Change in proptosis following extraocular muscle surgery: Effects of muscle recession in thyroid-associated orbitopathy

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PURPOSE
To evaluate the effect of strabismus surgery on proptosis in patients with thyroid-associated orbitopathy.

METHODS
The medical records of 22 consecutive patients with thyroid-associated orbitopathy undergoing strabismus surgery were reviewed. Data pertaining to the number of muscles operated on, amount of muscle recession, prior orbital decompression, and exophthalmometry were evaluated.

RESULTS
Thirty-eight eyes in 22 patients with thyroid-associated orbitopathy were studied before and after strabismus surgery. The mean change in exophthalmometry following strabismus surgery in all eyes was $+0.6\text{ mm} (p < 0.01)$. Eyes with prior decompression averaged a $0.9\text{ mm}$ increase following strabismus surgery ($p < 0.01$); those without decompression averaged a $0.2\text{ mm}$ decrease ($p = 0.658$). In eyes that underwent two rectus muscle recessions the increase in Hertel measurements averaged $1.2\text{ mm}$; when only one muscle was recessed, the average increase was $0.2\text{ mm}$. In the eyes with muscle recession $\leq 5\text{ mm}$, the mean exophthalmometric increase was $0.7\text{ mm}$. When a muscle recession of more than $5\text{ mm}$ was performed, the exophthalmometry showed a mean increase of $0.5\text{ mm}$.

CONCLUSIONS
Strabismus surgery on patients with thyroid-associated orbitopathy can worsen proptosis, especially in those with prior decompression. When planning for orbital decompression, the surgeon should consider this effect. Moreover, patients should be made aware of the possible changes to their appearance. (J AAPOS 2007;11:377-380)

Thyroid-associated orbitopathy is a chronic inflammatory, potentially disfiguring, and frequently disabling disease that most of the time is related to systemic disorders of the thyroid gland.

Thyroid disease has a variable clinical presentation with approximately one-half of patients presenting with thyroid-associated orbitopathy. However, using imaging exams, subclinical abnormalities of the orbital structures can be demonstrated in the majority.1-3

The increase in volume of intraorbital tissues, such as orbital fat and extraocular muscles, within the limited bony orbital space can explain most of the clinical signs and symptoms of thyroid-associated orbitopathy. As the intraorbital volume increases inside a nonexpandable orbit, it may cause forward protrusion of the globe. The resultant proptosis may cause significant disfigurement.

The decision to treat thyroid-associated orbitopathy relies on the severity and activity of the disease. Stable severe thyroid-associated orbitopathy with no signs of activity shows no benefit with medical treatments and requires surgical treatment.4 The surgical rehabilitation of thyroid orbitopathy often involves a staged approach to address the multiple issues in this condition and may include orbital decompression, extraocular muscle surgery, and eyelid repair.

In strabismus surgery, muscle recession can theoretically allow the globe to move more anteriorly, and in severe cases, worsen preexisting exposure keratopathy and proptosis. Thus, patients with moderate to severe exophthalmos may benefit from orbital decompression prior to muscle surgery.5 To our knowledge, the effect of strabismus surgery on exophthalmos has not been studied in thyroid-associated orbitopathy. In this study, we examined this relationship.

Subjects and Methods
The medical records of 22 consecutive patients (38 eyes) with thyroid-associated orbitopathy were reviewed retrospectively. All
patients presented to the University of California, San Diego (UCSD), Thyroid Eye Center, a university-based tertiary referral center, and underwent strabismus surgery by the same surgeon (DBG). No patient presented with any sign of ocular or periocular inflammatory activity prior to extraocular muscle surgery. IRB approval through UCSD Human Research Protections Program was obtained for this study.

The following data were obtained: gender, age at surgery, follow-up period, number of muscles operated on (horizontal and/or vertical rectus muscles), type of muscle surgery (total length of muscle recession), and preoperative and postoperative Hertel exophthalmometer readings (a Naugle exophthalmometer was used in patients who underwent lateral rim advancement).

Patients were then divided into two groups according to whether or not they underwent orbital decompression prior to strabismus surgery (groups 1 and 2, respectively). For each patient, the same device was used pre- and postoperatively. No patient had previous strabismus surgery. The primary indication for strabismus surgery in all patients was to relieve diplopia. All muscle procedures were recessions.

Statistical analysis was performed using Student’s paired-samples t-test to compare preoperatively and postoperatively within groups and a nonparametric Mann-Whitney test to compare both groups (SPSS for Windows, version 11 [SPSS, Inc., Chicago, IL]). A p-value of <0.05 was considered statistically significant.

Results

A total of 22 patients (38 eyes) was included in this study. Follow-up after the last strabismus surgery ranged from 4 to 17 months with a mean of 13.5 months. The average age of the subgroup of patients in the prior decompression surgery group (group 1) was 55.6 years, while those patients in the non-decompression group (group 2) was 65.8 years (p < 0.001).

The mean exophthalmometry reading of all 38 eyes was 19.4 ± 3.0 mm, preoperatively, and 20.0 ± 2.8 mm, postoperatively (p = 0.006). In group 1, the mean preoperative exophthalmometry measurement was 19.1 ± 3.3 mm, and the mean postoperative measurement was 20.1 ± 3.0 mm (p < 0.001) (Figure 1). In group 2 the mean was 19.8 ± 2.2 and 19.7 ± 2.3 mm, preoperatively and postoperatively, respectively (p = 0.658) (Figure 2). The average increase in proptosis of all eyes, following strabismus surgery, was 0.6 ± 1.2 mm (range, −2.0 to +3.5) (Table 1). Eyes in group 1 showed an average increase of 0.9 ± 1.1 mm in proptosis following strabismus surgery (range, −2 to +3.5 mm) (Figure 3); those in group 2 showed an average decrease of −0.2 ± 1.3 mm (range, −2 to +2 mm) (Figure 4). Using the nonparametric Mann-Whitney test, the mean changes for the two groups was statistically different (p = 0.012). (Complete data for each group is provided in e-Supplements 1 and 2, available at jaapos.org.)

In eyes with more than one muscle operated on, an average increase of 1.2 ± 1.2 mm was noted (range, −1 to
+3.5 mm); in those with one muscle operated on, the average increase was 0.2 ± 1.1 mm.

When analyzing the change in proptosis according to the length of muscle recession, if the total length of muscle recession was ≤5 mm, the average change in proptosis was an increase of 0.7 ± 1.3 mm. If >5 mm of recession was performed, the mean increase was 0.5 ± 1.2 mm (Table 2). In the decompression group, 17 eyes underwent muscle recession ≤5 mm, with a mean increase in proptosis of 1.0 ± 1.0 mm. In nine eyes of this group, muscle recessions >5 mm were performed, with a mean increase in proptosis of 0.8 ± 1.3 mm. In the decompression group, eight eyes underwent muscle recessions ≤5 mm, with a mean decrease of −0.12 ± 1.6 mm. Four eyes in the non-decompression group had at least one muscle recession >5 mm, with a mean decrease in exophthalmometry of −0.25 ± 0.5 mm.

Discussion

Our results showed that there was a statistically significant increase in proptosis following strabismus surgery in patients with thyroid-associated orbitopathy who had prior orbital decompression (Table 1). We theorize that this effect may due to the release of tethering of the extraocular muscles, allowing the globe to move more anteriorly within the orbit. Our results also demonstrated a larger increase in proptosis following strabismus surgery in those patients who had prior orbital decompression and multiple extraocular muscles operated on when compared with those patients with no previous decompression surgery or only one extraocular muscle operated on.

The timing and sequence of extraocular muscle surgery is important; if orbital decompression is indicated, it should be done first.5 Even when orbital decompression is not required, recession of tight rectus muscles can worsen proptosis. Typically, it is recommended to wait 6 to 12 months after stabilization of a patient’s motility examination before proceeding with corrective strabismus surgery.6,7 However, Coats and colleagues reported that strabismus surgery during active thyroid ophthalmopathy can result in long-term stable alignment and may be a useful alternative in selected patients.8

Ruttum9 reported that patients with thyroid-associated orbitopathy who have undergone orbital decompression frequently require correction for horizontal and vertical deviations and have a greater number of extraocular muscles operated on, compared with patients who have not had orbital decompression. This same study also showed that the need for decompression surgery in patients with
thyroid-associated orbitopathy reflects a more severe disease state. Therefore, the greater increase in proptosis seen in those patients with prior orbital decompression may be simply reflective of a greater tethering effect from more restricted muscles being released.

The drawbacks of this study are its retrospective nature, lack of suitable controls, and the limited number of patients enrolled in the study. Nevertheless, a statistically significant increase in proptosis was seen in the decompression group following strabismus surgery. Hertel measurements were taken in primary position, although it was not possible for all patients due to restriction of the inferior rectus muscles. Interestingly, the nature of exophthalmos measurement means that preoperatively these restricted patients were measured in eccentric gaze. However, postoperatively, the clinical assessment was performed in primary position. It is possible that this position shift is responsible for some of the variation in measurements. We are unaware of any evidence of the change in exophthalmos by gaze position.

Consideration of the changes in exophthalmometry following strabismus surgery in thyroid-associated orbitopathy is limited or absent. Strabismus surgery can affect proptosis and this should be taken into account when planning the care of patients with thyroid-associated orbitopathy, especially in those with prior orbital decompression. Although the average increase postoperatively was 0.9 mm in patients with prior orbital decompression, 6 of the 26 eyes showed an increase of 2 mm or more after strabismus surgery. We consider this shift clinically significant and it can also cause a change in lid position, confirming that the staged approach to the patient with thyroid-associated orbitopathy is appropriate. Additionally, since it can be anticipated that strabismus surgery following orbital decompression is likely to result in an increase in proptosis, particularly in patients who are to have multiple operations, this should be taken into account when planning the orbital decompression.

References