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END RESULTS IN MONOCULAR ESOTROPIA*

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OPINIONS are divided as to what may be expected as end results in monocular squint. Many believe that only parallelism can be obtained in the great majority of patients, with an exceptionally good termination now and then, including equal visual acuity in the two eyes and, to all intents and purposes, single binocular vision. In fact, not many years ago a member of this Society, an unusually good operator, expressed his belief in a paper that comparatively few children recover from squint with single binocular vision. There is, however, a minority of operators, in which the speaker is included, who believe the ideal goal can be obtained in the vast majority of young squinters, *if systematic measures are instituted, if the squint is treated at the proper age, and if the co-operation of the parents can be obtained.*

It might be well to state just what the ideal goal embraces in order to say "the results are ideal." In my judgment, ideal results include, first, good visual acuity in the squinting eye; second, single binocular vision which will stand the proper tests;

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third, good convergence for sustained close work; and fourth, comfort for the patient, which is necessarily predicated on a good muscle balance after treatment is completed. In order to obtain such results, each of the four conditions just mentioned plays an important rôle, but for obvious reasons they may not all be obtained in a given case. So long, however, as the break in the results does not occur because of our own misjudgment or neglect, there should be no laxity on our part to strive to obtain these ideal results in every case. To assume, however, that one can lay down certain definite procedures which, if followed, will bring about the desired goal, is begging the question. The object of this paper is to endeavour to establish these facts.

Factors which interfere with Ideal Results

Our purpose will be served best by reviewing, first, those facts which, if present, will definitely interfere with perfect results; and second, by analyzing the factors which have yielded this ideal goal in many cases, and will continue to yield the same end results in many others to come.

Aside from the neglect on the part of parents, whether from ignorance or from indifference, the two technical conditions which stand as a barrier to a perfect outcome are amblyopia ex anopsia and an undeveloped or absent fusion faculty. The former, in all but a few instances, is remediable under proper conditions. As to the latter a fusion faculty, if totally absent, cannot be developed, but if present, even in moderate degree, can be awakened by proper methods. As to how these barriers can be removed will be discussed in the second part of the paper. For the time being, I wish to stress the important fact that in a majority of instances in which only cosmetic results are observed, failure to obtain ideal results can usually be attributed to the presence of one or both of these barriers.

Factors which favour Ideal Results

In constructing our framework upon which a perfect issue may rest, there is one feature which is thoroughly understood and accepted, and this will be passed over rapidly. I refer to refraction.

1. *Refraction.*—The first essential is early and careful refraction. This is accepted by all as fundamental in the management of squint. It offers a large field for discussion, but suffice it to say that one's duty to squinters is not completed with the careful fitting of glasses. It is apropos to add that in the vast majority of cases, the prevailing error is high hyperopia with anisometropia. The latter element, in my experience, is the precipitating factor

which paves the way for the failure of a weak fusion faculty to hold the visual axes in alignment, and for the subsequent development of squint.

2. *Prevention and Correction of Amblyopia ex Anopsia.*—

In the course of treatment, the second factor which demands our attention—a factor which, in many instances in the very young child, is first in importance and in order of time—is the prevention or correction of amblyopia ex anopsia. In former communications, I have endeavoured to show that the amblyopia of squint is acquired in all but a few instances, and amenable to treatment under certain conditions.

Amblyopia ex anopsia is observed in three types of patients: First, in manifest monolateral esotropia of childhood; second, in adults who in early childhood had a manifest squint which disappeared spontaneously or by systematic treatment which may have included operation; and third, in adults in whom there is no history of squint in childhood. In these three groups, the characteristics of amblyopia ex anopsia are the same, save in the degree of amblyopia, and the dominating refractive error is that of anisometropia with prevailing high hyperopia almost universally present. The three characteristics of amblyopia ex anopsia, as pointed out in a paper before the last International Congress at Amsterdam, are: (1) A central, usually relative, scotoma about three degrees in diameter; (2) an enlargement of the blind spot of Mariotte; and (3) a moderate contraction of the form and colour fields. This evidence of lowered sensitivity can be demonstrated in almost all cases, and equally well can be shown to be the result of disuse and amenable to treatment. In all cases in which lowered central vision can be elicited by subjective tests, a central scotoma can be outlined. Those of you who have practised orthoptic training in young children up to the age of five years must be impressed with the ease by which the squint can be transferred from one eye to the other with lowering of central vision in the secondarily squinting eye. The younger the child, the more readily can the squint be transferred, whereas between the ages of four and seven, the transfer is less easily effected. I do not recall a single instance of transfer after the seventh year. What is equally interesting is the greater difficulty encountered in the entire correction of amblyopia in children over seven years of age.

According to Ida Mann*, the macula of the new-born does not take on the histological appearance of the adult until 16 weeks after birth. Furthermore, it is also a well-known fact that the functional development of the nervous system of the child is not complete until the child is five years of age. These facts are sufficient to

* The Development of the Human Eye, 1928.

explain the instability of macular vision, and the ease with which central vision can be disturbed in young children.

An observation which is equally interesting, and as readily demonstrated, is the ease with which lowered central vision can be corrected in children up to four or five years of age, and the increasing difficulty in correcting the same with each succeeding year of life after this period. The fact that the treatment of squint is so often instituted after the seventh year is probably responsible for the unfortunate prevailing opinion of many that nothing can be done to correct the amblyopia, and the equally inaccurate observation that the amblyopia of squint is congenital and, therefore, a cause of squint. Nothing is further from the truth.

It will take us too far afield to enter into a discussion of the details necessary for the correcting of this amblyopia. Suffice it to say it can be done in the young child, and to a less degree after the fifth year. If corrected, it furnishes the second important step which will admit of ideal results in monocular esotropia. Although an important barrier to cure in monocular esotropia, a moderate degree of amblyopia, with vision of 6/9 or better, is compatible with good fusion and otherwise good results. The fusion areas in the retinae extend beyond the fovea and probably beyond the macula. It is this fact which aids in cases of spontaneous cure of squint, and it also is operative in amblyopia ex anopsia of adults who do not have a history of squint, even in childhood. I have observed the same fact in otherwise perfect cures by training and operation. If fusion can be awakened to activity, a moderate degree of amblyopia will not prevent a cure. Its prevention or perfect correction, however, materially hastens and assures perfect results.

3. *Training of the Fusion Faculty.*—The third measure essential to ideal results deals with the fusion faculty. After the third year, the state of the fusion faculty can be determined in many instances. In some children this cannot be estimated before the fourth year, and in a few instances not before the fifth year. Its determination, however, is vital in the management of squint. Although it is a *sine qua non* in perfect restoration of single binocular vision, and in some instances associated with the first and second measures accomplishes the results without the necessity for an operation, its treatment, in some instances, may be deferred a year or two without seriously interfering with the ultimate goal. I refer in particular to those cases in which the squint is of such degree that an operation is necessary. Although any of the four measures mentioned accomplishes maximum results in young children up to five years, a child of seven is more pliable for the training of fusion. Good fusion is necessary for the prevention of squint, and in the final analysis, it is the keystone,

so to speak, of the arch which bridges the chasm between cosmetic results and the goal which is sought—single binocular vision. In my experience, if a fusion tendency is present but undeveloped, it can be awakened even in adult life. Because of this fact and the somewhat complex act required in its training, it can often be left to the age of six or seven years, if the younger child responds indifferently. In fact, in the second group of acquired amblyopias previously referred to (squint in early life with subsequent spontaneous cure), the results are brought about, in my judgment, by the self-awakening of the fusion faculty. Furthermore, the occasional brilliant results obtained after proper refraction and accurately performed operations, without special fusion training, are also the result of the self-awakening of a fusion faculty which previously was present, but in latent form, because it could not operate in the presence of wide deviation of the visual axes.

Without entering into a discussion of the nature of a fusion faculty, a fusion sense, fusion power, or any other term which is implied in single binocular vision, facts which are patent to all are the dominance of this faculty in all normal individuals, its total absence in true alternating esotropia, and its readiness to spring into activity in all cases of monocular esotropia when normal relations are restored by improving vision, by the prevention or removal of amblyopia ex anopsia, and by restoration of approximate parallelism of the visual axes. Something inherent in the individual tends to its normal return, but artificial stimulation hastens and restores it to normal function, and in many instances, becomes necessary to its full awakening.

4. *Operative Interference.*—In a large number of cases, the fourth and final step in the treatment of squint becomes necessary. The reasons for the necessity of this fourth step are to be found in high degrees of squint and in the molecular and organic changes in the muscles themselves, and in the capsule of Tenon. In high degrees of squint, the separation of the visual axes places the images beyond the reach even of normal fusion, and much beyond that which a feebly developed fusion faculty can bridge over. Anatomical changes which develop in the muscles, in their fascial sheaths and in the capsule of Tenon in well-established squint furnish a second barrier, which in many instances must be removed by operation. If the squint is of such degree, much is gained by an early operation. In fact, the longer one studies the various phases of squint, the stronger becomes the conviction that each of the four steps enumerated yields the best results before the end of the fifth year. In other words, if parallelism of the visual axes can be established in the early years—the formative period, vision is less endangered and the fusion faculty requires less

artificial stimulation. The fight against amblyopia ex anopsia must be kept up until parallelism is restored automatically, by consistent training, or by operation. If indicated at all, therefore, operation should be practised early.

The methods of operating are many. Each surgeon may have his own preference, but the patient's interests are best served by the choice of such procedures as are especially indicated in the individual case. We cannot stop to discuss the special advantages of the operations at our disposal. Only principles are of importance for our purpose. Basic principles which should be mentioned are the following :—

1. The converging power of the internal recti should be preserved. As a natural corollary, if it is necessary to operate on one or both internal recti, nothing but muscle recession should be practised. Tenotomies are contra-indicated.

2. If the squint can be corrected by shortening one or both external recti, the results will be most satisfactory and normal convergence will not be placed in jeopardy.

3. Supplementary operations, if necessary, should be reserved for the internal recti. There are occasional exceptions to this rule when the internus is definitely in a state of contracture.

4. Only such operations should be selected as will admit of the most accurate correction of the squint.

5. Although the cosmetic appearance of the bulbar conjunctiva is secondary in importance to the accuracy of the restoration of parallelism, it is worthy of serious consideration in the choice of operations.

No statistics are offered to assure you that the methods set forth will yield the ideal results which were stated in my premise. Statistics are rarely analyzed. I have been following this plan of procedure for many years, and can assure you that the end results obtained by this plan warrant the statement that single binocular vision, with good visual acuity and comfort to the patient, can be obtained in most cases of monocular esotropia during the first seven years of life. They can be obtained in older children in a smaller percentage of cases. The same systematic plan should be followed at all ages, and if followed, a nearer approach to ideal results will be obtained. The unbelief and scepticism as to such claims in monocular esotropia, which are prevalent but fortunately on the wane, are the result, first, of antiquated teaching, and second, of the fact that the average case of squint is treated too late to obtain anything but cosmetic results. If the family physician can be induced to refer his little squinting patient to the eye specialist as soon as the squint appears, and the measures advocated in this communication are conscientiously followed, the ideal results in monocular esotropia can be obtained.