

**A comparison of total and manifest hypermetropia, as determined by the the prisoptometer, with and without the use of mydriatics / by H. Culbertson.**

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73

A COMPARISON  
OF  
TOTAL AND MANIFEST HYPERMETROPIA,  
AS DETERMINED BY THE PRISOPTOMETER, WITH  
AND WITHOUT THE USE OF MYDRIATICS.

BY

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NAME.	No. of case.	Age.	Right or left eye.	Mydriatic used.	Formula for dioptrics of perimetropia total of mydriatic.
M. W. H. . . . .	1	11	L.	Duboisine.	+ 0.75 <sup>s</sup> + .5 <sup>c</sup>
C. L. . . . .	2	12	R.	"	+ 5.00 <sup>s</sup>
C. L. . . . .	3	12	L.	"	+ 6.00 <sup>s</sup>
A. J. T. . . . .	4	15	R.	"	+ 0.75 <sup>s</sup>
A. J. T. . . . .	5	15	L.	"	+ 0.75 <sup>s</sup>
W. Mc. . . . .	6	16	R.	"	+ 1.00 <sup>s</sup> - .5 <sup>c</sup> ax. 90°
W. Mc. . . . .	7	16	L.	"	+ 1.00 <sup>s</sup> - .25 <sup>c</sup> ax. 90°
S. M. C. . . . .	8	17	R.	Homatropine.	- 0.25 <sup>s</sup> + 2.5 <sup>c</sup> ax. 30°
S. M. C. . . . .	9	17	L.	"	- 0.25 <sup>s</sup> + 1.25 <sup>c</sup> ax.
I. S. . . . .	10	20	R.	Duboisine.	+ 1.00 <sup>s</sup>
I. S. . . . .	11	20	L.	"	+ 1.00 <sup>s</sup>
L. E. G. . . . .	12	21	R.	Homatropine.	+ 1.25 <sup>c</sup> ax. 0°
L. E. G. . . . .	13	21	L.	"	+ 1.00 <sup>c</sup> ax. 0°
M. B. . . . .	14	23	R.	Duboisine.	+ 0.50 <sup>s</sup>
M. B. . . . .	15	23	L.	"	+ 0.50 <sup>s</sup>
H. G. W. . . . .	16	24	R.	"	+ 1.75 <sup>s</sup> - 0.75 <sup>c</sup> ax.
H. G. W. . . . .	17	24	L.	"	+ 1.75 <sup>s</sup> - 0.75 <sup>c</sup> ax.
J. S. B. . . . .	18	24	R.	"	+ 6.00 <sup>s</sup> + 0.50 <sup>c</sup> ax.
J. A. . . . .	19	25	R.	"	+ 0.75 <sup>s</sup>
J. A. . . . .	20	25	L.	"	+ 0.75 <sup>s</sup>
M. R. . . . .	21	27	R.	"	+ 2.50 <sup>s</sup> - 0.50 <sup>c</sup> ax.
M. R. . . . .	22	27	L.	"	+ 3.50 <sup>s</sup> - 0.25 <sup>c</sup> ax.
J. B. E. . . . .	23	28	R.	"	+ 1.00 <sup>s</sup> - 0.50 <sup>c</sup> ax.
J. B. E. . . . .	24	28	L.	"	+ 0.50 <sup>s</sup>
H. R. S. . . . .	25	28	R.	"	+ 0.50 <sup>s</sup> + 0.75 <sup>c</sup> ax.
H. R. S. . . . .	26	28	L.	"	+ 0.75 <sup>s</sup> + 0.50 <sup>c</sup> ax.
H. M. . . . .	27	31	R.	"	+ 0.50 <sup>c</sup> ax. 50° r.
G. N. W. . . . .	28	31	R.	"	+ 0.50 <sup>s</sup>
G. N. W. . . . .	29	31	L.	"	+ 0.50 <sup>s</sup>
L. W. . . . .	30	33	R.	"	+ 0.75 <sup>s</sup> - 0.25 <sup>c</sup> ax.
L. W. . . . .	31	33	L.	"	+ 0.75 <sup>s</sup>
O. T. . . . .	32	33	R.	"	+ 0.25 <sup>s</sup>
O. T. . . . .	33	33	L.	"	+ 1.25 <sup>s</sup> - 1.00 <sup>c</sup> ax.
M. F. T. . . . .	34	33	R.	"	+ 1.00 <sup>s</sup>
M. F. T. . . . .	35	33	L.	"	+ 1.00 <sup>s</sup>
C. C. G. . . . .	36	34	R.	"	+ 1.00 <sup>s</sup>
C. C. G. . . . .	37	34	L.	"	+ 1.00 <sup>s</sup> + 0.25 <sup>c</sup> ax.
R. W. . . . .	38	45	R.	Atropine.	+ 1.50 <sup>s</sup> - 0.50 <sup>c</sup> ax.
J. J. R. . . . .	39	52	R.	Duboisine.	+ 1.75 <sup>s</sup>
J. J. R. . . . .	40	52	L.	"	+ 2.00 <sup>s</sup>
W. B. . . . .	41	59	R.	"	+ 1.75 <sup>s</sup>
W. B. . . . .	42	59	L.	"	+ 2.00 <sup>s</sup>
P. M. . . . .	43	60	L.	"	+ 0.50 <sup>s</sup> - 0.75 <sup>c</sup> ax.
W. W. . . . .	44	77	R.	"	+ 1.25 <sup>s</sup>
W. W. . . . .	45	77	L.	"	+ 2.25 <sup>s</sup>
Total. . . . .					

Dioptries of hypermetropia manifest with- astigmatic.	Sum of dioptries of hypermetropia total.	Sum of dioptries of hypermetropia manifest.	Per cent. of hyper- metropia mani- fest.	Sum of dioptries of hypermetropia total for each class of five yrs.	Sum of dioptries of hypermetropia manifest for each class of five yrs.	Per cent. of hyper- metropia mani- fest for each class of five years.
	0.75	0.75	100.00	} 13.25	11.75	88.67
	5.00	5.00	100.00			
	6.00	6.00	100.00			
	0.75	0.00	0.00			
	0.75	0.00	0.00			
- .5° ax. 90°	1.00	1.00	100.00	} 7.75	5.75	74.19
- .5° ax. 90°	1.00	1.00	100.00			
+ 2.5° ax. 30° r.	2.50	2.50	100.00			
+ 1.25° ax. 40° l.	1.25	1.25	100.00			
	1.00	0.00	0.00			
	1.00	0.00	0.00	} 14.75	6.75	45.75
ax. 0°	1.25	0.50	40.00			
ax. 0°	1.00	0.50	50.00			
+ 0.25° ax. 10° r.	0.50	0.25	50.00			
+ 0.25° ax. 10° l.	0.50	0.25	50.00			
- 0.75° ax. 90° r.	1.75	1.75	100.00	} 10.00	2.00	20.00
- 0.75° ax. 90° l.	1.75	1.75	100.00			
+ 0.50° ax. 50° l.	6.50	1.75	26.92			
	0.75	0.00	0.00			
	0.75	0.00	0.00			
	2.50	1.00	40.00	} 8.75	2.00	22.86
	3.50	1.00	29.57			
	1.00	0.00	0.00			
	0.50	0.00	0.00			
	1.25	0.00	0.00			
ax. 50° r.	1.25	0.00	0.00	} 1.50	1.00	66.66
	0.50	0.50	100.00			
	0.50	0.00	0.00			
	0.50	0.00	0.00			
	0.75	0.00	0.00			
ax. 90° r.	0.75	0.25	33.33	} 11.50	10.50	91.30
	0.75	0.00	0.00			
x. 0°	0.25	0.25	100.00			
- 0.5° ax. 90° l.	1.25	0.75	60.00			
	1.00	0.00	0.00			
	1.00	0.00	0.00	} 11.50	10.50	91.30
	1.00	0.25	25.00			
	1.25	0.00	0.00			
	1.50	1.00	66.66			
	1.75	1.50	85.71			
	2.00	1.75	87.50	} 11.50	10.50	91.30
	1.75	1.75	100.00			
x. 90° l.	2.00	2.00	100.00			
	0.50	0.00	100.00			
	1.25	1.25	100.00			
	2.25	2.25	100.00			
.....	67.50	39.75	58.88			





A COMPARISON OF  
TOTAL AND MANIFEST HYPERMETROPIA,  
AS DETERMINED BY THE PRISOPTOMETER,  
WITH AND WITHOUT THE USE OF MYDRIATICS.

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THE "prisoptometer" is an instrument invented by the writer to determine ametropia, through the aid of a prism of glass. A description of it may be found in the "Cincinnati Lancet and Clinic," January 20, 1883, and in the "Journal of the American Medical Association," January 5, 1884. It should be stated that its results are accurate, and that its application is simple.

The object of this paper is to decide, first, what is the degree of *manifest* hyperopia as shown by the instrument without the aid of mydriatics, and, secondly, to determine by it the total hyperopia after the use of agents which paralyze the ciliary muscle.

0°

|

90° —————

It should be stated that the scale of the "prisoptometer" is represented as follows. It runs from the vertical 0° to 90° on either side, and to the horizontal line.

By reference to the table it will be seen that hyperopic astigmatism, as well as the spherical hyperopia, has been included in the calculations.

The accompanying table gives a statement of the cases.

Each eye examined, in the same individual, is regarded as a case.

The least degree of *manifest* hyperopia observed in the table is in Case 36, in a patient aged 34 years—viz., 25 per cent. It follows, in this example, that there is shown the greatest increase of *total* hyperopia, 75 per cent.

In Cases 1, 2, 3, 6, 7, 8, 9, 16, 17, 27, 32, 41, 42, 43, 44, and 45 (= 16 cases) the *manifest* hyperopia, without the aid of mydriatics, was equal to 100 per cent. In some of these examples the degree of hyperopia was high, in several very low, but in most cases it was medium.

In the following cases no manifest hyperopia was observed without the use of mydriatics: 4, 5, 10, 11, 19, 20, 23, 24, 25, 26, 28, 29, 31, 34, 35, and 37. In each of these 16 cases the *total* hyperopia was of low degree.

If the sum of the dioptries, in the 45 cases, of *total* and *manifest* hyperopia be estimated *before* and *after* the employment of mydriatics, there will be found:

67·50 dioptries of hyperopia total.

39·75       “       “       manifesta, and hence

27·75       “       “       increase, as an average for

all the examples of the table = 41·12 per cent., and due to the influence of mydriatics.

The proportion of *manifest* to *total* hyperopia, deduced from the 67·50 *total* and the 39·75 *manifest*, as above, for all the cases, is 58·88 per cent. *manifest*, which is an average result for all the members of the table, and shown without the use of mydriatics.

If the cases of the table be excluded above the age of 45 years, then, in the 38 cases remaining, the sum of *total* and *manifest* hyperopia will be:

54·50 dioptries of hyperopia total.

28·25       “       “       manifesta,

26·25       “       “       increase = 48·16 per cent.,

and due to the agency of mydriatics.

From these figures 54.50 and 28.25, dioptics, the per cent. of *manifest* hyperopia, up to the age of 45 years, and without the aid of mydriatics, is 51.84.

If the table be classified in periods of five years, and the sum, each, of *total* and *manifest* hyperopia be computed for these several classes, the following record will be shown:

AGE—YEARS.	H. total D.	H. manifest D.	Hm. per cent.
11 to 15.....	13.25	11.75	88.67
16 to 20.....	7.75	5.75	74.19
21 to 25.....	14.75	6.75	45.75
26 to 30.....	10.00	2.00	20.00
31 to 35.....	8.75	2.00	22.86
36 to 40.....	No cases.		
41 to 45.....	1.50	1.00	66.66
Over 45 .....	11.50	10.50	93.30

According to these data, children from 11 to 15 years of age develop more *manifest* hyperopia than persons aged from 16 to 20, and from 21 to 35 years *this* diminishes to 22.86 per cent., and that after 45 years the *manifest* hyperopia increases to 93.30 per cent. These percentages are based on the sum total of hyperopia for each class.

Age, therefore, according to these results, is associated with a gradual diminution of *manifest* hyperopia from 11 to 44 years, after which age *this* increases and is nearly equal to the *total* hyperopia.

This does not correspond with Hirschberg's conclusions, as reported by Louis Daniel (Berlin), (see "Ophthalmic Review," October, 1883), who finds that from 26 to 35 years Hm. = 75 per cent., whereas the foregoing table reveals *manifest* hyperopia equal to (within the same age-period) 42.86 per cent. only. From 36 to 45 years the same observer found 80 per cent. of Hm., while the *table* for this age-period reveals hyperopia manifesta = 89.52 per cent. Perhaps a portion of this discrepancy is due to the fact that there is but one case in the table aged 45 years

Another cause of the disagreement cited may be that, in all this gentleman's cases mentioned, the hyperopia *total* was determined by direct ophthalmoscopic examination, and hence the full amount of hyperopia may not have been found, at least not so great a degree of *this* as would have been discovered had mydriatics been employed, especially duboisine.

On the other hand, it is probable that the degree of *manifest* hyperopia developed through the instrument is not erroneous, because its records correspond so nearly in the age-period, 6 to 25 years, with the Hm. found by Hirschberg; and, moreover, its results are practically the same as those detected in the cases of the table in distant vision with the test types of Snellen. Further, it should be stated that, in testing with this instrument, the eye not under examination is closed, the "object-plate" is placed at twenty feet from the observer, and, consequently, parallel rays of light are employed during the test, all of which favor the development of *manifest* hyperopia.

It should be added, too, that an instrument which is capable of recording 88.67 per cent. of Hm. in those aged from 11 to 15 years can not be defective in *its* operation in those of greater age.

The cases given in the table are all uncomplicated.

The average number of *dioptrics* for the 45 cases is 1.5 H. total, and 0.88 Hm.; so that the low average degree of hyperopia can not be the cause of the diminution of the Hm. between the ages from 30 to 40 years.

The decrease in the power of the ciliary muscle, due to advancing age up to 45 years, should increase the *manifest* hyperopia; but the table reveals that, from 11 to 28 years, the Hm. steadily diminished to 20.00 per cent. of the total H. On the other hand, the total H. gradually *increased* to 80.00 per cent. in the same age-class.

There has been no creation of hypermetropia, which has simply diminished as *manifest* and *increased* as latent hyperopia, and the reduction of the former has decreased as the power of the ciliary muscle is weakened, as the age approaches 45 years.

It is quite evident, too, that, while using the instrument to detect low degrees of hyperopia, the ciliary muscle does not relax, but, by its *positive contraction*, maintains and overcomes the manifestation of a portion of the hyperopia, so that only when this muscle is paralyzed can the total hyperopia be obtained, up to 45 years of age.

Before and including the latter age, the table reveals in these cases that there remained enough, or an excess, of *ciliary power* to maintain the diminishing hyperopia *manifesta* present after the total H. had been deducted from the dioptrics of ciliary power present in each case, according to the age. This is shown in the following table:

NO. OF CASE.	Age, years.	Ciliary power for the age, in dioptrics.	Dioptrics of total H.	Dioptrics, excess of ciliary power.	Dioptrics of Hm.
2	12	13·00	5·00	D8·00	D5·00
3	12	13·00	6·00	D7·00	D6·00
4	15	12·00	0·75	11·25	D0·00
8	17	9·00	2·25	6·50	D2·50
18	24	8·50	6·50	2·00	D1·75
33	33	5·50	1·25	3·25	D0·75
38	45	3·50	1·50	2·00	D1·00

After 45 years of age the records of the table suggest the presence of other influences in the eye, which determine an increase of the Hm. as well as the diminution of the ciliary power.

#### CONCLUSIONS.

1. That through this instrument from 50·00 to 100·00 per cent. of *manifest* hyperopia can be detected.

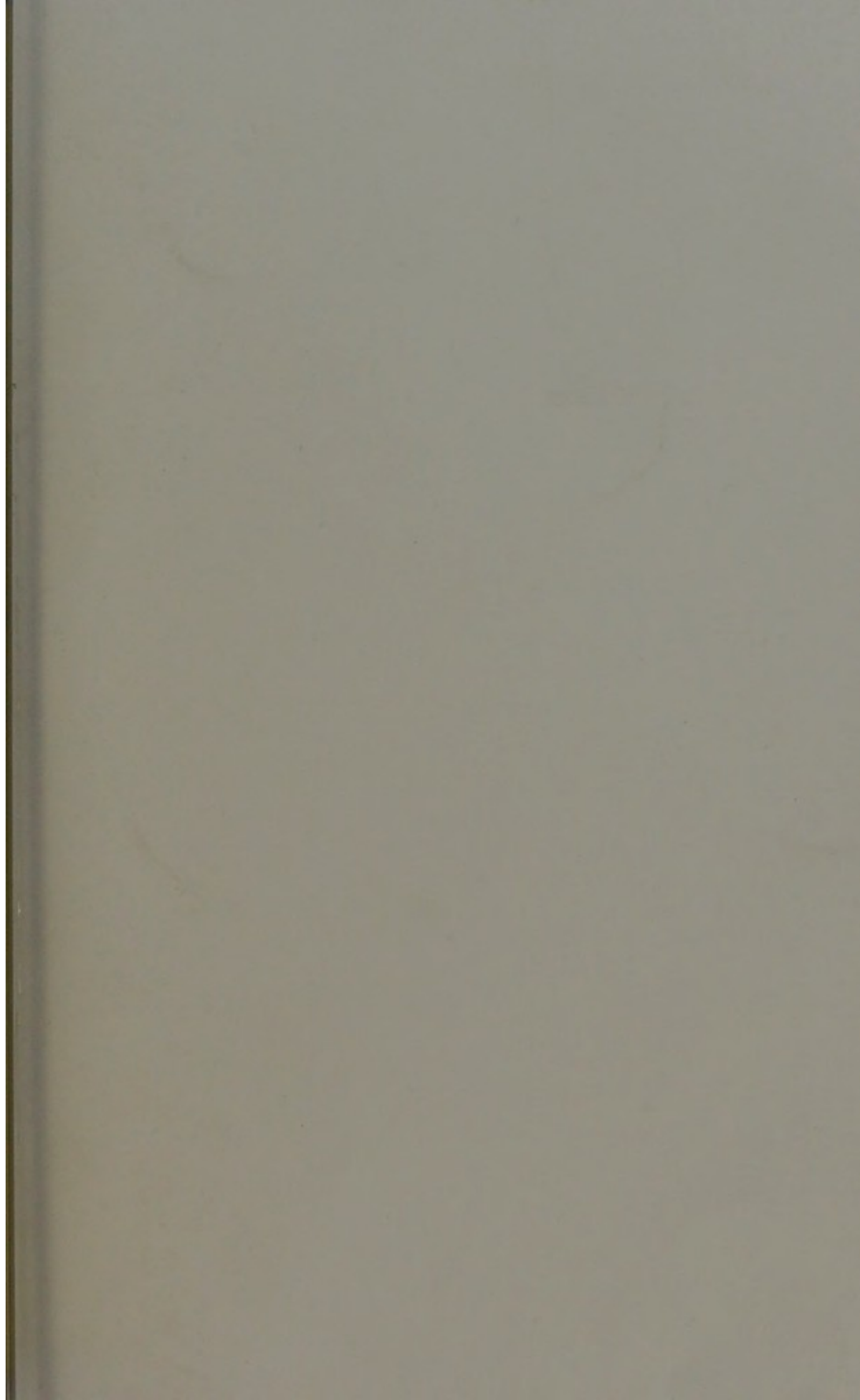
2. That with it there is shown, from 10 to 45 years of age, a gradual diminution of manifest hyperopia.

3. That through its aid high degrees of hyperopia will reveal a greater quantum of manifest hyperopia.

4. That its results denote that low as well as high grades of hypermetropia, both *manifest* and *total*, may be detected by the instrument; but that mydriatics will be required to determine positively the *total* hyperopia.

Perhaps it should be stated that this instrument is manufactured by Messrs. George Tiemann & Co., 67 Chatham Street, New York.

ZANESVILLE, OHIO, *February 5, 1884.*







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