

ADJUSTABLE SUTURE STRABISMUS SURGERY: A REVIEW OF 850 CASES

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Purpose. The aim of the study is to investigate the relationship between the different kinds of squint and the adjustment required in post-op.

Methods. Our personal case histories concerns 850 patients that underwent adjustable suture strabismus surgery during the last ten years, examined in our Department of Ophthalmology over the period 2000-2009. The same surgeon (G.L.) performed adjustable suture strabismus surgery as routine duties, whether on horizontal or vertical rectus muscles, but never on oblique muscles. Adjustments were always performed in the 24 postoperative hours.

With regard to the relationship between previous surgeries, and requested regulation: 669 cases not underwent previous surgery; 181 cases previously underwent surgery one or more times.

Results. First we seek for the statistical significant difference between the various results found, computing χ^2 , ρ and the relative risk. We can conclude by saying that who made a vertical muscle squint surgery presents a relative risk of 3 times greater to take hypocorrection rather than hypercorrection and that who made before squint surgery presents a relative risk of 2,72 times greater to take regulation.

Conclusions. We predicted this result because it confirms that the use of adjustable suture is the more frequent as the muscle fibrosis is the more significant. And the fibrosis is an usual outcome of previous squint surgery.

Keywords. Strabismus, Squint surgery, Adjustable suture

INTRODUCTION

The wide fields of action of adjustable sutures have been and still today are the purpose of an inquiry by the squint-surgeons: if some surgeons think that the adjustable suture can be useful only in selected cases, other ones usually apply this technique (1,2,3,4).

In our case we believe that we can apply this technique in every kind of squint as routine. But above all we would like to demonstrate that it is irreplaceable in the resurgeries and in all the situations in which the anatomic muscle structure presents great pathologic anatomical changes due to extensive cicatricial and synechial instances. In practice in all that conditions in which we cannot predict the reaction to the muscle reinforcement or weakening(5,6,7).

So we focalized our attention searching for correlations between previous or not squint surgery, and the necessity of adjustable suture regulation (8,9,10,11), seeking for the statistical significant difference between the various results found, computing χ^2 , ρ and the relative risk.

METHODS AND MATERIALS

The peculiarity of strabismus surgery is strictly connected with the precise quantification of weakening or

reinforcement practice that we apply to the concerned muscles to obtain the complete correction of the deviation angle and, when it's possible, the reinstatement of binocular vision.

The outcome of surgery practice is conditioned by two main factors. On one hand the innervational factors, difficult to quantify because related to the emotional condition of the patient, responsible for the so-called "muscle tone", and completely eliminable only under general anaesthesia(12,13,14).

On the other hand we have the mechanical factors that derive from the pathologic anatomical changes of the muscle (both for congenital and acquired diseases) that however modify the tension-length ratio of the muscle and consequently the muscular strength. The mechanical factors gain more importance in the presence of extensive cicatricial and synechial instances, as the outcome of previous muscle surgery. Obviously using topical anesthesia only the mechanical factors will act (15,16,17,18). Concluding, while on one hand the surgery enables us to continuously monitor the innervational condition using topical anesthesia, on the other hand only the use of general anaesthetics enables us to quantify the mechanical factors in the right way.

Consequently, the ideal solution is to evaluate both pa-

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rameters. So we have to fully value the mechanical factors in the absence of the so-called “muscle tone”; but we also have to verify and correct the surgery outcome in a second time when we will have the restarting of the innervational factors, that is at the end of the general anaesthesia (when the muscle tone is active again) using the adjustable suture strabismus surgery. We usually execute a limbical-conjunctival approach, completed by radial section (19,20,21).

An absorbable double-armed suture (Vicryl 6-0) is passed on both sides of the muscle insertion in the recession procedure, or at a distance of few millimetres from the muscle insertion in the resection procedure. Therefore the muscle is disconnected from the globe, and, if it is necessary to strengthen its work, it is also shortened. The two ends of the double-armed suture are passed back through the sclera at the insertional stump, and if it is necessary to weaken the muscular action strength, the muscle insertion is replaced at a distance of few millimetres from the original place, towards the equator. Therefore the two ends of the double-armed suture are tied making first an overhand-knot, and then a bow that can be simply loose at the regulation time to precede or to recede the muscle.

The conjunctiva must be suture to the sclera in such a way to exhibit the knot and to facilitate the regulation of the adjustable suture. Usually we make it after 24 hours from the surgery, sometimes later, never before: in fact the regulation must be always done when we are sure that the muscle tone is completely retake (22,23,24,25).

In fact we uncover the patient’s eye and we instill some drops of antibiotic, of anti-inflammatory steroid and finally of topic anesthetic into the fornix of the operated eye. Now we evaluate the patient to find the quantification of the deviation angle (to discover possible hypercorrections or hypocorrections); usually we make it from far and near, always with the patient’s optics correction. On the basis of this evaluation the knot must be release and the muscle must be further advance or recede till the complete angle’s correction.

Only when we obtain both the optimum conditions and the motor fusion (in an enough roomy space arch) we can definitively shut the suture’s knot and the surgical technique can be considered complete.

REPORT OF CASES

Our personal case histories concerns 850 patients that underwent adjustable suture strabismus surgery during the last ten years, in our Department of Ophthalmology, Siena (Table I). All the surgeries were performed by the same surgeon (G.L.), to guarantee the surgery technique homogeneousness.

Adjustments were always performed in the 24 postoperative hours, with the exception of those cases in which we made use of adhesive stuffs, so that the timing was prolonged.

We performed adjustable suture strabismus surgery as routine duties, aside from the strabismus pathogenesis;

obviously we practiced an exception to the rule with regard to those patients that just do not offer enough guaranty of cooperation.

We applied adjustable suture whether on horizontal or vertical rectus muscles (26,27), but never on oblique muscles. The patients age were between 7 and 82 years, middle age was about 37 years; 452 were males and 398 were females; 585 horizontal rectus muscles and 265 vertical ones.

With regard to the pathogenesis:

- 568 cases of non paralytic strabismus;
- 133 cases of paralytic strabismus;
- 149 cases of muscle fibrosis (above all referable to dysthyroid orbitopathy).

The evaluation of the surgical outcome has produced the follow results:

- about the horizontal rectus muscles we obtained 287 hypercorrections, 100 hypocorrections, and 198 cases in which no adjustable suture regulation was necessary;
- about the vertical rectus muscles we obtained 48 hypercorrections, 147 hypocorrections , and 70 cases in which no adjustable suture regulation was necessary.

With regard to the relationship between previous surgeries, typology of deviation and requested regulation:

- 669 cases (467 horizontal rectus and 202 vertical ones) not underwent previous surgery, adjustable suture regulation was necessary in 233 (of wich 145 horizontal rectus and 88 vertical ones);
- 181 cases (118 horizontal rectus and 63 vertical ones) previously underwent surgery one or more times, adjustable suture regulation was necessary in 172 (of which 116 horizontal rectus and 56 vertical ones).

Only in one case the deviation angle correction produced the incidence of diplopia; it was so hard that we had to reproduce the pre-surgery angle of deviation. It is interesting to note that the anamnestic reconstruction of the patient history revealed behaviour disorders and psychotropic drugs dependency.

Table I. Adjustable strabismus surgery: 850 cases

		HORIZONTAL RECTUS	VERTICAL RECTUS
		NONE PREVIOUS SURGERY	REGULATION NECESSARY
	REGULATION NOT NECESSARY	322	114
	TOT.	467	202
		HORIZONTAL RECTUS	VERTICAL RECTUS
		PREVIOUS SURGERY	REGULATION NECESSARY
	REGULATION NOT NECESSARY	2	7
	TOT.	118	63

We never had symptoms certainly referible to the oculo-cardiac reflex, but 7 patients exhibited other vagal responses (lipothymia) that spontaneously resolved without the use of specific drugs, but simply positioning the patient in Trendeleburg.

In 6 cases the complete absence of cooperation (at the regulation time) made useful the use of topic anaesthetics to obtain definitive knot closure.

In 13 cases, at the regulation time, the bow was not completely tight and the muscle was glided back towards the equator.

RESULTS

First study

During the data processing, we focalized our attention searching for correlations between previous or not squint surgery, and the necessity of adjustable suture regulation. First of all we compute the relative risk obtaining the following results.

Who made before squint surgery to correct an horizontal strabismus presents a relative risk of 3,17 times greater to take regulation (Table II) and who made before squint surgery to correct a vertical strabismus presents a relative risk of 2,04 times greater to take regulation, in comparison with who did not make previous squint surgery (Table III).

Table II. First study: horizontal rectus muscle.

	REG.+	REG.-	TOT.
Previous surgery +	116	2	118
Not previous surgery -	145	322	467
Patients who underwent previous surgery to correct an horizontal strabismus show a relative risk of 3,17 times greater to need adjustment versus patients who did not.			

Table III. First study: vertical rectus muscle.

	Adjustment needed+	Not adjustment needed.-	TOT.
Previous surgery +	56	7	63
Not previous surgery -	88	114	202
Patients who underwent previous surgery to correct a vertical strabismus show a relative risk of 2,04 times greater to need adjustment versus patients who did not.			

Finally we can conclude by saying that who made before squint surgery presents a relative risk of 2,72 times greater to take regulation (Table IV).

Table IV. First study: overall estimation

	REG.+	REG.-	TOT.
Previous surgery +	172	9	181
Not previous surgery -	233	436	669
Tot	405	445	850
Patients who underwent previous surgery show a relative risk of 2,72 times greater to need adjustment (the fibrosis is an usual outcome of previous squint surgery).			

We predicted this result because it confirms that the use of adjustable suture is the more frequent as the muscle fibrosis is the more significant. And the fibrosis is an usual outcome of previous squint surgery.

Second study

Subsequently we evaluated if there is correspondence between making surgery on an horizontal rectus muscle, a vertical one and the type of necessary correction. So, who made a horizontal muscle squint surgery presents a relative risk of 1,113 times greater to take hypo- or hypercorrection (that is to need an adjustable suture surgery) (Table V) and that who made a vertical muscle squint surgery presents a relative risk of 3 times greater to take hypocorrection rather than hypercorrection.

Table V. Correspondence between surgery on an horizontal rectus muscles, a vertical one, and the adjustment needed.

	HYPH/ HYPERCORRECTION	NO ADJUSTEMENT REQUIRED	TOT.
Vertical rectus operated	195	70	265
Horizontal rectus operated	387	198	585
Surgery on a horizontal muscle shows a relative risk of 1,113 times greater to need adjustment.			

Third study

With regard to the relationship between previous surgeries, typology of deviation and requested regulation:

- 1) 669 cases (467 horizontal rectus and 202 vertical ones) not underwent previous surgery, adjustable suture regulation was necessary in 233 (of which 145 horizontal rectus and 88 vertical ones);
- 2) 181 cases (118 horizontal rectus and 63 vertical ones) previously underwent surgery one or more times, adjustable suture regulation was necessary in 172 (of which 116 horizontal rectus and 56 vertical ones).
- 3) Then we seek for the statistical significant difference between the various results found, computing χ^2 and ρ .

Statistical significant difference regarding previous surgery or not, horizontal or vertical muscles, computing χ^2 and ρ .

No previous surgery (1)

	Horizontal rectus	Vertical rectus
ADJUSTMENT REQUIRED	145	88
ADJUSTMENT NOT REQUIRED	322	114
TOT.	467	202

$$\chi^2=9,730, \rho =0,018$$

The difference is a statistical significant difference because $p<0,05$.

Previous surgery (2)

	Horizontal rectus	Vertical rectus
ADJUSTMENT REQUIRED	116	56
ADJUSTMENT NOT REQUIRED	2	7
TOT.	118	63

$$\chi^2=7,707, \rho =0,0055$$

The difference is a statistical significant difference because $p<0,05$.

Difference between adjustable suture squint surgery not applied on vertical and horizontal rectus, apart from previous surgery or not (3)

$$\chi^2=11,874$$

$$\rho = 0,0006$$

The difference is a statistical significant difference.

CONCLUSIONS

The adjustable strabismus surgery can be considered safe as any usual surgical technique. Certainly this surgical procedure is not proposable in the teen age; we can performe this technique in every kind of squint as routine, but we think it is mandatory in the reoperations and in all the cases in which the muscle's structure shows greatest metaplasia.

The adjustable sutures help to gain the desired alignment in the short term follow up, but not in the long term follow up; in fact the final result is related to many factors, particularly to the sensorial inputs.

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