

# THE CONTROL OF MYOPIA

A rationale for a functional approach

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## BIOGRAPHICAL SKETCH

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## ABSTRACT

This paper shall present, in a question and answer format, a short review and documentation of the current understanding of the nature and control of progressive myopia taken from ophthalmological as well as optometric literature. The primary intent of this paper is to inform parents of the merits of a functional approach to myopia control.

*"Even more deeply rooted in human nature, and strongly nurtured in all scientific training, is a profound skepticism of all new propositions."*  
Walter D. Lancaster, M.D., 1943

*"When a tradition once becomes established by the hallmark of acknowledged authority, it takes more than cold facts to uproot it from men's minds - it takes time."*  
W. Nicholson, 1919

Q. Who are likely candidates for nearsightedness?

A. Since 1813,<sup>1</sup> observers and researchers have associated a relationship between myopia and the reading process. Cohn,<sup>2</sup> in 1867 found increasing myopia in school populations from kindergarten through graduate and professional schools. Also, a study of the Japanese population from 1913 to 1966<sup>3</sup> shows a strong relationship between educational level and increasing levels of myopia. The Japanese have followed the development of myopia in great detail over the years. Interestingly, there is a data break during the war years with a surprising decline in myopia once the data resumes in 1948. A highly similar progressive pattern has been established once again, apparently coinciding with the reestablishment of their societal patterns.

Therefore, it appears that in societies where there is emphasis on educational achievement, people are exposed to an environment that is in some way conducive to progressive myopia.<sup>4, 5, 6, 7, 8, 6, 10, 11</sup> Conversely, it has been noted that among school dropouts, myopia is rare.<sup>12</sup>

Q. At what age does myopia begin?

A. Years ago, myopia usually developed at age 12-15, leading some researchers to believe it was associated with changes at puberty, and thus was essentially a delayed response to heredity. This pattern is no longer seen. Myopia is now beginning at much younger ages, as young as 5 to 6.<sup>13</sup>

Most examiners in clinical practice have seen the largest percentage of beginning myopes at ages 8-10. Additional clusters of beginning myopes appear at ages 13-15 and 18~21.<sup>14</sup> These findings seem to correspond to shifts in demand of nearpoint tasks: the switch in the later part of fourth grade from learning to read (1st through 4th grade) to reading to learn. Junior high schools emphasize greater independent study and increased volume of reading; and college level demands and/or an occupational emphasis on additional nearpoint work may account for these changes.<sup>15, 16, 17</sup>

Q. What causes myopia?

A. After years of debate, it seems clearer than ever that sustained accommodation (focusing) is the primary stimulus to a stretching of the scleral fibers; the eye gradually lengthens, producing the nearsighted condition.<sup>18, 19, 20</sup>

Heredity was long suspected to be the primary causal factor,<sup>21, 22</sup> but great inconsistencies in the age of onset and the frequent lack of myopia in the family genetic structure tends to rule this out in most cases.<sup>23, 24, 25, 26</sup> A few infants are born highly myopic either with or without immediate hereditary factors. However, this is an extremely small segment of a myopic population.

Recent research<sup>27, 28, 29, 30, 31</sup> indicates that, in studies on primates (monkeys and chimpanzees), constricted visual space creates myopia and axial length increase in the animals and that drug-induced paralysis of the focusing mechanism prevents this ocular adaptation. A similar study<sup>32</sup> with atropine (a muscle-paralyzing drug) in humans yielded decreased amounts of myopia in the subject's atropinized eye while rather large increases in myopia occurred in the non-atropinized eye. The test condition was then reversed and the eye that had previously become progressively more myopic actually became less myopic under drug influence, and the previously improved eye now became progressively more myopic. Other studies have also shown that atropine-like control is effective<sup>33, 34, 35, 36, 37</sup> The closed-in world of the student at his desk and with his reading and writing day in and day out creates a spatially constricted environment like the laboratory tests described.<sup>38, 39, 40, 41</sup>

Q. Why has the cause of myopia not been understood before now?

A. The theories underlying the control of myopia actually have existed for decades, at the least. However, they have not been popular ideas. All in all, there is no good reason why prevention of myopia has not progressed further in its practice than it has.

Then, too, it is apparent that some influential authors have either overlooked or ignored valuable research available in the literature at the time they published their works.<sup>42</sup> Unfortunately, their opinions were received by unquestioning readers. However, even Duke-Elder himself concluded and hinted that genetics did not explain the whole picture: "...the realization of these potentialities [i.e., genetic influences on myopia] depends on the **environment**."<sup>43</sup> (Emphasis added.) More recently, several experts have shown that the eyeball does not adhere to a rigid, genetically-governed growth pattern, but is a tissue system with the plasticity to compensate for many variations in the optical elements.<sup>44, 45</sup>

There are other suspected causes of myopia, but their incidence is thought to be a minor fraction of the total nearsighted population.

Ultimately, two very significant considerations generating the controversy over the cause and the lack of progress in using myopia prevention methods must be that human research is expensive to perform and difficult to adequately control; and that there is also a very unobjective and human trait among practitioners and researchers to consider only evidence that has come from within their own discipline.

Q. How do we prevent, retard, or arrest myopic progression?

A. The arrest rate for atropinization is high.<sup>46, 47</sup> This method has serious drawbacks, however, since atropine can be lethal. Bifocal lenses must be used for reading if both eyes are to be treated because the focusing mechanism becomes artificially paralyzed. However, the atropine method can be considered somewhat academic. We find that bifocals alone, set high up in the corrective lens, can result in an arrest rate of 66% or more in a similar age group.<sup>48, 49</sup>

The elimination of atropine results in an elimination of any hazard or mishap from the patient's control of the drug with only a slight degree of reduction in benefit to the test (or clinical) group. We also find that bifocals have been recommended as the therapy of choice by medical and physiological researchers in other studies and texts.<sup>50, 51, 52, 53, 54</sup> Studies have also shown that the use of contact lenses tends to arrest the progression of myopia although the method is not well understood and several possible reasons have been suggested.<sup>55, 56, 57</sup>

Virtually all babies are farsighted at birth.<sup>58, 59</sup> This gradually declines through the early school years, then stabilizes.<sup>60</sup> One observer recommended that college students enter their first year with 1.00 D. of farsightedness to avoid the development of myopia during their four year course of study.<sup>61</sup> He also notes that an emmetropic eye (no lens prescription at all) is, for all practical purposes, an abnormal eye and that those people with no prescription have "borderline conditions definitely on the way to myopia." It would appear that it behooves us to consider protection of complicated or undercompensated farsightedness until the student's years are over in order to reduce the chances of myopia onset.

Visual therapy can be employed to restore binocular focusing facility or to counter uncompensated phorias (a form of eyestrain) frequently found in the early stages of a focusing loss.<sup>62, 63</sup>

Q. What other factors are involved in myopia and myopia control?

A. The person who is myopic or who is susceptible to myopia is making a total response to the stress of the near-centered task. Therefore, the whole organism is involved and any stress factors may aid the adaptation into

myopia. Because of this, we find emotional aspects reflected in his adaptation and contributing to its progression.<sup>64,65</sup>

Also, there has been renewed interest in the nutritional status of myopes. Certain vitamin and mineral deficiencies that directly affect the internal pressures of the eye have been associated with those who are becoming progressively more myopic.<sup>66,67</sup>

Lastly, the effects of systemic disease in the appearance of sudden and large amounts of refractive error is widely known clinically and may relate to syntoxic or catatoxic hormone release as a result of the systemic stress.<sup>68</sup>

Because of the possibility of any or all of these factors being present in any specific case, there can be no certainty that a functional approach will work. As Dr. Leo Manas states in his textbook, **Visual Analysis**, "It is obvious that often we cannot be certain as to the precise etiology [cause] of a particular myopia. However, the functional approach has been the most fruitful in the prevention, alleviation, and stabilization of myopia. It is for this reason this approach is emphasized."<sup>69</sup> We must provide the best of professional care with a positive, nurturing environment.

## SUMMARY

Q. Who are likely candidates for nearsightedness?

A. Students who like to read and adults who perform intense near work.

Q. At what age does myopia begin?

A. The great majority of myopes begin to develop and progress between ages 6 and 21. Myopia does begin at later ages.

Q. What causes myopia?

A. There are several causes. The primary factor of concern in preventing, arresting or retarding progressive myopia is accommodative (focusing) spasm.

Q. Why has the cause of myopia not been understood before now?

A. The theories actually have existed for decades and new data refutes old concepts. Some authors have not reported these factors or taken them into consideration. There is also a reluctance to change concepts.

Q. How do we prevent, arrest, or retard myopic progression?

A. Atropine drops and others have been used but are impractical in most cases. Reading lenses, bifocals and/or visual therapy have been highly successful. Contact lenses have some therapeutic effect and are occasionally recommended for this reason.

Q. What other factors are involved in myopia and myopia control?

A. The relationship of emotions and nutrition to myopia has been reported in the literature and their roles are becoming clearer. Systemic disease has also been known to play a role in refractive problems. But, as Dr. Leo Manas states in his textbook, **Visual Analysis**, "It is obvious that often we cannot be certain as to the precise etiology (cause) of a particular myopia. However, the functional approach has been most fruitful in the prevention, alleviation and stabilization of myopia. It is for this reason that this approach is emphasized."

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