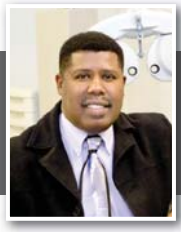
CLINICAL SIGNIFICANCE OF THE AC/A RATIO



It is not uncommon to find the busy practitioner and student overwhelmed by research publications. *Vision*, in each edition will present summaries of certain clinical research topics highlighting some of the most salient points. This will aid clinicians and students to keep in touch with the latest developments in eye care and related fields.

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INTRODUCTION

The accommodation convergence to accommodation ratio, commonly known as AC/A ratio is the measurement of the convergence induced by accommodation per dioptre of accommodation. The purpose of obtaining this value is to determine the change in accommodative convergence that occurs when the patient accommodates or relaxes a given amount. AC/A ratio is an important tool in clinical decision making.

WHY DO WE NEED THE OBTAIN AC/A RATIO?

Accommodation and convergence have a synkinetic relationship which enables clear, stable, single, binocular vision across a range of viewing distances. When accommodation (A) is exerted, our eyes are induced to converge, which is known as accommodative convergence (AC). The ratio of accommodative convergence to accommodation (AC/A) is a measure of how much accommodative converge is induced by one dioptre of accommodation. This is an important measurement in the diagnosis and management of binocular vision anomalies where the AC/A may be abnormally high or low. The AC/A ratio generally remains almost constant throughout life until the onset of presbyopia. Distance heterophoria is dependent on tonic vergence and near heterophoria is dependent on the AC/A ratio. The normal AC/A ratio is between 3 to 5 $^{\Delta}$/D. A low AC/A ratio may be indicative of a convergence insufficiency problem. A high AC/A ratio may be indicative of a convergence excess problem or latent hyperopia. The AC/A ratio can be useful when determining the lens power for the optical correction of convergence problems.

There are two ways to determine the AC/A ratio, namely, calculated and gradient method.

CALCULATED METHOD

$AC/A = IPD_{(cm)} + N_{(m)}(D' - D)$ where,
IPD = interpupillary distance in cm
N = near fixation distance in metres
D' = near phoria (eso is plus and exo is minus)
D = far phoria (eso is plus and exo is minus)

Case No 1: A 12-year-old female who has a pd of 57mm has 3Δ of exophoria at 6m and 8Δ esophoria at near.

$$AC/A = IPD_{(cm)} + N_{(m)}(D' - D)$$
$$= 5.7 + 0.4(8 - (-3))$$
$$= 10.1$$

Case No 2: A patient TW who has a pd of 61mm, has 2Δ of exophoria at distance and 11Δ exophoria at 40cm.

$$AC/A = IPD_{(cm)} + N_{(m)}(D' - D)$$
$$= 6.1 + 0.4(-11 - (-2))$$
$$= 2.5$$

The problem with the calculation method is that you have to be a mathematically-savvy optometrist, otherwise you can incorrectly substitute or omit values and hence draw incorrect inferences. Another problem with the calculation method is that the phoria values are generally obtained from the cover test, which requires great skill in measuring the magnitude of the heterophoria. I use the cover test at the beginning of my examination while patient is using his habitual prescription or unaided if the patient does not wear glasses. The cover test allows me to assess the quality of the patient's fusion movements quite early on in my examination routine. The cover test also helps me to distinguish between a phoria and a tropia and that early stage of my routine I do not consider the AC/A ratio. I determine the AC/A ratio after my subjective refraction is complete and my final Rx has been decided. I use the gradient method to determine my AC/A ratio and utilise the heterophoria values using the Maddox Rod technique. These will be explained further.

GRADIENT METHOD

The gradient method of determining the AC/A ratio is where the phoria is measured a second time using either a -1 or +1 lens. It is the change in the additional minus or plus that is the gradient AC/A ratio. I have made my own phoria test which costs R60. It is a Maddox rod dissociated phoria test. Using Prentice equation, p = cF, where p = prism dioptre, c = displacement in cm and F = focal length in dioptres. I have made one side of the card for distance phoria measurement and the other for near. I hold the Maddox rod card and shine a transilluminator light through the central hole of the card. I prefer the transilluminator since it has a coaxial light source which maintains a straight line of light for a long distance. The patient wears the final prescription while holding the Maddox rod over the right eye. For measuring horizontal phoria, the grooves of the Maddox rod are oriented horizontally and for measuring vertical phoria, the grooves of the Maddox rod are oriented vertically. The patient will see a vertical streak when measuring horizontal phoria and a horizontal streak when measuring vertical phoria. The patient is instructed to keep the scale clear and report the location of the streak on the scale. The patient has to inform you the location of the streak relative to the light: left, right or centre for horizontal phoria and up, down or centre for vertical phoria. For horizontal phoria, if the streak is through the light, the patient has no deviation(orthophoria). If the streak is to the right of the light, the patient has esophoria. If the streak is to the left of the light, the patient has an exophoria. For the right eye, the patient will see a streak vertical, while the left eye will see the central round light. phoria, the Maddox rod is oriented vertically. If the patient reports that the streak is above the light, the patient has a left hyperphoria. If the streak is below the left, the patient has a right hyperphoria. To determine the magnitude of the phoria, the patient has to tell you the corresponding number through which the streak passes.

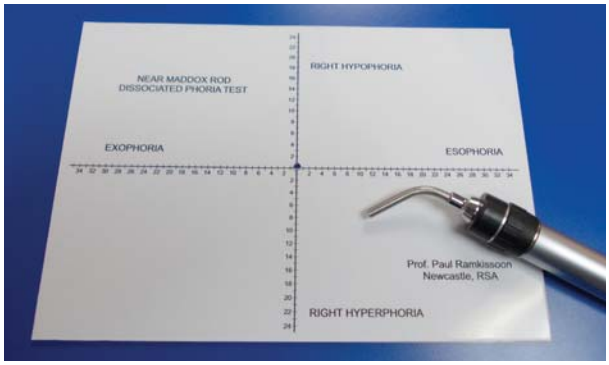

Figure 1. Maddox rod disotiatec card and transilluminator. The front side is for near dissociated phoria measurement and the reverse for distance phoria measurement.