

Superior rectus transposition as a feasible surgical method for diplopia due to abducens paralysis with small angle esotropia: a case report and comprehensive perspective on other new trend surgical methods

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ABSTRACT

A 57-year-old male with diplopia presented to our clinic due to sixth nerve palsy (SNP). His medical history encompasses a traffic collision and blunt head injuries from one year prior. This study addresses the appropriate surgical intervention for diplopia resulting from SNP that is a neuro-ophthalmologic disorder characterized by palsy of the lateral rectus (LR) muscle. This palsy leads to diplopia and head position owing to difficulties with lateral gaze in the affected eye. The medical management of SNP is determined by its underlying condition. Most individuals with SNP get spontaneous resolution within a period of six months, systemic treatment. However, a limited number of individuals may necessitate intervention owing to diplopia as their primary complaint. Especially in such cases, it is necessary to choose an appropriate surgical method by taking into account the amount of squint in order to minimize surgical complications such as anterior segment ischemia. The objective of this case presentation is to provide information on Superior rectus transposition (SRT) surgery, a viable technique for treating SNP. Additionally, this case seeks to review current treatment approaches by evaluating alternative trend surgical procedures.

Keywords: Sixth nerve palsy, superior rectus transposition, transposition surgery, augmentation suture, diplopia

INTRODUCTION

SNP is a neuro-ophthalmologic disorder characterized by the paralysis of the LR muscle. This palsy leads to diplopia and difficulties with lateral gaze in the affected eye.^{1,2}

The medical management of sixth nerve palsy is determined by its underlying condition. The majority of individuals with sixth nerve palsy get spontaneous resolution within a period of six months, without the need for systemic treatment. However, a limited number of individuals may necessitate intervention owing to diplopia as their primary complaint.³

Possible treatments for individuals with sixth nerve palsy include prism therapy, strabismus surgery, and *Botulinum* toxin (BTx) injections.

The objective of this case presentation is to provide information on SRT surgery, a viable technique for treating sixth nerve palsy. Additionally, this case seeks to comprehensively review current treatment approaches by evaluating alternative trend surgical procedures.

CASE

A 57-year-old male with diplopia presented to our clinic. His history included a traffic accident and blunt head trauma one year ago. The beginning of diplopia came about after a trauma that was causally associated with it. Visual acuity is observed 20/20 in each eye. Anterior and posterior segment examinations were found within the normal limits, no distinct pathology was noted. In primary position, he had 20 prism diopter (PD) esotropia at far and 25 PD esotropia at near. (Figure 1). During an attempted lateral gaze, right eye cannot be moved beyond the midline and had -3 degree limitation of abduction in right eye on nine gazes examination (Figure 2). He had face turn 20° toward right side that affected side. In forced duction test, there was no restriction to horizontal, vertical or oblique plane. Medial rectus (MR) contraction was not observed. In a surgical intervention that superior rectus transposition (SRT) was planned.

During the surgery, a paralimbal incision was performed between between 9 and 12 o'clock, and then it was dissected

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Figure 1. In the primary position, there was esotropia due to right sixth nerve palsy

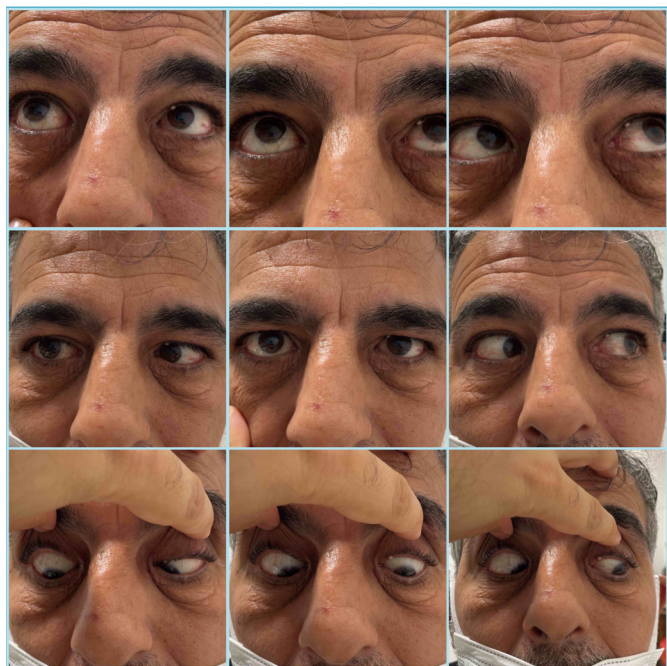


Figure 2. On nine gaze examination, right eye cannot be moved beyond the midline during an attempted right gaze

and become visible. The surgeon gained access to both the SR and LR. The superior oblique muscle fibers under the SR were completely separated and sutured with 6/0 prolene thread adjacent to the LR insertion, parallel to the spiral of Tillaux. Furthermore, an augmentation suture was placed from a distance of 8 mm to the spiral of Tillaux. The 5/0 ethibond suture passed through the border of the SR, LR muscles and sclera (Figure 3).

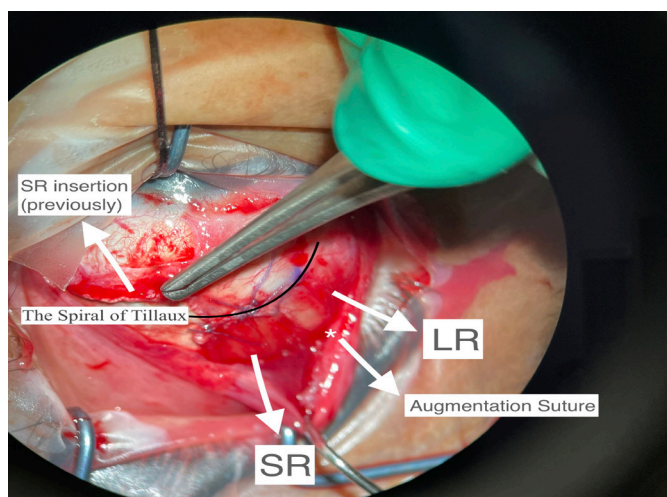


Figure 3. The SR was transposed next to the LR insertion according to spiral of Tillaux and performed an augmentation suture (*)

SR: Superior rectus, LR: Lateral rectus

One year following the surgery, we observed visual acuity at 20/20. There is no pathological finding in the anterior and posterior segments. Head position improved. There was not any surgical complication such as diplopia. There was not any vertical or torsional squint on nine gaze examination (Figure 4).



Figure 4. Esotropia improved totally after SRT surgery. On nine gazes examination, there was no limitation in right eye during abduction

SRT: Superior rectus transposition

DISCUSSION

The management of abducens nerve palsy is based on the underlying cause. Typically, the focus of treatment is on underlying or systemic conditions. The diplopia caused by abducens nerve dysfunction may be surgically treated, prescribed prisms, occluded, or alleviated by BTx injection.⁴

When deciding on surgery, the residual function of the LR is the most crucial factor. If there is currently residual function in the LR muscle, a surgical technique involving resection of the afflicted LR and recession of the corresponding MR also known as the “R and R” surgery is often carried out. If LR muscle function is absent, a several type of transpositions procedures such as full tendon transposition, Jensen, Hummelsheim, Nishida and their modified forms or SRT may be considered. When deciding on surgery, contraction of the MR is another important factor. If there is currently contraction in the MR muscle, a surgical technique involving effective ways of weakening procedures may be preferred such as recession.

Regarding to transposition procedures, Hummelsheim and Jensen procedures are two distinct but related surgical techniques used to treat sixth nerve palsy, a condition that causes weakness or paralysis of the LR muscle, leading to impaired horizontal eye movement and strabismus. Both procedures aim to improve eye alignment and function by redistributing the strength of adjacent muscles. The Hummelsheim procedure involves transposing part of the superior and inferior rectus muscles toward the lateral rectus to help restore abduction. The Jensen procedure, on the other hand, involves a partial transposition of the medial rectus

and adjacent rectus muscles, preserving the insertion of the muscles while relocating their lateral portions. Because of the numerous difficulties that have arisen, particularly anterior segment ischemia, these surgical treatments have been abandoned in recent times.⁵

Currently, modified Nishida and SRT are the most trending surgeries because they are pretty safer than other surgical procedures in terms of anterior segment ischemia. A new and current technique, developed by Hernandez-García et al.⁶ in 2003, involves adjusting the vertical rectus muscles in the eye. The procedure includes hooking the vertical recti, and longitudinally splitting the vertical muscles of belly 14 mm from insertion. Following this, 6-0 nylon sutures are used to secure the temporal half of each muscle, 8-10 mm posterior to the insertion. The same sutures are then is passed through the sclera 8 mm posterior to the insertion of lateral rectus beside the superior or inferior margin. This method was afterward modified, and Muraki et al.⁷ defined a muscle transposition procedure in which the vertical rectus muscles were not split, but rather the lateral margin of each vertical rectus muscle was transposed superotemporally or inferotemporally and sutured onto the sclera without tenotomy or muscle splitting.

In a comparative study, patients with sixth nerve palsy who underwent modified Nishida alone, modified Nishida with medial rectus recession (MRc), and modified Nishida with MRc and BTx injection. In summary, the average correction achieved with the modified Nishida approach alone was 29.4 ± 6.6 PD. However, when an MR recession was added, the correction increased to an average of 62.6 ± 23.8 PD. The combination of the modified Nishida technique with MRc and BTx corrected 95.0 ± 18.0 PD esotropia. There were no observed postoperative issues such as anterior segment ischemia in any patients.⁶ Tauscher describe adjustable modification of Nishida procedure. They present a modified version of the transposition that can be adjusted to address vertical or torsional abnormalities after surgery.^{7,8}

As a novel technique, SRT is a method used especially in small-angle esotropia due to sixth nerve palsy that does not move beyond the midline. Regarding the SRT procedure, a study including 11 patients with sixth nerve palsy who had an average near deviation of 25.82 ± 7.73 PD showed that after undergoing SRT surgery alone, the deviation amounts decreased to 7 ± 6.15 PD during the postoperative period.⁹ Particularly when esotropia exceeds 30 PD, MRc may be required in combination with SRT surgery. In another study, including 7 patients with sixth nerve palsy who had an average near deviation of 53.5 PD).¹⁰ In another study, including 11 cases of sixth nerve palsy found that the average esodeviation was 55.7 ± 23.8 PD before surgery. After undergoing SRT+MRc surgery, the esodeviation was 3.7 ± 5.5 PD. In addition, there was no intraocular complication or vertical deviation requiring surgery.⁹ Based on the examinations conducted, it was determined that SRT surgery was suitable for this case.

In conclusion, SRT is an adequate and reliable procedure in cases with sixth nerve palsy that does not move beyond the midline or does not have LR function and does not exceed 30 PD, while reliable methods such as SRT+MRc combined treatment or modified Nishida can be performed in cases with esotropia exceeding 30 PD.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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