

## ANALYSIS OF THE AC/A RATIO IN A SAMPLE OF INTERMITTENT EXOTROPE OF DIVERGENCE EXCESS TYPE

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### Abstract

Previous authors have suggested that many of the patients diagnosed as intermittent exotropes of divergence excess are, in fact, simulated forms of this condition, ie., that some of these patients control an equally large near deviation by excessive accommodative convergence and possess a high AC/A ratio. In order to investigate the type of AC/A ratio present amongst a sample of seventeen intermittent exotropes of divergence excess type the AC/A was calculated by the gradient method at 1/3m using +3.00 DS lenses. An equivalent normal sample was also investigated. When comparing the two groups the intermittent exotropic sample had a significantly greater proportion of high AC/A subjects. Disclosure of a high AC/A ratio is valuable when considering orthoptic and surgical management of the intermittent exotrope of divergence excess.

**Key words:** AC/A ratio, intermittent exotropia of divergence excess type.

Intermittent squints generally are an example of a dichotomy in the laws of strabismus, by presenting as a controlled heterophoria and a manifest deviation under different circumstances. The nature of an 'intermittent' deviation provides excellent potential to achieve good control of the manifest component and a high standard of binocular vision.

Windsor<sup>1</sup> suggests that intermittent exotropes of divergence excess are rare. These patients are believed to have a basic mechanical or anatomical abnormality which creates a significantly greater divergent deviation in the distance. Recent research implicates the existence of an active divergence centre, Tamler and Jampolsky<sup>2</sup> and Seaber,<sup>3</sup> proposed an innervational aetiology for divergence excess.

Many of the patients who present clinically with heterophoria at near fixation and a manifest squint in the distance are said to be a simulated form of divergence excess. Duke-Elder<sup>4</sup> states

simulated or pseudo-divergence excess intermittent exotropes control an equally large near deviation by means of excessive fusional or accommodative convergence.

Burian<sup>5</sup> has outlined an investigative procedure which reveals this larger near angle when the influences of accommodation and fusion are suspended. The method involves preventing fusion by a period of diagnostic occlusion. The influence of accommodation may be eliminated by the use of +3.00 DS lenses at 1/3m.

Burian classified those patients whose near deviation increased to equal, or exceed the distance angle as simulated forms of divergence excess. Those patients whose near deviation could not be significantly altered by either procedure were considered to be examples of true divergence excess.

Various clinical studies adopting Burian's criteria,<sup>6,7,8</sup> support the theory that the majority

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TABLE 1  
AC/A Scores in each Group

	AC/A Ratio (to nearest whole number)								
	9	8	7	6	5	4	3	2	1
Divergence Excess group	1	4	1	2	1	—	4	4	—
Normal group	—	—	—	—	2	9	1	5	—

of intermittent exotropes are simulated forms of divergence excess. Windsor<sup>1</sup>, indicates that failure to expose simulated forms of divergence excess will result in inappropriate surgical correction, reduced potential to achieve and maintain an adequate standard of binocular vision, and increase the necessity for additional surgery.

Duke-Elder<sup>4</sup> and Brown<sup>9</sup> propose that patients whose near deviation increases significantly under the influence of +3.00 DS lenses possess a high AC/A ratio. This study was designed to investigate the type of AC/A ratio amongst a sample of intermittent exotropes of divergence excess type.

#### METHOD

A sample of seventeen intermittent exotropes of divergence excess type were selected from a variety of clinical encounters. The subjects were required to have a distance deviation measured by prism bar cover test 15 diopters greater than the angle at near fixation and have no significant refractive error. Windsor<sup>1</sup> stipulates that the accommodative convergence induced by uncorrected hypermetropia will reduce the maximal divergent deviation measurable in exotropes. In order to maintain accommodative consistency the same detailed target was used when the near deviation was calculated, and then recalculated with +3.00 DS lenses in place. Calculation of the AC/A ratio at a fixation distance of 33 cm was chosen principally because the subjects selected for this study displayed greater abilities to relax accommodation at near fixation. Difficulties were encountered when these patients tried to clear an accommodative target at 6 m through -3.00 DS lenses, possibly due to cognitive ability, unfamiliarity with accom-

modating in the distance and the sensory adaptations present. Since the near deviation was measured with and without +3.00 DS lenses by the same examiner, using the same accommodative target, the influence of proximal and accommodative convergence were considered standardized. The AC/A was calculated by the gradient method. In order to validate this method an orthoptically screened sample of seventeen normal subjects were also investigated.

#### RESULTS

The AC/A ratio is considered normal by Lyle and Wybar<sup>10</sup> when its value falls between 3 and 5. The AC/A ratio mean of the normal sample was 3.72 with a standard deviation 0.96. The individual scores for the normal sample are presented in Table 1, where it can be seen that 58.8% of the sample were found to possess an AC/A ratio within normal limits, 29.4% had a low AC/A, while 11.8% had a high AC/A.

The divergence excess group had a higher average AC/A ratio of 5.21 with a standard deviation of 2.6. It is evident that a greater proportion of intermittent exotropes possess a high AC/A ratio with 47.1% of the sample displaying an AC/A ratio greater than 5. Only 29.4% of this group have an AC/A ratio within Lyle and Wybar's normal range, 'considerably less than the control group. Subjects with an AC/A ratio less than 3 account for 23.5% of the divergence excess sample, a figure quite comparable with the control group.

Using the "t" test to compare the two groups, a significant "t", ( $t = 3.26$   $P < 0.05$ ) was obtained. It may be concluded that a significant difference exists between the two groups.

The two groups are represented graphically in Fig. 1, where the divergence excess sample is seen to deviate markedly from the normal curve shown by the control group.

#### DISCUSSION

It would appear from the results of the study that a high AC/A ratio occurs more frequently amongst intermittent exotropes of divergence excess than amongst normal subjects. These results would support those who propose that

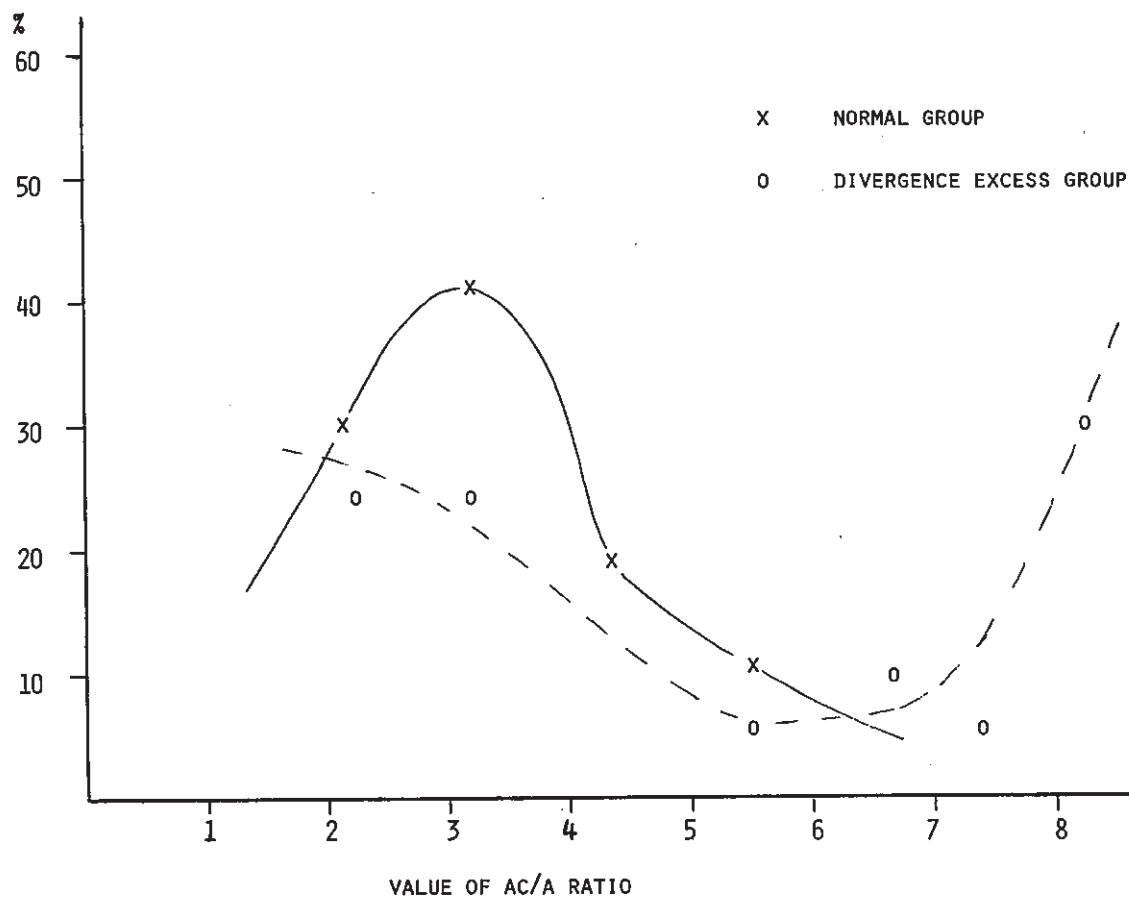


Figure 1: Distribution of AC/A values for each group.

some intermittent exotropes of divergence excess control a large near angle with accommodative convergence.

It is obvious, however, that not all intermittent squints of this type have a high AC/A ratio, and therefore achieve control at near fixation by other means. It is likely that fusional convergence must be another controlling factor, but discussion of this would require further research.

The existence of a low AC/A ratio is not necessarily inconsistent with an intermittent exotropia of divergence excess as often a reasonably large exophoria may be noticed in these cases when cover testing at  $\frac{1}{3}$  m. It is likely that this angle is controlled by strong fusional and proximal convergence mechanisms.

Knowledge of a high AC/A ratio is valuable when considering orthoptic management by minus overcorrection in intermittent exotropia of divergence excess. Accurate assessment of the AC/A may aid in the selection of suitable candidates for minus lenses, ensuring that those patients who cannot possibly benefit from this type of treatment are managed surgically and not subjected to an unproductive treatment period, where vision may be blurred and sensory adaptations reinforced, before eventual surgery is performed.

The AC/A is also an important consideration when surgery is contemplated. Failure to expose the masked near deviation may result in inadequate surgical correction, reducing the functional

result and increasing the possibility of post surgical redvergence, particularly with the onset of presbyopia when accommodative convergence is no longer functioning to maintain binocularity. Often the usual bilateral lateral rectus recession is insufficient for the intermittent exotropes of divergence excess with a high AC/A and a recess-resect procedure is indicated.

Despite the importance of the accommodative-convergence mechanism in many forms of strabismus, the AC/A ratio remains a useful piece of clinical information seldom obtained. Clearly a high AC/A ratio has a great significance with regard to aetiology and management of some intermittent exotropes of divergence excess.

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