

## Comparison of Graded Inferior Oblique Recession to Graded Myectomy for Primary Inferior Oblique Overaction

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### Abstract

**Purpose:** To compare the outcome of graded recession to graded myectomy of the inferior oblique in patients with primary inferior oblique overaction (IOOA).

**Materials and methods:** Patients with unilateral or bilateral primary inferior oblique overaction, with a horizontal comitant squint, were subjected to either a recession or a myectomy of the inferior oblique in this prospective study. The amount of recession or myectomy performed depended on the degree of inferior oblique overaction. Horizontal muscle surgery was done as per primary position deviation.

**Results:** 50 eyes of 32 patients were enrolled in the study. 28 eyes of 17 patients underwent a recession and 22 eyes of 15 patients underwent a myectomy. Postoperatively, no or grade 1 IOOA was noted in 24/28 eyes (85.7%) in the recession group and 16/22 eyes (72.7%) in the myectomy group ( $p=0.2$ ). Residual IOOA of grade 2 or more was noted in 3/28 eyes (10.7%) in the recession group and 4/22 eyes (18.2%) in the myectomy group ( $p\text{-value}=0.7$ ). For unilateral surgeries, 5/6 eyes (83.3%) that underwent recession had no or grade 1 IOOA postoperatively, compared to 5/8 eyes (62.5%) that underwent myectomy ( $p\text{-value}=0.5$ ). Consecutive hypotropia was seen in 25% (2/8) of myectomies and none of the recessions ( $p\text{-value}=0.4$ ).

**Conclusion:** Surgical outcome after surgery for IOOA appear to be slightly better for recession compared to myectomy, more so in unilateral cases. However, performing a myectomy in a grade 2 IOOA carries a risk of overcorrection with consecutive hypotropia in the operated eye.

**Keywords:** Inferior oblique overaction; Myectomy; Inferior oblique recession

### Introduction

Primary inferior oblique (IO) Overaction may cause a socially noticeable vertical hypertropia of the affected eye in primary position and contralateral gaze. Surgical management is often required to improve alignment. Treatment of this entity is varied. Inferior oblique weakening is the most common procedure performed on oblique muscles [1]. A number of procedures have been described for weakening the inferior oblique muscle. Duanne first described a transcutaneous tenotomy of the inferior oblique at its origin [2]. Disinsertion (myotomy) of the muscle at its scleral origin was suggested in the early part of the last century [3]. However, the most commonly used techniques today are myectomy and recession [4,5]. The former involves transection of the muscle at a certain distance from its scleral insertion. The proximal part of the muscle is allowed to retract into its sheath and spontaneously reattach to the sclera at the new site. The latter involves disinsertion of the muscle at its insertion and surgical reattachment at a point on the sclera more proximal to the original insertion of the muscle. As is evident, recession is a controlled procedure, with the amount of muscle weakening depending on the amount by which the muscle is recessed. On the other hand, it has been suggested that myectomy is a self-adjusting procedure [6]. The more the degree of initial muscle overaction, the more will be the tone

in the muscle, and the more it will recede into its sheath once transected. Thus, the final attachment site to the sclera will be more proximal.

There is no consensus on which is the better surgery for inferior oblique overaction. Various studies have provided conflicting results [5,7-9].

However, all studies on inferior oblique weakening procedures done till date have compared two different types of procedures. No study has evaluated the effect of similar procedure done in a graded manner. In this study, we performed graded recessions and myectomies on the inferior oblique in patients with primary inferior oblique overaction, with the extent of the recession or myectomy depending on the degree of muscle overaction. Post-operative outcomes in terms of residual inferior oblique overaction were compared.

### Materials and Methods

This was a prospective study conducted at a tertiary care hospital in North India. The study and data collection conformed to all local laws and were compliant with the principles of the Declaration of Helsinki. Patients with primary inferior oblique overaction with or without a horizontal squint were enrolled in the study after informed consent. Patients who had undergone previous strabismus surgery or who had extra-ocular muscle paresis or mechanical restrictions, dissociated vertical deviations, acquired or congenital ocular structural

abnormalities, or recognized abnormalities of the central nervous system were excluded from the study.

Inferior oblique overaction was classified into 4 grades of severity, as described by Min et al. [10]. Oblique muscle dysfunction was graded in the approximately 45° adducted eye on a nine point scale from -4 underaction to +4 overaction. For this the fixating abducted eye first remained elevated approximately 30° above mid-level and then lowered to approximately 30° below mid-level. The underactions and overactions of the oblique muscles were graded in approximately 7° increments. For example, the adducted eye with a +3 overactive inferior oblique muscle would be approximately 21° upturn than the adducted fixating eye.

Patients were subjected to either recession or myectomy of the inferior oblique. Amount of recession done was based on grade of overaction-Finks' recession for grade 2, Parks' recession for grade 3, Modified Elliott Nankin recession for grade 4. Similarly a 6 mm, 7 mm and 8 mm myectomy was done in grade 2, 3 and 4, IO overaction respectively which was a modification of the grading system used by Burke (Simple myotomy for minimal overaction to 8 mm myectomy for marked overaction) [11].

Post operatively the patient was evaluated on the first postoperative day, and then 1 week, 1 month and 3 months later. The degree of inferior oblique overaction at 3 months was noted and graded. Success was defined as no or grade 1 overaction of the inferior oblique at 3 months post operatively.

The rates of success with both the procedures were compared using the chi square test of statistical significance. A p value of ≤ 0.05 was considered as being statistically significant.

### Surgical Procedure

The initial steps in both recession and myectomy were similar. An infero-temporal fornix conjunctival incision was made. The tenon was separated by blunt dissection using a tenotomy forceps. The lateral rectus muscle was then caught using a muscle hook and retracted superiorly, providing greater exposure of the inferior oblique, which was then hooked. Attachments of the inferior oblique to the surrounding structures were released to free the muscle along its length. Subsequent steps differed for recession and myectomy.

In recession, the muscle was held with a serrated forceps close to its insertion, and dis-inserted from the sclera. The hooked lateral rectus was now released. Next, 6-0 vicryl sutures were passed through the inferior oblique muscle near its insertion, and then attached to the sclera at points decided by the type of recession to be performed. For Finks' recession, the anterior end of the inferior oblique was reinserted to the sclera at a point 6 mm inferior and 6 mm posterior to the inferior edge of the lateral rectus insertion. For Parks' recession, the anterior end of inferior oblique was attached 3 mm posterior and 2 mm lateral to insertion of inferior rectus. For modified Elliott and Nankin recession, the anterior end of the inferior oblique was attached adjacent to insertion of the inferior rectus muscle. For all three procedures, the posterior end of the inferior oblique was attached 5 mm posterior to the anterior end.

For myectomy, once the inferior oblique had been released from surrounding structures, a 6, 7 or 8 mm mark (depending on the extent of myectomy planned) from its insertion was made on the muscle. The muscle was then clamped with two mosquito forceps along its length such that the mark came between the two clamps. The muscle was then

transected at the site the mark had been made. Both ends of the transected muscle were cauterized. The proximal part of the muscle was allowed to recede into its sheath.

### Statistical analysis

All the data were tabulated in an excel sheet. SPSS software was used for statistical analysis. Descriptive data was presented as percentages or as mean ± standard deviation. Significance of associations was tested using Chi square for categorical variables and Student's t test for continuous variables. Difference between the two groups was compared by t-test (for normal distribution) or Mann Whitney test (non-normal distribution). For paired values such as pre and post intervention assessment in the group, paired-t test or Wilcoxon Sign Rank test were used at informed levels of significance p<0.05, p<0.01 and p<0.001. For qualitative data, Chi-Square or Fischer Exact test were used to observe difference between proportions for independent groups. For dependent groups, Mc Nemar test was used.

### Results

50 eyes of 32 patients were enrolled in the study. Eyes in group 1 underwent an IO recession, whereas those in group 2 underwent myectomy. For patients with bilateral IOOA, both eyes were included in the same group. The distribution of cases in each group is shown in Table 1.

	No. of patients	Unilateral IOOA	Bilateral IOOA	No. of eyes	Surgery done
Group 1-recession	17	6	11	28	Finks' recession-5
					Parks' recession-16
					Modified E and N recession-7
Group 2-myectomy	15	8	7	22	6 mm myectomy-6
					7 mm myectomy-10
					8 mm myectomy-6

**Table 1.** Profile of inferior oblique overaction in the two groups.

Success rate with the two procedures is shown in Table 2. Residual inferior oblique overaction of grade 2 or more was noted in 3 out of 28 eyes (10.7%) that underwent a recession and 4 out of 22 eyes (18.2%) that underwent a myectomy. The difference was not statistically significant (p=0.7).

Surgical overcorrection resulting in an inferior oblique underaction was noted in 1 eye in the recession group and 2 eyes in the myectomy group, the difference being insignificant (p=0.6). Of note is the fact that both the eyes that developed inferior oblique underaction in the myectomy group had a grade 2 IOOA preoperatively. Thus, 1/3<sup>rd</sup> (2/6) of eyes with grade 2 IOOA undergoing myectomy developed a postoperative underaction of the inferior oblique.

When evaluating the outcomes of unilateral surgeries in terms of the above parameters, we found a 83.3% (5/6) success rate with recession as compared to 62.5% (5/8) with myectomy (p=0.5). Residual IOOA was noted in 16.7% (1/6) of recessions and 12.5% (1/8) of myectomies (p=1). Postoperative hypotropia resulting from

overcorrection was seen in 25% (2/8) of myectomies and none of the recessions ( $p=0.4$ ). Persistent overaction of IO muscle after disinsertion results from insufficient retraction of the muscle from the subtenon's space. It can be both prevented and managed by complete dissection of the IO muscle from its all facial attachments and pushing the proximal terminal of the muscle completely out of subtenon's space through its sheath traversing Tenon's capsule after a segment myectomy and cauterization.

Grade of IOOA	Recession	Myectomy	p-value
Grade 2	5/5 (100%)	4/6 (66.7%)	
Grade 3	14/16 (87.5%)	7/10 (70%)	
Grade 4	5/7 (71.4%)	5/6 (83.3%)	
Overall	24/28 (85.7%)	16/22 (72.7%)	$p=0.2$

**Table 2.** Success rates with the two procedures.

Contralateral inferior oblique overaction has been reported after surgeries for unilateral inferior oblique overaction [12].

In our study, we found contralateral inferior oblique overaction in 1 out of 6 (16.7%) unilateral cases undergoing a recession and in 3 out of 8 (37.5%) unilateral cases undergoing a myectomy. The difference did not approach statistical significance ( $p$ -value=0.5).

## Discussion

Both recession and myectomy are excellent procedures in management of inferior oblique overaction. However, the superiority of one over the other has not been established. Rajavi et al. reported similar success rates of the two procedures in primary IOOA in a randomized controlled trial [7]. They concluded in another study that both the inferior oblique myectomy and anterior transposition procedures are effective in reducing IOOA with similar satisfactory results. DVD and hypertropia were also corrected in their patients similarly by these two surgical procedures [13].

Shipman et al. compared recession with myectomy in a prospective study [5]. They found myectomy to be marginally better in correcting preoperative hyper-deviation. Costenbader et al. retrospectively compared inferior oblique myectomies, recessions, and dis-insertions on eyes of patients with diverse strabismus aetiologies [8]. They concluded that the postoperative outcome was generally comparable for all procedures. Parks prospectively evaluated 319 patients ranging in age from 6 months to 17 y with bilateral inferior oblique muscle overaction [9]. 4 different weakening procedures were compared. He found inferior oblique muscle recession to be the most effective procedure in reducing preoperative hyper-deviation.

The general consensus is that both procedures are equally effective, and the choice in any individual case rests on the operating surgeon. Most studies that compared the two procedures involved a fixed amount of recession or myectomy in all study subjects, irrespective of the grade of inferior oblique overaction which was however symmetrical. Logically, the amount of recession or myectomy should be tailored as per the extent of IOOA preoperatively. This would ensure better surgical results with less likelihood of overcorrection or under correction. Also, when comparing the outcomes of the two procedures, tailored recessions and myectomies would provide a more practical evaluation of outcome [9]. Self-grading of myectomised IO is just a

hypothesis. No one till date has studied the actual attachment of IO after a myectomy. These are just possible theories that a more active muscle will contract more as compared to a lesser overaction IO. The largest prospective study on IO surgery is by Parks who has shown that there were higher overcorrections in patients who preoperatively had slight overactions and a greater percentage of under corrections in patients who preoperatively had marked overactions with the same amount of surgery [9]. He also showed that underaction of the IO was most frequently seen with myectomy (which was not graded) on a minimal overacting muscle. The incidence of this was double than that of recession which was graded. High underaction rate (19%) has also been seen by Harcourt et al. [14]. However they have not classified as to which grade of IO overaction had more incidence of post op underaction. Parks also showed that maximum incidence of post op hypotropia was seen in the myectomy (not graded) group. Keeping this in mind, we designed our study. Graded recession and myectomy of the inferior oblique was performed in two groups of eyes with primary IOOA, and the post-operative outcomes compared.

On the whole, we found that both recession and myectomy reduced the function of the overactive inferior oblique muscle. The success rates for recession were higher than those with myectomy, but the difference was statistically insignificant. The rates of residual inferior oblique overaction were comparable between the two groups.

The success rates found in our study with the two procedures compare with or exceed those from previously reported literature. Parks [7] found a success rate of 81% with recession and 49% with myectomy. However, he did a standard 8 mm myectomy in all cases, not a graded approach as we took. In his series underaction occurred most frequently with myectomy in cases of minimally overacting inferior oblique muscle. Rajavi et al. [4] also found similar success rates to ours with the two procedures.

Postoperative hypotropia resulting from surgical overcorrection was noted in 1 eye in the recession group and 2 eyes in the myectomy group. While in itself, this difference was not statistically significant, it is important to note that both cases in the myectomy group had had a grade 2 IOOA preoperatively and had undergone a 6 mm myectomy. The incidence of postoperative overcorrection in eyes with grade 2 IOOA undergoing myectomy came out to 33% in our study. This suggests that one should be cautious in performing a myectomy in a grade 2 IOOA.

In our study, we also evaluated the outcomes of the two procedures in patients with unilateral IOOA. We found that although the numbers did not achieve statistical significance, all post-operative parameters (success rates, residual overaction, and surgical overcorrection) were consistently better in the recession group when compared to the myectomy group. This shows that in cases of unilateral IOOA, recession is a more controlled procedure. In patients with unilateral inferior oblique overaction who undergo an inferior oblique weakening procedure, contralateral inferior oblique overaction has been reported post-surgery [11,15-17]. It has been suggested that this may represent unmasking of pre-existing inferior oblique overaction in the other eye [17]. In our study, the rates of contralateral inferior oblique overaction after surgery for unilateral IOOA were comparable between the two groups.

The major limitation of our study is the small sample size. The tests of statistical significance might thus have been falsely negative. The raw data suggested superiority of recession compared to myectomy in the management of inferior oblique overaction, particularly in unilateral

cases. Larger prospective studies are needed to evaluate this. Also, the role of myectomy in mild inferior oblique overactions needs to be evaluated separately. However, from our data, we recommend caution while performing myectomy in a unilateral inferior oblique overaction.

## Conclusion

Both recession and myectomy are excellent procedures in management of inferior oblique overaction. However, the superiority of one over the other has not been established. Rajavi et al. reported similar success rates of the two procedures in primary IOOA in a randomized controlled trial [7]. They concluded in another study that both the inferior oblique myectomy and anterior transposition procedures are effective in reducing IOOA with similar satisfactory results. DVD and hypertropia were also corrected in their patients similarly by these two surgical procedures [15,18].

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