 17. Exceptions occurred in 14 per cent of the 50 control cases, in that before the age of 13, myopization slowed abruptly.

The number of cases in this experimental group was 10 and in 60% of these cases similar decreases occurred. Of the 4 children whose myopization rate did not change, one could not overcome his habit of reading at a 7 inch distance and another had a serious physical disability. Most significant was the fact that the change in the myopization rate in the 6 cases followed exactly the use of the bifocals."<sup>5</sup>

<sup>5</sup>Paul W. Miles, "Children With Increasing Myopia Treated With Bifocal Lenses", Missouri Medicine, (Dec. 1959) p. 1154-5

Hiles' summary and conclusion reached from his study was that "of the 10 cases of increasing myopia treated with bifocals before the age of 13, 6 showed an immediate and sustained decrease in myopization rate. However, such a decrease in myopization rate occurs in about 14% of myopic children not wearing bifocals. Since it isn't known how to bring about this desirable effect without bifocals, this harmless treatment deserves further use and research. It should be restricted to those children whose myopia is increasing one or more diopters per year."<sup>6</sup>

This study did not utilize enough subjects to lend much validity and, going along with this, the conclusions were drawn from a very small number of subjects. There were no criteria used governing either the control group or the experimental group as in Mandell's study, but this would have to rank second behind Mandell's study in the number of subjects used and the completeness of the studies in this area.

In 1958, Dr. Richard Feinberg sent out a post-card questionnaire to 20,000 optometrists to survey

<sup>6</sup>Ibid, p. 1155

the current attitude toward supplying bifocals to children with myopic symptoms and the quantitative decree to which such prescribing is done. At the time the article was written, over 5,000 of the cards had been returned.

"The statistical results of the estimated percentage of myopic children provided with bifocals is represented below:

% of Myopic Children Provided with Bifocals	Practitioners- Number of	% of Practitioners Responding
0	108	10.8
1-9	217	21.7
10-19	148	14.8
20-29	115	11.5
30-39	54	5.4
40-49	33	3.3
50-59	90	9.0
60-69	39	3.9
70-79	73	7.3
80-89	40	4.0
90-99	73	7.3
100	10	1.0

The medial equals 30% of myopic children going to optometrists, who replied to the survey, get bifocals."<sup>7</sup>

Dr. Feinberg's conclusion is that "from the data presented, it is clear that the greatest number of optometrists (80.2%) believe in the use of bifocals for children presenting myopic symptoms."<sup>8</sup>

<sup>7</sup>Richard Feinberg, Bifocals For Children - A Survey, Optometric Weekly, (Oct. 15, 1959), Vol. 50, Part II, p. 2057

<sup>8</sup>Ibid.

"Perhaps those O.D.'s who wrote comments like one of the sample ones, 'there is a great need for a statistical survey on bifocals with a control group' were right. But under whose auspices and where would a study be made that was free from bias and capable of scientifically controlled procedure? Perhaps the weight of evidence will always be with the preponderance of men who have clinically observed results in their patients and are convinced of the procedures followed in developmental visual care."<sup>9</sup>

This study was strictly one of attitudes and practices and didn't represent one concerned with the thesis subject. I was disappointed that the questionnaire didn't include some question concerning directly the practitioners ideas on whether the bifocals reduce the myopic progression.

Robert B. Mandell made one of the most systematic and comprehensive studies. He obtained his data from the case records of a private optometric practice in Southern California. This data included a total of 175 myopic patients with 59 of these having at some time or another received bifocals. This total of 175 patients are all the myopic patients in this practice who, between the years of 1946 and

<sup>9</sup>Ibid., p. 2058

1957, received two or more refractions, the second in all cases being given before the age of 30.

The controls and conditions under which this study was conducted included the fact that all the refractions were done by the same practitioner. A large number of schools were attended by these patients and they had diverse social and economic backgrounds. Certain criteria were also met and they are:

"1. The measurement of the degree of myopia must be conducted in the very same way for each examination represented in the study. In other words, there must be consistency of the test-technique.'

"2. Every patient with myopia in a designated age group occurring in the practice must be included in the study, or at least a large enough random sampling to leave no doubt as to the probable status of the remaining group. The only allowable exception to this rule would be in those patients exhibiting pathology likely to invalidate a test measurement.'

"3. The study must follow each subject for a period of time long enough to establish true changes in the refractive status and to elim-



inate misinterpretation due merely to normal errors by the examiner in the measurement of refractive findings."<sup>10</sup>

In the first comparison a total of 59 patients, male and female, were represented and the time period shown represented both before, during, and after these patients had worn bifocals. An overwhelming majority of them progressed even though bifocals were worn. Only 2 patients reversed their direction of progression and only 3 remained at their original refractive status. Almost  $\frac{1}{2}$  of the patients progressed one diopter or more, eight progressing over two diopters.

Another comparison showed all the male and female patients not wearing bifocals at any time. This group also shows some rapidly progressing cases but in general, shows less progression than was found in those patients who wore bifocals.

The last comparison represented all the patients in this study, plotted in relation to their age and degree of myopia found upon each exam. Upon graphing this data, it becomes evident that many more of the bifocal than non-bifocal wears already possess-

<sup>10</sup>Robert B. Mandell, "Myopia Control With Bifocal Correction," American Journal of Optometry and Archives of American Academy of Optometry, Vol. 36, (Dec. 1959), p. 653

ed considerable myopia when they received their first correction. They also average 2.8 years older. The graphs also show that most of the patients over 14 years and requiring less than 2 diopters correction do not progress even though no bifocal correction was given.

The conclusion that Mandell reached was that "the data of this study show that the bifocals used on myopic patients in this practice have not eliminated or reduced the progression of myopia beyond what might be expected to happen on a chance basis as determined by a comparison group to which bifocals weren't given. The graphs show that any patients with less than 2 diopters of myopia and over 14 years of age has little likelihood of progressing any significant amount regardless of the type of correction."<sup>11</sup>

He then summarized his findings thusly: "Bifocal corrections were given to 59 out of 175 myopic patients of a private practice. All patients wearing bifocals continued to progress except 5, one-half of the patients increasing one diopter or more. The bifocals apparently had no influence on the rate of myopic progression."<sup>12</sup>

<sup>11</sup>Ibid., p. 657

<sup>12</sup>Ibid., p. 659

This study is the most complete one conducted on this subject. Certain criteria were set up by the author as listed in the discussion. There was a control group of similiar cases with the group also being broken down into females and males. This study was conducted in such a manner that for this population, i.e., the patients of this practice, the conclusions drawn appear to be quite valid. Another possible step would be to follow a group under the criteria and controls used in this study who all received the full correction of their myopia and note the results.

A medical man, Dr. Eggers, places great importance on the state of the accommodative system. He states that where accommodation is present, by sparing it he believes that he has been able to appreciably retard the progress of myopia. The criteria he uses is that for anyone younger than 20 years, the minimum additional accommodation possible at 11 inches should be 5 or more diopters.

Dr. Eggers presented 6 case histories in which the myopic progression stabilized with the introduction of bifocals. He states the following regarding the use of controls, etc. and also states his conclusion.

"Many more case histories could be cited, but not sufficient for statistical analysis; also there would be no control series. Therefore for the present at least, I merely say that it is a matter of personal clinical observation that young myopes engaged in much close application of their eyes will steadily become worse if their accommodation is weak unless the strain on the latter is relieved. The disbeliever will state that all myopias cease to progress after awhile and that it was just a coincidence that in some patients this occurred at the time that the bifocals or the equivalent were prescribed. I can only reply that it would be remarkable coincidence for the rate of progression to decrease suddenly at this time. Furthermore, in my experience, young patients with myopia and weak accommodation continue to increase until the age of 30, although the rate of increase does decrease after the age of 20."<sup>13</sup>

This study doesn't meet the standards that a scientifically controlled and conducted experiment should and his conclusion can't be considered valid from this standpoint. But he does admit this and

<sup>13</sup> Harry Eggers, "The Cause and Treatment of School Myopia, Optometric Weekly, (May 16, 1963), Vol. 54, Part II, p. 907

and says that clinical observations through the years have left him with his stated opinion.

## CONCLUSION

The first thing that comes to mind is the extreme scarcity of actual studies on this subject contained in the literature. There is a wealth of material written by different men stating their beliefs and clinical routines they use in their office but with usually either a small amount or no statistical evidence to support their beliefs.

In the studies which I presented there was an almost equal division of opinion on the effectiveness of bifocals in controlling myopia. But getting away from opinion and dealing with those which arrived at scientifically sound and valid conclusions, the only one actually qualifying would be Mandell's. The others are mere statements of beliefs or studies with inadequate controls and number of subjects to lend any justification to the conclusion.

It would seem that there is still much to be done before completely conclusive evidence is obtained and the present state of knowledge is such that there is room for argument either way and one opinion seems as acceptable as the other.

The next step would seem to be to conduct a study in which there are two groups similar in age,

sex, refractive status plus any other characteristics deemed important and then one group fitted with the full correction of their refractive error and the other with bifocals and then the results compared.

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