



# Mono rectus Transposition: Paving the future in Monocular Elevation Deficiency?

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## Abstract

**Aim:** To demonstrate the effectiveness of Mono rectus transposition in managing congenital monocular elevation deficiency.

**Case:** A 4-year-old male with congenital MED had 40 PD Hypotropia, 35 PD Exotropia on modified Krimsky's test, along with a -3-elevation deficit and a poor Bell's reflex. Intraoperatively, FDT was mildly positive, and 5.5mm IR recession was performed in the 1<sup>st</sup> stage, followed by mono rectus transposition with Foster's augmentation in the 2<sup>nd</sup> stage.

**Conclusion:** Mono Rectus Transposition with Foster's Augmentation suture offers a promising alternative to Knapp's or modified Nishida's procedure, especially when addressing concomitant horizontal deviation with a single horizontal muscle.

**Keywords:** Monocular Elevation Deficiency, Double Elevator Palsy, Forced Duction Test, Foster's augmentation, Mono Rectus

### Abbreviations:

MED: Monocular Elevation Deficiency

DEP: Double Elevator Palsy

PD: Prism Diopter

FDT: Forced Duction Test

BCVA: Best Corrected Visual Acuity

IR: Inferior Rectus

MR: Medial Rectus

SR: Superior Rectus

LR: Lateral Rectus

## Introduction

Monocular Elevation Deficiency (MED), also known as Double Elevator Palsy (DEP), is characterised by limitation in the upward movement of the affected eye in both adduction and abduction.

MED can be either congenital, often sporadic, or acquired due to causes such as trauma, thromboembolism, or tumours.

Type 1 of MED is typically caused by primary inferior rectus restriction or fibrosis. The Forced Duction Test (FDT) reveals a tight inferior rectus. Upward saccades remain normal until the tight inferior

rectus limits upgaze. Bell's phenomenon is often poor in this type.

Type 2 is a result of poor innervation of the elevator muscles, such as primary superior rectus palsy. The FDT does not show any obstructions, and upward saccades are delayed both below and above the midline. Bell's phenomenon is usually absent in Type 2.

Type 3 MED is associated with a supra nuclear type and is commonly present at birth. This type is characterised by preserved or slightly reduced vertical saccadic velocity below the midline but abnormal or absent velocity above the midline.



## Case Report

A 4-year-old male was brought to the outpatient department with a history of drooping of left eye and decreased vision in left eye, Birth history was insignificant. On examination, the best corrected visual acuity (BCVA) was 6/9 in right eye and 6/36 in left eye. Child did not comprehend for worth four dot and stereoacuity tests.

The cycloplegic refraction was +3.25dsp/-1.75dc@172 in the right eye and +3.00 dsp/-1.75 dc@9 degrees in the left eye. Anterior and posterior segment evaluation of both eyes were unremarkable. On Ocular motility examination the child was found to have a -3 limitation of elevation in the left eye with severe ptosis of the left eye with a poor Bell's reflex, there was no improvement of ptosis on occlusion of the right eye which confirmed true ptosis .On alternate prism cover test, the child exhibited a 40 (Prism Diopters) left Hypotropia and 35 PD Exotropia

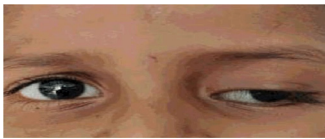


Figure 1: Primary gaze showing exotropia and ptosis in left eye.



Figure 2: 9 gaze of the child showing MED -3 limitation of elevation in left eye.

### Ptosis of left eye

A diagnosis of Congenital Severe Monocular Elevation deficit with Moderate Amblyopia and severe ptosis was made. With due fitness the child was taken up for surgery under general anaesthesia after explaining the possibility of staged surgeries to the parents. The parents were also explained the requirement of a ptosis surgery later and intensive amblyopia therapy.

### Surgical Note

The surgical approach for this case involved a multi-step strategy. Initially, a force duction test (FDT) was performed for the left eye Inferior rectus muscle, which was moderately positive during the intraoperative assessment. Following this an Inferior Rectus muscle recession of 5.5 mm was performed with special attention paid to the separation of lid retractors as a part of the stage 1.

Post operatively minimal improvement in Hypotropia was noted.

The two options available to tackle the condition were a full tendon Knapp's procedure in left eye with a recession/resection for horizontal deviation in right eye vs a Mono-rectus Transposition of medial rectus to superior rectus muscle with a Foster's augmentation suture and bilateral lateral rectus recession.

At this stage a Mono Rectus i.e medial rectus Transposition with a foster's augmentation suture to the superior rectus in left eye with bilateral lateral rectus recession was carried out

At the 3-month follow-up evaluation, it was noted that the patient had 10 pd exotropia with flick left hypotropia. There was significant improvement in left eye elevation from -3 to -1.

Consequently, corrective surgery for ptosis was performed at 3 months, resulting in a significant improvement in the patient's condition. The child was advised patching and was prescribed glasses to counter Amblyopia.

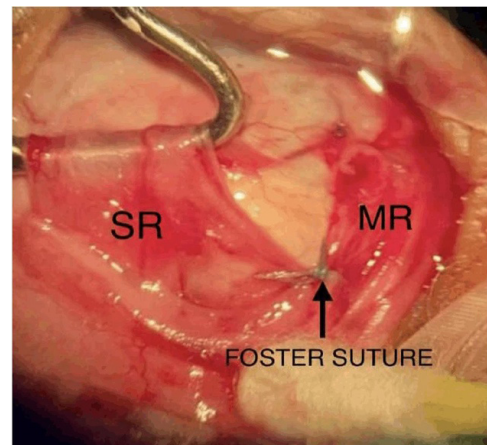


Figure 3: Intraoperative picture showing foster's augmentation suture.

## Result

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Figure 4: 9 gaze taken post operatively improvement in left eye elevation from -3 to -1.

## Discussion

The surgery of choice by and large depends on the result of the FDT, the goals of surgery are to counter the vertical deviation and diplopia caused by the same, ptosis correction is done after the same. Surgery for MED must be individualised depending upon the FDT and Bell's reflex.[2]

The options available are:

1. Knapp's procedure: The full tendon of the medial and lateral rectus muscles is transposed to the insertion of the superior rectus muscle[3]

2. Augmented Knapp's procedure: Knapp's procedure combined with posterior fixation sutures on the horizontal recti, known as Augmented Knapp's[4]

3. Modified Nishida Procedure in MED: Newer No split-No tenotomy technique which involves using non absorbable suture to transpose superior 1/3rd of MR and LR to a point on sclera midway between SR and MR, SR and LR respectively.[5]

Management of MED with positive FDT results, specifically related to tight inferior rectus (IR) muscle, categorises the condition based on the measurement of hypotropia into three ranges: less than 10 PD, 10-25 prism diopters PD and 25-35 prism diopters PD. For patients with less than 10 PD, the recommended management is inferior rectus (IR) muscle recession of 5-8mm. In cases where the measurement is between 10 and 25 PD, IR muscle recession along with a modified Knapp's procedure is advised. For individuals with 25-35 PD, the suggested approach involves IR muscle recession combined with Knapp's procedure.

The management of MED with a negative FDT involves a series of steps depending on the deviation measurement. For deviations less than 10 PD, the treatment includes inferior rectus (IR) recession and the Modified Knapp's procedure. Deviation between 10-25 PD may require SR resection due to positive FDT. Prior IR recession calls for the Modified Knapp's procedure. For deviations of 25-35 PD, IR recession combined with the Knapp's procedure is recommended. Deviations exceeding 35 PD necessitate IR recession and the Augmented Knapp's procedure for effective management.

## Conclusion

Mono rectus Transposition with a Foster's augmentation suture is a good alternative to full tendon Knapp's procedure or a modified Nishida's procedure as it leaves one horizontal muscle available to be utilised for tackling concomitant horizontal deviation in Monocular Elevation Deficit (MED), has lesser chances of Anterior segment ischemia and is also a one setting surgery as opposed to multiple surgeries with significant improvement of the affected movement

## Conflict of Interest

None.

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