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# A review of the management of 323 consecutive patients seen in a specific learning difficulties clinic

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**Summary**

Visual correlates of specific learning difficulties (SpLD) include: binocular instability, low amplitude of accommodation, and Meares–Irlen Syndrome. Meares–Irlen Syndrome describes asthenopia and perceptual distortions which are alleviated by using individually prescribed coloured filters. Data from 323 consecutive patients seen over a 15 month period in an optometric clinic specialising in SpLD are reviewed. Visual symptoms and headaches were common. 48% of patients were given a conventional optometric intervention (spectacles, orthoptic exercises) and 50% were issued with coloured filters, usually for a trial period. 40% of those who were given orthoptic exercises were later issued with coloured overlays. 32% of those who were issued with coloured overlays were ultimately prescribed Precision Tinted lenses. Approximately half the sample were telephoned more than a year after the last clinical appointment. More than 70% of those who were prescribed Precision Tints were still wearing them daily, and results for this intervention compared favourably with data for non-tinted spectacles. The data suggest that many people with SpLD need optometric care and that the optometrist needs to be skilled in orthoptic techniques and cognisant of recent research on coloured filters. 

## Introduction

The most common specific learning difficulty (SpLD) is specific reading difficulty (SRD), which is usually associated with specific spelling difficulty (Evans, 1993). Most research on SpLD concentrates on SRD and this paper is no exception. A less constrained term, *reading difficulties*, is often used to describe general difficulty with reading. The term dyslexia is usually reserved for a fairly severe degree of SRD which cannot be readily attributed to factors such as lack of educational opportunity and low IQ.

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### *Correlates of dyslexia*

There is considerable evidence that the main causes of SRD are deficits in the phonological processing skills required to translate the cortical visual representation of text into sounds during reading (Rack, 1997). There have been attempts to classify dyslexia, although it has been argued that the condition is so heterogeneous that it does not readily fall into sub-groups (Evans, 1993). Nevertheless, many researchers have suggested that there may be a small sub-group of 'visual dyslexics' who, in contrast to the larger 'auditory sub-group' with the phonological processing problems described above, have a difficulty with the high level analysis of the visual–spatial elements on the page. It should be stressed that the hypothesised visual deficit here is very different from the visual deficits that optometrists usually investigate. The problem in the visual–spatial sub-group is not thought to lie in

the perception of the visual image, but more in the high level analysis of this image. Low level visual correlates of SRD are significantly correlated with phonological deficits (Eden *et al.*, 1994).

In addition to the psychometric correlates of dyslexia, there is considerable evidence to support the existence of some optometric correlates. A recent review identified these 'low-level' clinical correlates as: a lower than average amplitude of accommodation, reduced convergent and divergent fusional reserves, and vergence instability when the eyes are dissociated (Evans, 1998). The low fusional reserves and vergence instability characterise a condition called binocular instability (Evans, 1998). These ocular motor (binocular and accommodative) deficits are not present in every case of SpLD and can be so mild that they do not require treatment. In some cases, however, they are associated with symptoms and may contribute to the reading difficulty (Cornelissen *et al.*, 1992; Rundstrom and Eperjesi, 1995). Binocular and accommodative dysfunctions can be treated by orthoptic exercises or spectacles (Evans, 1997a).

Some people with reading difficulties have symptoms of asthenopia and/or perceptual distortions without having any conventional optometric anomalies. Others with these symptoms are found to have ocular motor anomalies yet when, after treatment, the orthoptic function is normal the symptoms still persist. In many of these cases the symptoms can be alleviated by the use of individually prescribed coloured filters and these cases are described as suffering from Meares–Irlen Syndrome (Evans, 1997b). A double-masked placebo-controlled trial showed that the reduction in symptoms from the use of tinted lenses in Meares–Irlen Syndrome is not solely attributable to a placebo effect (Wilkins *et al.*, 1994). In addition to reducing symptoms, the coloured filters have a significant positive effect on reading performance (Wilkins *et al.*, 1996).

Research often concentrates on visual factors in *dyslexia*, but the visual correlates of dyslexia may also be correlates of non-specific *reading difficulties* (Eden *et al.*, 1994, 1995). Until more data on other learning difficulties are available, it may be sensible for optometrists to investigate any child with suspected academic difficulties to look for the visual correlates described above and this approach was taken in the clinic described in the present paper.

*Clinical protocol*

An initial system for prescribing tinted lenses by people who are not professionally qualified as eyecare practitioners (Irlen, 1991; Evans and Drasdo, 1991) has recently been supplemented by a new system (Wilkins, 1995) which is now widely used in the UK by optometrists in primary care practice and some hospital eye departments. Children are tested with a range of coloured overlays (Intuitive Overlays)[1] which were designed to comprehensively and systematically sample CIE 1976 UCS chromaticity (Wilkins, 1995). If children show a preference for a coloured overlay then they are issued with this and instructed to use the overlay for reading if they find it helpful. The purpose of this trial period is to minimise the dispensing of coloured glasses to children who report an improvement solely for novelty or placebo reasons.[2] Instructions that are given out with the overlay ask that, if it is still being used after at least a school term, then they should return for testing with the Intuitive Colorimeter.[3] This is an instrument which allows the very precise determination of the optimal specification for tinted lenses (Wilkins, 1995). The Intuitive Colorimeter is used in conjunction with a range of 'Precision Tints' to prescribe tinted spectacles (Wilkins, 1995). The Intuitive Colorimeter and Precision Tinted spectacles are necessary because different people need different tints and the optimal tint for a given person may need to be very specific (Wilkins *et al.*, 1994). The sequential protocol (Lightstone and Evans, 1995) for the optometric management of children with SpLD is summarised in *Figure 1*.

The procedure for adults is similar to that described above except that the testing with overlays is sometimes omitted. This is because, after testing with the Intuitive Colorimeter, adults can be expected to make a reliable subjective decision about whether the appropriate Precision Tinted trial lenses improve their symptoms.

The Institute of Optometry Specific Learning Difficulties Clinic, established in 1992, was one of the first centres where the Intuitive Colorimeter was in regular use. The aim of the present study was to evaluate the clinical protocol described above by auditing the management of patients seen in this clinic over a prolonged (15 month) period. In particular, we sought to determine the frequency of use of several interventions and other management outcomes. In cases where more than one intervention was used, we evaluated the sequence of treatments. We also investigated patients' symptoms to determine whether these could be used to predict those patients who needed an optometric intervention. Finally, we carried out a telephone survey to assess the prolonged use of interventions.

[1]Available from 100 Marketing Ltd, 0171 378 0330.
[2]Since the present study was completed an alternative method has become available for assessing the immediate effect of coloured overlays, using a new Rate of Reading Test (Wilkins *et al.*, 1996).
[3]Available from Cerium Visual Technologies, 01580 765211.

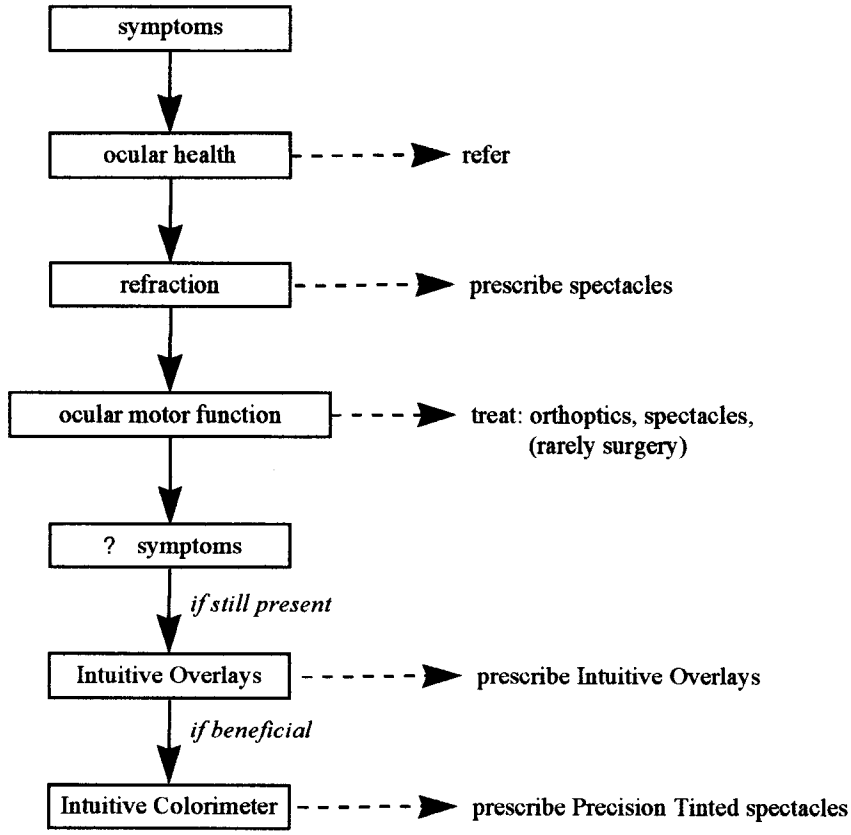


**Figure 1**. Summary of sequential clinical protocol for the optometric investigation of children with SpLD. Dashed lines show the management if a clinically significant abnormality is detected in the test described in the appropriate 'box'. With adults, the overlay test is often omitted.

## Method

*Subjects*

The records for all patients seen in the Institute of Optometry Specific Learning Difficulties clinic between 5th July 1993 and 12th October 1994 were extracted. The present study concentrated on the presenting symptoms and the management option that the clinician followed at the end of each appointment.

*Symptoms and history*

At or before the initial appointment patients and, if children, their parents were asked to complete a questionnaire which asked over 90 questions about symptoms and history. The clinician checked this questionnaire at the appointment and expanded upon certain areas as required. The data in *Table 1* were extracted from the questionnaire and entered into a database for statistical analysis.

[1]Available from 100 Marketing Ltd, 0171 378 0330.

*Management options*

The management outcome at the end of each clinical appointment was entered as one or more of ten options, which are listed in the first column of *Table 2*.

Spectacles were prescribed without a prismatic component to correct refractive errors or, occasionally, to correct a binocular vision anomaly. Spectacles with a prismatic component were prescribed for binocular vision anomalies which: were not amenable to orthoptic exercises or refractive correction, had not responded to orthoptic exercises, or where patients were unwilling to carry out orthoptic exercises at that time (Evans, 1997a).

Push up convergence exercises are the classic 'pencil-to-nose' exercises (Evans, 1997a). The jump convergence exercises involved either the use of flippers or the patient changing fixation from a detailed distance target to a detailed near target. Patients doing this exercise were given verbal and written instructions.

The Institute Free-space Stereogram (IFS)[1] exercises are a range of exercises that have been developed by

**Table 1.** Summary of questionnaire and data entered into database

| QUESTION | DATA |
|---|---|
| Gender | male/female |
| Date of birth and date of first appointment (to give age at first appointment) | years and months |
| 'Who referred you to us?': | self referral/optometrist/teacher/psychologist |
| 'Date of last visit to an optician/optometrist' | yes if has visited; or no |
| Do you wear glasses now? | yes/no |
| 'Please state whether the birth was normal, or give details of any complications (for example, was it a forceps delivery?)' | normal/forceps/Caesarean |
| Is distance vision normally clear? Does it ever blur?<br>Is near vision normally clear? Does it ever blur/jump around/go smaller or bigger/fade or disappear/get faint colours around it?<br>Do you ever experience double vision? | The number of symptoms was summed<br>Maximum score: 9 |
| 'Have you ever suffered from epilepsy, or any fits or convulsions?' | yes/no |
| 'Please think of the headaches you have had over the last month, and whether they have been getting more frequent or less frequent. Use this information to arrive at your best guess as to how many headaches you have had in the last 12 months, and write the number here' | number |
| Number of migrainous associated factors present with headaches (loss of appetite, nausea, vomiting, numbness, tingling, feeling of weakness, difficulty with speech, dizziness, photophobia, phonophobia, visual disturbances, other) | answered yes/no to each of these factors, sum of yes' was entered |
| 'Have you or anyone else ever noticed that you skip, re-read or omits words or lines?' | yes/no |
| 'Did parents or any of the other children in the family have learning problems?' | yes/no |
| 'Did parents or any of the other children in the family ever have a turning eye, patching, or eye exercises?' | yes/no |
| 'Did parents or any of the other children in the family ever have migraine headaches?' | yes/no |
| 'Are the parents or any of the other children in the family colour-blind?' | yes/no |
| 'Did any relatives ever have epilepsy?' | yes/no |

the first author (Evans, 1997a, pp. 107–108). Free-space techniques have been used in orthoptics for over 50 years and involve the fusion of two stereo-pairs by over-converging or under-converging in 'free-space' (without using a stereoscope). The IFS exercises use targets which create a stereoscopic image, which helps to motivate patients. The direction of the perceived stereopsis is checked to ensure that the exercises are being performed correctly.

The Intuitive Overlays design and testing procedure was described by Wilkins (1993). Overlays were only prescribed after any optometric (including orthoptic) anomalies had been corrected. Patients showing an inconsistent response to the overlay testing were re-tested at a later date. Patients showing a consistent and positive response were issued with an overlay of their preferred colour, as already described. Patients were only tested with the Intuitive Colorimeter if they had shown a sustained benefit from a coloured overlay, unless they were adults or were already wearing coloured lenses. Patients were only prescribed Precision Tinted lenses if they showed a consistent response when tested with the Intuitive Colorimeter and Precision Tints.

*Telephone survey*

A telephone survey was carried out to investigate compliance with and perceptions of the efficacy of the interventions. This was carried out between March and May 1996, approximately 18 months after the last clinical contact. Data were entered for all patients who could be contacted by telephone, and the analyses concentrated on those who were able to estimate how much they had used their interventions.

For each respondent, the interviewer completed one or more of four types of questionnaire sheets which referred to the use of Intuitive Overlays, Precision Tints, non-tinted spectacles, or orthoptic exercises. These sheets each had a similar design comprising closed and open questions (*Figure 2*).

## Results

*Subjects*

323 patients were seen in the clinic during the specified period, of whom 65% were male. Ages ranged from 4 years 1 month to 73 years 7 months, with a mean age of 14 years 9 months (standard deviation 10

**Table 2.** Clinical management options and the percentage of the patients receiving these at the first appointment (excluding the 10% of patients who had more than one management option). IFS: Institute Free-Space Stereograms

| Management option | % having option at first appointment |
|---|---|
| No action | 19 |
| Referred to medical practitioner | 1 |
| Spectacles with no prismatic component | 7 |
| Spectacles with prismatic component | 2 |
| Push up (pen to nose) home eye exercises | 7 |
| Jump (near to far or flipper) home eye exercises | 4 |
| IFS home eye exercises to increase convergent reserves | 11 |
| IFS home eye exercises to increase divergent reserves | 0 |
| Intuitive Overlay(s) | 36 |
| Precision Tinted lenses | 5 |

years 11 months; mode 11 years 11 months). 69% of subjects had received an unambiguous diagnosis of specific learning difficulties (including dyslexia). The referral sources are shown in *Figure 3*. During the period under survey there was some press coverage of the research on the use of coloured filters and many self-referrals originated from these reports. Teachers often refer patients informally to the SpLD clinic without a referral letter and some of these may be in the 'self-referral' category.

*Personal and family history*

88% of the patients had received a former eye examination. In a previous controlled-group study, Evans *et al.* (1994a) found that a similar proportion (80%) of children who had received a psychologist's diagnosis of dyslexia had undergone a previous eye examination, and that this percentage was significantly ($p = 0.001$) greater than that (28%) for control good readers (matched for age and IQ). 32% of the patients in the present study wore glasses. Significantly ($p = 0.01$) more of the dyslexic (41%) than the control (14%) subjects of Evans *et al.* (1994a) had a history of refractive correction.

Evans *et al.* (1995) used a questionnaire similar to the initial questionnaire in the present study to compare two groups of children, both of whom had SRD and mean IQ close to the fiftieth percentile. Evans *et al.*'s (1995) experimental group had symptoms of asthenopia and/or perceptual distortions when reading and received a benefit from using coloured overlays. The control children were asymptomatic and did not report a benefit from coloured overlays. The data from this asymptomatic group were used for comparison with the personal and family history data of the clinic children in the present study. Where appropriate, this control group's data are included in square parentheses below.

68% [c.f., 73%] of questionnaires described the birth as 'normal'; 12% were delivered using forceps; and 9% by Caesarean section. 5% [c.f., 0%] had a personal history of epilepsy, fits, or convulsions; which is also higher than the prevalence of epilepsy in the general population of 2% (Berkow, 1982).

Half [c.f., 27%] of the patients reported a family history of learning problems, 24% [c.f., 20%] a history of orthoptic anomalies, 52% [c.f., 60%] a family history of migraine, 14% [c.f., 13%] of colour vision defects and 11% [c.f., 25%] of epilepsy.

*Symptoms*

48% of the clinical population in the present study reported more than two visual symptoms (*Table 1*, rows 7–9), 19% reported more than four of these symptoms, and 4% more than six. The number of visual symptoms that were reported was not significantly correlated with age.

Previous research has found that the symptom of skipping, re-reading, or omitting words is very common (90–93%) in children who benefit from coloured filters (Evans *et al.*, 1995, 1996). In the present data, 90% of the patients reporting this symptom were prescribed some sort of optometric intervention. However, 75% of the children who did not need optometric interventions also reported this symptom. Hence, if this symptom was used for screening 10% of children who needed to see an optometrist would not be referred and 75% of those who do not need to see an optometrist would still be referred.

72% of the clinical population reported at least one headache a year, 66% more than two a year, 53% more than 6 a year, 42% more than 12, and 17% more than 52 a year. Abu-Arefeh and Russell (1994) found that 14.4% of an unselected population of schoolchildren reported more than two headaches a year which were severe enough to interfere with normal activities but were not attributable to a specific illness or trauma. Although our criteria for headache were a little different from those of Abu-Arefeh and Russell (1994), our data do suggest that the clinical

Usage: never, or hardly ever / less than once a month / about once a month / about once a week / about once a day / more than once a day

Do you the feel the glasses:

- ☐ made no difference to your problem or difficulties
- ☐ made your problem or difficulties slightly better
- ☐ made your problem or difficulties a lot better
- ☐ made your problem or difficulties worse
- ☐ caused you other problems (specify):.....

.....

Are/were any of the following problems with the glasses

- ☐ embarrassing
- ☐ too dark
- ☐ too light
- ☐ the colour is wrong
- ☐ makes it difficult for me to recognise colours
- ☐ frames uncomfortable
- ☐ I don't like the look of the frames

How long did you use them for?.....

[if worn,] Why do you use them?.....

.....

Is there anything that puts you off using them?

.....

.....

**Figure 2.** Questionnaire sheet used in telephone survey of patients last issued with Precision Tints. Similar questions were asked on the sheets used for the other interventions.

population may have had an unusually high prevalence of headaches.

The largest single group of Abu-Arefeh and Russell's (1994) sample (10.6%) was migraine. Of the subjects in the present study who reported at least one headache a year, 73% reported at least one of the associated factors suggesting migraine (*Table 1*, row 12), 45% at least three of these factors, and 25% at least five.

The subjects who were at some stage prescribed Precision Tinted lenses reported, at the initial consultation, a mean of 50 headaches a year compared with 35 headaches a year for those who did not require tinted spectacles. This difference did not reach significance ($t$-test, $p = 0.17$). Unlike Maclachlan *et al.* (1993), the prevalence of a family history of migraine was not significantly greater in the subjects who were prescribed Precision Tinted spectacles (chi-square $p = 0.3$).

### *Management*

*Management at first appointment. Table 2* summarises the management at the end of the first appointment for those subjects who had only one of the management options. Less than 10% of subjects received more than one management at the first appointment.

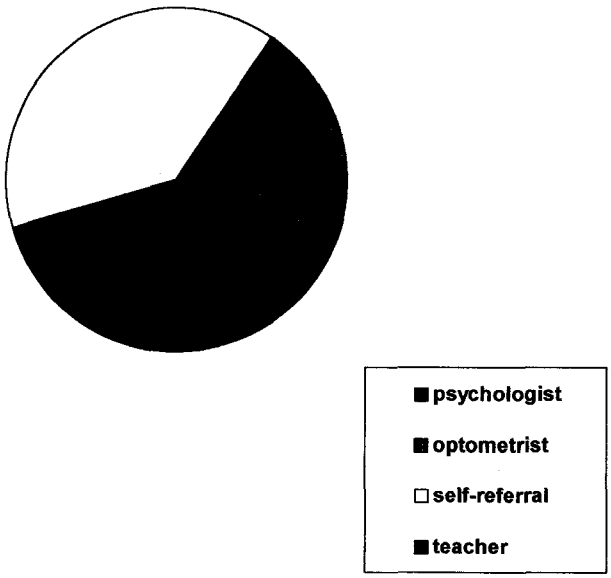


**Figure 3**. Referral sources to the clinic.

*Sequential management. Figures 4* and *5* show the sequence of management options, that is which management options were likely to follow a given previous management option. To simplify these figures, the management options have been reduced slightly by combining the prescribing of glasses with prisms and without prisms into one 'spectacles' group, and by combining all types of eye exercises into an 'orthoptic exercises' group. Patients who were discharged, returned to the care of their family optometrist, or who failed to return for follow-up visits are classified as 'Lost to follow-up' (see below).

*Overview of management. Figures 4* and *5* show that most of the patients who were lost to follow up were either discharged at the previous appointment, or were issued with an overlay. The clinical protocol outlined in the introduction stipulates that an overlay is only used after any conventional optometric anomalies have been eliminated and such patients are commonly asked to return to the Institute for a further appointment only if the overlay was helpful. Hence, the 'Lost to Follow-up' category is largely accounted for by the clinical management plan.

Combining the data for all the visits, 22% of patients were not treated, 48% had a conventional optometric intervention (glasses, orthoptic exercises), and 50% were issued with coloured filters (overlays or lenses or both). Some subjects had more than one management outcome over the 15 month period. In particular, 40% of those who were given orthoptic exercises were later issued with coloured filters.

Of those who were issued with Intuitive Overlays, 32% were ultimately prescribed Precision Tints. The clinical protocol was developed with the intention that conventional optometric treatments should, where appropriate, be prescribed before coloured filters. This goal seems to have been achieved since none of the patients who were prescribed Precision Tints subsequently required any other optometric intervention.

*Telephone survey*

Of the original 323 patients, eight telephone numbers were unobtainable, 49 could not be contacted, 58 had not been given any treatment, and three could not be included for other reasons (taken out of school, records lost, refused to return for exercises). This left 205 subjects who were interviewed, 159 of whom could provide estimates of how much they had used their interventions. The proportion of the subjects who were unable to recall how much they had used an intervention is as follows: exercises 28%, overlays 21%, precision tinted spectacles 10%, non-tinted spectacles 13%. Nearly three quarters of the subjects who could not recall their usage of an intervention had been given one of the interventions that are received early in the sequential management plan (overlays or exercises).

Data for 175 interventions were entered, since 16 of the 159 patients had received two concurrent interventions. 63 of the respondents (68 interventions) had been seen since 12th October 1994, but were still able to recall the effect of the last intervention(s) prescribed during the period under investigation.

*Exercises.* Of the 38 respondents who had been given exercises, nine (24%) had never or hardly ever done the exercises. Three (8%) had done the exercises about once a week, 26 (69%) once or more a day. When asked how long they did the exercises for, 20 (53%) did not reply, seven (18%) said for about one month, three (8%) said for between 1 and 3 months, five (13%) said between 3 and 6 months, and three (8%) for more than 6 months. Only nine patients (24%) described something that 'put them off doing the exercises', with the commonest reason (seven patients) being inconvenience. In no cases were the exercises said to be ineffective, impossible, or not understood. When asked how much difference the exercises had made to their problems, 12 (32%) did not answer; the responses of the others are illustrated in *Figure 6*.

*Overlays.* 57 of respondents had been issued with a coloured overlay and 32% of these had never or hardly ever used the overlay, 9% used it once a month to once a week, and 60% once a day or more. In answer to the question: 'How long did you use them for?', 23 (40%) did not answer, 17 (30%) said between

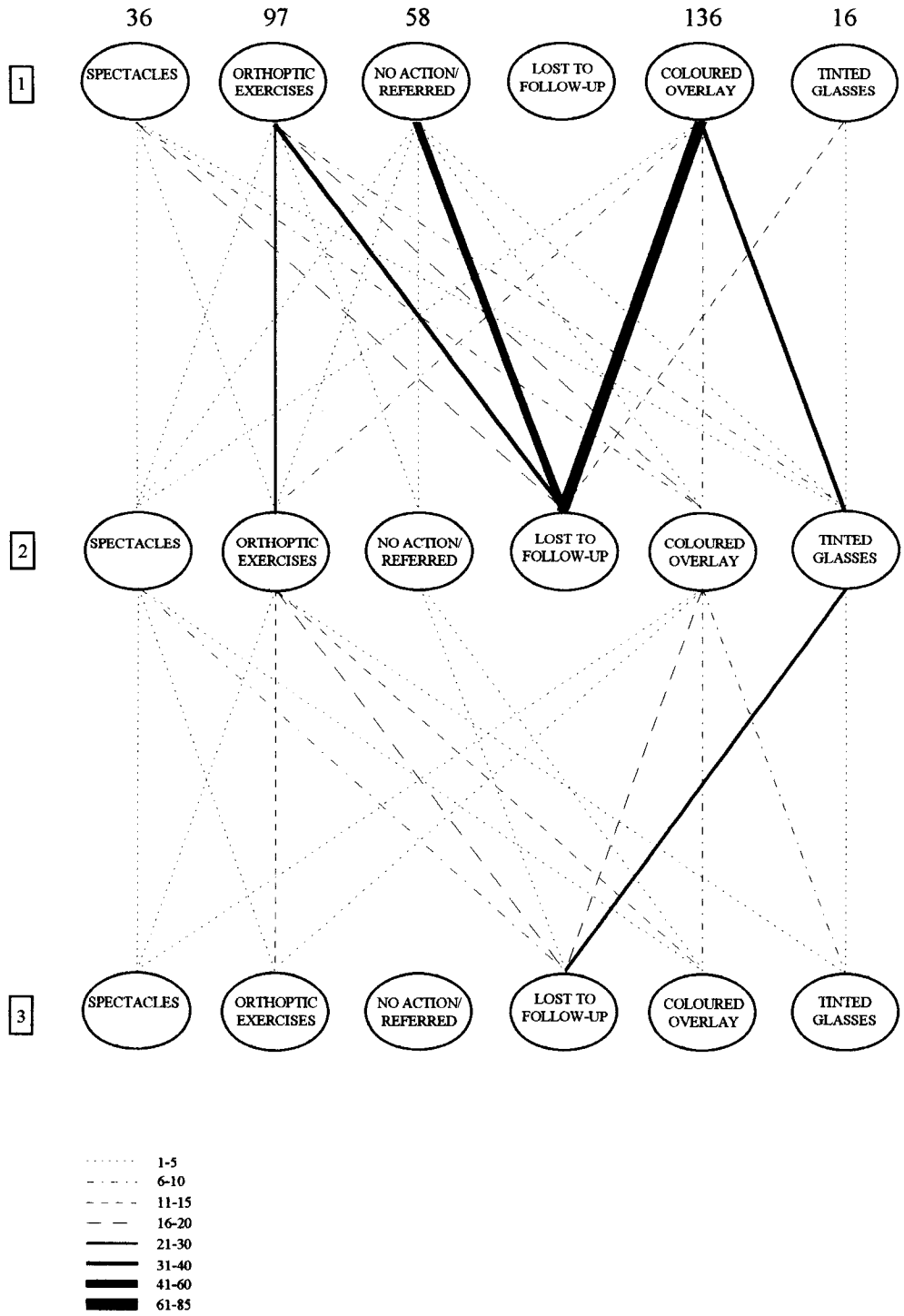


**Figure 4**. Sequential chart showing the clinical management at the end of the first three appointments. The figures at the top of the chart show the number of patients who were given each management option at the end of the first appointment; some patients were given more than one option. The dotted and solid lines represent the changes in management at the second appointment, and subsequently at the third appointment. The number of the appointment (first, second, or third) is identified by the number in the box on the left-hand side of the diagram. Different types of dotted line and thickness of solid line are used to indicate the numbers of patients, as illustrated in the key.

1 week and 2 months, 16 (28%) between 2 and 6 months, and one (2%) for 52 weeks. When asked what effect the overlay(s) had on their problem or difficulties, five (9%) did not answer and the responses of the others are illustrated in *Figure 6*. When asked if there were any problems with the overlays, the vast majority of the patients gave no answer, two said that the overlay was embarrassing, one said it was too dark, and one said it was awkward or a nuisance to use.

When asked why the overlay was used, the majority (30 patients) did not answer, four patients specifically said that it only helped initially, and nearly all of the rest said that it helped their reading. When asked if there was anything that deterred them from using their overlays, 30 (52%) did not report any deterrent, 14 (25%) said the overlay was of little or no help, seven (12%) said that it was inconvenient or that they forgot their overlays, and there were a few single cases with miscellaneous reasons.

*Precision Tinted spectacles.* 55 respondents were prescribed Precision Tinted spectacles and 82% of these had used them on a daily basis. When asked how long they were used for (*Figure 2*), of the 40 patients who answered this question, four (7%) said 1 week to 2 months, four (7%) replied 2 months to 6 months, seven (13%) said more than 6 months, and 40 (73%) were still using them. When asked how much difference the glasses had made to their problems, five (9%) did not answer and nearly 80% reported that the glasses made their problems a lot better (*Figure 6*). 15 patients (27%) ticked one of the list of possible problems with the glasses, 11 (20%) ticking the 'embarrassing' option, two (4%) the 'too strong' option, one (2%) that the strength of the glasses was wrong (this person changed to a different colour), and one (2%) that the frames were uncomfortable.

In response to the open question, 'Why do you wear them?', most (71%) patients either did not reply, just said when the Precision Tints were worn, or gave a vague statement that they helped. The responses to the open question, 'Is there anything that puts you off wearing them?' are summarised in *Table 3*.

*Non-tinted spectacles.* 25 of the respondents were prescribed non-tinted spectacles and 80% of these had used them on a daily basis. Only six patients (24%) stated that the glasses had only been used for a certain period, which ranged from 8 weeks to 24 weeks. When asked how much difference the glasses had made to their problems, two (8%) did not answer and the replies of the respondents are illustrated in *Figure 6*. Only three patients acknowledged any of a list of possible problems with the glasses, all giving the 'embarrassing' option.

Answers to the question of why the glasses were worn were generally unhelpful: most patients just repeated the prescriber's instructions of when to wear them. To the other open question, 'did anything put you off wearing them?', most subjects (15, 60%) did not reply; three (12%) said the effect wore off; three (12%) gave visual reasons; and four (16%) gave reasons that may be paraphrased as inconvenience, teasing, or cosmetic.

*Comparison of interventions.* The patients' perceptions of the efficacy of each intervention are illustrated in *Figure 6*. Coloured overlays are not strictly comparable with the other interventions since there was no validated quantitative clinical sign of Meares–Irlen Syndrome. Hence, overlays are prescribed as a trial. In contrast, refractive corrections and orthoptic exercises are prescribed in response to quantitative clinical signs. Precision tints are usually prescribed after a positive response to overlays. Orthoptic exercises were felt to be helpful, but not by as much as other interventions and this could reflect the greater demands that this intervention places on patients.

78% of the respondents wearing Precision Tints reported that these made their 'problem or difficulties a lot better', compared to 65% of respondents wearing non-tinted spectacles. Of the patients who had been prescribed Precision Tinted spectacles, 82% had used them on a daily basis. This compares well with the patients who had been prescribed conventional (non-tinted) spectacles, 80% of whom had worn them on a daily basis.

## Discussion

The clinical sample in this study had a wide range of suspected and diagnosed learning difficulties, predominantly SpLD. Patients who have consulted a specialist eyecare centre will inevitably contain a higher proportion of people with visual anomalies than would be found in a population who were not self-selected or referred. Additionally, owing to press coverage of a research project into coloured filters at the Institute, it is likely that there was an atypically high occurrence of the symptoms of Meares–Irlen Syndrome (including headaches) in our sample. Hence, the present data are likely to overestimate the prevalence of visual deficits, particularly Meares–Irlen Syndrome, in people with SpLD. A recent study of 152 school children suggested that the true prevalence of Meares–Irlen Syndrome in an unselected population could be as high as 12% (Jeanes *et al.*, 1997).

Although some optometric correlates of dyslexia (Evans, 1998) can cause blurring and diplopia, they

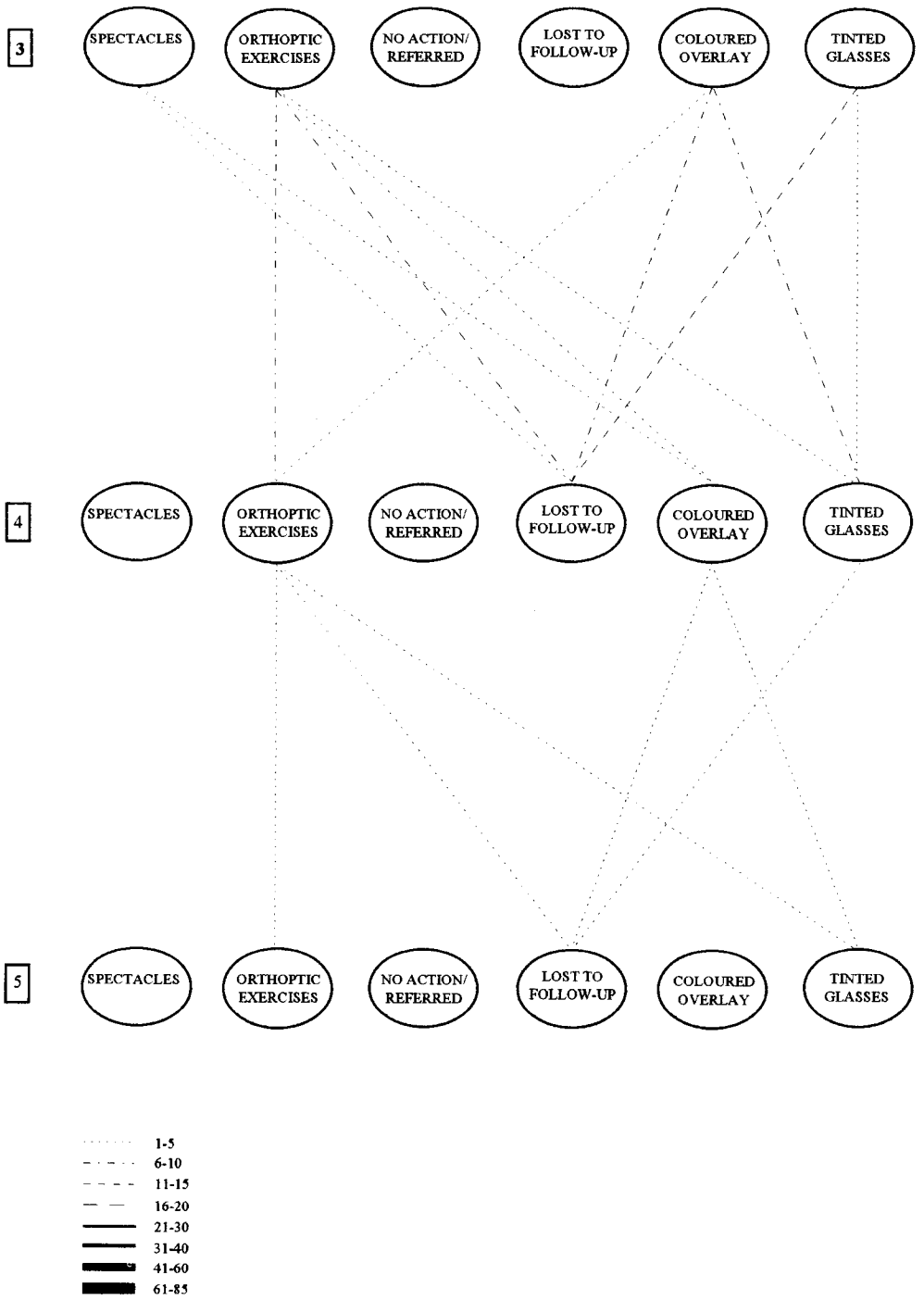


**Figure 5**. Sequential chart showing the clinical management at the end of the third, fourth, and fifth appointments. For explanation see caption to *Figure 4*.

are unlikely to be major causes of SpLD (Evans *et al.*, 1994a). Similarly, although coloured filters can alleviate symptoms and may increase reading speed (Wilkins *et al.*, 1994), they are also unlikely to 'cure' SpLD.

It does not seem, from the present data, as if any simple questioning about symptoms would clearly define the children who should be referred to optometrists (more recent work has addressed this issue in detail; Wilkins *et al.*, in preparation). Symptomatic children may be so accustomed to their symptoms that they fail to report them. It seems that, at present, the best advice is that all children with suspected SpLD should be referred for evaluation by an eyecare professional who has specialised in this field.

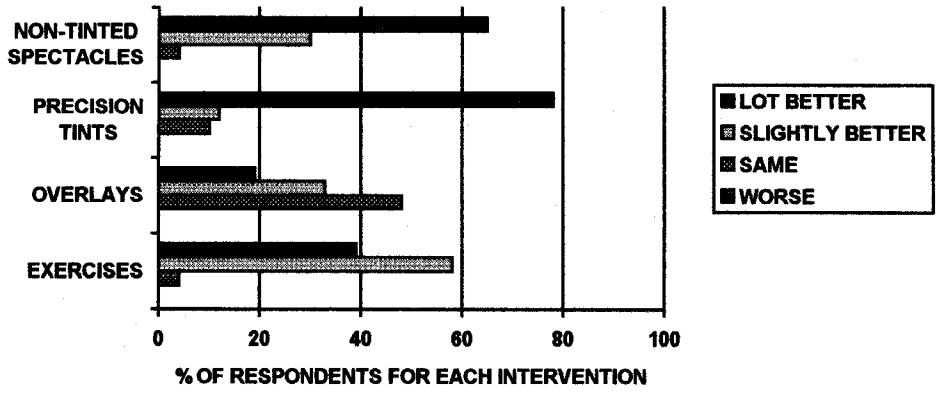


**Figure 6.** Patients' perceptions of the effect of their intervention on symptoms. None of the patients reported that any intervention made their symptoms worse.

The symptoms of ocular motor (binocular and accommodative) anomalies are very similar to those of Meares–Irlen Syndrome, and both types of condition often co-exist in SpLD (Evans *et al.*, 1996). The conservative protocol is to treat the conventional, ocular motor, factors first and to use coloured filters only if symptoms persist once the ocular motor function is within normal limits (*Figure 1*). The fact that 60% of the patients who were given orthoptic exercises were not subsequently issued with coloured filters suggests that, in many cases, symptoms can be resolved by orthoptic exercises alone (see Blaskey *et al.*, 1990). However, some 40% of patients whose ocular motor function was normalised by orthoptic exercises still had symptoms which were helped by coloured filters. In determining whether symptoms remained, the clinicians were careful not to lead patients to answer in a certain way. Patients may have been more likely than usual to report that symptoms remained because they knew that a further intervention was available. It is also possible that, in other clinics, patients tend to report that their symptoms are resolved after orthoptic exercises because they know this is what the practitioner expects, or because they do not want to be given any more exercises.

It appears that a specialist knowledge of a tinted lens therapy is not enough to help children with reading problems and visual symptoms. Neither is it enough to just be skilled in orthoptic techniques. Eyecare practitioners who examine people with reading difficulties need to be skilled in orthoptics and coloured filter treatment. We believe that the data in this paper provide support for the sequential clinical protocol outlined in *Figure 1*.

The purpose of using coloured overlays for a trial period before coloured lenses are considered is to reduce the number of children who are prescribed coloured glasses for a novelty or placebo effect. The finding that only a third of those who are prescribed Intuitive Overlays go on to be prescribed Precision Tints justifies this conservative approach. In an alternative approach, a new rate of Rate of Reading Test has been shown to identify those who are likely to show a sustained benefit from coloured overlays (Wilkins *et al.*, 1996). This new test can be a useful tool to help determine whether or not to prescribe Precision Tints.

Data from a telephone survey 18 months after treatment will inevitably be imperfect. In particular, 22% of patients contacted were unable to recall how much

**Table 3.** Comments of users of Precision Tinted spectacles

| 'Is there anything that puts you off wearing them?' | Number of respondents |
|---|---|
| No answer | 31 |
| Teased/peer pressure/avoids wearing at school | 10 |
| No | 4 |
| Did not help | 4 |
| Effect wore off after a while (1 of these changed colour) | 2 |
| Blurred distance vision | 1 |
| Inconvenient/spectacles broke | 1 |
| Eyes hurt | 1 |
| Tint too dark | 1 |

they had used their intervention. Most of these patients had been prescribed the interventions that are given earliest in the sequential management plan, suggesting that a major reason for their poor recollection may just be time.

One and a half years after patients were prescribed their interventions, 73% of those who were prescribed Precision Tinted spectacles were still using them on a daily basis. In the open trial of Precision Tints by Maclachlan *et al.* (1993) a similar figure of 81% was obtained. Patients' perceptions of the benefit they received from their Precision Tints compared very favourably with other interventions, with nearly 80% reporting that the tints made their problems or difficulties a lot better. Although reading performance was not directly measured in the present study, recent research has supported an improvement in rate of reading associated with the use of individually prescribed coloured filters (Wilkins *et al.*, 1996).

Meares–Irlen Syndrome is not always a stable condition and the prescription for Precision Tints can change (Wright, 1994). Since the period during which the data in this study were collected, it has become usual clinical practice to re-check Intuitive Colorimetry on patients at least once a year. This has probably increased the success rate of the Precision Tints still further.

Nearly 20% of those who were prescribed Precision Tints described problems with peer pressure or teasing at school. The recent introduction of Precision Tinted Contact Lenses may help with this worrying issue, although clearly they should only be prescribed when clinically appropriate.

4–10% of children suffer from dyslexia (Yule, 1988), and coloured filters might also have therapeutic uses for other populations (Wilkins, 1995). Eyecare practitioners should be an important part of the multi-disciplinary team that is required to manage cases of SpLD. Meeting the needs of this population of patients represents an exciting challenge for optometry.

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