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COMMUNICATIONS

THE DIAGNOSIS, DISEASES, AND THERAPEUTICS OF AMETROPIA*

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[We are unable, owing to lack of space, to publish Dr. Gould's long opening address, *in extenso*. After enumerating "some ametropic amblyopias of the world," and discussing the oculist, his office and tools, and the oculist's patients, he deals with "the art of measuring ametropia."]

"*Crude suggestions toward acquiring the art of refraction* are all that one may tell another. The so-called objective methods of measuring ametropia are of little or no value. Retinoscopy by a rare expert, for very young children is of occasional service.

First, and absolute, is the exceptionless rule that up to 45, and sometimes up to 50 years of age—largely depending upon the art and skill and experience of the oculist—there can be no accurate diagnosis of the ametropic errors without cycloplegia. My own practice is never to use atropin for this purpose; it wastes too much time for the patient; other reasons suggest themselves.

*An opening address, introducing a discussion upon Errors of Refraction, at the Oxford Ophthalmological Congress, July 1917.

I use a 10-grain solution of homatropin to the ounce, with a dash of cocain added, instilling six times a drop in each eye about every six minutes, and I find, usually, the accommodation "dead" in about 45 minutes. I have never noticed the least tendency to produce hypertension by these drops. When the tests have been made, if desirable, I instil a few drops of eserin solution to bring the pupils and accommodation wholly or partially back to normal, or to make the patient more comfortable. I lend my patients "London-smoked" spectacles to wear until the return of the pupils to normal.

The Practical Testing.—During the tests the patients must not cross the legs, nor cant the head, nor rotate it to one side. The body should be kept as near vertical as possible. These four rules are advisable because of the fact that some 80 or 90 per cent. of patients have lateral spinal curvature, and the axes of astigmatism are changed or influenced by the lack of verticality of the head and body. There are a few cautions or rules that may help one to avoid inaccuracies. For instance, no light from behind must strike the posterior surface of the lenses. If any accommodation whatever is present, never start the testings by trying any minus lens, thus making existing myopia greater, and turning low hyperopia into myopia. The mistake is because in low and even moderate hyperopic defects the minus lens sharpens vision by challenging and over-stimulating the ciliary muscle. This, once more, stresses the need of the cycloplegic. Every child is born hyperopic, but also astigmatic, because in all previous ages eyes were adapted for securing sharp vision at a distance, when near-work, reading, etc., had not yet arrived. Civilization as we know it is a very recent affair, and the hyperopic eye, unaided, cannot perform the duties suddenly thrust upon it. Hence the strain produces an enlarging of the eyeballs generally, and sooner or later comes myopia. But it comes to millions of us moderns unnecessarily and through a criminal ophthalmology which instead of preventing it multiplies and morbidizes it, by giving too early minus corrections when they should be plus ones, which increase existing slight myopias into enormous ones that minimize or kill distant objects, so that the soul is shut in a close-walled and windowless subjectivism.

Any plus lens that increases acuteness of vision in the least proves the eye is hyperopic. It is best to begin with a low power plus cylinder, fixing at once, approximately the axis. If the error is high (as shown by low acuteness) quick trials with alternating 0·25 or 0·37, spheres and cylinders, soon bring approximate normality of acuteness. Then the use of the trial 0·12 testers, spheres and cylinders, both plus and minus, soon bring the fixation of limits and accuracies.

In the progress towards this ideal one may find that 20/20 "old style," gives neither the finish of the affair nor perfect acuteness, and, *e.g.* :—

(*a*) The low astigmatism suddenly reverses the axis.

(*b*) There is amblyopia; but that may not be real, and other combinations may bring perfect acuteness.

(*c*) There may be mixed astigmatism.

(*d*) Is the amblyopia due to retinal disease, or cloudy media?

(*e*) Or to a sad history of quack spectacles.

In cases of low and genuine myopia, diagnosticated under cycloplegia, one may usually prescribe at once for patients under 40, the mydriatic estimate, if accurate, being correct for constant use.

In all hyperopic cases no prescription should be written until the normal accommodation has fully returned, in about two days, especially if eserin has been used. This is necessary because, chiefly, there may exist little, or much, or enormous hypertrophy of the ciliary muscles. This is all the more advisable with patients from 35 to 45 years old, and markedly if the life-long hyperopia has been high.

In the last condition it is plain that presbyopia really begins at 35, 38, and surely at 40, according to the amount of the precedent hyperopia. It may be necessary in such cases to order bifocal lenses. This depends on occupation, on the existence of previous ocular or systemic diseases, and sometimes on other conditions, doubts, etc. Even the expert may find himself in trouble.

As regards astigmatism, every eye has more or less, and the first proviso is that both the axes and the amount must be determined with the greatest care. The total astigmatism and the exact axes, when rigidly determined, must be ordered for constant use. I have seen cases of amblyopia in the astigmatic axes only, or in their opposite axes, and then woe will follow, for the patient and oculist, unless the thoroughgoing neutralization has been made, and the patient, even then, may have to suffer for awhile.

In truth there are many more instances of irregular astigmatism than the novice or the careless are aware of. May I ask attention to a little device which has been of daily use to me in fixing axes with precision? With the best correction possible in the trial frame, I use the bridge of the nose as a pivot of rotation of the frame, covering the excluded eye with a blinder. By see-sawing or rotating the frame 5° or 10° the eye will easily detect a change of axis of 2°, 3°, or 5°, and in many instances that little misplacing of the axes may mean unhealth and unhappiness to the sufferer.

Full correction, or not, of ametropia?—If certain of the accuracy of our diagnosis of astigmatism, both as regards amounts and axes, the full correction is always to be ordered. As to hyperopia, it is a different affair. Only the mydriatic can give us the exact

measurement of this most common defect. And yet, of course, we do not order the full amount except when presbyopia has become complete. Every patient differs from others as to the amount of the hypertrophy of the ciliary muscles that may exist in a special case. There is no other problem with greater dangers than this when we come to writing the prescription. Rules cannot be made for further guidance, and different patients. We must study the patient, his occupation, the amount of near-work demanded, etc. Age has also to be considered. With high excess of accommodation the danger must be kept in mind that too high-power lenses will, for a time at least, make the distant vision so poor that the patient will for too long a time be unable to see well. If he leaves the glasses off the abnormal excess of accommodation-power will never lessen. Sometimes, even though youthful, the patient may be compelled to wear bifocals until the over-powerful muscles lessen in strength. In all cases the accommodation must be left a certain freedom or play, but never so much as to run amok.

As to *Anisometropia*, each eye must be treated as an independent organism, and given the lens best suited to bring it and keep it in function, preserving, certainly, right-eyedness in the right-handed, and left-eyedness in the left-handed."

[Dr. Gould then deals with the question of heterophoria, insufficiency, and squint, presbyopia, and "right-eyedness and left-eyedness."]

"*Have it clearly understood by the patient*:

1. No eye, or its refraction, remains the same for over two years. Lenses must be changed, sometimes, in less than two years.

2. If relief of ocular or systemic diseases due to eyestrain has not come about, the patient must return in order to find out why, and we must closely and clearly inquire:

3. Has the patient, as promised, worn the glasses during the entire waking life?

4. Have the frames become bent or misplaced in position?

5. Have the lenses been cleaned and polished, in the manner ordered, at least six times a day?

6. Have the lenses been scratched, and their transparency dulled?

7. One patient returned several hundred miles because, in the wind, a grain of sand had flecked one lens, opposite the pupil, 1/100 of an inch in diameter.

8. Stone-cutters and other workmen often have injured lenses from flying bits of stone. A plano lens, "hook-front," is advisable in such cases.

9. If the axes of astigmatism are not 90° or 180°, a dropped-out lens may be replaced wrong side up. A professor of chemistry

was compelled to journey a thousand miles to reverse the same lens with axis of astigmatism as ordered.

10. A "stunning" ribbon, guard, or chain, on eye-glasses is really "stunning" to eyes and brain. Unless one has a nose unusually shaped for holding eye-glasses, do not allow them."

"*The ocular diseases caused by Ametropia.*—Every year of the thirty-two that I have been in practice my conviction has been deepened that ametropia is greater than all other causes, direct or secondary, of ocular diseases. . . . Except when (rarely) caused by specific infection, I think the following ocular diseases are almost always caused by ametropia:

Blepharitis, styes, conjunctivitis, pterygium, all heterophorias, strabismus, epiphora, iritis, keratitis, retinitis, glaucoma, and surely, cataract. Neutralize perfectly the ametropia, and sufficiently, and early, and late, and often, and these diseases do not appear, except in rare traumatic and toxic cases.

[Among diseases caused by eyestrain Dr. Gould includes migraine, neuritis, neurasthenia, Ménière's disease, nutritional diseases, mental diseases, despondency and suicide, lateral spinal curvature, optic neuritis, etc.]

"*Notes concerning the history of eye-strain reflexes.*—The discoverers of the truth that certain ocular and systemic diseases are caused by ametropia should be rated as among the greatest benefactors of the world. Sometime this will be, but probably not very soon. So far as I can learn, the first man who discovered the truth was Halfort. His book was published in 1845, and entitled *Entstehung, Verlauf, und Behandlung der Krankheiten der Künstler- und Gewerbetreibungen.* It is the first time that artisans (whose labour is so greatly ocular) are thus emphasized as so decidedly subject to occupational disease. The author, concerning straining of the eyes in industries, speaks of the now forgotten truth that the eyes are most delicately constructed and noble organs of the body; he emphasizes the reasons for such strain as follows:—

1. By long continuing looking at small objects, mentioning especially watchmakers, typesetters, embroiderers, lacemakers, miniature-painters, manuscript-copyists, engravers, etc.
2. Work with harsh colours, or upon highly illuminated objects.
3. Labour under poor or fluctuating illumination, such as by flickering oil or candle-lights, and even with good lights if long continued.
4. Sudden change from darkness to light.

The diseases resulting from these abuses are thus listed:—

1. Shortsightedness from work on minute objects.
2. Inflammation of the external parts of the eyes, and later of the internal parts, leading to loss of vision and cataract.

3. Visual deterioration, amaurosis, deep-seated pain of the eyes, more frequently intense headache, etc.

Spectacles and hygienic precautions are recommended to obviate the foregoing ills. The nervous irritability, etc., of yarn-spinners is emphasized. And there, forgotten or ignored, this wise old observer is left!

I think this discovery one of the most remarkable in the history of medicine. But, as always, it was long in advance of the time possible for acceptance, and so the great discoverer had to die without a single person in the world crying him *Amen*. That's the way with medical men—one to discover and all the rest to ignore, perhaps to curse. In 1867 Dr. Green, of St. Louis, wrote that astigmatism was an active cause of myopia.

Then in 1874-1875-1876, Dr. S. Weir Mitchell, of Philadelphia, published three articles. Halfort had been forgotten, of course, or ignored. Mitchell's reports were based upon those of the contemporary oculists, Drs. Thomson and Norris, of eight cases of headache, migraine, giddiness, etc., which were at once cured by glasses. To these two men, therefore, the honour belongs rather than to Mitchell. But, as before, there was again a silence which seemed destined to endure forever. The rest-cure was invented, but of all unholy things it may not be endowed with eternal life. The planned silence, with the necessary forgetting, and all the rest-cures in the world, could not keep the truth from re-emerging, and from 1885 there began a series of witnessings to the fact ever growing in frequency and power, and the number of oculists and physicians and patients who in no wise will be snuffed out or sneered down for ever.

In 1882 Dr. G. C. Savage published an article in which he reported cases of sick headache cured by hypermetropic and astigmatic glasses.

In 1888, Dr. E. G. Martin, a French oculist, published his sound and brave article on the subject. Up to that time it was the best and most complete demonstration that the whole migrainic symptom-complex is caused by eye-strain. But, again, no oculist or physician ever gave him a word of recognition. Schmidt-Rimpler scorned Martin's contribution and theory with genuine unscience. But by this time others were welcoming the truth which was fast passing into recognition after the usual and necessary condemnations and silences of forty or more years."

(Under the heading *Ametropia and Psychology* Dr. Gould writes:—)

If we class astigmatisms with the two spherical defects, we have two great ocular abnormalisms remaining—hyperopia and myopia, or colloquially farsight and nearsight, and the median, emmetropia.

But the perfect or ideal eye of emmetropia, in a strict sense, is almost unknown. I have never seen a pair of emmetropic eyes. In some few the defect is indeed slight, but never inconsiderable. The great majority of eyes are hyperopic, but are practically worsened by more or less astigmatism.

The moderately hyperopic pair of eyes is therefore manifestly the better instrument for rightly seeing and knowing the world in which we live. The man or nation having a low degree of hyperopia, and combined with the least astigmatism, will come nearer seeing the world as it is, and he will in general have the most accurately functioning mind. Other things equal, he will make fewer blunders, spiritually be more efficient, and better serve humanity and civilization whose glad servants we should all be. This low degree of hyperopia has furthermore an innate power of "accommodation," as it has been called, which, for common visual purposes, makes it functionally even better than the most rare emmetropic eyes. Consequently, its range of approximately accurate vision is the nearest perfect that is possible. Therefore, that people, especially its educated and ruling classes, the majority of whose eyes are slightly or moderately hyperopic, are the best seers and knowers of the world, i.e., they have the best minds ethically and intellectually wherewith to lead in civilization. And they will see and know the beautiful and lovely in that world better than the more ametropic nations.

Thus the two most numerous and dominating errors of refraction will roughly differentiate and govern the direction of development of national types of character. That is, a nation will roughly tend toward far-sightedness, ocularly and mentally, or toward ocular and mental near-sightedness. The excellencies and faults of the visual organs will in time and in proportion to their relative prevalence direct national habits, energies, developments, efficiencies and deficiencies, in certain directions and to successes or failures of peace, or to tragedies of war.

* * *

Visually, emmetropia is the grey half-way between day and night, with not too much or too little of effort, or of want, or of satiety. And few there are that reach that island of dreams!

If impossibly it should be the rule of a nation, it would develop fairly well-rounded minds, good folk, but occasionally with a dip towards good-for-nothingness; somewhat indolent of will, philosophic, self-contented; moderately well-to-do and successful, with a kind of sleepy science; literary, but not overmuch so, mildly poetic, in blank verse, but preferring a monotonous and lethargic prose, somewhat, for instance, after the manner of Pater. It would keep out of war, or try to do so, because it would be governed by lukewarm and self-respecting emotions and foresight.

A nation of moderate hyperopes would be the best visualizers in

the world, capable always of easy and accurate far-sight, but when wishful or from necessity with "accommodation," capable of as clear and perfect vision of the near thing as is desirable. It commands the healthiest eyes, and the most accurate and most enduring vision. But best of all it images the world of fact the nearest perfectly of any visual mechanism. And the perfect glasses of the hyperope (which he can and usually would get) do not change or depreciate the appearance of the actualities of the world nor morbidize the mind by distorting or magnifying or belittleing the retinal pictures or their ontologic storehouse—the mind. The moderately hyperopic eye is that first of the American, with the English as a close second.

In myopia, real or only apparent, the greatest ophthalmologic sin is to omit the mydriatic in making the tests. This is because without the cycloplegic the ametropia often simulates myopia in low hyperopic defects, and it is endless injury to order low myopic lenses for such patients, when low hyperopic lenses are needed. Such treatment is, as a rule, common in certain countries, and whole peoples may thus be made artificially and increasingly myopic. Especially in the educated and ruling classes as high a proportion of myopics as 60 per cent. has been demonstrated in university undergraduates.

What now is the mental peculiarity and result of persistent use of myopic eyes? It is simply that the distant thing is by them not seen at all, or is minimized beyond all clear seeing and actional relation to reality. The myope looks as if through a reversed opera glass, or field glass, and he naturally finds himself seemingly the largest thing in the world. Hence a sort of mental thaumaturgy that creates self-esteem, egotism, and self-will, ending, perhaps, in some dogmatism and tyranny. All of which may be caused or enormously exaggerated by ignoring astigmatism, and the use of spectacles that turn low hyperopias into myopia, and that soon enormously increase the unnecessary degree of myopia. This deprivation of ocular farsightedness would naturally be increased if the great majority of educated and ruling minds should become myopic. In such a supposed case it would be natural and inevitable that whether in statesmanship or war, in ethics or religion, in literature, or science, they would teach and rule, somewhat tyrannically and harshly. Would they not abjure the humanistic side of learning and "go in" for materialistic science? They would, we may suppose, become slightly dictatorial, seeing themselves giants, their enemies small and contemptible. There would be a slight exaggeration of egotism and a little danger of delight in power. They would also be infinitely capable in meticulous accuracies, things microscopical and chemical, but bunglers, I fear, in far-off visions and truths,—dead, indeed, spiritually and religiously."