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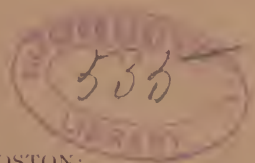
ERRORS OF REFRACTION AND INSUFFICIENCIES OF THE  
OCULAR MUSCLES AS CAUSES OF CHOREA,  
WITH CASES.

BY

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## ERRORS OF REFRACTION, AND INSUFFICIENCIES OF THE OCULAR MUSCLES AS CAUSES OF CHOREA, WITH CASES.<sup>1</sup>

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OCULAR defects, in their relation to the functional neuroses, is a subject that has been brought very prominently before the medical profession, within the last few years, by Dr. George T. Stevens of New York. This gentleman has maintained that refractive errors and ocular insufficiencies were to be regarded as the most common causes of epilepsy, chorea and other functional nervous troubles. Also, that these diseases can, as a rule, be successfully treated by a correction of the ocular defects when they are found to be present. These claims, on account of their sweeping nature, have naturally, and probably justly, met with much opposition and criticism, and the subject has not, perhaps, received as thorough an investigation as it deserves.

It certainly cannot be denied that cases of epilepsy and chorea are occasionally met with that are of undoubted reflex origin, and it is reasonable to suppose that errors of refraction and ocular insufficiencies should, at times, act as exciting causes in precipitating diseases of this nature when a neurotic predisposition exists.

I have examined, up to the present time, the eyes of twenty-three choreic patients, and in cases where ocular defects were found to be present, they were, with a

<sup>1</sup> Read before the Section for Clinical Medicine, Pathology and Hygiene of the Massachusetts Medical Society, December 11, 1889.

few exceptions, corrected by means of glasses or operations. Nineteen of these cases were referred to me from the Out-Patient Nervous Department of the Massachusetts General Hospital, and four from the Children's Hospital by Dr. Townsend. They were, in no sense of the word, selected, but were examined, as they presented themselves, without regard to the presence or absence of ocular symptoms. The examinations were made, as a rule, after the use of atropine or homatropine, and when muscular insufficiencies were present, the eyes were kept under the influence of the mydriatic for some time. When a patient was found to have both a refractive error and ocular insufficiency, glasses correcting the refractive error were prescribed, and were used for a week or more before any attempt was made to correct the muscular defect. This course was adopted in view of the fact that apparent insufficiencies sometimes disappear after an error of refraction has been corrected.

In speaking of muscular insufficiencies where no apparent deviation of the visual axes exist, the terms exophoria, esophoria and hyperphoria will be used to denote the direction of the deviating tendency. The first, denoting a tending of the visual axes outward (commonly called insufficiency of the internal recti); the second, a tending of the visual axes inward (commonly called insufficiency of the external recti); and the third, the tending of one visual axis above the other; the term right hyperphoria being applied when there is a tending of the right visual axis above the left, and left hyperphoria when the opposite condition is present.

Of the twenty-three patients examined, thirteen were found to have hypermetropia of not less than one diop-  
tre; five, astigmatism; and one, myopia. Four were practically emetropic. Esophoria existed in six cases;

exophoria, in one case; hyperphoria, in one case; and intermittent converging strabismus, in one case. The sex, age, refractive and muscular condition of these patients is shown in the following tabulation:

1. Female, age 12.  
 V. O. D. (s. mydriatic) =  $< 0.9$ . c. + 1.50 D. = 1.  
 V. O. S. (s. " ) =  $< 0.9$ . c. + 1.50 D. = 1.
2. Female, age 14.  
 V. O. D. (s. mydriatic) =  $< 1$ . c. + 1.75 D. = 1.  
 V. O. S. (s. " ) =  $< 1$ . c. + 1.75 D. = 1.
3. Female, age 17.  
 V. O. D. (s. mydriatic) c. + .50 D. = 1.  
 V. O. S. (s. " ) c. + .25 D. sph.  $\odot$  + 3.50 D. cyl. axis  $100^\circ$   
 =  $< 0.7$ .
4. Female, age 16.  
 V. O. D. (s. mydriatic) = 1 Em.  
 V. O. S. (s. " ) = 1 Em.
5. Male, age 14.  
 V. O. D. (s. mydriatic) c. - 2 D. = 0.9.  
 V. O. S. (s. " ) c. - 2 D. = 0.9.  
 Exophoria,  $8^\circ$ .
6. Male, age 8.  
 V. O. D. (c. atropine) c. + 1.50 D. =  $< 1$ .  
 V. O. S. (c. " ) c. + 1.50 D. =  $< 1$ .  
 Intermittent converging strabismus, o. s.
7. Female, age 17.  
 V. O. D. (s. mydriatic) c. - 5 D. sph.  $\odot$  - 1.25 D. cyl. axis  $0^\circ$   
 = 0.7.  
 O. S. high degree of myopia, amount not determined.
8. Female, age 14.  
 V. O. D. (c. homatropine) c. + 1.75 D. = 1.  
 V. O. S. (c. " ) c. + 1.75 D. = 1.  
 Esophoria,  $6^\circ$ .
9. Female, age 7.  
 V. O. D. (c. atropine) c. + 1.75 D. = 1.  
 V. O. S. (c. " ) l. + 1.75 D. = 1.
10. Female, age 7.  
 V. O. D. (c. homatropine) c. + 2.75 D. sph.  $\odot$  + 1 D. cyl. axis  $0^\circ$   
 =  $< 0.9$ .  
 V. O. S. (c. homatropine) c. + 3 D. sph.  $\odot$  + 1.50 D. cyl. axis  $100^\circ$   
 =  $< 0.5$ .  
 Esophoria,  $3^\circ$ .

11. Male, age 8.  
V. O. D. (s. mydriatic) = 1 Em.  
V. O. S. (s. " ) = 1 Em.
12. Female, age 18.  
V. O. D. (c. homatropine) c. + 1.75 D. = 1.  
V. O. S. (c. " ) c. + 2 D. = 1.  
Esophoria, 1<sup>2</sup>.
13. Female, age 6.  
O. D. 2 D. cyl. axis vertical (ophthalmoscope).  
O. S. 2 D. " " "
14. Male, age 14.  
V. O. D. (c. atropine) c. + .50 D. = 1.  
V. O. S. (c. " ) c. + .50 D. = 1.  
Left hyperphoria, 1 $\frac{1}{2}$ <sup>2</sup>.
15. Male, age 11.  
V. O. D. (s. mydriatic) c. + .50 D. = 1.  
V. O. S. (s. " ) c. + .50 D. = 1.
16. Female, age 11.  
V. O. D. (c. atropine) c. + 1.75 D. = 0.9.  
V. O. S. (c. " ) c. + 1.75 D. = 0.9.  
Esophoria, 3<sup>2</sup>.
17. Male, age 7.  
V. O. D. (c. atropine) c. + 1.50 D. = 1.  
V. O. S. (c. " ) c. + 1.50 D. = 1.  
Esophoria, 2<sup>2</sup>.
18. Male, age 12.  
V. O. D. (c. atropine) c. + 1.25 D. = 1.  
V. O. S. (c. " ) c. + 1.25 D. = 1.  
Esophoria, 6<sup>2</sup>.
19. Male, age 9.  
V. O. D. (c. atropine) c. + 1.25 D. = 1.  
V. O. S. (c. " ) c. + 1.25 D. = 1.
20. Male, age 8.  
V. O. D. (c. atropine) c. + 2.25 D. = 1.  
V. O. S. (c. " ) c. + 2.25 D. = 1.
21. Male, age 5.  
V. O. D. (c. atropine) c. + 2 D. = 1.  
V. O. S. (c. " ) c. + 2 D. = 1.
22. Male, age 10.  
V. O. D. (c. atropine) c. + .75 D. cyl. axis 85° = 1.  
V. O. S. (c. " ) c. + .50 D. cyl. axis 85° = 1.
23. Female, age 11.  
V. O. D. (c. atropine) c. + 1.50 D. = 1.  
V. O. S. (c. " ) c. + 1 D. = 1.

The per cent. of refractive troubles is probably larger than would be found in an equal number of non-choreic healthy children. A moderate degree of hypermetropia cannot, of course, be regarded as an abnormal condition in the young, and asthenopic symptoms are often entirely wanting when the amount is very considerable. It is not safe to assume, however, that because one individual with a high refractive error suffers little or no discomfort from using the eyes, that a smaller error is incapable of producing severe asthenopic symptoms in another. One-half a dioptré of astigmatism is certainly a small amount, and does not, as a rule, give trouble, yet in certain cases this amount will cause severe headaches, and almost constant pains in the eyes. On the other hand, many individuals with four or five times this amount of astigmatism used the eyes in reading, sewing and other near work for hours at a time without suffering from asthenopia or headaches in consequence.

In regard to the muscular defects, it is impossible to say, with our present knowledge of the subject, just how much importance is to be attached to their existence. In two of these cases the esophoria is certainly of a high degree, and when we consider that the normal abducting power is of about eight degrees, it is reasonable to suppose, when this power is but a fourth or a third of the normal, that the nervous strain resulting from the effort to keep the visual axes parallel and thus prevent diplopia, must be very great. An intermittent horizontal diplopia was a prominent symptom in two of these cases, and an intermittent vertical diplopia in one case. Asthenopia was severe in one case, of moderate severity in four, and slight in five. Headaches were severe and frequent in six cases, moderate in four, mild and occasional in six. Of the twenty patients found to have ocular defects, three

failed to return after the first examination, and three others to report after correcting glasses had been prescribed. The remaining fourteen, which I report in detail, were kept under careful observation, receiving, with one exception, no general treatment while under my care.

CASE I. B. K., a school-girl, twelve years of age, was first seen by me June 13, 1889. She has had three previous choreic attacks within the last four years, which are said to have been mild, and were not treated. The present attack, which began about the middle of last April, is of considerable severity, and involves muscles of the face, neck and of both the upper and lower extremities. There is also some difficulty in speaking. Headaches and pains in the eyes have been complained of for a number of years. Upon examination of the eyes, the pupils were found to be widely dilated and to react sluggishly. The vision in both eyes was less than nine-tenths, but was up to the normal after a manifest hypermetropia of one and one-half dioptries had been corrected. Punctum proximum without glasses, twenty centimetres. Muscular condition, normal. Glasses correcting the manifest hypermetropia were ordered for constant use, and the patient was asked to return in two weeks. She had been under treatment of the Out-Patient Nervous Department of the Massachusetts General Hospital since June 10th, and Fowler's solution, which had been prescribed, was not discontinued.

She was next seen July 6th, after wearing glasses for two weeks. The choreic twitchings had almost entirely ceased, there had been no complaint of headaches or pains in the eyes, and the pupils were normal in size and of good reaction. The patient was requested to return in two weeks, but was not again seen.



CASE II. A. T., a school-girl, seventeen years of age, first seen by me July 9, 1889. Patient says that she has suffered from headaches and pains in the eyes for years; the headaches, which occur as often as once in two or three weeks, are severe and are usually accompanied by nausea and vomiting. She is thin and anæmic, and has a slight hacking cough, which has persisted for a number of months. The heart is rather rapid, otherwise, negative. No previous rheumatic history. The chorea began about three weeks ago, and is of moderate severity. The twitchings involve muscles of both the upper and lower limbs and of the trunk. Upon examination of the eyes, the pupils were found to be normal in size and of good reaction. The vision of the right eye was normal, while that of the left was less than two-tenths. The patient was asked to return for further examination on the following day, but was not again seen until July 16th. An examination of the eyes made at this date gave the following results: V. O. D. = 1. Hm. 50 D. V. O. S. =  $< 0.2$  c + .25 sph.  $\ominus$  + 3.50 cyl. axis  $100^\circ = < 0.7$ . No muscular insufficiencies. Fowler's solution, which had been taken since July 9th, was discontinued, and glasses, correcting the manifest hypermetropia in the right eye and the astigmatism in the left, were ordered for constant use. August 6th, the patient reported that she had been much better since wearing glasses. The choreic twitchings were less and were confined principally to the right hand and arm. She was again seen August 20th. There had been no headaches or pains in the eyes since wearing glasses, but there was no farther improvement in the chorea, and she was referred back to the Nervous Department for general treatment.

CASE III. A boy, eight years of age, was referred to me by Dr. Carter, July 18, 1889. The mother,

who comes with the child, says, that the nervous trouble began during his fifth year, and although at times the twitchings have been very slight, that he has never since been entirely free from them. He has been subject to headaches for a number of years, and they are much more frequent when he is attending school, than during vacation. He has never complained of pains in the eyes, or of dizzy spells. Within the last few months, it has been noticed that the left eye at times turns in a little.

The patient was first seen at the Out-Patient Nervous Department of the Massachusetts General Hospital, October 2, 1887, five months after the commencement of the chorea. He was under treatment for about three months, and at the end of that time, is said to have been about well. A few months after this, he had a second attack, the exact time and duration of which cannot be learned.

The present attack is of two months' duration, and of considerable severity. The twitchings involve muscles of both upper and lower extremities, neck and face. He has been treated at the Nervous Department since June 10th, but as yet there is no improvement in the chorea. Upon examination I found a slight converging strabismus of the left eye, and a moderate amount of hypermetropia in both eyes. Vision, both eyes, normal. An examination of the eyes, after the use of atropine, was made in the afternoon of the same day, and gave the following results: Left eye, converged slightly; when a colored glass was placed before one eye, and the patient instructed to look at a small white card at a distance of twenty feet, he said that he saw two cards. Both eyes were found to have a hypermetropia of one and a half dioptries. In making the vertical diplopia test, a prism of eight degrees, base out, was required to place the two images in the same vertical

plane. Glasses correcting the full amount of hypermetropia were prescribed for constant use, and instructions were given to stop all general treatment. The patient was again seen August 3d. The glasses had been lost at the end of the first week, so that he had been without them for six or seven days. There was no change in the chorea, or condition of the eyes. Correcting glasses were again ordered, and he was asked to return in four or five days. August 8th, there was found to be little, if any, change in the boy's condition. An operation for the correction of the insufficiency seemed indicated, and I did a complete tenotomy of the left rectus internus under cocaine.

The patient returned five days later, and was decidedly better. The twitchings were not severe, and were much less frequent. The prism tests revealed an exophoria of about four degrees. He was examined by Dr. Carter, August 20th, twelve days after the operation, who reported that the choreic twitchings had almost entirely ceased. The boy was not again seen until October 1st. There were then no choreic movements, he was going to school and was perfectly well in every respect.

CASE IV. R. H., a school-girl, fourteen years of age, was referred from the Out-Patient Nervous Department of the Massachusetts General Hospital, August 1, 1889. The muscular twitchings began about six years ago; for the first four or five years they were not of great severity, and were confined principally to the muscles of the lids and forehead. Within the last year, the twitchings have increased in frequency, and now involve muscles of the eyes, lids and face, and also, to a considerable extent, the muscles of the right hand and arm. When questioned, the patient states that headaches are of almost daily occurrence, and that they are much worse when she is

going to school, than during vacation. The eyes never ache, but she frequently sees objects double. An examination of the eyes, under homatropine, revealed a hypermetropia of one and three-quarter dioptries. Esophoria was also found, but the amount was not accurately determined at this visit.

Glasses correcting one and a half dioptries of the hypermetropia, were ordered for constant use. August 29th, after wearing glasses for ten days, the patient reported that the twitchings of the lids had been less frequent, but aside from this, that there had been no improvement. The muscular condition was as follows: Esophoria, six degrees, adducting power, twenty degrees, abducting power, three degrees, and a prism of two degrees was overcome, with its base down, before the right eye, and one of one and a half degrees, base down, before the left. September 4th, a second examination of the muscular condition, after the use of a one per cent. solution of atropine, three times a day for one week, gave the following results: Esophoria, six degrees, adducting power, twenty degrees, abducting power, four degrees, a prism of two and one-half degrees was overcome, with its base down, before the right eye, and one of two degrees, base down, before the left. A partial tenotomy of the internal rectus of the left eye was performed under cocaine, and the patient asked to return in one week.

September 20th, the twitchings had been slight, and hardly noticeable since the operation. An examination under atropine results as follows: Esophoria, two degrees, adducting power, eighteen degrees, and abducting power, six degrees. The patient seemed about well, but as there is still an esophoria of two degrees, a partial tenotomy of the right rectus internus was performed under cocaine.

October 16th, there had been no twitchings since the

last visit, and no headaches for more than a month. There was still an esophoria of one and a half degrees. The patient was referred to Dr. Walton, who wrote me as follows: "I find no choreic movements of the hand or arm, no twitchings of the lids, nor abnormal ocular movements."

The patient returned November 13th, and said that for the last ten days there had been slight twitchings of the eyes, eye-lids, and right hand. Atropine was ordered, and after using it for three days she reported that she was considerable better. An examination of the muscular condition revealed an esophoria of three and a half degrees; the adducting power was eighteen degrees, and the abducting power four degrees. A partial tenotomy of the rectus internus of the left eye was performed under cocaine.

November 19th, I found an esophoria of two degrees, and although the choreic movements had almost entirely ceased, a partial tenotomy seemed advisable, and was performed on the right rectus internus three days later. The patient returned to the hospital at the end of a week, and said that there had been no twitchings since the last operation. She was referred to my office for an examination of the muscular condition, but failed to appear. She was again seen December 10th. There had been no choreic twitchings or headaches, but there was no apparent change in the ocular condition, that is, there was still an esophoria of two degrees.

CASE V. M. M., a school-girl, seven years of age, was referred from Out-Patient Nervous Department of Massachusetts General Hospital, August 3, 1889. The chorea began when the child was about two years of age, and has continued with varying intensity up to the present time. The muscles of both the upper and lower limbs and of the face are affected, but

the twitchings are not frequent or severe. She has never complained of being dizzy, or of seeing objects double, but is subject to occasional headaches and pains in the eyes. There is no history of previous rheumatism. Examination of heart negative. Upon examination of the eyes, the pupils were found to be moderately dilated, the right a little more than the left, and to react sluggishly. The refractive and muscular condition was not accurately determined at this visit, but an examination August 5th, after the use of a one per cent. solution of atropine for two days, revealed a hypermetropia of 1.75 D. O. U. The muscular condition was normal. Glasses of + 125 D. O. U., were ordered for constant use. The patient returned August 27th, after wearing glasses for two weeks. There had been no complaint of headaches or asthenopia, but there had been little or no improvement in the chorea. September 21st, the choreic twitchings had almost entirely ceased, and she was said by the mother to be much better in every respect. The patient was again seen November 27th. The choreic twitchings became more severe soon after the last visit. She has been going to school for about two months and has complained some of headaches and pains in the eyes. Her condition at present is practically the same as when first seen at the hospital.

CASE VI. T. G., a school-boy, fourteen years of age. Referred from the Out-Patient Nervous Department of the Massachusetts General Hospital, August 4, 1889. The chorea began about the middle of last May. He has received general treatment from that time up to the present, but there has been little, if any, improvement in his condition. The choreic twitchings are of considerable severity and involve muscles of right arm and leg and of face. The boy is unusually well developed physically and shows no signs of

anæmia or general weakness. He has been subject to headaches and dizzy spells for years. For a number of weeks preceding the choreic attacks, headaches and dizzy spells are said to have been of almost daily occurrence, and he was obliged to remain from school a number of days on account of their severity. Pains in the eyes are rarely complained of, but he frequently sees objects double; the diplopia usually being vertical but sometimes horizontal. These symptoms have persisted up to the present time. No previous rheumatic history. Examination of heart, negative. Upon examination of the eyes, the pupils were found to be moderately dilated, the right a little more than the left, but of good reaction. The vision was normal, and there was no manifest refractive errors. A one per cent. solution of atropine was prescribed, to be used three times a day. The patient returned August 29th, and an examination of the eyes under atropine, gave the following results: Hypermetropia, .50 D. O. U., vision, with correcting glasses, normal; left hyperphoria, one and one-half degrees, adducting power, twenty degrees, abducting power, eight degrees. A prism of one and one-half degrees was overcome with its base down before the right eye, and one of five degrees, base down, before the left. He was ordered to continue the use of the atropine, and return two days later. August 31st, he reported that the twitchings had been less severe since using drops, and that he had had but one headache, and no dizzy spells. The muscular condition was found to be unchanged, and I did a partial tenotomy of the left rectus superior under cocaine. September 2d, the muscular condition was found to be as follows: Left hyperphoria, one degree; a prism of two degrees was overcome with its base down before the right eye, and one of four degrees, base down, before the left. There

had been no headaches since the operation, but one or two dizzy spells. The choreic twitchings were somewhat less frequent. During the month of September, I performed five partial tenotomies, two of the left rectus superior, and three of the right rectus inferior, which failed to decrease to any apparent degree, the hyperphoria. The eyes were under the influence of atropine during this period, and although the headaches and dizzy spells had almost entirely ceased, there was no decided change in the chorea. October 15th, an examination of the muscular condition, gave the following results: Left hyperphoria, one degree; a prism of three degrees was overcome with its base down before the right eye, and one of five degrees, base down, before the left. A partial tenotomy of the right rectus inferior was performed under cocaine. In order to increase the effects of the operation, the opposing muscles were made to overcome prisms of from one to three degrees, the exercise being continued for about five minutes. On the following day a prism of five degrees was overcome with its base down before the right eye, and one of four degrees, base down, before the left. October 17th, the muscular balance was found to be normal, a prism of four degrees being overcome with its base down before either eye. October 28th, the patient's condition was found to be greatly improved. The twitchings of face and of right leg had entirely ceased and were much less severe in right arm and hand. November 9th, the twitchings were slight and confined to the right hand. November 14th, the choreic movements had entirely ceased. Upon examination of the eyes, the muscular condition was found to be normal.

CASE VII. E. P., a school-girl, eleven years of age, was first seen by me Sept. 10, 1889. There is a previous history of three choreic attacks; just when they



occurred and their duration is not known. Headaches have been severe and frequent for a number of years, and she has also complained at times, of dizzy spells. The eyes never ache, and she never sees double. The present choreic attack began about eight weeks ago, and for the past six weeks she has been under treatment at the Out-Patient Nervous Department of the Massachusetts General Hospital. The twitchings are quite severe and are confined almost entirely to the right side. An examination of the eyes gave the following results: pupils normal in size and reaction, vision normal, manifest hypermetropia one-half a dioptré. The muscular condition was not examined. A one per cent. solution of atropine was prescribed to be used in the eyes three times a day.

The patient returned September 12th. The hypermetropia with the eyes under atropine was found to be one and three-quarters dioptrés. The muscle-tests revealed an esophoria of one and one-half degrees. The adducting power was fifty degrees, the abducting power four degrees, and a prism of three degrees was overcome with its base down before the right eye, and one of two and one-half degrees, base down, before the left eye. Instructions were given to continue the use of the atropine, and glasses correcting one dioptré of the hypermetropia were ordered for constant use. The general treatment was discontinued. The patient returned after wearing glasses constantly for two weeks. She had had one severe headache during this time, but no dizzy spells. The choreic twitchings were thought by the family to be a little less severe, but the improvement was not marked. The eyes were still under the influence of atropine, and an examination of the muscular condition revealed an esophoria of two degrees.

October 2d I found no improvement in the chorea,

and the esophoria had increased to two and one-half degrees. October 7th I did a partial tenotomy of the left rectus internus under cocaine. The patient returned five days later and was said to have improved very considerably since the operation. October 15th she was again seen and was much worse than she had been at any time during the present attack. The choreic movements were violent, and involved muscles of both upper and lower extremities, and to some extent of trunk. The muscle-test gave the following results: Esophoria three degrees, adduction fifty degrees, abduction five degrees.

October 18th there was little, if any, change in the chorea, and the esophoria was found to have increased to four degrees. A second operation seemed indicated, and I did a partial tenotomy of the right rectus internus under cocaine. The patient returned October 26th eight days after the last operation. The improvement in her condition was very decided. The choreic movements had almost entirely ceased, and the child's aunt said she often went for hours without twitching at all. Upon examination, I found that there was still an esophoria of one and one-half degrees. The adducting power was fifty degrees and the abducting power six degrees.

The child was again seen November 4th. The choreic movements had entirely ceased and had not been noticed for a number of days. There had been no complaint of headaches or dizzy spells since the last operation.

The amount of esophoria, one and one-half degrees, found at the first examination was certainly small, and if it had not increased after the use of glasses and atropine, it is doubtful if an operation would have been advisable. At the time of the first operation the esophoria had increased to two and one-

half degrees. Eight days after the operation it was found to be of three degrees and eleven days after, of four degrees. The sudden increase of the trouble may be accounted for, by supposing a latent esophoria to have become manifest, and as muscular defects are undoubtedly at times latent, this would seem to be probable. A cicatricial contraction following a partial tenotomy of the opposing rectus internus must, however, be considered as a possible cause.

Another point of considerable interest in this case is the sudden increase in severity of the choreic symptoms in connection with the increase of esophoria, and the rapid recovery following an operation which nearly corrected the muscular defect.

CASE VIII. L. H., a school-boy, seven years old, was referred from the Out-Patient Nervous Department of the Massachusetts General Hospital, September 7, 1889. The chorea, which is of about two years' duration, is mild in character, and has never been worse than at the present time. The twitchings are not confined to any special group of muscles, but are found in both the upper and lower extremities, trunk, face and eyes. Headache, dizzy spells, or double vision are never complained of, but the eyes sometimes ache after reading. An examination of the heart in the Nervous Department revealed a systolic and pre-systolic murmur. No history of previous rheumatism. Upon the examination of the eyes, the pupils were found to be moderately dilated but of good reaction. Vision normal, manifest hypermetropia 75 D. O. D. and 1.75 D. O. S. A one-half per cent. solution of atropine was prescribed to be used three times daily for one week. The patient returned September 14th. An examination of the eyes under atropine gave the following results: Hypermetropia 1.50 D. O. D. hypermetropia 2.50 D. O. S. Vision normal.

Esophoria two degrees, adducting power twelve degrees, abducting power six degrees, and a prism of two and one-half degrees was overcome with its base down before the right eye, and one of three degrees, base down, before the left. Glasses were prescribed,  $+1$  D. O. D. and  $+2$  D. O. S. which were to be worn constantly. The patient was again seen September 20th. There had been no twitchings of the eyes or lids since using glasses, but aside from this, there was no change in the chorea. Upon examination of the muscular condition, the esophoria was found to have decreased to one degree. September 26th there was no improvement in the chorea, and he was referred back to the Nervous Department.

CASE IX. J. S., a boy, twelve years of age, was referred from the Children's Hospital by Dr. Townsend. First seen by me September 23, 1889. The choreic movements began some time during the patient's ninth year, and continued with varying intensity for about two years. The muscles of the eyes, eye-lids, and face were principally affected during this period, but at times twitchings of the body and limbs were also noticed. Headaches, pains in the eyes, or double vision are never complained of. The present attack began last March, and is of considerable severity. The muscles of the eyes, eye-lids, face and arms are most actively involved, while those of the trunk and lower limbs are also affected in a moderate degree. The patient also has a habit of placing the hands suddenly before the face and eyes, and as quickly removing them. This movement is executed with great rapidity, and if he becomes excited from any cause it is repeated as often as two or three times in a minute. An examination of the eyes gave the following results: Pupils, normal in size and reaction, vision normal, no manifest hypermetropia, slight esophoria. The pa-

tient returned September 25th, after using atropine for two days. Upon examination I found a hypermetropia of one and one-quarter dioptries and an esophoria of two degrees. The adducting power was twenty-four degrees, the abducting power six degrees, and a prism of three degrees was overcome, base down, before either eye. Instructions were given to continue the daily use of atropine, and prisms of two degrees, base out, were prescribed for constant use. The patient was again seen October 4th. He had worn the glasses for one week but there was no improvement in the chorea. When the glasses were removed he complained of double vision, and the muscle-tests showed an esophoria of seven degrees. He was ordered to discontinue use of glasses, and to return on the following day. An examination of the muscular condition, October 5th, gave the following results: Esophoria, six degrees, adducting power twenty degrees, abducting power two and one-half degrees. I did a partial tenotomy of the left rectus internus. October 6th, and four days later performed the same operation on the right internus. One week after the last operation, October 17th, the patient returned, and the muscle-tests gave the following results: Esophoria two and one-half degrees, adducting power twenty degrees, abducting power five degrees. I did a partial tenotomy of the left rectus internus at this visit, and upon examination of the eyes four days later, the muscular condition was found to be normal. The chorea began to improve soon after the first operation. Two weeks after the last operation the twitchings were very slight, he often going for hours without twitching at all. Dr. Townsend examined the boy November 27th and pronounced him to be practically well.

CASE X. G. S., a school-boy, nine years of age, was referred from the Out-Patient Nervous Depart-

ment of the Massachusetts General Hospital by Dr. Putnam. First seen by me October 10, 1889. The chorea is of six weeks' duration, is of moderate severity and involves principally the muscles of the left arm and leg. The boy's mother says that he has never been strong and that he has had sick headaches as often as once in two or three weeks for a number of years. He complains frequently of pains in the eyes, more severe in the left, and also of feeling dizzy. An examination of the eyes gave the following results: Pupils normal in size and reaction, vision normal, manifest hypermetropia, .75 D. O. U. A second examination was made after the use of a one-half per cent. solution of atropine for two days. The muscular condition was found to be normal. Hypermetropia 1.25 D. O. U. Glasses correcting one dioptré of the hypermetropia were ordered for constant use. The patient returned October 22d, after wearing glasses for one week, and was pronounced by Dr. Putnam to be decidedly better. The eyes had not ached since wearing glasses, but there has been one severe sick headache.

November 5th, the muscular twitchings had almost entirely ceased, and the boy was practically well.

CASE XI. S. B., a school-boy, eight years of age, referred from the Out-Patient Nervous Department of the Massachusetts General Hospital, October 11, 1889. The chorea is of three weeks' duration, of moderate severity, and involves muscles of both the upper and lower extremities. There is a history of one previous attack five years ago. Headaches are occasionally complained of, but the eyes never ache, and he is never dizzy.

Upon examination of the eyes, the pupils were found to be normal of size and reaction, vision, normal, manifest hypermetropia one dioptré. An examination of

the eyes, October 14th, after the use of atophine gave the following results: Hypermetropia 2.25 D. O. U. Vision normal. Muscular condition, normal. Glasses ordered for constant use  $+1.25$  D. O. U. The patient was again seen October 29th. There was no improvement in the chorea, and he was referred back to the Nervous Department for general treatment.

CASE XII. R. P., a boy, five years of age, was referred to me from the Children's Hospital by Dr. Townsend, October 12, 1889. The chorea began two weeks ago, and is of considerable severity. The twitchings involve muscles of both the upper and lower extremities, and of trunk. An examination of the eyes gave the following results: Pupils, normal in size and reaction, vision, normal, manifest hypermetropia, 2 D. O. U.

A second examination was made after the use of a one-half per cent. solution of atropine, October 19th, and the hypermetropia was found to be of 2.50 D. O. U.

The boy's youth made it impossible to determine with any degree of accuracy the muscular condition. Glasses ordered for constant use,  $+2$  D. O. U.

The patient was again seen October 27th, after wearing glasses for one week. The chorea was decidedly worse, and he was referred back to the Children's Hospital for general treatment.

CASE XIII. C. V., a school boy, ten years of age, was referred to me by Dr. Townsend, October 17, 1889. The child has had a choreic attack every year for the last three years. These attacks were of about three months' duration and were quite severe. The mother says that the boy has been nervous and irritable for the last two weeks, and she has also noticed slight twitchings of the hands. The trouble usually comes on in this way, and fearing that another attack was beginning, she took him to the hospital. Headaches,

and pains in the eyes, are sometimes complained of, but are not severe. Upon examination, the pupils were found to be of normal size and reaction. There was a small amount of astigmatism in both eyes, and after this was corrected, the vision was up to the normal. October 21st, the eyes were again examined, after the use of atropine for four days. The astigmatism was corrected with a  $+ .75$  cyl. axis  $85^\circ$  before the right eye, and with a  $+ .50$  cyl. axis  $85^\circ$  before the left. The muscular condition was found to be normal. Glasses correcting the astigmatism were prescribed October 26th. The patient was again seen November 5th, the mother said that he had been much less irritable and nervous since wearing the glasses, and that the twitchings of the hands had entirely ceased.

CASE XIV. L. L., a school girl, eleven years of age, was referred from the Out-Patient Nervous Department of the Massachusetts General Hospital, November 13, 1889. The chorea began four months ago, and is not of great severity. The muscular twitchings are confined principally to the upper extremities and to the face. Headaches are complained of, and usually come on after using the eyes in near work. There is sometimes pain in the left eye, but it is not severe. An examination of the eyes gave the following results: Pupils moderately dilated, the right being a little larger than the left, but of good reaction. Vision, normal, manifest hypermetropia 1 D. O. D. and .50 D. O. S. A second examination made November 14th, after the use of a one per cent. solution of atropine resulted as follows: Hypermetropia 1.25 D. O. D., hypermetropia 1 D. O. S. Vision normal, right hyperphoria, one-half degree, adducting power ten degrees, abducting power five degrees, prism of two and a half degrees overcome with its base down before the right eye, and one of one and one-half degrees, base down, be-



fore the left. Glasses ordered for constant use O. D. + 1 D. O. S. + .75 D.

The patient was again seen November 21st. The head had not ached since wearing glasses and the choreic movements had almost entirely ceased.

In forming conclusions as to the value of ocular treatment in chorea, the fact that patients frequently recover while undergoing no treatment whatever, must, of course, be taken into consideration. The marked improvement and rapid recovery, together with the relief of headaches and ocular symptoms, following the correction of muscular and refractive errors, in some of these cases, however, make it seem more than probable that the ocular defects were the exciting causes of the disease.

#### DISCUSSION.

DR. STANDISH: This whole subject of the relief of nervous symptoms by the relief of the strain arising in illy balanced ocular muscles has been so befogged by extravagant claims on the part of its advocates, and prejudice on the part of its opponents that clear reports, such as Dr. Cheney has just read, are very much needed. What we wish to know is how much the ocular insufficiency was; what was done, the amount of relief to the insufficiency, and the result. I have been very glad to hear the paper.

I think that it should not be claimed that chorea, for instance, is due to the strain from an insufficiency of an ocular muscle, but that in an already unstable state of equilibrium of the nervous system the strain is sufficient to precipitate or prolong the symptoms,

especially if much near work is undertaken with the eyes. When we think of the strain upon one's endurance which a constant effort, during all the waking hours to avoid diplopia may produce, it does not seem strange that it should be the additional burden, which might cause the nervous phenomena — in the presence of some other condition which is, more properly speaking, the origin of the disease.

It has been claimed that this operation does not effect the mechanical result desired, but when one does the operation and finds a constant insufficiency of  $7^{\circ}$  reduced to a constant insufficiency of  $2^{\circ}$ , for instance, there seems to be no doubt as to the fact.

In a series of cases operated on by me for constant and severe headaches, accompanied by a more or less neurasthenic condition, the relief has been prompt and exceedingly satisfactory. The relief has also been permanent thus far, and one case was operated on in May, 1888, and has had no return of his troubles.

As to chorea I have never operated on a case, but I have given marked relief, a cure as far as symptoms go, by prescribing glasses. These cases have been cases in which a choreic attack has developed every year for several years. The symptoms disappeared upon wearing glasses, and in several cases, about which I have had an opportunity to know the subsequent history, there has never been another attack. If correcting the error of refraction will lift the load sufficient to allow a patient to recover from a choreic attack I do not see why relief of strain from the ocular muscles might not do the same.

DR. E. E. JACK: Unfortunately I have had but little experience in examining for ocular defects in chorea. Until recently my only knowledge of the subject had been from Dr. Stevens's writings.

At the suggestion of Dr. Bullard a series of ten

cases was examined at the dispensary. The strength of the different muscles was tested by their ability to overcome prisms. In all the cases the muscles, except the interni, run up to the accepted standard. The interni varied from a third to a half their normal strength. This is always so and signifies nothing, the full strength of the interni being known only after many trials, when the patient has learned to use the associated power, accommodation, while looking at the distance. A series of ten normal cases gave practically the same results. The diplopia-test was not used as there was no phorometer at hand, and it seemed to me that the axis of the prism ought to be surely known to make any observation reliable. I realize now that muscular tests to be of value must combine both methods and be repeated. Notice must be taken also of the effect of refractive correction on the state of the muscles. Since these cases were tested I have examined several more, using both methods, but with negative results. About one-half to two-thirds of all the cases had refractive errors, mostly astigmatism, and in two cases when refraction was corrected there was hastened convalescence. It seems to me plausible that muscular insufficiencies may act as one of several causes in producing or prolonging chorea. Whether, if an insufficiency is found, it is an accompaniment or a cause, can be told only by relief got from prisms or tenotomy, eliminating, in the case of tenotomy, the moral effect produced by the operation.

DR. TOWNSEND said that he had been much interested in watching the results of Dr. Cheney's treatment in three cases he had sent from the Children's Hospital. Two of these had had repeated attacks of chorea, in both marked ocular defects, were found, and both were practically cured by the correction of these defects. The third case was sent in a primary attack,

and although the very slight ocular defect was corrected, no improvement followed in the symptoms. It had occurred to him, therefore, that these results might be explained on the supposition that primary attacks of chorea were due to a specific cause, and that in the subsequent life of these patients any local irritation, like the eye strain due to ocular defects, might in a reflex manner cause a discharge of nervous action along the same channels as in the original disease chorea. In the same way after an attack of whooping-cough the irritation caused by a subsequent attack of bronchitis, brought on a renewal of the spasmodic nervous symptoms of the former disease.

He would like to ask the reader, therefore, whether his good results were obtained in primary or secondary attacks of the disease.

DR. CHENEY replied that the patients apparently most benefited by the treatment had had one or more previous attacks.

DR. F. C. SHATTUCK said that the very interesting series of cases reported by Dr. Cheney strongly suggests that there may be two or more kinds of chorea: and that, as Dr. Townsend acutely remarks, a distinction must often be drawn between choreic movements and chorea. Chorea is in all the books still classed as a functional neurosis, a classification which is probably indicative of our ignorance rather than of our knowledge. It is not likely that the correction of an optical defect can have any notable influence on the motor symptoms of that remarkable group of cases in which the choreic movements are associated with articular swelling and pain, or with an endocarditis frequently entailing permanent valvular damage, or with both at once; an association which points strongly to a general infection. We have learned of late years to differentiate between true and Jacksonian epilepsy;

and must be almost painfully conscious of the extreme imperfection of our knowledge; especially with regard to the so-called functional affections of the nervous system. In making these remarks the speaker would not be understood as wishing to undervalue the importance of the paper presented. Every general practitioner and clinician should carefully treasure the results of such experience as that of Drs. Cheney and Standish.

DR. MORTON PRINCE said that he had listened with great interest to the important discussion, and was deeply impressed with the evident fairness of those who hold opposite, or at least, somewhat conflicting views upon the subject under discussion. Any one who has seen large numbers of cases of chorea, cannot believe that any great proportion of such cases are dependent on ocular defects. In these cases where cure has followed the operation, the probability is that either they were not true chorea, or the outbreak of the disease was independent of any ocular trouble; but, having once started, the choreic movements were kept up by the local irritation.

Dr. Prince thinks that Dr. Shattuck is right in assuming that there are different forms of choreic manifestations to which he has called attention, and which would seem to explain some of the otherwise unaccountable and erratic manifestations of this disease.

The claims of the paper have been well defended, and all fair-minded listeners must agree that operation should be given a fair trial in properly selected cases.

DR. E. D. SPEAR asked the reader if he had made any investigations in relation to dizziness in these cases. The semicircular canals are supposed to be related in some way with the organ of space, and the

phenomenon of dizziness in relation with chorea may have some unexpected relations with this function or organ. Lenses before the eyes will sometimes cause dizziness. It is an interesting question whether this fact will be of service in locating the organ of space.

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