

ANALYSIS OF SURGICAL MANAGEMENT OF A-V PATTERN DEVIATIONSK. Sivakumar¹, T. G. Umamaheswar²¹Senior Assistant Professor, Department of Ophthalmology, Government Stanley Medical College, Chennai.²Senior Assistant Professor, Department of Ophthalmology, Regional Institute of Ophthalmology, Chennai.**ABSTRACT****BACKGROUND**

A and V patterns have been commonly seen in at least one fifth of esotropia and exotropia. This study emphasizes on the efficiency of transposition along with recession/resection surgery of horizontal and oblique muscles in correction of A-V pattern deviations.

MATERIALS AND METHODS

A prospective study was carried out on 50 eyes of 25 patients who underwent either transposition and recession/resection surgery (R-R surgery) of horizontal muscles or oblique muscles weakening and R-R surgery of horizontal muscles with A-V pattern deviations at Regional Institute of Ophthalmology and Govt. Ophthalmic Hospital, Chennai for the period of 1 year. Surgeries done by single surgeon was taken for the study.

RESULTS

The patients underwent either transposition and R-R surgery of horizontal muscles or oblique muscle weakening and R-R surgery of horizontal muscles depending upon the type and degree of deviation and the degree of oblique muscle over action. The postoperative correction of degree of deviation, improvement in amblyopia and attainment of BSV were assessed at the end of 1st and 8th week.

CONCLUSION

Transposition of horizontal and oblique muscle surgeries yielded correction of degree of deviation, improvement of vision in amblyopia and improvement in binocular single vision.

KEYWORDS

A-V Pattern Deviations, Transposition of Muscle Surgeries, R-R Surgery, Gain in BSV.

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BACKGROUND

A-V patterns are horizontal deviations (esotropia or exotropia) which may be comitant in horizontal gazes and incomitant in vertical gazes on looking up or looking down. (They are described by the alphabetical terms as A and V patterns, because the changes of horizontal deviation in up and down gaze resembles the alphabets A and V.¹ They are classified into A exotropia, A esotropia, V exotropia, V esotropia. Many aetiologies like horizontal, vertical and oblique muscle dysfunctions,² facial characteristics and abnormal muscle insertions has been suggested but there is no unanimity concerning the pathophysiology of A and V patterns has been established.³

Aim and Objectives- To study the efficiency of transposition of the horizontal muscles and the oblique muscle surgeries in the correction of A- V pattern deviations.

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**MATERIALS AND METHODS**

A prospective study was carried out on 50 eyes of 25 patients who underwent either transposition and R-R surgery of horizontal muscles or oblique muscle weakening and R-R surgery of horizontal muscles with A-V pattern deviations at regional institute of ophthalmology and Govt. Ophthalmic Hospital, Chennai. Surgeries done by single surgeon was taken for the study. The patients were classified into 2 groups depending upon the degree of deviation. Group I patients- patients with 30-60PD, Group II patients- patients with 60-90PD. Depending upon the degree of deviations recession of horizontal recti or both recession-resection of horizontal recti should be planned. The postoperative correction of degree of deviation, improvement of vision in amblyopia and attainment of BSV were assessed.

Inclusion Criteria

Non-paralytic heterotropia with A & V pattern.
 2 to 25 years age group with A&V pattern.

Exclusion Criteria

1. Paralytic exotropia.
2. Severe amblyopic cases.
3. Cases that had undergone previous surgery and those associated with congenital anomalies.
4. Restrictive syndrome.

Cases that had undergone previous surgery and those associated with congenital anomalies.

RESULTS

Sex Incidence and Age at Surgery- Of the 25 patients (50 eyes) included in the study, 17 were males and 8 were females. Among 17 male patients, 6 had A-eso, 1 patient had A-exo, 5 patients had V-eso and 5 patients had V-exo. Of the 8 female patients, 2 had A-eso, 1 had A-exo, 3 had V-eso and 2 had V-exo.

The age group of patients taken up for surgery ranged from 2-25 years.

Sex	Number of Cases				Total
	A-ESO	A-EXO	V-ESO	V-EXO	
Males	6	1	5	5	17
Females	2	1	3	2	8
Total	10		15		25

Table 1. Sex Distribution

Preoperative Deviation- Based on the preoperative deviations, the patients were divided in two groups. Group 1 constitutes 14 patients with preoperative deviation of 30-60. Group 2 constitutes 11 patients with preoperative deviation of 60-90.

Preoperative Deviation in Degrees	Number of Cases
30-60	14
60-90	11

Table 2. Preoperative Deviation

Refractive Error- With regard to the refractive error of the 25 cases, 3 cases were emmetropic, 9 cases were myopic, and 13 cases were hypermetropic. Of 13 patients with hypermetropia, 7 patients had A-eso, 4 patients had V-eso. Of the 9 myopic patients, 7 had V-Exo, 1 had A-exo and 1 had A-eso. All 3 emmetropes had V-eso.

Refractive error	Number of Cases
Emmetropia	3
Myopia	9
Hypermetropia	13
Total	25

Table 3. Preoperative Refractive Status

Preoperative Amblyopia- The criteria for defining the amblyopia was visual acuity less than 6/12 or above. Among 25 patients, 8 patients had strabismic amblyopia. None of them had anisometropic amblyopia and visual deprivation amblyopia.

Preoperative BSV- Of the 25 cases, none of the patients had BSV. All of them had suppression in one eye to a significant degree.

A-V Patterns- 25 patients of A-V pattern were evaluated and taken up for surgery. 8 patients had A-esotropia, 2

patients had A-exotropia, 8 patients had V-esotropia, 7 patients had V-exotropia. Of the 25 patients, 10 had A pattern and 15 had V pattern. Of the 25 patients, 8 patients had A-eso, 2 had A-exo, 8 had V-eso and 7 had V-exo.

Pattern	Number	Percentage
A Pattern	10	40%
V Pattern	15	60%

Pattern	Cases	Percentage
A ESO	8	32%
A EXO	2	8%
V ESO	8	32%
V EXO	7	28%

Table 4. A-V Pattern Distribution

Choice of Surgery

1. V-Esotropia

V-Esotropia with no inferior oblique overaction bi-medial rectus recession with down shifting of 5 mm or bi-medial rectus recession along with lateral rectus resection and up shifting can be done. Out of 8 cases of v-esotropia, 2 patients with V-esotropia who had no inferior oblique overaction underwent bi-medial rectus recession with downshift was done.

V-Esotropia with minimal inferior oblique overaction

The above procedure was also done for V-esotropia with grade 1 and 2 inferior oblique overaction (within 30 degree). 2 patients who had V-esotropia with minimal inferior oblique overaction underwent bimedial rectus recession with downshifting.

V-Esotropia with severe inferior oblique overaction

Bi-medial rectus recession with inferior oblique recession or bi-medial rectus recession plus bilateral lateral rectus resection with inferior oblique recession can be done for grade 3 and 4 inferior oblique overaction (more than 30 degree). Out of 8 cases of V esotropia, 3 patients who had V-esotropia with severe inferior oblique over action underwent bi-medial rectus recession with inferior oblique recession.

Pattern	No.
V Esotropia with no inferior oblique over action	2
V Esotropia with minimal inferior oblique over action	2
V Esotropia with severe inferior oblique overaction	3
Total	8

Table 5. V-Esotropia Grading

2. V-Exotropia

V-Exotropia with no inferior oblique overaction

Bilateral lateral rectus recession with up shifting with or without bi-medial rectus resection with down shifting (5 mm) can be done. Among 7 patients, 3 patients who had V-exotropia with no inferior oblique overaction underwent bilateral lateral rectus recession with upshifting along with bi-medial rectus resection with down shifting.

V-Exotropia with minimal inferior oblique overaction-

The above procedure was also done for V-exotropia with grade 1 and 2 inferior oblique overaction (upto 30 degree). 2 of the patients who had V-exotropia with minimal inferior oblique overaction underwent bilateral lateral rectus recession with upshifting along with bi-medial rectus resection with downshifting.

V-Exotropia with severe inferior oblique overaction

Bilateral lateral rectus recession with inferior oblique recession or bilateral lateral rectus recession plus bi-medial rectus resection with inferior oblique recession can be done for grade 3 and 4 inferior oblique overaction (more than 30 degree). Out of 7 patients with V exotropia, 2 patients with severe inferior oblique overaction underwent bilateral lateral rectus recession along with bi-medial rectus resection with inferior oblique recession.

Pattern	No.
V Exotropia with no inferior oblique overaction	3
V Exotropia with minimal inferior oblique overaction	2
V Exotropia with severe inferior oblique overaction	2
Total	7

Table 6. V-Exotropia Grading

3. A-Esotropia

A-Esotropia with no superior oblique over action

Bi-medial rectus recession with upshifting of 5 mm or bi-medial rectus recession along with lateral rectus resection and upshifting can be done. Out of 8 cases of A-esotropia, 6 patients with A-esotropia with no superior oblique overaction underwent bi-medial rectus recession with upshifting was done.

A-Esotropia with minimal superior oblique overaction

The above procedure was also done for A-esotropia with grade 1 and 2 superior oblique overaction (upto 30 degree). 2 patients who had A-esotropia with minimal superior oblique overaction underwent bi-medial rectus recession with upshifting.

A-Esotropia with severe superior oblique overaction

Bi-medial rectus recession with superior oblique recession or bi-medial rectus recession plus bilateral lateral rectus resection with superior oblique recession can be done for grade 3 and 4 inferior oblique overaction (more than 30). No cases of A-esotropia with severe superior oblique overaction were present in the study.

Pattern	No.
A Esotropia with no superior oblique overaction	6
A Esotropia with minimal superior oblique overaction	2
A Esotropia with severe superior oblique overaction	Nil
Total	8

Table 7. A-Esotropia Grading

4. A-Exotropia

A-Exotropia with no superior oblique over action

Bilateral lateral rectus recession with upshifting 5mm or RR surgery with transposition is done for cases of A-exotropia for no superior oblique overaction. 1 patient had A-exotropia with no superior oblique overaction for whom bilateral lateral rectus recession with upshift and bi-medial resection with up shift was done.

A-Exotropia with minimal superior oblique over action

Bilateral lateral rectus recession with upshift and bi-medial rectus resection with downshift is done for cases of A-exotropia with minimal superior oblique overaction upto grade 2, i.e 30 degree. 1 patient had A-exotropia with minimal superior oblique overaction for whom bi-lateral lateral rectus recession with upshift and bi-medial rectus resection with downshift was done.

A-Exotropia with severe superior oblique over action

Bilateral lateral rectus recession with superior oblique weakening procedure or RR surgery with superior oblique weakening procedure is done for severe superior oblique over action (i.e. more than 30 degree). No patient had A-exotropia with severe superior oblique overaction in this study.

Pattern	No.
A Exotropia with no superior oblique overaction	1
A Exotropia with minimal superior oblique overaction	1
A Exotropia with severe superior oblique overaction	Nil
Total	2

Table 8. A-Exotropia Grading

	Pattern	Surgery
1	V-Esotropia with inferior oblique overaction	Medial rectus recession or recession-resection surgery combined with inferior oblique weakening
2	V-Exotropia with inferior oblique overaction	Lateral rectus recession or recession-resection surgery combined with inferior oblique weakening
3	A-Esotropia with superior oblique overaction	Medial rectus recession or recession-resection surgery combined with superior oblique weakening
4	A-Exotropia with superior oblique overaction	Lateral rectus recession or recession-resection surgery combined with superior oblique weakening
5	V-Esotropia without overaction	Bi-medial recession with MR downshift of 5 mm
6	V-Exotropia without overaction	Bilateral lateral recession with LR upshift of 5 mm
7	A-Esotropia without overaction	Bi-medial recession with MR upshift of 5 mm
8	A-Exotropia without overaction	Bi-lateral lateral recession with LR downshift of 5 mm

Table 9. Surgical Options for AV Patterns

1 mm surgery on medial rectus corrects 3-4.5 pd of deviation and 1 mm surgery on lateral rectus corrects 2-3pd of deviation. For recession –resection surgery maximum of 6mm for medial rectus and 8 mm for lateral rectus was done. The weakening procedure for obliques are graded (6, 8, 10 mm) recession for mild, moderate and severe overactions

Preoperative Analysis

Preoperative Analysis	Number of Cases
Preoperative V/A	
6/6	3
6/12	5
6/18	5
6/24	1
6/36	2
Preoperative Deviation	
30-60	14
60-90	11
Preoperative Amblyopia	8
Preoperative BSV	0
A-V Pattern	
V-Esotropia	8
V-Exotropia	7
A-Esotropia	8
A-Exotropia	2

Table 10. Preop analysis

Outcome

Improvement in Deviation

A Favourable outcome in group 1 contributing 14 patients with preoperative deviation of 30-60 prism dioptres was defined as orthophoric postoperatively. Of 14 patients in group 1, 11 cases (79%) were orthophoric in the first week which increased to 13 (93%) in 8 weeks postoperatively. A favourable outcome in group 2 contributing 11 patients with preoperative deviation of 60-90 prism dioptres was defined as postoperative deviation within ± 10 prism dioptres (consecutive-residual deviation) postoperatively. Of 11 patients in group 2, 9 cases (82%) had residual/consecutive deviation within 10 prism dioptres which increased to 10 (91%) in 8 weeks postoperatively.

Sl. No.	Preop in Δ	Number of Cases	1 st Week	8 th Week
1	30-60	14	11	13
2	60-90	11	9	10
Total		25	25	23

Table 11. Post-Op Improvement in Deviation

Improvement in Amblyopia- Out of 8 eyes which had a preoperative strabismic amblyopia, 2 cases showed improvement in 1st postoperative week. 6 cases showed improvement in the 8th week (82%). 4 cases had one line improvement. 2 cases had two line improvement of visual acuity in snellens chart.

Sl. No.	No. of Cases Preop Amblyopia	Post Op	
		1 st Week	8 th Week
1	8	2	6

Table 12. Post-Op Improvement In Amblyopia

Gain in BSV- Out of 25 cases none of them had BSV preoperatively. At the end of 8 weeks of surgery, 8 patients had some grades of BSV. 5 of them had simultaneous macular perception (SMP). 2 of them had SMP and fusion. One had SMP, fusion and stereopsis.

Sl. No.	No. of Cases	Pre-op BSV	Post OP BSV	
			1 st Week	8 th Week
1	25	0	0	8

Table 13. Post-Op Gain in BSV

Post-operative Analysis of A-V Pattern Deviations

A Esotropia with no superior oblique overaction of 6 patients who had A esotropia with no superior oblique muscle overaction, 5 patients underwent bi-medial recession with upshifting. The procedure was successful in all patients and the patients were orthophoric in all gaze positions. One patient who underwent bi-medial recession with upshifting and bilateral lateral rectus resection with downshifting had residual esotropia of 5 prism dioptres which was not increasing in up and down gazes. Hence the A pattern was corrected.



Figure 1. Before Surgery



Figure 2. After Surgery

1.A Esotropia with minimal superior oblique overaction Two patients who had A esotropia with minimal superior oblique overaction underwent bi-medial recession with upshifting. The patients were orthophoric in all gaze positions. Hence the A pattern was corrected.

2. A Exotropia

A Exotropia with no superior oblique overaction

Of one patient with A exotropia with no superior oblique overaction underwent bilateral lateral rectus recession with upshifting and bi-medial rectus resection with downshifting had a residual deviation of 5 prism dioptres which was not increasing in up and down gaze. Hence the A pattern was corrected.

A Exotropia with minimal superior oblique overaction

Of one patient with A exotropia with minimal superior oblique overaction underwent bilateral lateral rectus recession with upshifting and bi-medial rectus resection with downshifting had a consecutive eso deviation of 5 prism dioptres in the first postoperative week, which became orthophoric in all gazes in the 8th postoperative week.



Figure 3. Before Surgery



Figure 4. After Surgery

3. V ESOTROPIA

V Esotropia with no inferior oblique overaction

Of two patients who had V esotropia with no inferior oblique overaction underwent bi-medial recession with downshifting. One patient was orthophoric in all gazes and one patient had residual eso of 5 prism dioptres which was not increasing in up and down gazes. Hence the V pattern was corrected.

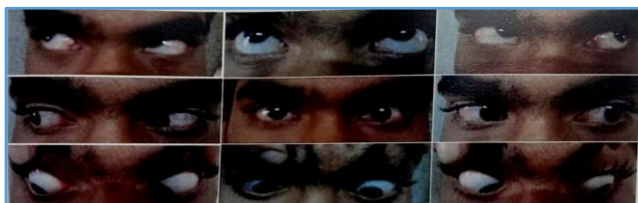


Figure 5. Before Surgery



Figure 6. After Surgery

V Esotropia with minimal inferior oblique overaction-

Of two patients who had v-esotropia with minimal inferior oblique overaction underwent bi-medial recession with downshifting. Both the patients were orthophoric in all gazes. Hence the V pattern was corrected.

V Esotropia with Severe Inferior Oblique Overaction

Of three patients who had V esotropia with severe inferior oblique overaction, all of them underwent bi-medial recession with inferior oblique recession. All of them had a residual eso deviation of 10 prism dioptres which was not

increasing in up and down gazes. Hence the V pattern was corrected.



Figure 7. Before Surgery



Figure 8. After Surgery

4. V EXOTROPIA

V Exotropia with no inferior oblique overaction

Of three patients who had V exotropia with no inferior oblique overaction, all 3 underwent and bilateral lateral rectus recession with downshifting with bi-medial resection with upshifting. 2 patients were orthophoric in all gazes. One patient had residual exotropia of 10 prism dioptres which was not increasing in up and down gazes. Hence the V pattern was corrected.

V Exotropia with minimal inferior oblique overaction

Of two patients who had a V exotropia with minimal inferior oblique overaction, both underwent bilateral lateral rectus recession with downshifting with bi-medial resection with upshifting. 1 patient was orthophoric in all gazes. One patient had residual exotropia of 10 prism diopters which was not increasing in up and down gazes. Hence the V pattern was corrected.

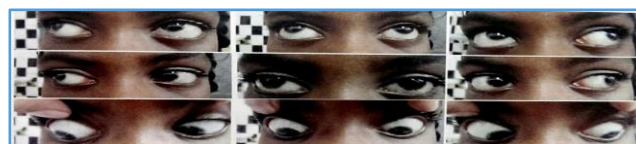


Figure 9. Before Surgery



Figure 10. After Surgery

V Exotropia with severe inferior oblique overaction

Of two patients who had a V Exotropia with severe inferior oblique overaction, both underwent bilateral lateral rectus recession and bi-medial resection with inferior oblique recession. 1 patient was orthophoric in all gazes. One patient had residual exotropia of 20 prism dioptres in the first postoperative week which decreased to 10 prism dioptres in 8th postoperative week which was not increasing in up and down gazes. Hence the V pattern was corrected.



Figure 9. Before Surgery



Figure 10. After Surgery

Pattern	No.	After 1 st Week	After 8 th Week
A-ESO	8	8	8
A-EXO	2	2	2
V-ESO	8	7	7
V-EXO	7	6	6

Table 14. Results of AV Pattern Correction

DISCUSSION

Binocular single vision (BSV) is one of the hallmarks of the human race. Grades of BSV are simultaneous macular perception, fusion and stereopsis.⁴ If there is a loss of BSV, some adaptations are needed to tackle it. The adaptation can be motor or sensory.⁵ Motor adaptations include fusion, changes in head posture, blind spot mechanism. Sensory adaptations include suppression, anomalous retinal correspondence, amblyopia resulting from prolonged uniocular suppression.

Strabismus is classified into horizontal, vertical and torsional strabismus. In the horizontal strabismus if the eye is convergent it is called as esotropia and if it is divergent, it is called as exotropia.⁶ Esotropia are further divided into accommodative, non-accommodative and partially accommodative depending upon the role of accommodative and refractive element in its causation. Vertical concomitant strabismus is classified into hypertropia and hypotropia. Torsional squint or cyclotropia are divided into incyclotropia and excyclotropia.⁷

A and V pattern have been commonly seen in about one fifth of horizontal deviations.⁸ V patterns are commoner than A pattern in which V- esotropia is the most common anomaly followed in order of frequently A-esotropia, V-exotropia and A-exotropia. While esodeviations are more common in west, the exodeviations are more common in Indian and African race. There is no single etiological factor that can explain all A and V patterns. An Apparent overaction or underaction of oblique muscles and horizontal recti is the most common clinical finding and surgery on these muscles has been successful in elimination of these patterns.⁹

V and A patterns are treated surgically depending on whether a functional or cosmetic result or both is needed. In

functional result, surgery is indicated to restore a useful field of binocular single vision particularly on downgaze without need for compensatory head posture. In cosmetic result, surgery is usually performed if the pattern is cosmetically unacceptable.¹⁰

CONCLUSION

1. Vertical transposition of horizontal muscle along with recession and resection was effective in A-V patterns in no oblique muscle overaction.
2. Vertical transposition of horizontal muscle along with recession-resection was also effective in A-V patterns with minimal oblique muscle overaction.
3. Oblique muscle weakening was not necessary in A-V patterns with minimal oblique muscle overaction.
4. Weakening of oblique muscle was effective in patients with A-V patterns with severe oblique muscle overaction along with recession-resection surgery.
5. Patients who underwent transposition of horizontal and oblique muscle surgery for AV patterns also had an improvement in amblyopia.
6. Patients who underwent transposition of horizontal and oblique muscle surgery for AV patterns also had a gain in BSV.

REFERENCES

- [1] Sharma P. Strabismus simplified. 2nd edn. CBS Publishing 2013.
- [2] Urist MJ. The etiology of the so-called A and V syndromes. Am J Ophthalmol 1958;46(6):835-844.
- [3] Apt L. An anatomical reevaluation of rectus muscle insertions. Trans Am Ophthalmol Soc 1980;78:365-375.
- [4] Adler FH, Hart WM. Adler's Physiology of the eye: clinical applications. 9th edn. St. Louis: Mosby 1992.
- [5] Tychsen L. Binocular vision. In: Adler FH, Hart WM, eds. Adler's physiology of the eye: clinical applications. 9th edn. St. Louis: Mosby 1992:773-853.
- [6] Brodie SE. Photographic calibration of the Hirschberg test. Invest Ophthalmol Vis Sci 1987;28(4):736-742.
- [7] Bixenman WW, von Noorden GK. Apparent foveal displacement in normal subjects and in cyclotropia. Ophthalmology 1982;89(1):58-62.
- [8] Fink WH. The A and V syndromes. Am Orthopt J 1959;9:105.
- [9] Postie G. Etiopathogenic des syndromes A et V. Bull Mem Soc Fr Ophthalmol 1965;78:240.
- [10] Prieto-Diaz J. Management of superior oblique overaction in A-pattern deviations. Graefes Arch Clin Exp Ophthalmol 1998;226(2):126-131.