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# The reduction of A-V patterns with oblique muscles overaction in unilateral and bilateral surgery

## *Redukcja zespołów literowych z nadczynnością mięśni skośnych w zabiegach jedno- i obustronnych*

Olimpia Nowakowska<sup>1</sup>, Anna Broniarczyk-Loba<sup>2</sup>, Piotr J. Loba<sup>1</sup>

<sup>1</sup> Department Ophthalmology and Ophthalmology Clinic of Medical University of Łódź

Chief: Professor Wojciech Omulecki, MD, PhD

<sup>2</sup> Department Pathophysiology Binocular Vision and Strabismus Therapy of Medical University of Łódź

Chief: Anna Broniarczyk-Loba, MD, PhD

### Summary:

**Purpose:** A-V strabismus patterns may occur with or without oblique muscles overaction and thus require different surgical approach. The aim of our study was to evaluate the efficacy of unilateral vs bilateral surgery for A and V pattern strabismus in children with oblique muscles overaction.

**Material and methods:** A retrospective review of 45 children with oblique muscles overaction was performed. All children underwent unilateral or bilateral oblique weakening procedures over a period of 2 years. The mean reduction of A-V pattern angle was measured in all groups.

**Results:** Among the patients with V pattern, treated with unilateral surgery the mean angle reduction was  $11.8\Delta \pm 6.26\Delta$  and among those who underwent bilateral procedure it was  $17.06\Delta \pm 8.46\Delta$ . In A pattern group the mean angle reduction were  $8.0\Delta \pm 2.82\Delta$  and  $15.0\Delta \pm 8.9\Delta$  respectively.

**Conclusions:** The bilateral oblique weakening procedure is significantly more effective ( $p < 0.01$ ) in reducing the angle in A-V patterns than the unilateral surgery. It appears that in A pattern with superior oblique overaction the bilateral surgery gives better results than in V pattern with inferior oblique overaction.

### Key words:

strabismus, A and V patterns, strabismus surgery.

### Słowa kluczowe:

zez, zespoły A i V, leczenie chirurgiczne zez.

### Background and objective

Alphabetical patterns A and V are conditions in which the strabismus' angle is different in down and up gaze. The incidence of those entities ranges from 12% to 50%, of all strabismus' patients (1). They may coexist with esotropia or exotropia and with or without oblique muscles overaction. A pattern may be diagnosed when the difference between angles measured in up and down gaze is greater than  $10\Delta$  and V pattern when greater than  $15\Delta$  (2).

Several theories concerning the etiology of A-V patterns have been proposed. Most authors suggest that oblique muscle dysfunction plays a major role (1). On the other hand those entities may originate from abnormal rectus muscle insertions or pulley anomalies (3,4).

Surgery is the only effective treatment reported in the literature (1,2,5). The amount of the surgery needed, depends on the presence of oblique muscle overaction, primary position and down-gaze alignment, binocular function, torsion and anomalous head posture. As the oblique muscle dysfunction is

considered to be a major cause of A-V patterns the surgery on those muscles is recommended (5,6). The procedure may be performed unilaterally or bilaterally depending on the magnitude of the overaction (1). In cases with clinically dominant inferior oblique overaction, graded recession and anterior transposition is suggested (7). Tucking should be performed in patients with superior oblique underaction and tenotomy or silicon expander implantation are used in it's overaction (2,8).

The aim of this study was to evaluate the reduction in strabismus angle in vertical gaze positions in children with A and V patterns and oblique muscle overaction, after unilateral and bilateral surgery.

### Patients and Methods

A retrospective review of 45 children 3 to 14 years old (mean  $8.97 \pm 3.84$ ) that had undergone a surgery in our department for A or V pattern over a period of 2 years (2003-2005) was performed. The inclusion criterion was oblique muscles dysfunction. The studied group consisted of 35 patients

(15 males, 20 females) with V pattern and 10 patients (5 males, 5 females) with A pattern strabismus. The follow-up period ranged from 6 to 12 months.

A complete history was taken and the patients underwent full ocular and orthoptic examination. The ocular alignment in primary position, upgaze and down-gaze were measured by a prismatic cover test before and after the surgery.

In most patients oblique muscle dysfunction coexisted with horizontal strabismus. In 18 (40%) patients there was V esotropia, in 16 (35.5%) V exotropia, in 7 (15.5%) A esotropia and in 3 (6.7%) A exotropia. In just one case (2.3%) with V pattern, in primary position there was no horizontal deviation.

To adjust ocular alignment, a number of surgeries were performed. Patients with V pattern undergone inferior oblique weakening procedures, which were in 43% bilateral. In a total of 50 muscles, tenotomy was performed on one muscle, 34 muscles were recessed in '+1' overaction, 12 muscles in '+2' and recession and anterior transposition was done on 3 muscles in '+3'. There were no cases with '+4' overaction in the studied group.

In patients with A pattern and superior oblique overaction, various width of tenotomy was performed. In a total of 18 muscles, 1/3 of the tendon was incised in 9, 1/2 in 7 and 2/3 in 2 muscles. Bilateral surgery was performed in 8 (80%) cases.

In many patients rectus muscle adjustments were indicated. In 11 patients one horizontal rectus muscle was involved, in 17 two, in 6 three and in 2 four muscles. In 9 cases there was no indication for rectus muscle surgery, mostly because oblique muscle surgery positively influenced the horizontal alignment. Only in 5 patients adjustment of vertical muscles was required. In 3 patients one muscle was operated and in 2 patients three muscles were operated. In most cases the surgery was performed in two or three stages.

**Results**

We have assessed the effectiveness of the surgery performed by measuring the mean reduction of the alphabetical patterns. Pattern value was calculated for each patient by subtracting the measured angle in up- and down-gaze. The angle reduction was calculated by subtracting the pattern values from before and after the surgery. Results are presented in Tables: I and II. In general, mean angle reduction found after unilateral surgery was  $5.82\Delta \pm 3.35\Delta$  and  $8.96\Delta \pm 5.13\Delta$  after bilateral surgery. By means of statistical analysis, using t-test, we found that the angle reduction in A-V patterns was significantly ( $p < 0.01$ ) higher after bilateral surgery (Tab. I, Tab. II).

Surgery	Unilateral	Bilateral
Mean pattern value before surgery	$20\Delta \pm 9.92\Delta$	$31.2\Delta \pm 11.08\Delta$
Mean pattern value after surgery	$6.5\Delta \pm 5.68\Delta$	$7.14\Delta \pm 6.22\Delta$
Mean pattern reduction value	$11.8\Delta \pm 6.26\Delta$	$17.06\Delta \pm 8.46\Delta$
N = 35	20	15

Tab. I. Efektywność operacyjnej redukcji zespołu V. V pattern reduction efficacy.

Surgery	Unilateral	Bilateral
Mean pattern value before surgery	$15.0\Delta \pm 7.08\Delta$	$25.76\Delta \pm 8.72\Delta$
Mean pattern value after surgery	$4.0\Delta \pm 3.9\Delta$	$4.76\Delta \pm 3.5\Delta$
Mean pattern reduction value	$8.0\Delta \pm 2.82\Delta$	$15.0\Delta \pm 8.9\Delta$
N = 10	2	8

Tab. II. Efektywność operacyjnej redukcji zespołu A. A pattern reduction efficacy.

**Discussion**

Among our patients V esotropia was more common than V exotropia, A esotropia and A exotropia. V patterns contributed for 75.5% of all cases what is similar to the incidence reported by Rizk and Taalab (5). In their study they found A pattern in only 13.2% and slightly higher frequency of exotropia to esotropia. Similar study made by Arezzo et al. (9) also indicates the dominance of V pattern (69.4%), but with a higher incidence of esotropia (37.75%) what is more consistent with our results. Ohba et al. (10) reports 90.3% of exotropes in which 51.6% were V patterns.

All patients with V pattern underwent unilateral (57%) or bilateral (43%) graded recession of inferior oblique muscle. Similar procedure was carried out by Monteiro de Carvalho et al. (7) in 53 patients with V pattern and +1 to +3 inferior oblique overaction. In their study satisfactory result (V pattern less or equal to  $8\Delta$ ) was achieved in 57% to 75% depending on the basic deviation. Better results were attained in patterns that were less than  $20\Delta$  and more disappointing in those over  $29\Delta$ . In all cases considered as satisfactory undercorrection was noted.

Caldeira (6) performed a bilateral inferior oblique recession in 22 patients with V pattern exotropia, although he encountered bilateral overaction only in 86.4%. After the surgery 72.7% of his patients had the deviation under  $15\Delta$  and in this group 36.4% had it totally eliminated. On the basis of his research he suggests, that bilateral inferior oblique recession is the most effective procedure in such cases.

In the group with A pattern we conducted unilateral (20%) or bilateral (80%) superior oblique weakening procedure. We incised the tendon from 1/3 to 2/3 of its width. Rizk and Taalab (5) proposed a variety of superior oblique weakening procedures. They performed not only tenotomy, but also tenectomy, Z-tenotomy, recession to the nasal margin of superior rectus with posterior transposition and silicon expander implantation. The authors proposed a detailed algorithm for the management of A-V patterns.

Surgery on the horizontal muscles was needed in 36 and on vertical muscles in 5 patients. The necessity of operating on oblique, horizontal or sometimes vertical muscles is unanimously underlined by other strabologists (1,5). Caldeira (8) states even that recession of the inferior oblique muscle, particularly bilateral, may induce vertical disparity.

Rizk and Taalab (5) estimated the joint decrease of the A-V pattern value at  $19.6\Delta$ . The amount of the surgery performed in their study was not limited to one or both oblique muscles but was extended to 3 or 4 oblique muscles in some cases. In their

estimations they have also included vertical muscles transpositions. Similar reduction measurements were carried out in the paper by Ohba et al. (10,11) giving the mean of 10.3Δ for V pattern and 20.3Δ for A pattern.

### Conclusions

The bilateral oblique weakening procedure is significantly more effective ( $p < 0.01$ ) in reducing the angle in A-V patterns than the unilateral surgery. It appears that in A patterns with superior oblique overaction the bilateral surgery gives better results than in V pattern with inferior oblique overaction.

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Praca wpłynęła do redakcji 04.04.2008 r. (1043)  
Zakwalifikowano do druku 20.10.2008 r.

Adres do korespondencji (Reprint requests to):  
dr n. med. Olimpia Nowakowska  
ul. Muszłowa 7a  
93-474 Łódź  
e-mail: o.m.nowakowscy@neostrada.pl

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