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Recession Vs Myotomy – Comparative Analysis of Two Surgical Procedures of Weakening Inferior Oblique Muscle Overaction

Jasmina Alajbegovic-Halimic, Denisa Zvizdic, Amra Sahbegovic-Holcner, Amira Kulanic-Kuduzovic

Eye Clinic, Clinical center of University of Sarajevo, Sarajevo, Bosnia and Herzegovina

Corresponding author: Ass. Prof. Jasmina Alajbegovic-Halimic MD, PhD. Eye Clinic University Clinic Center Sarajevo. Bolnička 25, 71 000 Sarajevo, Bosna & Herzegovina. Phone: + 387 61 10 71 07, E-mail: jasna_halimic@hotmail.com

ABSTRACT

Introduction: Inferior oblique overaction (IOOA) can be primary or secondary, isolated or combined to other types of horizontal deviation, mostly with esotropias. Surgical weakening of IOOA means several techniques like; recession, myotomy, myectomy, anteroposition etc. **Goals:** we analyzed the effect of inferior oblique muscle surgical weakening comparing two groups of patients with primary hypertropia. **Material and methods:** In 5-years retrospective study, we observed 33 patients on which we did the surgical procedure of weakening inferior muscle overaction by two methods; recession and myotomy. **Results:** In total number of 33 patients, there were 57,6% male and 42,4% female patients with average age of $10,6 \pm 7,5$ (in range of 4–36). There was 33,3% of isolated primary hypertropias, and 66,7% combined with esotropias. At 23 (69,9%) patients the recession surgical procedure was done, and with 10 (30,1%) myotomy. Better effect and binocularity was in 65,2% of patients in recession group which was statistically significant with significance level of $p < 0,0$, $\chi^2 = 5,705$; $p = 0,021$. **Conclusion:** Comparing of two surgical procedures of weakening inferior oblique muscles overaction, recession is better procedure than myotomy.

Key words: comparison, weakening, inferior oblique muscle, recession, myotomy.

1. INTRODUCTION

Overaction of the inferior oblique muscle (IOOM) is manifest by overelevation of the adducted eye. Inferior oblique muscle overaction may be primary or it may be secondary to ipsilateral superior oblique palsy or contralateral superior rectus palsy. The primary and secondary overactions of the inferior oblique muscles have different clinical presentations (1, 2, 3, 4, 5).

Primary overaction of the inferior oblique muscle may have its onset equally in the two eyes or it may occur only in one eye. Primary IOOM is characterized by elevation of the eye in adduction, with smaller or minor vertical deviation in the primary position, with smaller or minor torticollis and negative *Bielschowsky* test. The vertical deviation in the primary position in secondary overaction of the inferior oblique muscle usually ranges between 10 to 25 Pd (prism diopters). Secondary hyperfunction of oblique muscle is caused by ipsilateral or contralateral paresis of superior oblique muscle, when we, also, have the eye elevation in adduction, but vertical deviation is

present in primary position too, with strong torticollis and positive *Bielschowsky* test.

Overaction of the inferior oblique muscle or hypertropia can be isolated or combined with other types of deviations, according to *Parks*, 72% of patients with congenital esotropia, 34% of patients with accommodative esotropia, and 32% of patients with intermittent exotropia (1, 2, 3, 4, 5, 6, 7).

Surgeries of weakening of IOOA are done because of functional, but the aesthetic reasons too. The variety surgical procedure have been performed including: recession, hang-back recession, myotomy, myectomy, anterior transposition, nasal transposition, denervation and muscle fixation. Myotomy is simpler version of myectomy, is not technically complicated and is easy to perform; freed oblique muscle is cutted-down, and bonds are freed, after cauterization. Recession is, according to many authors, the best method of inferior oblique muscle weakening and according to *Parksu* dominant to all other methods. Isolated muscle is recessed 2 mm laterally and 3 mm tem-

porally or more towards lateral edge of insertion of inferior rectus muscle. By this method, recession can be adopted and dosed in accordance to the hyperfunction degree; for 1+ overaction, the inferior oblique muscle is recessed 6 mm; for 2+ overaction 10 mm and for 3+ overaction 14 mm, which is the maximum recession (2, 3, 4, 5, 6).

But, the decision on choosing the surgical procedure is individual and is based on personal experience of surgeon (3). Indications for these surgeries, whether inferior oblique overaction is primary or secondary, are to treat hypertropia, diplopia, binocular vision compromise in the field of adduction, torticollis, and to improve cosmetic appearance. However, these surgeries may have effect not only on vertical deviation, but also on horizontal deviations in varying degrees (4). When the hyperfunction is unilateral, usually the only one muscle is weakened, and if the hyperfunction is bilateral, weakening procedure is done symmetrically. Also, inferior oblique muscle weakening procedure, in case of existence of horizontal deviation, is done at the same time with correction of horizontal deviation (3, 4). During and after surgery, in spite of procedure the possible surgery and postoperative complications must be considered. One of them is intraoperative and postoperative bleeding and hematoma in orbit, "adherent syndrome", postoperative and continued hyperfunction of IOM, hypotropia, internal ophthalmoplegia etc (3, 4, 5, 6, 7).

2. MATERIAL AND METHODS

The study was conducted as a retrospective, clinical, controlled and descriptive study of a period of five years at the Department of Strabology and Pediatric Ophthalmology in Eye Clinic of the University Clinic Center Sarajevo. We evaluated total number of 33 patients who had primary inferior oblique muscle overaction, isolated or combined with esotropia. Other forms of horizontal deviations were not considered. At all patients was measured; vertical deviation with the prism Cover test or Krimsky test, on primary position and 9 diagnostic gaze positions, Hess-Lancaster test for diplopia testing and binocularity which we tested with Lang and Titmus fly tests 3, 6 and 12 months after surgery. Patients were divided into two groups: in one group, depending on vertical deviation, the weakening of inferior muscle overaction done by recession and in other group; weakening of inferior muscle overaction myotomy was done. The data is shown in tables according to the number of cases, percentage, arithmetic mean, standard deviation, median, and range were given as descriptive statistics for quantitative data. Qualitative data are summarized using frequency and percentages. For testing of predicted hypothesis and proving the goals, we used the *Hi-square test*, *Student's test* and *Pearson's* or *Spearman's* correlation coefficient test. Results were accepted as statistically significant on significance level of $p < 0,05$. Data were analyzed by using statistic software IBM Statistics SPSS v21.0 (Chicago, Illinois, USA). The procedures confirmed with the tenets of the Declaration of Helsinki.

3. RESULTS

In total number of 33 patients, were 19 (57,6%) males and 14 (42,4%) females. Analysis of sex, according to the

type of surgery, shows that number of male patients was higher than female in total number and in recession group, while in a myotomy group the number of male and female patients was equal. Statistical analysis shows that there is no statistically significant difference of the patients in accordance to the sex distribution $p > 0,05$ (Figure 1).

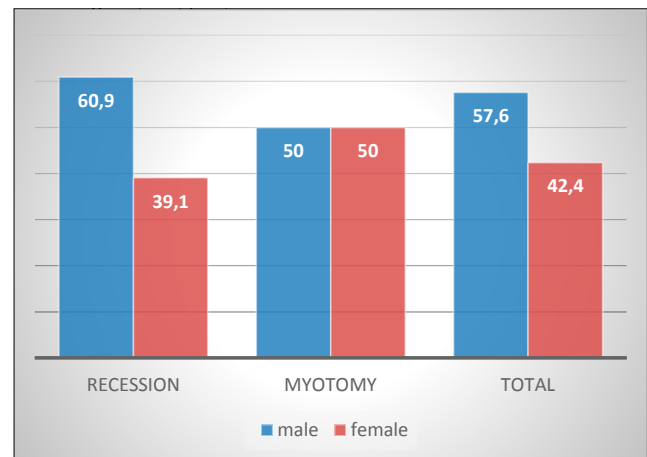


Figure 1. Sex distribution is no statistically significant ($p > 0,05$). $\chi^2=0,337$; $p=0,419$

Analysis of average age during the surgery shows that the patients were operated in the average age of $10,6 \pm 7,5$ (age 4 to 36), and that the patients in recession group were older with average age of $12,4 \pm 8,1$ (age 5 to 36), comparing with patients in myotomy group with average age of $6,5 \pm 3,8$ (age 4 to 17). Statistical analysis shows the significant difference in average age during the surgery in accordance to type of surgery presented with significance level of $p < 0,05$ (Figure 2).

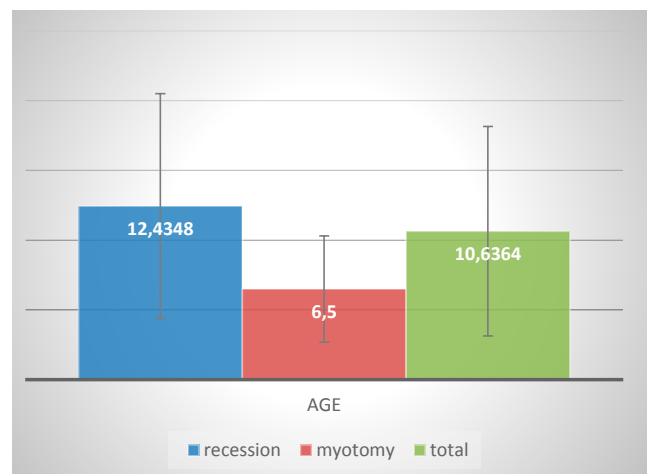


Figure 2. Age distribution is no statistically significant ($p > 0,05$). $t=4,878$; $p=0,035$

Out of the 33 patients, 11(33,3%) patients had isolated primary inferior oblique muscle overaction and 22(66,7%) patients combined with esodeviation. All patients in myotomy group had esotropia (100%). In recession group, we had almost equal distribution of patients with esotropia 12(52,2%) and hypertropia only 11(47,8%), which is statistically significant $p=0,007$.

The most commonly performed surgery was inferior oblique muscle recession in 23 (69,9%) cases and myotomy in 10(30,1%) cases. Of the 33 patients, 19(57,7%) underwent unilateral weakening procedure and 14(42,42%)

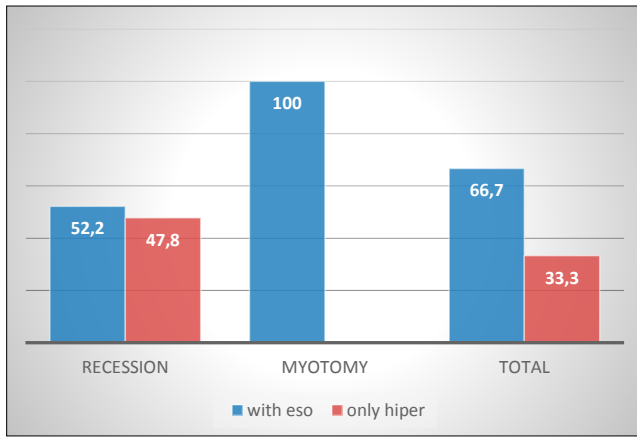


Figure 3. Type of deviation regarding to type of surgery procedure. $\chi^2=7,174$; $p=0,007$

bilateral surgery (Figure 3). Preoperative angle of vertical deviation in a total number of patients was, in average, $7,5 \pm 3,9$ (range 3-20) and was bigger in recession group ($8,7 \pm 4,3$; range 3-20), comparing with patients in myotomy group ($5,9 \pm 2,7$; range 4-13), but without statistically significant difference in accordance to the type of surgery $p > 0,05$. (Figure 4).

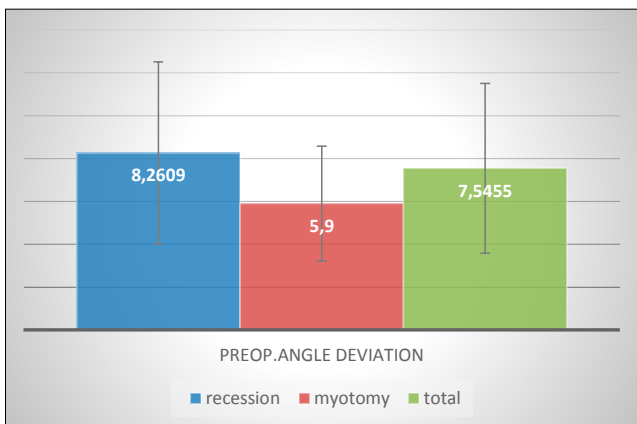


Figure 4. Preoperative angle of vertical deviation, $p > 0,05$. $t=2,599$; $p=0,117$

In total number of patients, postoperative angle of vertical deviation was in average $1,4 \pm 0,96$ (range 0-4). The values in myotomy group were $1,5 \pm 0,8$ (range 0-3) and $1,3 \pm 1,0$ (range 0-4) with patients in recession group, but without statistically significant difference, in accordance to type of surgery $p > 0,05$ (Figure 5).

Binocularity was at 65,2% in recession group and at 20% of the patients in myotomy group, which is statistically significant shown with significance level of $p < 0,05$ (Figure 6).

Comparing two groups of patients and analysis of correlation between binocularity and other analyzed parameters, we noticed that, beside statistically significant correlation, better effect and binocularity have the following factors: older age of patients during surgery ($r=0,734$), isolated hyperfunction of IOM ($r=0,429$), recession as surgery procedure ($r=-0,416$), and smaller postoperative vertical deviation angle ($r=-0,39$). Other parameters did not show any statistically important influence (Figure 7).

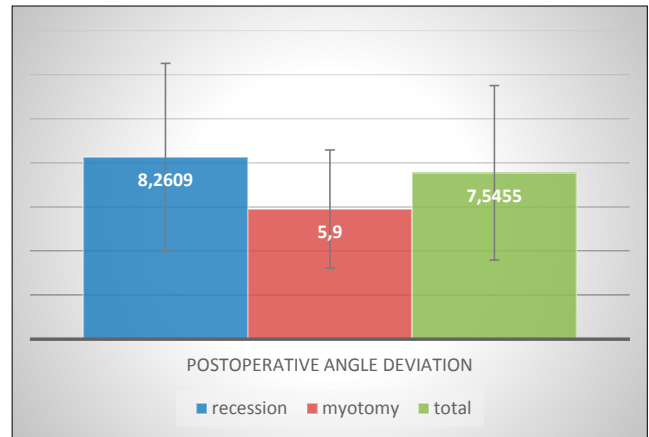


Figure 5 Postoperative angle of vertical deviation, $p > 0,05$. $t=2,599$; $p=0,117$

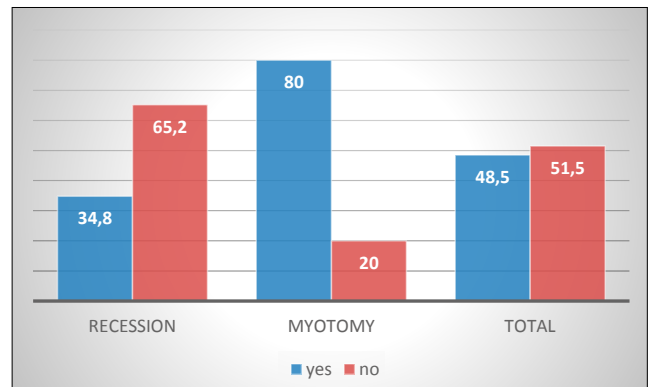


Figure 6. Binocular vision according to type of surgery $p < 0,05$. $\chi^2=5,705$; $p=0,021$

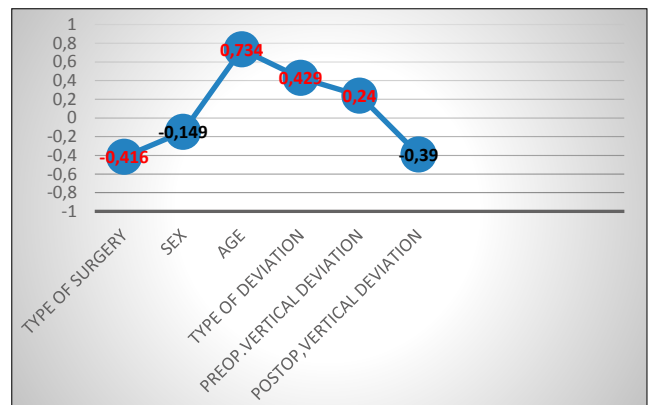


Figure 7. Correlation coefficient towards of effect of surgery on. $p < 0,05$ and $p < 0,01$ level

4. DISCUSSION

Inferior oblique muscle overaction (IOOA) may be primary or secondary and very often combined with horizontal deviations, mostly with esodeviations. In our cases, we had in total number of 33 patients with primary hypertropia and 33,3% of patients had only inferior oblique overaction and 66,7% of patients had inferior oblique muscle overaction with esotropias. Analysis of average age of patients according to the type of surgery, shows that patients were operated, in average, in the age of $10,6 \pm 7,5$ (range 4-36 years of age), which was statistically significant presented on significance level of $p < 0,05$.

Wilson and Parks found primary overaction of the inferior oblique muscle in 72% of patients with congenital es-

otropia at an average age of 3.6 years, 34% of patients with accommodative esotropia at an average age of 5.2 years, and 32% of patients with intermittent exotropia, also at an average age of 5.2 years (7). Weakening surgery for IOOA either primary or secondary includes recession, disinsertion, myectomy, tenotomy, myotomy and anteriorization. The most commonly performed inferior oblique muscle weakening procedure are inferior oblique myectomy and inferior oblique muscle recession. The surgical decision appears to be primarily based on individual experience and preference (7). The aim of all these surgeries is to release IOOA and reduce related vertical deviations. In previous studies, we found the data of better usage of recession, as a modern method of weakening of inferior oblique muscle and is usually compared with myectomy or transposition, and not with myotomy. In no study we found enough data on binocularity. By our analysis, according to binocularity, we showed that stereo vision is present at 65,2% of patients in recession group, and at 20% of patients in myotomy group, which was statistically significant presented on significance level of $p < 0,05$. Comparing binocularity and other parameters, we can see that, beside statistically significant correlation, the strongest influence to stereo vision have the following factors: older age of patients, smaller deviation angle before the surgery, isolated hyperfunction of inferior oblique muscle, type of surgery – recession, and smaller angle of vertical deviation postoperatively. Other parameters did not show statistically strong influence. In 1 (4,3%) case, we had postoperative hypotropia, we think that is the so called “*adhesive syndrome*”, but statistical analysis shows that there is no significant difference in repeating the surgeries, according to type of surgery what was significance with $p > 0,05$ (8). Parks found inferior oblique muscle recession to be the most effective procedure. He observed a persistent inferior oblique muscle overaction in 37% of patients and inferior oblique muscle underaction in 8% of patients after an inferior oblique muscle myectomy and 13% incidence of inferior oblique muscle adhesive syndrome when the myectomy was performed at the inferior oblique muscle insertion (2, 3, 4, 5, 7).

After the surgery, the angle of vertical deviation decreased, and was in average $1,4 \pm 0,96$ degrees. In myotomy group there was $1,5 \pm 0,8$ (range 0-3), in recession group $1,3 \pm 1,0$ (range 0-4), but without statistically significant difference according to type of surgical procedure $p > 0,05$.

Cooper and Sandall found that a measured recession will decrease the hyper deviation by 6.88 prism diopters in primary position and by 12.3 prism diopters in the field of action of the overacting inferior oblique muscle. They analyzed recession and myotomy group, but no data about binocularity (9). Shipman and Burke had total of 23 patients, 12 myectomies and 11 recessions and follow-up period of 12 months. All but one patient, had demonstrable binocular single vision. The average preoperative hyper deviation in contralateral gaze was 26.5 prism diopters in the myectomies and 20 prism diopters in the recessions. This was reduced at 12 months postoperatively to 1.75 prism diopters in the myectomies and to 3 prism diopters in the recessions. Both procedures were largely self-grading, so that the larger the preoperative hyper deviation, the greater the effect of surgery (10).

Sekeroglu and coauthors did the qualitative analysis at 76 patients, 30 male and 36 female, average age 11(1-49). Out of 76 patients, 54,5% had secondary hyperfunction of IOM, and 45% primary hyperfunction of IOM. Three surgery procedures were done: 8,5% anteriorization, 43,9% tenotomy and 7,6% recession. They did not find any difference between different types of surgery in terms of horizontal deviations correcting effect. Unfortunately, there is no data about binocularity (11).

Ehrt and others had retrospective studies of 234 patients in the age of 2-81, during the period of 9 years, where the quantitative analysis IOM weakening effect by recession, and described reduction of vertical deviation from 25 degrees to 6. They propose this method as safe and suitable, but with smaller risk from consecutive hypotropia and limited elevation, which they get in one case (12).

Risović and all in their study had 79, divided into two groups: first as a primary overaction IOM, and other and dissociated vertical deviation. Binocularity was found at 67% patients from first group and 55,6 % patients from second group, but without big statistical significant difference between groups (13).

5. CONCLUSIONS

The intention of the present study was not to evaluate effect of weakening of inferior oblique muscle on horizontal deviation, but to investigate it's effect to condition of binocular vision. When it comes to this, the better results were at recession as method of inferior oblique muscle weakening was used. Recession is safe and effective procedure to eliminate inferior oblique overaction and can be dosed and adopt to overaction. But, when planning of surgery of inferior oblique muscle weakening, the knowledge and experience on it's influence to horizontal deviation and binocularity is needed, as well as dosing and possible operative and postoperative complications.

CONFLICT OF INTEREST: NONE DECLARED.

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