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# To Compare Horizontal Muscle Plication with Resection In Comitant Squint

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## ABSTRACT

**Background and Aim:** The procedure used commonly for correction of squint is divided into weakening and strengthening procedures. The standard weakening procedure done is recession. Present study aims to compare its efficacy with resection on horizontal rectus muscles and also see the long-term outcome of plication.

**Material and Methods:** This was a randomized prospective interventional study at a tertiary health care centre, Central India. Eighty-Seven patients were included in the study. The comprehensive ocular examination consisted of visual acuity, anterior segment examination with slit lamp, detailed fundus evaluation along with Intraocular Pressure (IOP) measurements. Squint workup consisted of Hirschberg test, cover-uncover tests, Prism bar cover tests (PBCT). The PBCT with glasses is the final angle of deviation which is to be operated upon. Distance and near squint was measured by a prism and alternate cover testing at 6m and 1/3$^{rd}$ m respectively with best correction.

**Results:** In esotropia the success rate for Lateral Rectus (LR) resection was 86.36%, with success rate for plication being comparable with 88.89%. While in the exotropia group, the success rate for MR resection was 90.00%, with a success rate for plication being 72.22%. Due to varied fundamental pathophysiological features, plication, and resection of MR have modestly less linear and less predictable effects in the treatment of exotropia. Preoperative angle of deviation with smaller deviations has better postoperative change. For Resection, all complications of plication were present also one case of slip muscle and a case of anterior segment ischemia was seen.

**Conclusion:** As compared to the classical strengthening procedure Resection which is irreversible, Plication has many advantages like being less traumatic, lack of risk of lost muscle, Reversibility in the early postoperative period. A very major advantage being the potential less disruption of anterior ciliary vessels.

***Keywords:*** *Exotropia, Lateral Rectus resection, Plication, Squint*

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## 1. INTRODUCTION

Many of the cases of squint are due to refractive errors and thus a sizeable proportion is seen in children [1]. The treatment of which leads to significant correction of the manifest squint. Those not correcting by refraction need surgical correction. As majority of patients undergoing squint surgery are children and young adults, an irreversible procedure has its side effects life-long. If in future need arises for re-surgery for overcorrection or under correction, it becomes difficult. Hence new procedures without irreversible removal of tissue are searched for and plication is one of them.

Recently, in the light of irreversible complications of Resection, newer procedures have been searched for and tried in various specialty centres. Plication is one of such procedures with lesser side effects and dose-response relationships similar to Resection.

Plication is considered as a substitute muscle strengthening procedure with advantages being easy to learn and master, involves muscle to sclera plication which does not leave conspicuous tissue[2,3,4,5,6] , less surgical injury, potential reversibility, shorter intra operative time, saving anterior ciliary circulation [5,7,8,9,10,11,12] and excluding risk of lost muscle[4,13, 14,15]. It can be done under topical anesthesia[13] with minimal invasive strabismus surgery incision [2,15]. In various studies it has been found to as effective as plication with similar response per mm of plication as compared to resection with sustainable long-term effects. In the light of advantages of plication, this study aims to compare its efficacy with resection on horizontal rectus muscles and also see the long-term outcome of plication.

**Aims and Objectives**

1. To study the clinical and demographic profile of comitant squint.
2. To compare the success rates of horizontal muscle plication versus resection in comitant squint also keeping in mind about the side effects.
3. To compare complications and long term changes in ocular alignment in horizontal muscle plication versus resection in comitant squint.

## 2. MATERIAL AND METHODS

This was a randomized prospective interventional study at a tertiary health care centre, Central India. All study participants were taken through informed consent process. This study was conducted as per the tenets of the Declaration of Helsinki and the Institutional Ethics committee; Department of Pharmacology of the tertiary health care centre has approved the study.

**Inclusion Criteria**

Basic esotropia or exotropia (distance and near measurements varying within 15 Prism Diopter / PD ) for rectus muscle plication or resection combined with a known amount of antagonist muscle recession.

**Exclusion Criteria**

1. Paralytic squint.
2. Restrictive squint.
3. Previous squint surgery on the muscle to be operated now.
4. Concurrent superior oblique surgery.
5. Pre-existing eye diseases (Thyroid eye disease, Duane's Retraction syndrome, CPEO (Chronic Progressive External Ophthalmoplegia), prior scleral buckle surgery).
6. History of trauma to eye.
7. Dry eye disease.
8. Ocular surface disorder or any infection in and around the eye.

As per the study by Huston PA and Hoover DL[16] , the authors reported the success rates for different treatment procedures. The least success rate was observed for Medial Rectus (MR) plication which was 77.4%. Success rates for other procedures were 90% and above. Thus, for the proposed study, the success rate for MR plication was considered, which resulted in a sample of 67 cases to be included in the study that can give this rate with 95% confidence and a 10% margin of error. However, 20 more patients were added to the data set resulting in a final sample of 87 patients to add more power in the study.

The comprehensive ocular examination consisted of visual acuity, anterior segment examination with slit lamp, detailed fundus evaluation along with Intraocular Pressure (IOP) measurements. Those falling in exclusion criterion were omitted. The patients having squint falling in inclusion criterion who consented underwent a thorough squint workup, which consisted of history of squint with duration, history of amblyopia and orthoptic treatment, the static angle, ocular movements.

Squint workup consisted of Hirschberg test, cover-uncover tests, Prism bar cover tests (PBCT). The PBCT with glasses is the final angle of deviation which is to be operated upon. Distance and near squint was measured by a prism and alternate cover testing at 6m and 1/3$^{rd}$ m respectively with best correction. We supposed an equivalent effect for plication and resection procedures [13,16]

Success rates were interpreted as under correction of <_10 PD and overcorrection of <_4 PD at distance measured at the last clinical presentation.

Statistical information was gathered and recorded systematically, also, data management and analysis were done using continuous variables and with the help of Statistical Software STATA version 18.0 using appropriate statistical methods. Data was analysed using Chi square test.

## 3. RESULTS

In esotropia the success rate for Lateral Rectus (LR) resection was 86.36%, with success rate for plication being comparable with 88.89% [Table No 01 & Figure No 01]. While in the exotropia group, the success rate for MR resection was 90.00%, with a success rate for plication being 72.22% [Table No 02 & Figure No 01 ].

The less success rate for MR plication with most probable reasons [17,18]: It was seen in large angle squint more than 40-45 PD i.e. in the 6-7 mm plication group.

Due to varied fundamental pathophysiological features, plication, and resection of MR have modestly less linear and less predictable effects in the treatment of exotropia.

Also, it was found that the preoperative angle of deviation with smaller deviations has better postoperative change.

Also, the complications seen for plication were less significant and lesser in number like Granuloma at the plication site, Bulging of the plicated muscle over the sclera, tenocyst with few minor complications. For Resection, all complications of plication were present also one case of slip muscle and a case of anterior segment ischemia was seen.

**Table No 01: Comparison of correction between two procedures in Esotropia group**

| Correction based on Prism diopters | Esotropia (n=49) | | P-value* |
|---|---|---|---|
| | MR recession + LR plication (n=27) | MR recession + LR resection (n=22) ₸ | |
| **Under correction** | | | |
| ≤ 10: Success | 21 (77.8%) | 19 (86.4%) | 0.999 (NS) |
| > 10:Failure | 3 (11.1%) | 3 (13.6%) | |
| **Overcorrection** | | | |
| ≤ 4 :Success | 3 (11.1%) | 0 | - |
| > 4:Failure | 0 | 0 | |

*Obtained using Chi-square test; NS: Not Significant; ₸ No improvement: 3 in resection

**Table No 02: Comparison of correction between two procedures in Exotropia group**

| Correction based on Prism diopters | Exotropia (n=38) | | P-value* |
|---|---|---|---|
| | LR recession + MR plication (n=18) ₸ | LR recession + MR resection (n=20) ₸ | |
| Under correction | | | |
| ≤ 10: Success | 13 (72.2%) | 15 (75.0%) | 0.652 (NS) |
| > 10:Failure | 4 (22.2%) | 2 (10.0%) | |
| Overcorrection | | | |
| ≤ 4 :Success | 0 | 3 (15.0%) | - |
| > 4:Failure | 0 | 0 | |

*Obtained using Chi-square test; NS: Not Significant; ₸ No improvement: 1 in Plication and 3 in resection

**Figure No 01: Success rate in Exotropia and Esotropia group**

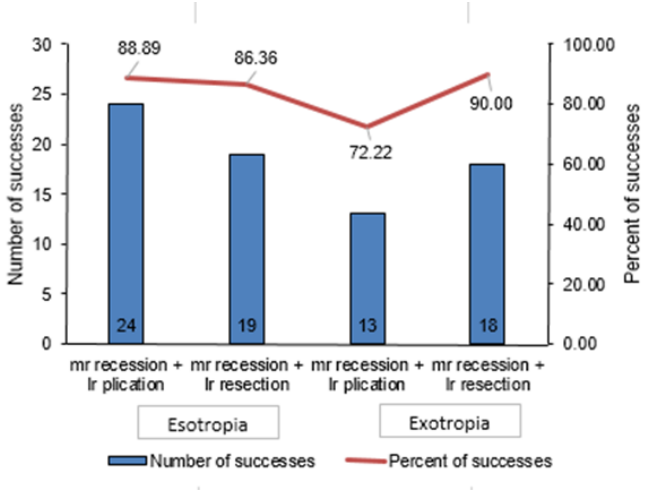



**Figure No 02: Column chart showing number of patients with complications in two procedures in Esotropia group**

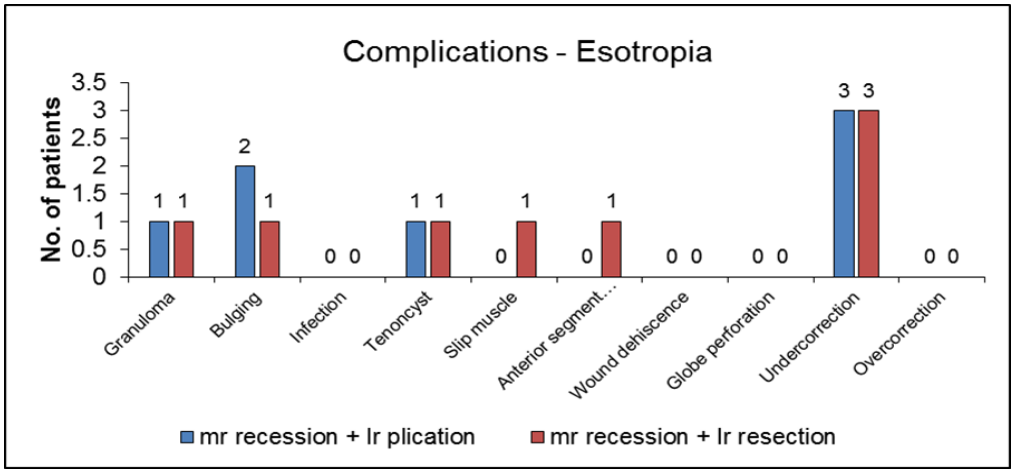
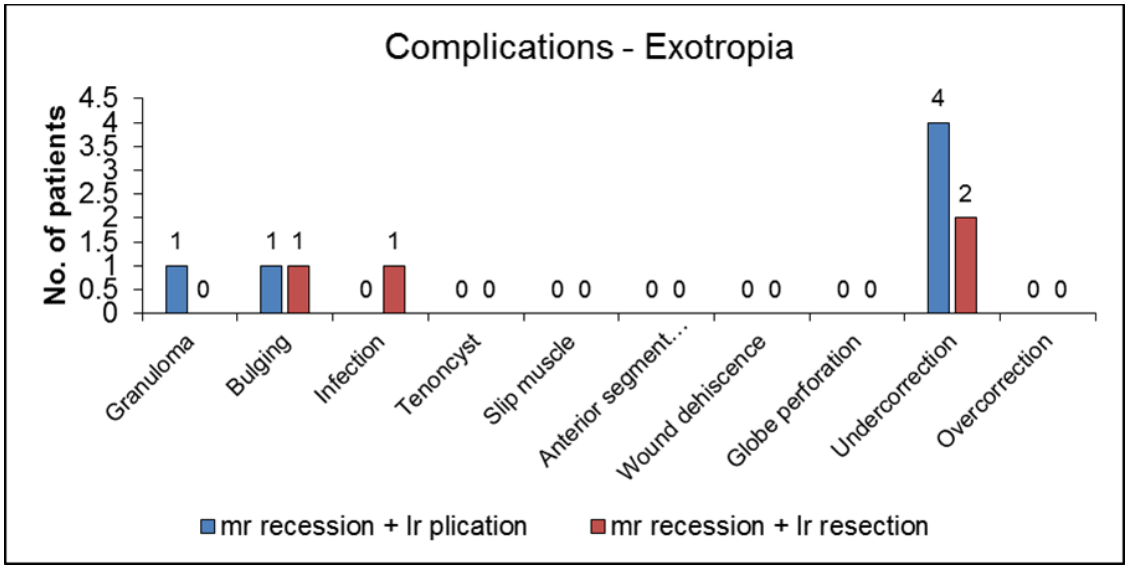



**Figure No 03: Column chart showing number of patients with complications in two procedures in Exotropia group**



## 4. DISCUSSION

There were no reoperation and, in our study, the follow ups for each patient were done at 1 week, 6 weeks and 6 months which was constant for resection as well as plication.

Our study reviewed 18 cases of MR plication with 20 cases of MR resection and found out that the effect on extraocular alignment was statistically equivalent. The success rates in the two treatment groups differed insignificantly with a p-value of 0.999 using the Chi-square test.

4 patients of plication and 2 patients of resection (all under corrections) showed failure and were seen in patients of plication and resection 6 – 7 mm and the Preoperative angle of deviation was more than 40 PD.

Our study used limbal conjunctival incisions only. They are associated with more inflammation with scarring of muscle to secure it in place.

According to Sonwani P et al [14], no significant difference in postoperative surgical outcomes between patients plicated or resected was seen. This was a double-masked, randomized with allocation concealment with 18 patients for plication and 22 patients for resection. They also evaluated the postoperative inflammatory score.

According to Chaudhari Z.et al [13]no significant differences were seen in postoperative success between resection and plication. It involved 22 patients for plication compared with 31 historical controls of resection. The follow-up period of resection was 1243 days as compared to plication which was 137 days. At the last follow up ,similar outcomes were reported. Here the preoperative deviation was of the lesser amount so the amount plicated/resected was also less. They also used limbal conjunctival incisions which produce more inflammation securing plicated muscle to place. This study also included reoperations in their study. They found in their study that due to varied fundamental pathophysiological features, plication and resection of MR have less linear and less predictable results in surgical correction of exotropia.

According to Sukhija and Savleen Kaur et al [17], effects of plication in large angle deviations, especially Exodeviations (surgery on MR) is remarkably impacted by the preoperative angle of deviation with lesser deviations having better postoperative improvement.

It concluded that rectus muscle plication preserves anterior segment circulation and perhaps a cautious sustitute to resection in patients at risk of ASI. According to Repka and Fishman et al[3], conjunctival incision location may also be a variable with higher rates of ischemia seen after limbal incision compared to fornix incision in an animal model.

The success rate for MR plication was 72.22% was least in my study which was supported by the study done by Alkharashi M et al[18]. This was supported by the finding that was seen in large angle squint, more than 40-45 PD, in the 6-7 mm plication group.

According to Huston and Hoover et al [16], the success rates obtained at 4-16 weeks for MR plication were 77.4%.

According to Sonwani P et al[14] which compared the total inflammatory scores postoperatively in resection and plication groups found no significant differences in both at any time of the followup. There were no similar differences in success rates either. This study thus points out that plication can be a substitute to resection and offers comparable outcomes in their postoperative inflammation, SV and surgical success.

According to Chaudhuri Z et al [13] , animal studies have demonstrated that plication to sclera preserves ciliary blood flow of muscle undergoing surgery. Placement of sutures at the muscle margins during plication averts ciliary destruction. Thus making plication valuable in situations in which anterior segment ischemia is a consideration. It also causes less postoperative inflammation thus can be a better substitution of resection in thyroid ophthalmopathy. Plication is also better suited in reoperations.

## 5. LIMITATIONS OF THE STUDY

This study did not take into consideration the visual outcome of the patient. Pre and post-operative visual status of the patient was not considered. This study only involved the correction of manifest squint.

The presence of amblyopia was not taken into consideration.

The gain of stereo acuity/ depth perception/ binocularity after surgery was not taken into consideration.

The last follow-up in some patients was 6 months, thus the long term reliability of plication needs to be evaluated properly before considering it as a standard muscle strengthening procedure.

## 6. CONCLUSION

As compared to the classical strengthening procedure Resection which is irreversible, Plication has many advantages like being less traumatic, lack of risk of lost muscle, Reversibility in the early postoperative period. A very major advantage being the potential less disruption of anterior ciliary vessels. Thus, it can be used in patients with risk of anterior segment

ischemia post squint surgery like in older patients with atherosclerosis and hyper viscosity syndromes, with the previous history of retinal detachment surgery. This forms a major advantage especially when large-angle squint is to be operated where multiple muscle surgery is required or in patients requiring re-surgery.

Plication can be done under topical anesthesia with minimal invasive strabismus surgery incision. It has less noticeable post-operative tissue in newer muscle to sclera plication. It has a similar surgical effect per millimetre as resection in the treatment of comitant squint. We conclude that the rate of significant complications was lesser in the plication group as compared to the resection group with similar postoperative success rates.

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