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Pitfalls in testing children's vision by the Sheridan Gardiner single optotype method

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During routine work in the Orthoptic Department, we noticed that, in some children who were having their visual acuity tested by the Snellen method for the first time, the results proved worse than those recorded previously by the Sheridan Gardiner method. The majority of patients concerned had been having occlusion for amblyopia, which was either presumed or shown to exist by a test of the visual acuity. In this paper, we analyse the discrepancies which were apparent between the two tests in these amblyopic patients.

Material

The criterion for inclusion in this study was a difference in the patient's visual acuity of at least two lines between the maximum on the Sheridan Gardiner test and that on the result of the first Snellen test. A total of 75 children showed such discrepancy. The average age of those children at their first attendance at the Orthoptic Department was 3 years and 3 months (range 8 months to 7 years). Table I shows the visual acuity recorded at the first visit (where such had been possible). Thirteen children had their vision first measured by the "E" test. This variation does not invalidate the pertinent points in the survey, as all patients eventually had a Sheridan Gardiner test before their first Snellen test.

Table I *Visual acuity in the amblyopic eye, as recorded at the first visit*

Visual acuity	*Total cases*		*Sheridan Gardiner*	
	No.	*Per cent.*	*Test*	*"E" Test*
6/60 or less	21	28	16	5
6/36	7	9·3	4	3
6/24	5	6·7	4	1
6/18	2	2·7	0	2
6/12	3	4	7	1
6/9	8	10·7	3	1
6/6	3	4	3	0
Test not possible	26	34·7	—	—
Total	75		36	13

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Two of the 75 patients were not originally treated for amblyopia. Both had equal vision when recorded by the Sheridan Gardiner method. One of these had bilateral congenital lamellar cataracts and had no occlusion before the vision was recorded by the Snellen chart. The second child showed suppression when tested on the synoptophore and was consequently given part-time occlusion for a short period. Only after a test with the Snellen chart was the presence of amblyopia evident.

One patient only, an anisometropic amblyope, had binocular single vision. The majority of the patients had constant convergent squints.

These were the only trends found in this group of patients. In a study which is partly retrospective and spans treatment over a number of years, it is difficult to assess percentages of the total number of patients treated for amblyopia. To obtain a better assessment a similar, but prospective, comparison would need to be made.

Method

It has been our practice in the past to test the visual acuity using the Snellen Test type as soon as the child knew his alphabet, which was usually not until the age of 7 years. However, we now find that from the age of 5 years the average child can accurately "draw the letters in space" rather than name them. We therefore achieve a measurement of the visual acuity by using the Snellen chart 2 years earlier. A few of the acuities tested with the Snellen chart were obtained in this way. No distinction between the two methods has been made in the following Tables.

In young children unable to co-operate in either of the above methods, the Sheridan Gardiner test is used. From the age of 3 years the average child has the ability to carry out this test. It was originally designed for handicapped and retarded children, but has been found acceptable in orthoptic clinics, and has been used in our Department for the past 3 years.

All acuities are recorded at a distance of 20 feet. The Sheridan Gardiner test depends upon the child identifying on one card, held in his hand, various-sized letters shown by the examiner on a second card. The child is first given the key card and shown a few letters at close range and asked to find the same letter on the key card. When the procedure is understood, each eye is tested separately at 20 feet. The key cards may have nine, seven, or five letters: the younger child finds it easier to use the test card with the smaller number of letters. The test letters are shown individually from a booklet. This form of testing was originally described by Pugmire and Sheridan (1957, 1960) and Sheridan (1963, 1969a,b).

Most of our patients were originally found to be amblyopic with a constant convergent squint. Conventional occlusion improved the vision in the amblyopic eye up to a maximum value, as measured by the Sheridan Gardiner test (Table II). Once this degree of acuity was obtained, the occlusion was stopped. The patient was observed regularly and his vision was recorded by repeated Sheridan Gardiner tests. The acuity remained stable with no further occlusion until the child was old enough to be tested by the Snellen method, when the discrepancies were found. The time interval between the maximum Sheridan Gardiner reading and the first estimate of the visual acuity using the Snellen test type was recorded (Table III). The patient then had further occlusion until once again a maximum stable vision was obtained with the Snellen test.

Eight patients continued with intermittent occlusion during this period because their vision had not reached a stable level. These are included in the report because a drop in acuity was shown with their first Snellen test.

Results

After the original period of occlusion, two-thirds of the total number of patients attained a vision of 6/9 or 6/6 (see Table II), which would be considered acceptable. An apparent decrease in visual acuity was evident when the patients were first tested with the Snellen chart (Table IV), almost 70 per cent. showing differences of at least three lines. The change in acuity is considerable. For example, two patients had maintained a vision of

Table II *Maximum visual acuity in amblyopic eye after occlusion (using Sheridan Gardiner test)*

Visual acuity	*Total cases*	
	No.	*Per cent.*
6/18	5	6·7
6/12	20	26·7
6/9	33	44
6/6	17	22·7

Table III *Time in which the maximum visual acuity recorded with the Sheridan Gardiner test remained stable, without occlusion*

Time (mths)	*Total cases*	
	No.	*Per cent.*
3	4	5·3
6	14	18·7
9	7	9·3
12	20	26·7
15	3	4
18	3	4
24	11	14·7
>24	3	4
Occlusion not stopped	9	12
No occlusion	1	1·3

Table IV *Difference between the maximum visual acuity of the amblyopic eye recorded by the Sheridan Gardiner test, and the first Snellen test*

Expressed as "lines" of difference

No. of lines	*Total cases*	
	No.	*Per cent.*
1	0	0
2	23	30·7
3	30	40
4	16	21·3
5	5	6·7
6	1	1·3

Table V *Difference in visual acuity between the maximum Sheridan Gardiner reading and final acuity using the Snellen chart*

No. of lines	*Total cases*	
	No.	*Per cent.*
0	7	9·3
1	29	38·7
2	12	16·0
3	4	5·3
4	0	0
Patients continuing occlusion	19	25·3
Patients "lost" to further testing	4	5·3

6/6 for 2 years after occlusion was stopped. When tested with the Snellen chart, they showed a remarkable drop to 6/60 and 6/36 respectively.

Table V shows the end-results after further occlusion: 25 per cent. of the patients are still being treated, and 5 per cent. have been "lost" to further examination. In the patients who have finished treatment, there has been a definite improvement, as shown by a decrease in the number of lines of difference (Tables IV and V). Out of 52 patients, 36 now show only one line of difference or none. In the remaining patients these figures will change but the results show that a considerable amount of amblyopia was still present, although the visual acuities had apparently remained stable with the Sheridan Gardiner test.

Discussion

Raynar-Smith (1970), in an article discussing the prognosis of strabismus, reviewed 32 cases in which, after occlusion, equal vision was obtained when recorded with a single letter, but in which there was a disparity of three lines or more when tested with the Snellen chart. The fact that it is easier to see a single letter than to distinguish a row of letters is well known. It must be emphasized that this applies particularly to amblyopic patients. Von Noorden and Lipsius (1964) reviewed 58 patients whose ages ranged from 5 to 17 years who received pleoptic treatment. All had previously had occlusion to treat amblyopia without success. We would agree with their statement that the single letter acuity may be normal or near normal in the presence of amblyopia, and that the pathological condition becomes manifest only when linear acuity is tested. Von Noorden and Lipsius believed that the visual acuity determined by a single optotype provided insufficient information regarding the functional state of the eye. Schlossman (1961) reached the same conclusion.

There are certain theories regarding the cause of this phenomenon, but positive proof for any is lacking. In amblyopia there is an active suppression of unwanted or rival information. This suppression is at a cortical level and in the early stages it may be reversible, but after a certain time no reversal is possible. It is in the initial stages that one finds the difference in acuity between single and linear types. This difference may be peculiar to amblyopia and in our series this is borne out.

An explanation has been put forward that this occurrence is a natural phenomenon which can be explained only by the various physiological factors concerned in perception in which modification or exaggeration in amblyopia accentuates the normal difference in acuity. These include the consideration of the various fine eye movements, fixation reflexes, inhibition, contrast, and psychological factors. The fixation difficulties known to be present in amblyopia are probably the underlying significant factor in the legibility difference (Ffooks, 1965a,b).

Summary

A series of 75 amblyopic patients is presented, each of whom showed a considerable difference in visual acuity when tested with the Snellen chart for the first time, as compared with the acuity previously recorded by the Sheridan Gardiner method.

The period of time in which the maximum visual acuity using the Sheridan Gardiner test was maintained without occlusion was recorded.

After the initial test with the Snellen chart, further occlusion was carried out, and 52 of the patients have now completed treatment. In these patients we have noted the "lines"

of difference between the maximum Sheridan Gardiner reading and the final visual acuity as recorded by the Snellen method.

Our findings show that, whilst the Sheridan Gardiner test is useful in recording the visual acuity of children too young to co-operate with the Snellen test, it must be used with certain reservations. This applies particularly to children who are suspected of being amblyopic. Improvement in visual acuity after occlusion, as tested by the Sheridan Gardiner test, must always be regarded with some suspicion. Eventual testing with the Snellen types may show that considerable amblyopia to linear types still remains and that this will require further occlusion.

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