TREATMENT OF CONVERGENCE INSUFFICIENCY IN AUSTRALIA

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Abstract

Data on 190 cases of convergence insufficiency who received treatment from a variety of orthoptists during 1984 and 1985 is analysed. Results show that patients are typically young adults, have no refractive error and complete treatment in approximately eight weeks, requiring about three office visits. Significant improvements are found in measures of convergence, accommodation, near deviation, and fusional convergence. No significant change is found in the distance deviation or fusional divergence.
Key words: Convergence insufficiency, orthoptic treatment.

Convergence insufficiency is probably one of the major conditions for which orthoptic treatment is given in Australia. It is considered[1-3] as a relatively simple and efficient method of overcoming asthenopic symptoms for near, yet little data is available on it's effectivity, or on other factors such as the types of patients treated, the most common forms of treatment given, or the usual length of a course of treatment, in Australia. Without such information, justification of public or private spending for orthoptic services cannot be made and standards are not available against which one can measure individual patient characteristics.

In an attempt to overcome these perceived shortcomings, the Scientific Committee of the Orthoptic Association of Australia initiated an Australia wide survey to establish data on some of these issues. Members were requested to record information pre and post treatment on patients referred for convergence training. Patients were excluded from the study if they were on medication, had an history of head trauma or systemic disease, had a manifest ocular deviation or a distance heterophoria of greater than -10Δ, $+6\Delta$ or 2Δ of hyperphoria. Visual acuity had to be at least 6/9 in each eye. Information was recorded on the following issues:

1. *Patient Characteristics:*
   Age, refractive error, symptoms.

2. *Treatment:*
   What was the main reason for treatment, how long did it last, how many office visits were required, what forms of treatment were given?

3. *Effect of Treatment:*
   Change in symptoms, near and distance heterophoria, convergence near point, accommodation, fusion reserves, stereoacuity.

To gain the maximum amount of information, respondents were encouraged to return information whether or not all the variables were recorded.
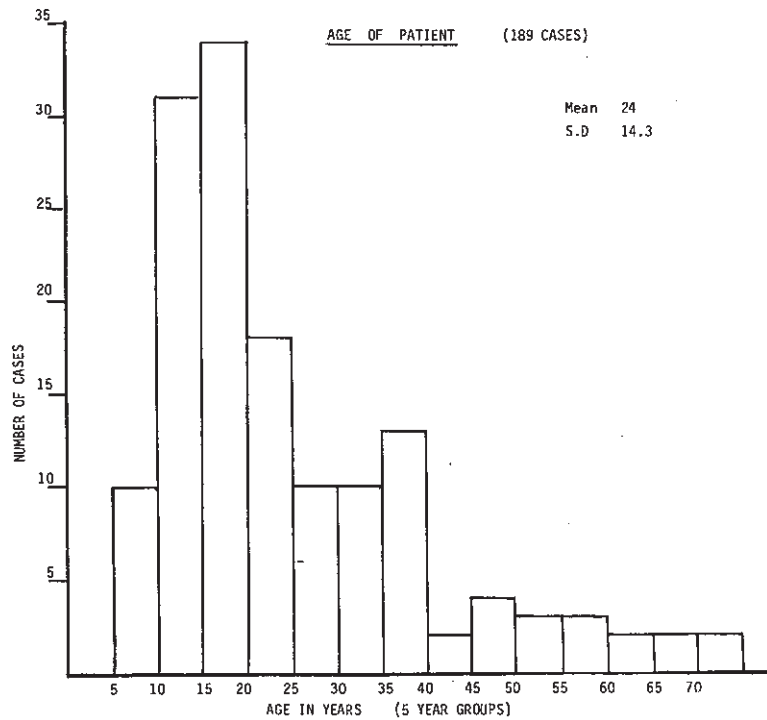
Figure 1

RESULTS

Data on 203 patients were returned, of which 190 fulfilled the required criteria. However, information from all 190 cases was not necessarily available on each specific issue studied.

PATIENT CHARACTERISTICS

1. *Age* (See Figure 1)

It can be seen that the patients are predominantly young adults, most commonly between the ages of 15-25 years. Nevertheless, older patients are still treated. It is interesting to note that the least common age group is between 40-45 years, when near symptoms would most likely be treated by reading glasses.

2. *Refractive Error*

Of 151 cases, most (93 or 61.5%) were emmetropic; 19 (12.5%) were hypermetropic, 16 (11%) were myopic and 12 (8%) were presbyopic. The remaining 7% had varying types of astigmatism.

3. *Symptoms*

The most common recorded symptom (in 114 cases) was asthenopia — that convenient name for a mixture of symptoms related to general ocular discomfort. 94 complained specifically of blurred vision, 89 of headaches, 28 of diplopia and 19 of other symptoms (many patients had more than one symptom). Only six were said to be asymptomatic, of these five were aged 14 or younger, probably reflecting the perception that it is worthwhile to treat convergence defects in children to prevent future symptoms.

4. *Reasons for Treatment*

188 responses were available for this question. Treatment was given based on symptoms alone in 46% (87), on clinical signs alone in 6% (11 cases) and for both reasons in 48% (90 cases). Therefore, in 83.5% (157) the patient's symptoms were significant in the decision to carry out treatment.
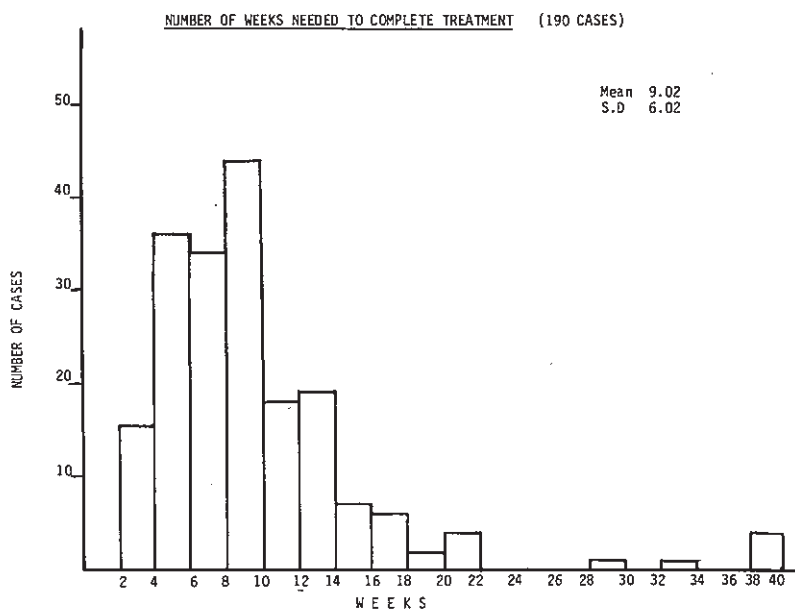
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NUMBER OF WEEKS NEEDED TO COMPLETE TREATMENT   (190 CASES)

Mean 9.02
S.D   6.02

Figure 2

TREATMENT

1. *Length of Treatment and Visits Required* (See Figures 2 and 3)

The treatment period itself was relatively short, most commonly 8-10 weeks, with usually only 2-3 visits required. At the most (two cases only), eight visits were required.

2. *Specific Exercises*

Of course, for each patient, several forms of treatment may have been given. Information was available on all 190 cases. The most common exercise given was simple convergence (140 cases) followed by training on stereogram cards (125 cases). Training in voluntary convergence, development of fusional reserves (using prisms or the synoptophore), physiological diplopia and relaxation exercises were given to between 75 and 85 cases. Anti-suppression treatment was given to only 23 cases. "Other" treatment (in some cases named as "Union Jack" and "red work"), was given to 40 cases.

EFFECTS OF TREATMENT

1. *Symptoms*

Information was available on 65 cases, of whom 97 (63%) were recorded as being asymptomatic after treatment. Of the remaining two, one still had headaches, the other ocular discomfort. It was disappointing that more respondents did not answer this question, due probably to the design of the form which may have appeared to relate symptoms only to the main reason for treatment. (A lesson for next time!). However, of the responses available, the results are certainly good.

2. *Deviation Size* (See Table 1)

The distance deviation did not change significantly with treatment, however, in 92 cases there was a significant change in the size of the near deviation of the whole group with 41 (38%) showing a reduction in exophoria, at times much as 12Δ (see Figure 4). It is worth considering the reasons for this change. Tradi-
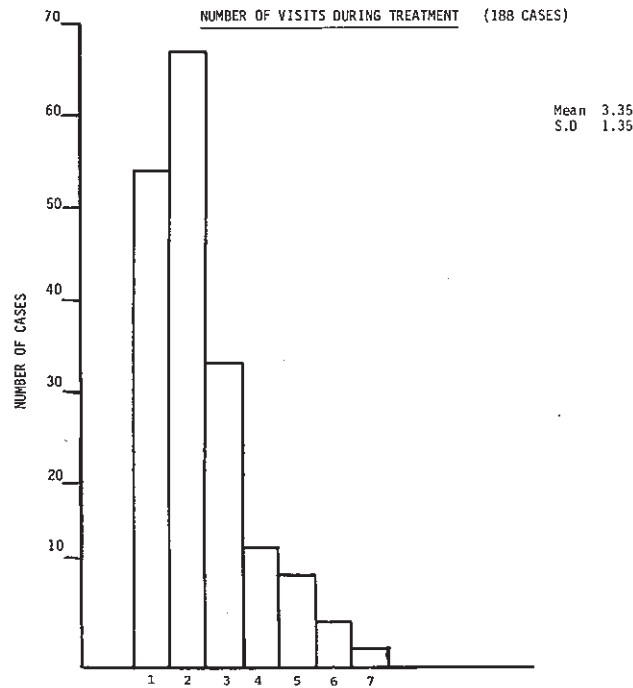
NUMBER OF VISITS DURING TREATMENT   (188 CASES)

Mean 3.35
S.D   1.35

Figure 3

tionally, convergence treatment is said to develop fusional control over a near exophoria.[2,4] However, this should not, of course, affect the size of this exophoria. Therefore, it is likely that other factors such as proximal convergence[5] or accommodation (leading to improved accommodative convergence) have also been affected by this treatment. Some criticisms[6] have been made of the logic in developing the near point of convergence in the treatment of convergence insufficiency. However, it is quite likely that this exercise would stimulate both accommodation and proximal convergence and could thus explain the above reduction in the near deviation.

3. *Convergence Near Point*
   (CNP, as measured on the RAF rule).
   The improvement in the CNP in virtually all cases can be clearly seen in Figure 5. Before treatment, the mean value was 15.5 cm (S.D. 17.4 cm) and after treatment 6 cm (S.D. 7.6 cm). This was found on the t test to be significant at the .001 level. The possible reasons for the effectivity of this form of treatment have already been discussed.

4. *Accommodation*
   Because of the normal variations in the range of accommodation which occur with age, respondents were asked to record whether the near point of accommodation was normal or

TABLE 1
Change in Deviation Size with Treatment

Distance	No. of Cases	Deviation (Δ) Before Treatment	Deviation (Δ) After Treatment	Significance ('t' test)
33 cms	92	−4.8 (S.D. 4.9)	−3 (S.D. 3.4)	P < .001 (Highly Significant)
6 m	87	−0.8 (S.D. 2.5)	−0.7 (S.D. 3)	(Not Significant)

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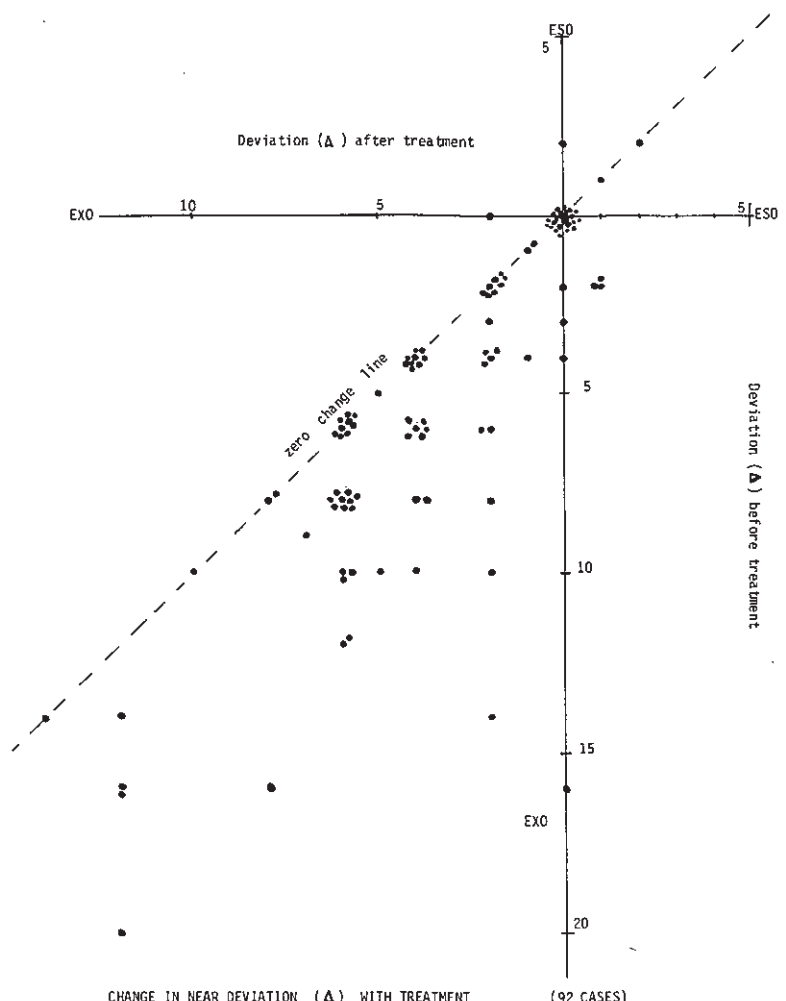Figure 4

CHANGE IN NEAR DEVIATION (Δ) WITH TREATMENT   (92 CASES)

abnormal for the patient's age, allowing for any uncorrected refractive error. Of 109 cases, accommodation was recorded as normal before and after treatment in 45% (49 cases) and abnormal, remaining so, in 2.7% (3 cases). However, for the remaining 52.3% (57 cases) accommodation was reduced before treatment and improved to normal with treatment. It is unlikely that these were cases of true accommodation insufficiency as described by Hitch,[7] but were probably secondary to reduced convergence.

Nevertheless, improvement in accommodation doubtless leads to improved accommodative convergence and, as discussed, may well have contributed to the reduced exophoria for near shown in Figure 3.

5. *Fusion Amplitudes* (See Table 2)

Whether fusional amplitudes were evaluated using prisms or the synoptophore, it can be seen that, whereas there was no significant change to divergence, there was a highly significant improvement in convergence amplitudes. The apparently better ranges achieved at the synoptophore were no doubt due to the fact that the prism bar "runs out" at 40Δ, and most orthoptists accepted this as
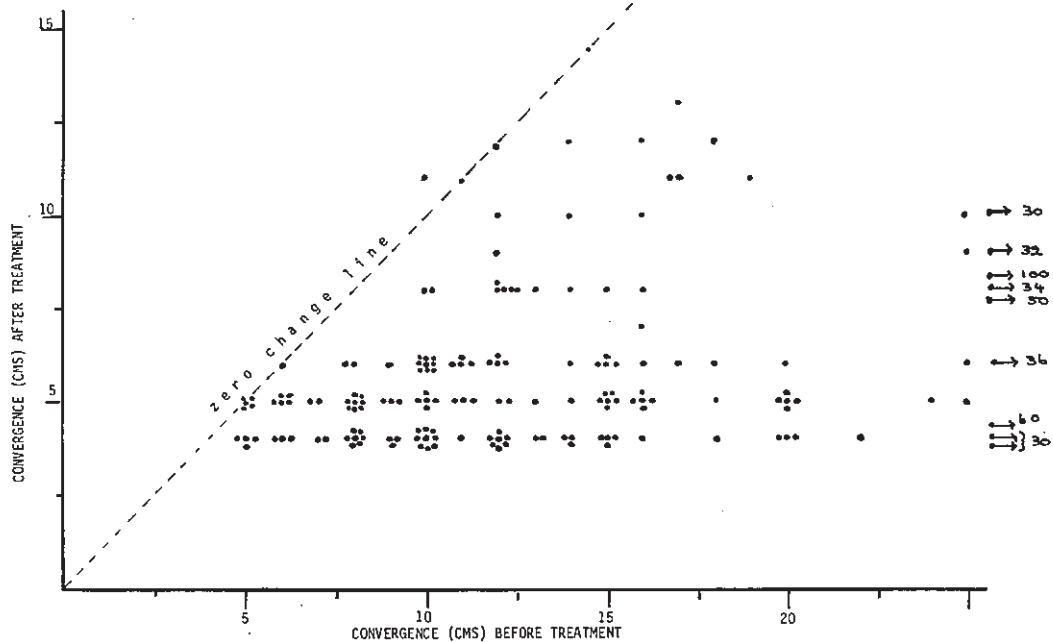
Figure 5

satisfactory. The synoptophore, of course, does not have this limitation.

6. *Stereoacuity*

Stereoacuity, was measured before and after treatment in 82 cases. Of these, 65% (53) showed no change in acuity which was usually high (40'') before and after treatment. However, 35% (29) did show improvement,

9 by 10'', 10 by 30''-60'' and the remaining 10 by 100'' or better. The mean value before treatment was 83.5'' (SD 109.5'') and after treatment 53.6'' (SD 46.6''), an improvement significant on the t test at the 0.01 level.

As all of these cases had good distance visual acuity before and after treatment this improvement could be attributable to either

TABLE 2
Change in Fusional Amplitudes with Treatment

	Range Before Treatment (Δ)	Range After Treatment (Δ)	Significance ('t' test)
Fusional Convergence			
1. Measured with prisms at 6 m (59 cases)	12.8 (S.D. 8.3)	27.3 (S.D. 11)	P < .001 (Highly Significant)
2. Measured at the synoptophore (92 cases)	15.3 (S.D. 10.4)	36.9 (S.D. 14.4)	P < .001 (Highly Significant)
Fusional Divergence			
1. Measured with prisms at 6 m (59 cases)	3.9 (S.D. 1.3)	4.1 (S.D. 1.2)	Not Significant
2. Measured at the synoptophore (92 cases)	4.5 (S.D. 1.9)	4.4 (S.D. 1.7)	Not Significant

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improved accommodation, or more precise alignment of the visual axes. This is an area which warrants further research.

SUMMARY
It is readily acknowledged that this study is by no means a comprehensive assessment of all variables influencing convergence insufficiency treatment or its results. It is also possible that some examiner bias may unintentionally have influenced some of the data. Certainly, the ability to converge to within a few centimetres from the eyes is not a function that is required in normal situations, yet it has been shown that improving this function is accompanied, in many cases, by a reduction in the near deviation, improved accommodation and improved fusional reserves, all of which are required for comfortable reading. Most importantly, such treatment can be carried out efficiently, usually only requiring a few visits spaced 2-3 weeks apart. Since most patients are young adults, either students or in their early working life, ocular comfort for near is of obvious importance.

This study can be considered as a preliminary one only, as it has raised several areas where further evaluation is warranted. These include as a more detailed study of the effect of convergence treatment in accommodation, the relationship between measures of improvement and issues such as age, refractive error and amount of near exophoria. However, this type of evaluation of orthoptic treatment is overdue, and hopefully has provided incentive for similar future studies.

References
1. Hugonnier R and Clayette-Hugonnier S. Strabismus heterophoria, ocular motor paralysis. Clinical ocular muscle inbalance. Saint Louis: C.V. Mosby, 1969: 514.
2. Burian HM, and von Noorden, GK. Binocular Vision and Ocular Motility. Theory and Management of Strabismus, 2nd ed. Saint Louis: C.V. Mosby, 1980: 407.
3. Frauenfelder FT and Roy FH. Current Ocular Therapy. Philadelphia: W.B. Saunders Co., 1980: 398-391.
4. Raab EL. In: Scott WE, D'Agostino DD and Lennarsan LW (eds) Orthoptics and Ocular Examination Techniques. Baltimore: Williams and Wilkins Company, 1983: 272.
5. Cornell E. The Influence of Orthoptic Treatment on Proximal Convergence. Aust Orthopt J 1979-80; 17: 30-32.
6. Pittar G. V.D.U.s and Bank Clerks. (Letter) Med J Aust 1984; 140: 248.
7. Hitch A. Persisted Systemic Failure of Accommodation in Young Adults. Aust J Ophthalmol 1979; 1: 65-69.