THE RELATIONSHIP BETWEEN ANGLES OF EYE DEVIATION WITH THOSE OF FACE TURN IN DUANE'S RETRACTION SYNDROME TYPE I

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Abstract- Duane's retraction syndrome (DRS) type I is often associated with esotropia (ET) and face turn in those with fusion. This study was designed to delineate the quantitative relationship between the angles of eye deviation with that of face turn. Ten patients with DRS type I with ET and face turn toward the deviated eye, who had central fixation, were chosen. Esodeviation was measured by alternate prism-cover test, and the angle of face turn was measured by an orthopedic protractor in degree and then converted to prism diopter. The subtraction of eye deviation from face turn showed 2.4 prism diopters of face turn underestimation in comparison with esodevition, which is so small that deviations of eye and face may be considered virtually equal.

Acta Medica Iranica, 42(3): 205-208; 2004

Key words: Duane's retraction syndrome, esodeviation, face turn

INTRODUCTION

In the late 19th century, several papers were published that drew the ophthalmologists' attention to a syndrome consisting of marked limitation or absence of abduction, restriction of adduction, retraction of globe and narrowing of the palpebral fissure on adduction. These manifestations were frequently associated with depression or elevation of the globe in adduction (up-shoot and down-shoot). Globe retraction in a patient with severe limitation of ocular motility was described by Heuck (1) for the first time. Thereafter Turk (2) and Stilling (3) provided detailed descriptions of this syndrome but in 1905 Alexander Duane introduced 54 cases and fully described the different aspects of this syndrome which was named Duane's retraction syndrome (DRS) after him (4). This syndrome is relatively frequent in strabismus clinics, comprising 2% of strabismus clinic patients (5,6), a little more common in females and also more common in the left eye than the right and is usually unilateral (7-9). The retraction syndrome in its classic form is characterized by congenital onset (acquired forms are rare), severe limitation of abduction, slight limitation of adduction, globe retraction and narrowing of palpebral fissure on adduction, and is commonly associated with elevation or depression in adduction (10).

Since the introduction of DRS, many aspects of this syndrome have been discussed and literally hundreds of papers dealing with the retraction syndrome have been published with regard to the presence of face turn (FT) and strabismus. We intended to find out if there is any relationship between the amount of strabismus with that of FT. In a patient with fusion, it is apparent that the direction of the eye deviation and head posture is correlated. The patient holds the face turn to maintain fusion, *e.g.*, in type I of DRS with ET, the FT is always toward the involved eye. However, we did not find any document to present the relation between the amount of head and eye deviation. In this study we

Received: 3 Jan. 2004, Revised: 25 Apr. 2004, Accepted: 10 May 2004

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examined the quantitative relationship between these two deviations.

MATERIALS AND METHODS

In this study, 10 consecutive patients with DRS type I and ET were examined by the authors during 6 months. All the patients were referred to our clinic for the first time and had no history of eye surgery. Eye examination consisted of visual acuity testing with far Snellen chart (best corrected vision), dry and cycloplegic refraction, biomicroscopic examination of anterior segment, fundoscopy, visuscopy and determining the direction and amount of strabismus. All patients had central fixation approved by visuscopy. Deviometery of strabismus was undertaken with use of alternate prism-cover test with prism bar held over involved eye and changed with alternate covering until fixation movement in both eyes (not only the involved eye under cover) was neutralized. In order to quantitate deviation of face we used an orthopedic protractor. The amount of FT was measured by orthopedic protractor documented in degrees and converted to prism diopters (PD). The differences between eye and face deviation through using the formula: "FT-ET" was documented and the relationship was inferred with regard to its mean value.

RESULTS

Six patients were female and 4 were male (Table 1). Their mean age was 10.5 years (between 2.5 and 23 years). Best corrected visual acuity (BCVA) in normal eyes was considered central-steady-maintained (CSM) in children unable to read the chart and 10/10 in the remaining, and BCVA in involved eyes was CSM or between 7/10 and 9/10.

As is shown in table 1 visual acuity of all involved eyes was one line less than uninvolved eyes even with emetropic refraction. The refractive error was between -1.50_D and $+3.00_D$ in normal eyes (mean +0.40) and between -1.00_D and $+3.50_D$ in the involved eyes (mean +0.50).

The angle of eye deviation (Table 2) was between 15_{PD} and 40_{PD} (mean 27.5_{PD}) and the angle of FT was in the range of 7 to 20 degrees (mean 14.4) and after converting to prism diopter units, it was between 12.25_{PD} and 35_{PD} (mean 25.5_{PD}).

The most important variable was the difference between the amount of eye deviation and face turn in order to deduce the relation between them. Based on prism diopter units, the difference between FT and ET ranged between -2 to $+6.5_{PD}$ (mean -2.4_{PD}).

The correlation of two measurements was analyzed by Pearson correlation test with 95% confidence interval. This analysis shows significant positive correlations (r=0.896) between face turn and eye deviation (P= 0.001).

Table 1. Demographic and refractive features of patients

Case	Sex	Age	Eye	Refraction and vision			
1	F	10	R	OD=plano	2/10	OS=+0.50	10/10
2	F	18	L	OD= -1.5	10/10	OS=-1.00	9/10
3	F	9	L	OD= +3.50	8/10	OS=+3.50	7/10
4	M	11	L	OD=+0.75	10/10	OS=+0.75	9/10
5	F	23	L	OD=plano	10/10	OS=plano	9/10
6	F	4	L	OD=-25×180	CSM	OS=plano	CSM
7	M	14	L	OD=plano	10/10	OS=-0.75×20	10/10
8	F	2.5	L	OD=+0.5	CSM	OS=+0.5	CSM
9	M	4	L	OD=+1.5	CSM	OS=+1.75	CSM
10	M	14	L	OD=+0.25	10/10	OS=-1.0×20	9/10

Abbreviations: F, female; M, male; R, right; L, left; CSM, central-steady- maintained.

Table 2. Distribution of deviation of eye and face

	Eye deviation		Face turn angle		FT angle - Eye deviation	
Case	**PD**	**D**	**PD**	**D**	**PD**	**D**
1	30	17.1	28	16	-2	-1.1
2	25	14.3	21	12	-4	-2.3
3	30	17.1	24.5	14	-5.5	-3.1
4	15	8.5	12.25	7	-2.75	-1.5
5	40	22.8	35	20	-5	-2.8
6	25	14.3	31.5	18	+6.5	+3.7
7	35	19.5	32.4	18	-2.6	-1.5
8	20	11.4	15.75	9	-4.25	-2.4
9	20	11.4	21	12	+1.0	+0.6
10	35	19.5	31.5	18	-3.5	-1.5

Abbreviations: PD, prism diopter; D, degree; FT, face turn.

DISCUSSION

As mentioned earlier when the patients with DRS have fusion potential and central fixation they obtain a head posture to maintain the fusion. In order to be able to compare the two variables (eye versus face deviation) upon a single unit, degrees were converted to prism diopter.

As is evident 1_{PD} is the power of a prism, which can shift image of target at 1 meter away, 1 cm toward its base. A circle with a radius of 1 meter has a circumference of 628 cm, divided by 360 degrees, each degree will be equal to 1.75 $_{PD}$ and vice versa, each PD is equivalent to 0.573 degree (11,12). In clinics, each degree is usually considered equivalent to 2_{PD} (*e.g.,* Hirshberg test), but in order to be more accurate we used the exact equivalents.

There is some inaccuracy in measuring face turn with orthopedic protractor. Determining the direction of head and directing the arm of protractor in that direction is susceptible to mistakes, especially when different examiners undertake this examination, different values may be obtained. Measures obtained by one examiner may therefore be more accurate. There are better and more accurate protractors that are less susceptible to subjective measuring mistakes and easier to use, but they were neither accessible to us nor to most other clinicians. Therefore we chose the device that is within the access of most clinicians, and it is important for them to know results obtained by using this prevalent protractor. To our knowledge, no other study has been performed to delineate the quantitative relationship between face turn and ET in DRS. This study may be the first on this topic in Iran.

In order to compare the magnitude of difference between eye deviation with that of the face, we subtracted ET angle from FT angle (in prism diopters). The range of difference was between minus digits when FT angle was less than ET and plus digits when it was more. Eight patients had a smaller, and 2 had greater FT than ET angle, within a range of –2 to +6. The mean value was –2.4 prism diopters. This means that measuring the face turn angle with an orthopedic protractor in patients with DRS I, probably underestimated the ET angle by 2.4_{PD}, and vice versa the ET angle is overestimated by 2.4 $_{PD}$. For example a patient with an ET angle of 30 $_{PD}$ will have a FT angle of 27.5 $_{PD}$ or a patient with FT of 30 $_{PD}$ will have a 32.4 $_{PD}$ of esotropia. From a practical standpoint this difference of 2.4 $_{PD}$ is small enough to consider these two parameters (FT angle versus ET angle) equal. If this study had been performed with a more accurate protractor, the amounts of face turn and esodeviation would probably (and logically) have been equal. In conclusion, with reference to table 2 and the mean values obtained, the difference between angle of face turn with that of the eye was -2.4_{PD}. This means that face turn in comparison with eye deviation was underestimated by 2.4_{PD}. In other words, when we measure the angle of ET in DRS type I with face turn by alternate prism cover testing (as mentioned before), it may be only about 2.4_{PD}

more than the head's angle of deviation, and this difference is so small that we can consider the face turn and ET angle nearly equivalent.

We propose another study using a more accurate protractor and including a greater number of patients to delineate this relationship with more accuracy.

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