British Journal of Ophthalmology, 1977, **61**, 16–22

'Entente cordiale' in the early treatment of squint

R. PIGASSOU

'I regard as a highly satisfactory result a slightly anomalous type so that the condition represents a secondary form of microtropia' (Wybar, 1974).

'Guérir un strabique c'est lui donner une vision binoculaire normale; soulager un strabique c'est lui donner une union binoculaire esthétique (bien des signes fonctionnels dont se plaignent ces malades rendent inopportun le terme de soulagement). ... L'union binoculaire est à notre avis un échec, la fusion périphérique est en réalité une correspondance rétinienne anormale, celle-ci est mise en évidence si on utilise un test convenable' (Pigassou *et al.*, 1975).

There is no doubt that Wybar's conception of the functional prognosis of squint does not coincide with our own point of view. How can we explain these two opposing viewpoints, formulated by two ophthalmologists described as 'strabologists'? Is agreement possible? In our opinion agreement is indeed possible—the early functional treatment of strabismus permits the unification of the two points of view.

In the first part of our text we shall present the reasons underlying the two opinions, and in the second part we shall expose some of the chief characteristics of early treatment.

I. The reasons for the divergent viewpoints

A. The two methods

Both authors express their opinion on the prognosis for squint based on the results obtained in children aged between 5 and 8 years and *treated by different methods*. Let us consider first of all the essential characteristics of these two therapeutic methods and their respective results.

THE ESSENTIAL CHARACTERISTICS

The so-called 'classical' method.—Treatment is the same whether correspondence is normal or abnormal; bifoveal stimulation is provoked (flash or massage) by means of a device such as the 'amblyoscope'. The sessions last from 20 to 30 minutes and take place two or three times a week over a period of 2 to 6 months. Between these sessions the child wears an optical correction with or without occlusion.

The prismatic method (Pigassou, Garipuy, 1973a).—Treatment is *different* according to the state of the retinal correspondence. If *retinal correspondence is normal,* the treatment consists of *exact prismatic correction,* which permits bifoveal stimulation at the patient's objective angle all day long. If *retinal correspondence is anomalous,* the treatment must first destroy the abnormal correspondence by the prescription of overcorrecting prisms; once the abnormal correspondence is overcome exact prisms are placed. The child wears his prisms constantly on his spectacles. If possible he undergoes binocular afterimage sessions with electronic flash (optomultiflash).

THE RESULTS

The *classical method* is efficient, i.e., leads to binocular single vision, only in cases with underlying normal retinal correspondence, that is to say, in about 30% of cases. In the remaining cases it is not efficient.

The *prismatic method* can lead to binocular single vision in all cases of normal and abnormal retinal correspondence, only the alternating forms offering a less favourable prognosis. We say 'can lead' and not 'leads' as the technique is long and difficult; failures occur if the treatment is abandoned too early or if the instructions are not properly followed.

B. Since prismotherapy offers a more favourable prognostic and a wider range of application, why do so many ophthalmologists reject it?

We consider two main reasons to be responsible: the evolution of orthoptics; the difficulties encountered in prismotherapy. The *evolution of orthoptics* can be schematically divided into 3 periods.

FIRST PERIOD

The first period is that of the stereoscope: 'They date from the stereoscope originally introduced by Brewster in 1849 from Wheatstone's principles whereby the rays of light from two pictures were diverted by prisms. The original stereoscope was

Address for reprints: R. Pigassou, 31 Rue Roquelaine, 31000 Toulouse, France.

modified by Holmes in a simple clinical instrument wherein a convex lens before each eye was decentred to give the necessary prismatic deviation' (Duke-Elder, 1949). The principle of the stereoscope is to permit the fusing of different perspective images of the same object.

Remy's diploscope is used on the same principle. Diploscopic exercises may be divided into three stages: provocation of diplopia; establishment of simultaneous vision; establishment of stereoscopic vision (Cantonnet and Filliozat, 1932).

The aim of all these instruments is the same, i.e., to solicit binocular single vision. But their possibilities do not correspond to the theory underlying them, as there is no exact control of the objective angle. These enthusiastic attempts are short-lived, as they turn out to be ineffective, and the functional treatment of strabismus is thus abandoned for several years.

SECOND PERIOD

The second phase begins with the appearance of the amplyoscope (Duke-Elder, 1949). This instrument responds to more rational criteria, since one can carry out controlled stimulation at the objective angle. This method has become increasingly popular, and orthoptic units have been established in most countries and schools set up to train qualified technicians (orthoptists).

The aim of the treatment is to provoke not only a solicitation at the objective angle but also a bifoveal stimulation (by flash or massage).

Unfortunately the functional results are disappointing. Little by little orthoptic treatment is limited to cases of strabismus with underlying normal retinal correspondence, i.e., to 25 to 30% of cases. Sometimes orthoptic treatment is completely abandoned, since in cases of underlying normal retinal correspondence binocular vision develops spontaneously after surgery alone, when the operation re-establishes orthotropia.

THIRD PERIOD

The third period is marked by the importance given to the natural conditions of vision, both for examination and treatment. In the domain of *examination methods,* the first innovation is Bagolini's striated lenses associated with the filter bar. Then other methods appear—Pigassou's stereoprojector in polarised light, Aulhorn's phase haploscope (Pigassou, Aulhorn, and Bagolini, 1973).

So far as therapeutic methods are concerned, several techniques are intended to treat squint in conditions of free space (slight prismatic overcorrection by Bagolini, Lavat's objective angle in free space, Hugonnier's appreciation of diplopia). These different techniques have been described at length by their respective authors and we shall not develop them here. We shall recapitulate briefly the prismatic method, which is the method we practise.

When *retinal correspondence is normal* we use *exact prisms.* When *retinal correspondence is abnormal,* we use *overcorrecting prisms.*

Prismatic overcorrection of about 15 diopters with switch of fixating eye is the result of long experience and has been successively modified. It was clinical results (secondary postoperative divergence) which led us to practise prismatic overcorrection (Pigassou and Garipuy, 1963). The three main characteristics of the technique are the following: it is preoperative; it entails the placing of a prism of 15–20 diopters more than that necessary to place the patient at his objective angle; it changes the fixating eye.

Comments

We shall summarise the differing methods of the three periods.

FIRST AND SECOND PERIODS

1. Solicitation of single binocular vision in artificial conditions—the therapeutic development is—from single vision (first degree) to binocular vision (second degree); from fusion to stereoscopic vision (third degree).

2. The treatment is intended for squints with underlying normal retinal correspondence.

3. The therapy is effective only for the duration of the exercises.

THIRD PERIOD

1. Solicitation of binocular vision in natural conditions: only fusion tests are used, and tests of simultaneous vision and stereoscopic vision are used only for diagnostic ends.

2. The treatment is intended for squints with normal and abnormal retinal correspondence.

3. The therapy is effective all day long.

The difficulties of prismotherapy

The results obtained by prismotherapy are extremely favourable, but it is a difficult technique, demanding a great deal of rigour and precision and the exact execution of instructions. It is also a troublesome treatment, as it continues over one or two years.

It is precisely these difficulties which to our mind explain the hesitation of many strabologists to adopt the prismatic method, because it can only be successful in so far as one accepts its constraints. 'Few knowledgeable authorities doubt that it can be

effective, but also few authorities believe that ordinarily the time and expense involved are worth the benefits to be gained' (Fleming *et al.*, 1973). This quotation from Fleming (who worked for four months in our clinic on a National Institutes of Health Research Fellowship Grant, USA) describes the attitude of American specialists, but reflects exactly the viewpoint of many strabologists. We are sure that they think that binocular union is a second-best solution, but they hesitate because of the difficulties involved in the length of treatment, etc.

II. Early treatment

A. The aim of early treatment

The justification of early treatment lies in the fact that binocular vision is a conditioned reflex which develops in the first years of life. Normal binocularity includes the motor pattern and binocular division, which are both developmental functions. During the period of elaboration of this sensory-motor binocularity, a perturbation may upset the developmental mechanism, and in consequence an insufficient or abnormal binocular function will take place. The characteristic feature of squint is the perturbation of binocularity, and we consider these sensory-motor perturbations to be adaptive processes.

Early treatment is intended: to eliminate the risk of abnormal adaptations or to destroy these adaptations before they become too deep-rooted; to permit the development of high-quality binocular vision, since it will have been formed during the period of cortical plasticity.

B. The techniques

We exclude from early treatment the therapy called 'deferred therapy,' which to our mind is not a true treatment but a delaying treatment carried out until the 'orthoptic age' is reached. This palliative treatment, if it prevents the development of abnormal retinal correspondence, is often responsible for alterations which are just as difficult to cure as abnormal retinal correspondence. In addition, when the functional re-education is finally begun, after 4 years of age, the plasticity of the cortex is already greatly diminished, and the binocular vision obtained is of less quality.

There are two types of early treatment: early surgery, and orthoptic treatment, sometimes with subsequent surgery.

EARLY SURGERY

Early surgery is intended to permit the development of normal binocularity. However, the results do not always correspond to the desired goal, because, even if the surgical intervention is correctly carried out, postoperative orthotropia is maintained in only about 30% of cases. In the remaining cases we observe the development of a slight angle of anomaly, or binocular union (Weekers, 1962; Evens, 1971).

ORTHOPTIC TREATMENT

Orthoptic treatment has its place in the current therapy of all functional and developmental troubles. The principles are the same as those on which the treatment of the other functions is based, and in particular the troubles of general motricity. It is virtually possible to transpose the directives of Bobath on the early treatment of cerebral palsy to the early treatment of squint, keeping in mind that in cerebral palsy there are organic lesions and that in squint in normal children the perturbation has a functional origin.

'Early treatment is important because of the great adaptability and plasticity of the infantile brain' (Bobath, 1963). 'The learning of movements is entirely dependent upon sensory experience, upon sensory output which not only initiates but also guides motor output' (Bobath, 1967). 'Sensori-motor deprivation may cause mental retardation in children whose mental endowment may be normal' (Bobath, 1971).

We shall not describe here the technique itself, which differs from that applied between 5 and 8 years, as it has already been discussed in various communications (Pigassou, 1973, 1974a, 1974b). We shall simply indicate the conditions essential for the successful outcome of treatment. These are: the collaboration of the parents; the preliminary apprenticeship of the child before the examination itself (this is carried out by the parents); the adaptation of examination methods and treatment to the intellectual and sensori-motor capacities of the child; the training of the orthoptist to these new techniques, child psychology, etc.

Here briefly are some indications concerning these points:

The collaboration of the parents

All parents who bring a strabismic child to us for treatment receive an explanatory leaflet on squint, the aims of the treatment, the reasons underlying the instructions, etc. Parents whose child is under 3 years of age receive the leaflet appended to this article (Appendix 1).

The preparatory apprenticeship

Provided we take into consideration certain imperatives (maturity, motivation, repetition, etc.) the

child can, by carrying out the appropriate exercises, become capable of doing certain tests. All objective or subjective examinations are possible earlier than they normally would be if the child has previously carried out these preparatory exercises (an older child would answer these questions easily, as every-day sensori-motor experience would have naturally prepared him for them). These preparatory exercises are intended to prepare the child for a specific examination. To be effective they should be short and repeated frequently throughout the day, which is why we entrust them to the parents. We have established separate leaflets for each kind of practice exercise. As an example, we append the leaflet for the cover test to this article (Appendix 2).

The adaptation of the examination methods to the child's capacities

The examination of visual acuity can be carried out as early as 12 to 18 months, the time depending on the child's development and whether the tests are adapted to his cognitive and sensori-motor capacities. At this age Sheridan-type matching tests, which demand comparative visual exploration between two drawings, are difficult. 'The matching technique is not always possible between 2 and 4 years: the child may refuse to see the similarity between the two drawings, because these objects, whilst identical, are different' (Piaget, 1945). Tests which depend on orientation are impossible (Snellen or Landolt types) as the child does not yet distinguish left from right.

We have created a *visual acuity chart* for the examination of infants under 3, using drawings most frequently represented in nursery schools and which the child names in his own language (Fig. 1). 'This verbal approach is possible for the small child, as it corresponds to the laws of perceptive and cognitive development and precedes the matching capacity. In fact the mental process which leads to matching has its origin in the perceptive appreciation of a situation which in the normal child is necessarily verbal, thus explaining the predilection which children have for talking' (Duche, 1971). This method thus corresponds to the psychological and sensori-motor experience at this age and creates the optimum conditions for a correct answer.

The cover test, the examination of ocular motility, etc., demand sustained concentration on a precise object, and, as Jampolsky has emphasised, it is therefore essential that the object attract the attention of the child. To attract and more especially to sustain the interest of a baby of 1 year old, change or movement is necessary. We know that a motionless object in our visual field does not spontaneously attract our attention, whereas a moving object or the sudden appearance of a new object will attract our gaze. These facts are well exploited in publicity (signs with changing colours, flashing lights, etc.).

Since it is difficult to make the infant obey our instructions, we must make use of these reflexes to incite fixation, following movements, etc. To this end we have created certain objects specially adapted to the problem, e.g., flashing light in a doll's mouth (Fig. 2).

Therapeutic methods

The constraints involved in treatment should be minimised as far as possible. Since the wearing of glasses is virtually always necessary, they must be perfectly adapted to the facial, and more particularly to the nasal, morphology of the child. With this in mind we have had appropriate frames made (Fig. 3).

The training of the orthoptists

The orthoptists must be trained by means of systematic examinations of normal babies, and also be familiarised with infantile psychology.

Results

The results are extremely satisfactory, since, although the figure appears extraordinary, it is true that 100% of cures are obtained in children correctly treated. In nearly every case it is the lack of co-operation of the parents which is responsible for treatments incorrectly followed. (We would like to point out that a considerable number of parents give up the treatment in the initial stages.) The sensori-motor examinations carried out at 4 to 5 years of age in children having undergone a well-conducted early treatment show that the retinal correspondence is perfectly normal.

This fact makes redundant the divergent viewpoints on the treatment of eccentric fixation and anomalous retinal correspondence, since, thanks to early treatment, we should encounter in the future neither eccentric fixation nor anomalous retinal correspondence.

Conclusions

The current disagreements on the treatment of strabismus in children of 5 to 8 years of age stem from a different conception of squint and thus from the use of different therapeutic methods. At present it is more and more accepted that the functional treatment of strabismus should be begun between 1 and 3 years of age, and not 5 to 8 years. This opinion is in line with current therapy of all developmental troubles.

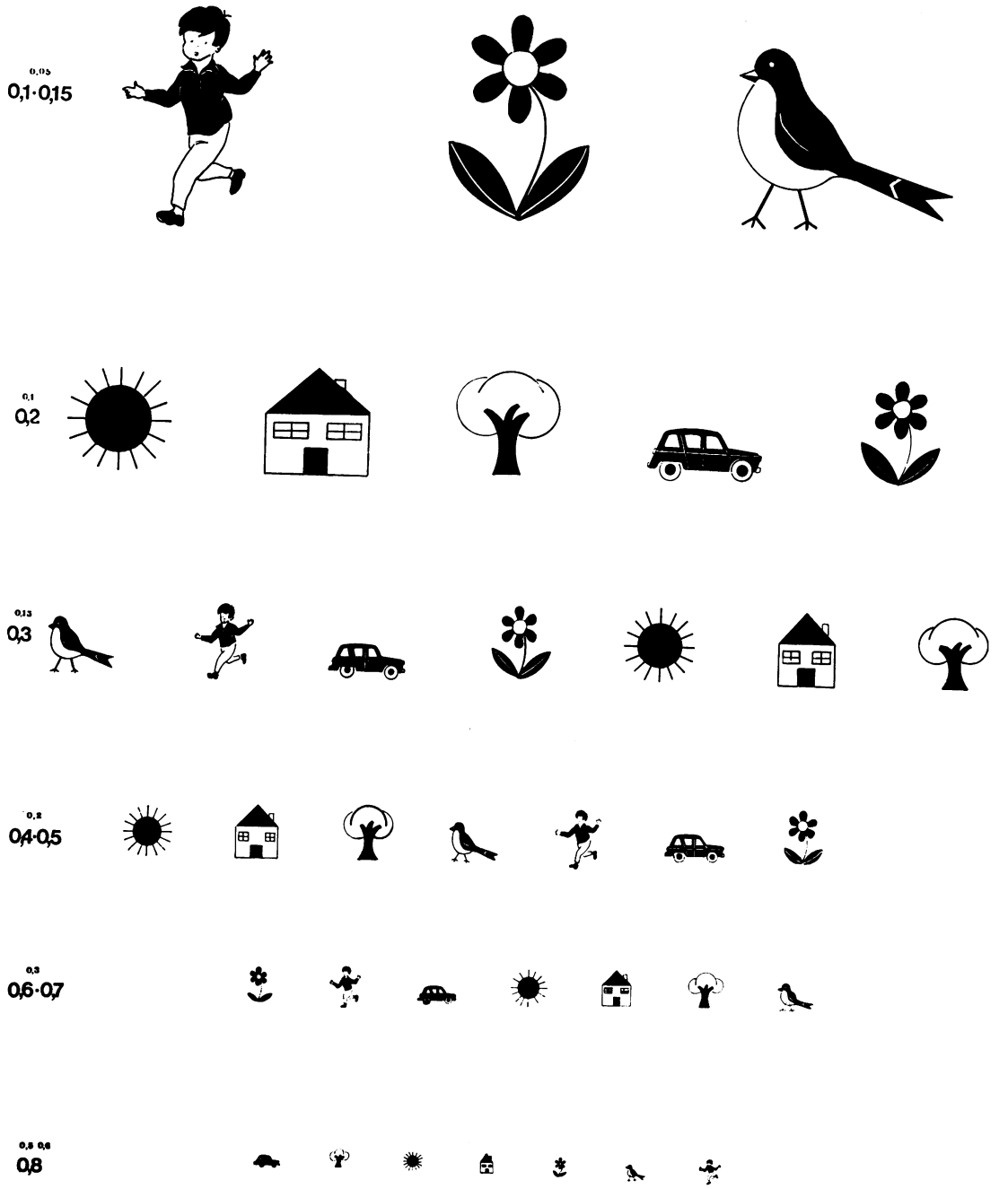

Fig. 1 *Visual acuity chart.*

Fig. 2 *Doll with flashing light in mouth.*

Early treatment is possible only in so far as a system of early detection of squint is organised and in so far as appropriate techniques are applied. The extremely favourable results obtained by a treatment especially adapted to infants make it the duty of every ophthalmologist interested in strabismus to modify his methods and to treat the child as soon as possible after the diagnosis of strabismus can be pronounced.

Appendix 1: Parental role in the early treatment of strabismus

Your child squints: can something be done for him? The answer is *yes,* but on condition that you help us. The treatment can succeed only if the instructions we give you are followed—home exercises and medical control over one or two years. It is therefore pointless to begin treatment unless you are determined to accept these imperatives.

Your participation falls into two categories:

Firstly, our *therapeutic instructions* which must be conscientiously carried out in order to obtain a positive result.

Secondly, there are *preparatory exercises* which your child must master so that we may subsequently carry out certain necessary tests. Each of these exercises will be first of all carried out in your presence; the leaflet we give you corresponding to the exercise is intended to help you memorise it.

During the preparatory exercises you must realise that a child's potential is considerable, but to learn he needs to be helped. He will succeed more easily if you do not neglect certain educational principles:

You must encourage him, for he will be clumsy at the beginning.

It is only by means of the first clumsy attempts that he will arrive at the correct gesture.

You must not tire him out with too lengthy exercises. They should be short and frequent.

The preparatory exercises and therapeutic advice may differ depending on the case and the stage of development, and for this reason you must bring your child for *regular check-ups.* On these occasions we shall give you the correct guidance corresponding to your child's rate of progress.

Appendix 2: The cover test—Preparatory exercise

This examination is fundamental for both ophthalmologist and orthoptist, as it enables them to decide whether the child has a squint or not.

This leaflet is intended to explain to you the preparatory exercises to do at home so that we may carry out the examination as soon as possible.

The child should first of all fixate properly, i.e., he must maintain his attention for several minutes on the object he is asked to fixate, so that his eye does not stray. The object of fixation should be small, either a source of light or an object with a contrasting part (for example, of different colour), this contrasting part being small enough to serve as a point of fixation.

When the child has learned to fixate properly, he has to learn two things:

He must accept that you cover one eye with your hand

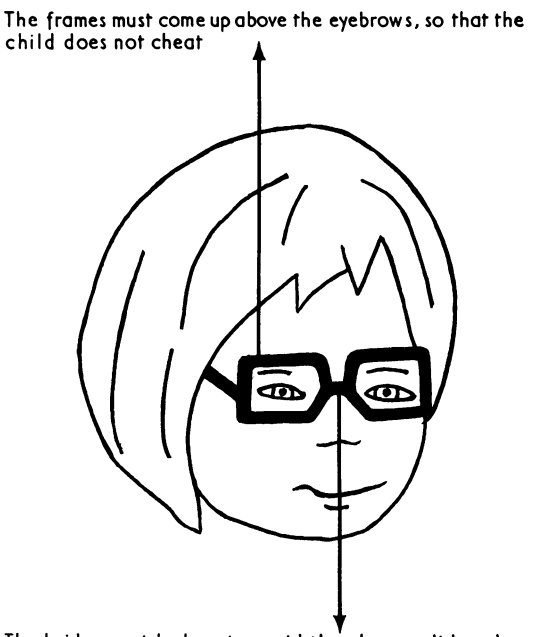

Fig. 3 *Special frame for child.*

or a suitable object without turning his head or removing the hand.

He must continue to fixate (or start to fixate) the object with the free eye when the other eye is covered.

References

Bobath, B. (1963). *Physiotherapy,* August, 242.

Bobath, B. (1967). *Developmental Medicine and Child Neurology,* **9,** 373.

Bobath, B. (1971). *Physiotherapy,* November, 1.

Cantonnet and Filliozat (1932). *Le Strabisme,* Paris.

Duche, D. J. (1971). Personal communication.

Duke-Elder, S. (1949). *Text-book of Ophthalmology,* **4,** 3924. London, Henry Kimpton.

Evens, L. (1971). *Bulletin de la Société Belge d'Ophthalmologie,* **159,** 686.

Fleming, A., Pigassou, R., and Garipuy, J. (1973). *Journal of Pediatric Ophthalmology,* **10,** 154.

Piaget, J. (1945). *La Formation du Symbole chez l'Enfant,* p. 277. Delachaux and Niestlé.

Pigassou, R., and Garipuy, J. (1963). *Archives d'Ophtalmologie et Revue Générale d'Ophtalmologie,* **23,** 575.

Pigassou, R., and Garipuy, J. (1973). *Albrecht v. Graefes Archiv für Ophthalmologie,* **186,** 209.

Pigassou, R., Aulhorn, E., and Bagolini, B. (1973). *British Orthoptic Journal,* **30,** 92.

Pigassou, R. (1973). *Bulletin des Sociétés d'Ophtalmologie de France,* **73,** 439.

Pigassou, R. (1974a). *Cahiers de l'Orthoptique,* **1,** 48.

Pigassou, R. (1974b). Congress of the Italian Association of Orthoptists, Parma, 1974. *Minerva Oftalmologica,* **17,** (1975).

Pigassou, R., Poitevin, B., and Sazy-Bureau, B. (1975). *Bulletin des Sociétés d'Ophtalmologie de France,* **75,** 631.

Weekers, R. (1962). *Archives d'Ophtalmologie et Revue Générale d'Ophtalmologie,* **22,** 5.

Wybar K. (1974). Personal communication.