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Vertical and torsional correction in congenital superior oblique palsy by inferior oblique recession

A. MATAFTSI, J. STRICKLER, G. KLAINGUTI

Ophthalmic Hospital Jules Gonin, University of Lausanne, Lausanne - Switzerland

PURPOSE. *Inferior oblique recession (Fink's technique) is one of various surgical procedures to manage congenital superior oblique muscle palsy. The authors aimed to determine the effectiveness of this operation in reducing vertical deviation and torsional deviation, and to assess the dose-effect relationship.*

METHODS. *Fifty-eight patients presenting with unilateral congenital superior oblique palsy had an inferior oblique recession of 6 mm, 8 mm, or 10 mm (16, 35, and 7 patients, respectively). Vertical deviation and torsional deviation were measured before and after surgery by means of the dark red glass dissociation in front of Harms' tangent screen and the data were analyzed retrospectively.*

RESULTS. *A cure rate of 88% was achieved, with no complications, and no overcorrections. For the 34 patients for whom long-term follow-up was possible (mean 2.8 years), final median postoperative vertical deviations and torsional deviations were 0.5° and 0°, respectively, both in primary position and in adduction upgaze.*

CONCLUSIONS. *Inferior oblique weakening by recession proves to be an efficient and safe procedure for congenital superior oblique palsy, and its effect on vertical deviation can be predicted on the extent of recession. The operation can therefore be adapted to the patient, depending on the degree of the preoperative deviation. (Eur J Ophthalmol 2006; 16: 3-9)*

KEY WORDS. *Congenital superior oblique palsy, Inferior oblique recession, Vertical deviation, Torsional deviation*

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INTRODUCTION

Congenital superior oblique muscle palsy is characterized by the presence of hyperphoria-tropia and excyclorotation of the affected eye, compensatory head position that is often subconscious, positive Bielschowsky head-tilt test, and increased vertical fusion amplitude (1).

Surgical management of this condition consists of either re-enforcing the superior oblique muscle or weakening the inferior oblique muscle of the paretic eye, or, eventually, in operating on the superior and inferior rectus muscles (1); a combination of the above procedures may also be used (1).

Studies published to date have focused on the effect of surgery on vertical deviation in primary position and have neglected torsional deviation, which is a major characteristic of superior oblique muscle palsy. In addition, patients with congenital and acquired palsy are often considered in the same group. Taking into consideration that the presence or absence of chronic compensatory mechanisms may influence the response to surgery of these two pathologies, we considered that they should be studied

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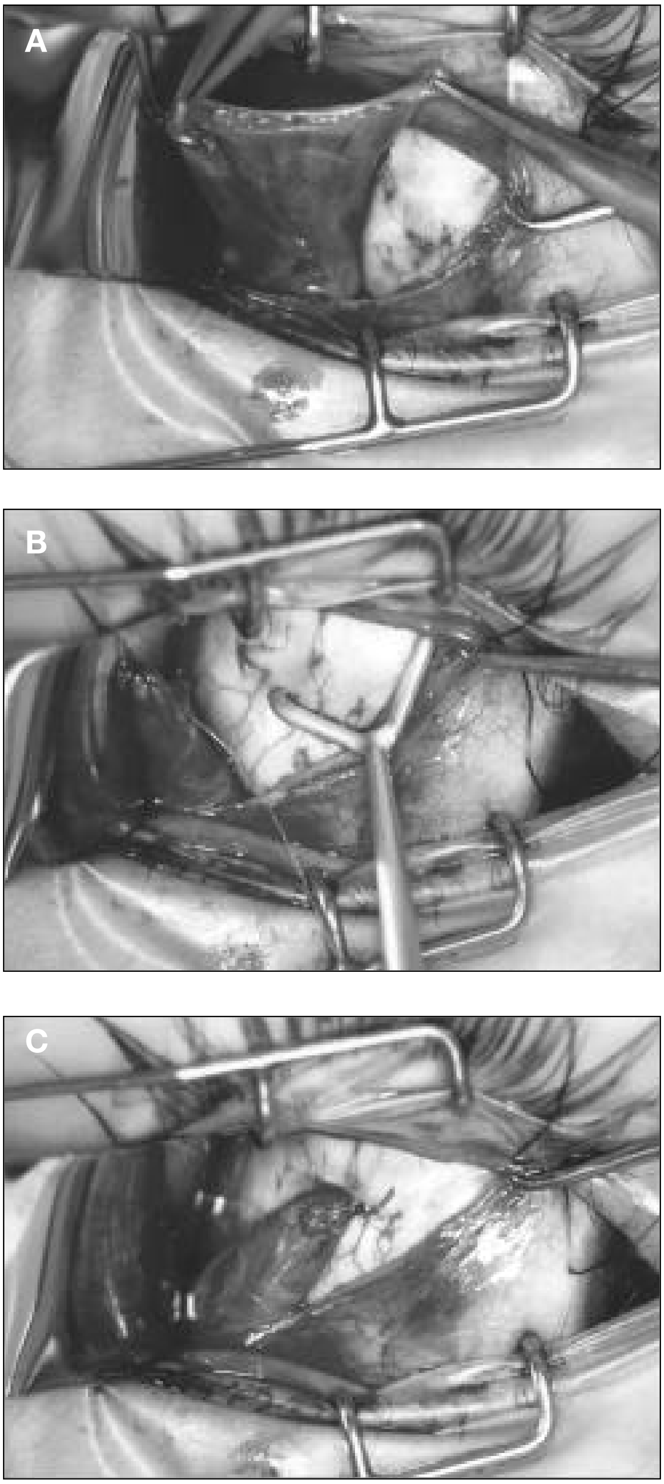


Fig. 1 - *Inferior oblique recession as described by Fink (2). Inferior oblique is completely disinserted* **(A)***. The new insertion point is localized by using Fink's marker: one shaft is positioned at the inferior end of the lateral muscle's insertion and parallel to the limbus, the other shaft giving the new insertion point* **(B)***. Finally, the anterior end of inferior oblique's insertion is reattached to the sclera* **(C)***.*

separately in order to evaluate one specific surgical technique.

The technique used in this study was weakening of the overacting inferior oblique muscle by its recession, as described by Fink (2). The recession was sized at 6 mm, 8 mm, or 10 mm (2). The purpose was to determine the effectiveness of this technique in reducing vertical and torsional deviation in the different gaze directions, as well as to evaluate the relationship between length of recession and effect.

PATIENTS AND METHODS

All patients who underwent inferior oblique muscle recession for unilateral congenital superior oblique muscle palsy from February 1992 to November 2001 were identified retrospectively. Patients who underwent an additional concurrent surgical procedure and those who had undergone a previous operation on the oblique or vertical rectus muscles were excluded, so as to be able to measure the pure affect of recessing the inferior oblique muscle.

The diagnosis of congenital paresis was based on the absence of trauma history, the progressive initiation of symptoms, an abnormal head position often unconscious and present since early childhood (previous family photographs), increased vertical fusion amplitude, weak incomitance of vertical deviation in adduction upgaze and adduction downgaze of the paretic eye (difference <5 degrees), and the vertical deviation being more pronounced than the torsional deviation in most gaze positions (1, 3).

All patients included in this study were operated on by the same surgeon (G.K.) and underwent the procedure described by Fink (2). The amount of recession was based upon the degree of the vertical deviation, not on the torsional deviation. Vertical deviation in primary position and in adduction upgaze and adduction downgaze was considered as small, moderate, or major, and a 6 mm, 8 mm, or 10 mm recession was subsequently performed.

Surgical technique

All operations were performed with the patient under general anesthesia. The inferior oblique muscle was revealed through a transconjunctival incision in the inferior temporal quadrant. It was then completely disinserted along its scleral insertion and its anterior part was fixed at

6, 8, or 10 mm from the lateral rectus insertion, using 6.0 Vicryl sutures (Fig. 1); the posterior part of the insertion was left unsutured.

Clinical evaluation

Subjective horizontal, vertical, and torsional deviation in the nine diagnostic positions of gaze were measured by means of the dark red glass dissociation and the use of the horizontal light bar developed by Kolling (4) in front of Harms' tangent scale (Fig. 2). Measurements in secondary and tertiary gaze positions are made at 25° eccentricity of gaze. Only vertical and torsional deviations in primary and tertiary gaze positions, which depict oblique muscle function most characteristically, are considered in this study. Deviation was always measured while the nonparetic eye was fixating. All measurements were made 1 to 7 days before surgery, within the first 7 days postoperatively, and, when possible, 4 months or more after surgery.

Anterior segment slit lamp examination and dilated fundus examination were performed on all patients both preoperatively and postoperatively.

Statistical methods

The Wilcoxon nonparametric test was used to compare the preoperative deviation in the three recession length groups. Paired t-test analysis was used to compare preoperative to postoperative deviation in each group. Results for which p was inferior to 0.05 were considered to be significant.

RESULTS

The cohort consisted of 58 consecutive patients, 38 (66%) of whom were male and 20 (34%) of whom were female ($p<0.05$). 29 patients had right-sided palsy and 29 had left-sided palsy. The mean age at the time of surgery was 32 years (range, 7–83 years). No significant surgical complication was encountered and no patient had unmasking of bilateral superior oblique muscle paresis postoperatively.

Patients were grouped by the amount of millimeters of inferior oblique recession: the 6 mm group comprised 16 patients, the 8 mm group comprised 35 patients, and the 10 mm group comprised 7 patients. Preoperative values (median and range) of vertical deviation and torsional deviation in the three groups (n=58) are presented in Figure 3. Vertical deviation value was significantly different between the 6 mm and the 8 mm group, and between the 6 mm and the 10 mm group, only as far as primary position and adduction tertiary positions are concerned ($p<0.05$). Torsional deviation value was not significantly different when comparing the three groups.

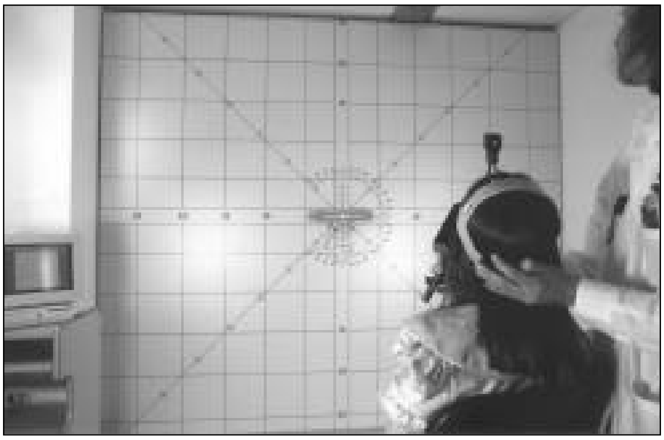


Fig. 2 - *Harms' tangent scale with the horizontal light bar developed by Kolling (4). Horizontal, vertical, and torsional deviations are measured at 3 m by means of the dark red glass dissociation and by using the principle of confusion.*

All patients were examined within 1 week after surgery (early postoperative result), whereas late postoperative follow-up was possible for 34/58 patients (8/16 in the 6 mm group, 21/35 in the 8 mm group, and 5/7 in the 10 mm group). This follow-up period ranged from 4 months to 9 years, with a mean of 2.8 years. When late postoperative results are being considered, only these patients are taken into consideration (n=34).

Median values of vertical deviation and torsional deviation measurements in the above patients are shown in Figures 4 and 5. In 26 of the 58 patients, a slight overcorrection of vertical deviation (median 2.25°, maximum 6°) in adduction upgaze was observed in the immediate postoperative measurement, but regressed in all cases (residual angle: median 0°, maximum 1.5°), thereby ruling out the diagnosis of iatrogenic Brown's syndrome. Torsional deviation was also overcorrected in adduction and abduction upgaze in the 8 mm group (median 4° and 1° of incyclorotation, respectively) in the early postoperative examination, but subsequent loss of effect normalized the values with a median of 0° in the late postoperative result. Apart from the above-mentioned positions of gaze, vertical deviation and torsional deviation were frequently undercorrected in the

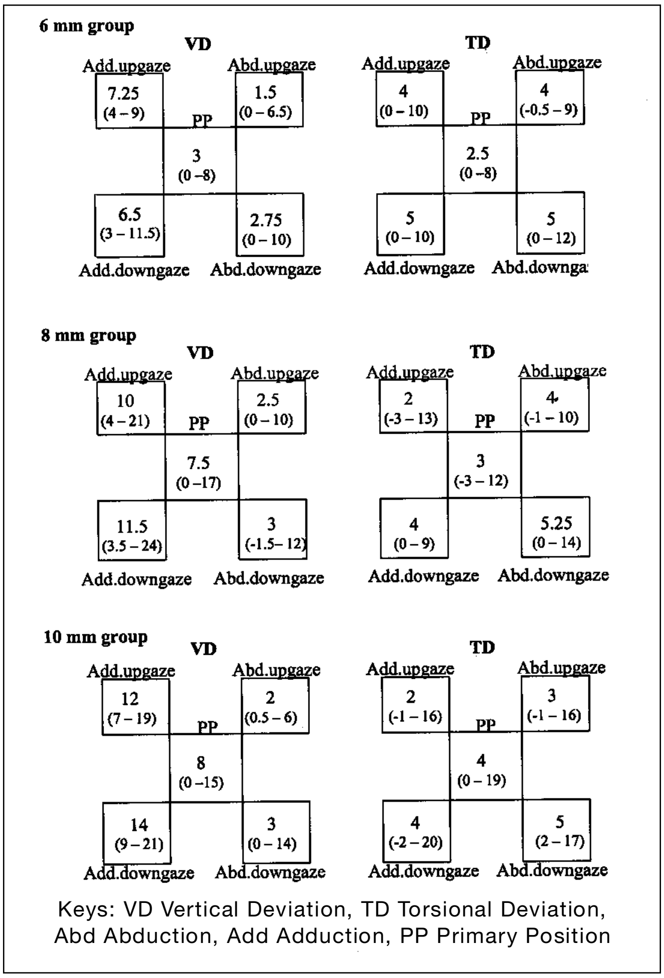


Fig. 3 - *Preoperative vertical deviation (VD) and torsional deviation (TD) in the three groups of patients. Each group of patients is named after the amount of millimeters of inferior oblique recession performed. The decision for the extent of recession was based upon the preoperative vertical deviation, especially in primary position and in adduction tertiary gazes. All above measurements are expressed in degrees (°) of deviation. Median value (range) are given for each gaze direction.*

early measurements, and in most cases continued to regress, finally reaching a value very close to 0° (Figs. 4 and 5).

When only patients with long-term follow-up are considered (n=34), the median final postoperative vertical deviation and torsional deviation in primary gaze were 0.5° and 0°, respectively (preoperative values: 7° and 3.5°). In adduction upgaze (maximal action field of inferior oblique muscle), final vertical deviation and torsional deviation were 0.5° and 0° (preoperative values: 8.75° and 3°).

Matched pairs analysis showed that the final postoperative value was significantly reduced in all groups and in all directions of gaze, apart from the following: torsional deviation in abduction upgaze in the 6 mm group, vertical deviation and torsional deviation in primary position in the 10 mm group, and vertical deviation in adduction downgaze in the 10 mm group.

All patients' notes state subjective improvement in both early and late postoperative phases. Intermittent diplopia and compensatory head tilt disappeared in all but four patients, in whom relapse occurred and who were reoperated on an average of 2.9 years after the inferior oblique muscle recession (range, 0.75–3.5 years). The second operation was a recession or a posterior fixation performed on the contralateral inferior rectus muscle, aiming to reenforce the effect of the first operation.

DISCUSSION

Superior oblique muscle palsy is a relatively common disorder that often necessitates surgical intervention (5). Several different operations are in use, the choice of which depends on the operator's experience and personal preference (6). The goal of this study was to evaluate the efficacy of inferior oblique muscle recession in terms of vertical and torsional deviation reduction in the different directions of gaze.

A first observation that has not been reported for congenital superior oblique palsy (SOP) up to now, and which probably needs to be confirmed in a larger series, is that the incidence of SOP in this cohort is significantly higher in males than in females (66% male, 34% female, $p<0.05$). There is no apparent explanation for this sex predilection, as opposed to traumatic SOP, in which the higher incidence in men is linked to their more frequent involvement in accidents (7).

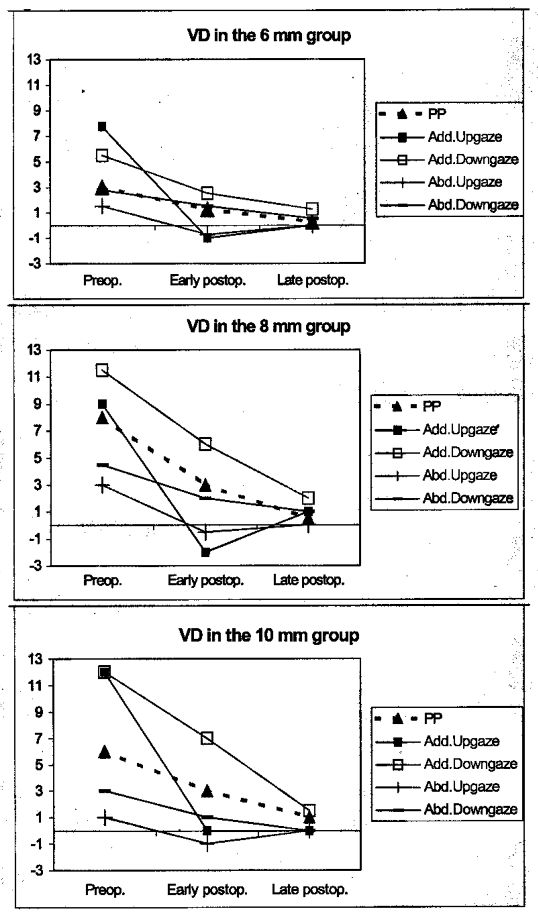
We chose to use the Harms' tangent screen, as it is an examination method that provides great precision and reproducibility, and permits horizontal, torsional, and vertical deviation measurement in the nine diagnostic positions of gaze (4, 8).

When considering preoperative values of deviation, vertical deviation in adduction upgaze and in adduction downgaze are similar, which is characteristic of congenital SOP, as opposed to acquired SOP where vertical deviation in adduction downgaze is significantly greater (3) (Fig. 3). Torsional deviation, on the other hand, presents a relatively uniform distribution in the different gaze directions, ranging from 2° to 6°.

The choice of the amount of recession to be performed (6, 8, or 10 mm) was based upon the vertical deviation measured in primary position and in adduction of the paretic eye during the preoperative clinical examination, while torsional deviation was not a criterion. Indeed, when the preoperative vertical deviation and torsional deviation values are analyzed retrospectively, the above selection criteria are confirmed; preoperative values of deviation in the three groups of patients differ significantly ($p<0.05$) only as far as vertical deviation is concerned, and only in primary position, in adduction upgaze, and in adduction downgaze. These values are very similar to those reported by Kolling (9), and could in some way serve as indicative reference values for further applications (detailed data shown in Fig. 3).

Statistical analysis in this study presents two major weaknesses. The number of patients in the 10 mm group is too small to provide significant results, and the effect of different extents of the same surgery (i.e., 6, 8, and 10 mm) cannot be tested on groups that are preoperatively dissimilar (non-randomized study). The latter point is practically impossible to overcome, since the endpoint of using different recessions is not an unbiased statistical analysis but a surgery that is adapted to each patient depending on the amount of preoperative deviation. Therefore, statistics cannot be used to compare the effectiveness of the three recessions. Matched pairs' analysis in each group indicates that the operation's effect was significant in practically all gaze directions and all groups. The exception of a few nonsignificant results in the 10 mm group can be assumed to result from the small number of patients.

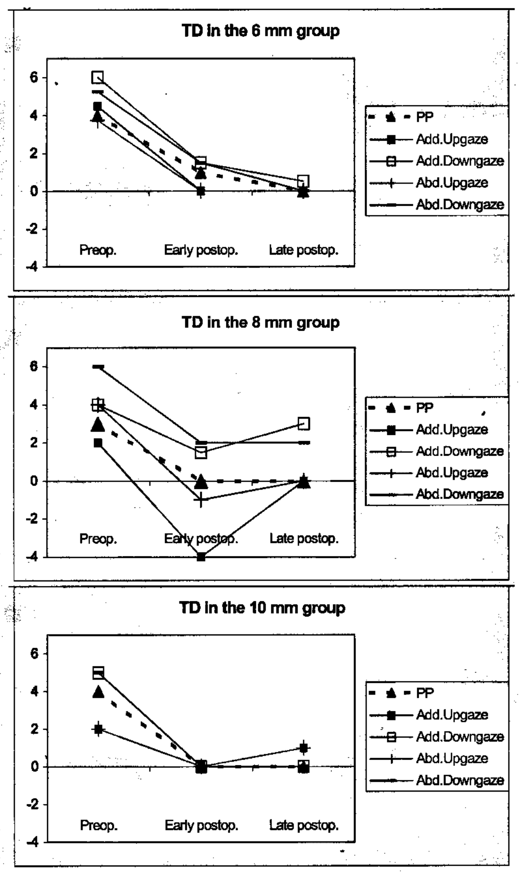
In our series of patients, the median final vertical deviation in primary position ranged between 0° and 1° in all groups, a result that meets the target of the operation. Reduction in vertical deviation was most pronounced in adduction upgaze in all groups. When this effect is calculated in terms of "degrees of reduction/mm of recession performed," vertical deviation in adduction upgaze is found to be proportionally reduced with the amount of recession: reduction of 1.1°/mm in the 6 mm group, 1.125°/mm in the 8 mm group, and 1.35°/mm in the 10 mm group. These observations confirm the expected maximal effect of the surgery in the gaze direction corresponding to the field of action of the recessed overacting muscle (inferior oblique), and prove the proportional dose-effect relationship that renders the surgical technique predictable.



Keys: VD Vertical Deviation, Preop Preoperative deviation (all values are expressed in degrees) Early postop 1 to 7 days postoperatively, Late postop >4 months postoperatively, PP Primary Position, Abd Abduction, Add Adduction

Fig. 4 - *Vertical deviation reduction induced by inferior oblique recession. Vertical deviation reduction is maximal in adduction upgaze in all groups. Late postoperative vertical deviation is close to 0° in all groups and in all directions of gaze. In primary position and in downgaze tertiary positions, vertical deviation continues to diminish from the early to late postoperative measurement, whereas in upgaze tertiary positions the effect is minimally reduced (minimal overcorrection is normalized to 0°) or remains stable during postoperative follow-up.*

In contrast, reduction in torsional deviation was similar in all gaze directions, and similar in all groups (Fig. 5). These results suggest that the effect of this surgery on torsional deviation is apparently not selective for a particular gaze direction; it is, however, therapeutic and predictable, reducing the deviation to a median final value of 0° in primary position in all groups. Although cyclotropia is less symptomatic in congenital than in acquired superior oblique palsy, it is very important for three-dimensional perception of the image (10), and its modification by



Keys: TD Torsional Deviation, Preop Preoperative deviation (all values are expressed in degrees) Early postop 1 to 7 days postoperatively, Late postop >4 months postoperatively, PP Primary Position, Abd Abduction, Add Adduction

Fig. 5 - *Torsional deviation reduction by inferior oblique recession. Torsional deviation reduction is rather uniformly distributed in the different gaze directions and in the three groups. A moderate loss of effectiveness on torsional deviation reduction between the early and late postoperative result in the 8 mm group may possibly be explained by sensory adaptation to cyclodeviation.*

surgery should not be considered as secondary.

Moderate loss of effectiveness on torsional deviation reduction was seen between the early and final postoperative result in the 8 mm group. This observation is probably not an artefact as it involves the best-represented group. Although hard to explain, we speculate that this phenomenon is due to sensory adaptation to cyclodeviation.

A cure, defined as elimination of signs or symptoms that led the patient to seek medical help (i.e., diplopia, cosmetically significant hypertropia, and/or ocular torticollis) (7), was achieved with a single operation in 30/34 (88%) of our patients who were available for long-term follow-up. This definition presumes a sufficient field of binocular single vision for the patient's needs. In our series no overcorrection, which is far more difficult to manage as it is not well tolerated by the patient, was observed. No complications, in particular iatrogenic Brown's syndrome or lower lid fullness, occurred.

The technique described by Fink corresponds anatomically to a recession-anteroposition of the inferior oblique (IO) muscle along its excursion, and to a simultaneous posterior tenotomy (2). It is a simple and not time-consuming technique that provides optimal visualization of the muscle's insertion in order to avoid missing part of it, which is very useful in cases of anatomic variations (11).

Comparison of our results with those of other studies is problematic, because patients with different causes of superior oblique palsy are elsewhere studied all together. Differences between subgroups, corresponding to different origins of SOP, have been recognized by other authors (12). Moreover, in other studies (12-15) results of different surgical techniques have been presented as a whole, sometimes in order to compare different techniques between them (16, 17). Our aim was to study a homogeneous population that was treated with a single surgical technique in order to evaluate its efficacy.

Toosi and von Noorden (18) report symptom relief in 27/33 (82%) of their patients treated with IO myectomy (23 patients with congenital SOP and 10 with acquired SOP). The effect of this surgery on vertical deviation was found to be similar in primary position and in the field of action of the IO, not permitting selective reduction of vertical deviation. Mulvihill et al (19) report satisfactory symptom relief in 84.6% of their 52 patients treated with IO disinsertion (47 patients with presumed congenital SOP) after a 3- to 12-month follow-up period. In their series, overcorrection was seen in three patients, but they remained asymptomatic.

Finally, Farvardin and Nazarpoor (20) report 94% success rate with anterior transposition of the IO, but in a limited number of cases (n=16) and with a follow-up of only 6 months. Success in their study is on the basis of objective reduction of hyperdeviation. However, the authors encountered some complications, including mild limitation of upgaze and fullness of the lower lid.

In contrast to myectomy, myotomy, or disinsertion, Fink's IO recession is a reversible technique, which remains an advantage even if no overcorrection that would necessitate reoperation on the IO muscle was ever encountered in our series. In addition, this technique, even though an old one, permits a controlled recession of the muscle at 6, 8, or 10 mm in a standard and reproducible way, in contrast to classic anteroposition, and as shown by this study, the effect on vertical deviation can be controlled.

In conclusion, this study reveals the efficacy and the major advantages of IO controllable recession: it is a simple, safe, and reliable technique with no complication seen in our series, and a high cure rate (88%). Furthermore, it reduces torsional deviation uniformly in all gaze directions, whereas vertical deviation is reduced mostly in adduction upgaze, this selective effect being useful and desirable. The most advantageous feature of the technique is the possibility of adapting the amount of vertical deviation reduction to the patient, depending on the degree of preoperative deviation.

The authors have no proprietary interest in any aspects of the article.

Reprint requests to:
G. Klainguti, MD
Avenue de France 15
1004 Lausanne, Switzerland
georges.klainguti@ophtal.vd.ch

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