

LITERATURE REVIEW

Surgical Outcomes of Correction of Upper Eyelid Retraction in Thyroid Eye Disease: A Literature Review

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ABSTRACT

Purpose: to evaluate the outcome of anterior blepharotomy in correcting eyelid retraction in patients with Thyroid Eye Disease (TED).

Methods: Literature search was conducted from MEDLINE database through PubMed, Google scholar and ClinicalKey. Outcomes included margin-reflex distance, palpebral fissure height, and upper eyelid margin-superior limbus distance.

Results: Sixteen articles were reviewed with a mean follow-up time in the studies varied, ranging from 6 to 61 months. The preoperative and postoperative mean MRDs varied. Although there were different success criteria, success rate for full thickness blepharotomy ranged from 59-93%, comparable with levator recession. The complication rates in 14 studies were less than 20%.

Conclusion: Full thickness anterior blepharotomy and Müller muscle and levator recession, are safe and effective in correcting upper eyelid retraction in patients with TED. The anterior blepharotomy is a relatively quick and simple procedure.

Keywords: thyroid eye disease, lid retraction, anterior blepharotomy, levator recession

According to Bartley et al¹, eyelid retraction presents when the upper eyelid is at or above the corneal limbus. It is the most common ophthalmic feature of Thyroid Eye Disease (TED), being present either unilaterally or bilaterally in more than 90% of patients at some point in their clinical course.¹ TED, also known as Graves' ophthalmopathy or thyroid-associated orbitopathy, is an autoimmune inflammatory disorder involving the soft tissues of the orbit. The incidence of TED in Kirana-Cipto Mangunkusumo Hospital from January 2013 to December 2014 was 68 patients

and there were 28 patients (41.2%) presenting with eyelid retraction.²

Patients with eyelid retraction in TED usually have complaints of discomfort with the "staring" look, foreign body sensation, ocular surface dryness and blurred vision. Eyelid retraction has a profound impact on patients' quality of life as it can result in visual acuity changes, exposure keratopathy, ocular discomfort, and alteration in physical appearance.³

The definitive treatment for upper eyelid retraction in TED is surgical. The eyelid surgery is recommended if there is a significant lid retraction of >1 mm and asymmetry of palpebral apertures. Another

indication is lateral (temporal) flare.⁴ Various surgical procedures have been developed to correct eyelid retraction in TED with variable degrees of complexity and success, including anterior or posterior recession or resection of Müller's muscle and/or the levator muscle or its aponeurosis, full thickness blepharotomy, levator recession with and without adjustable sutures, and levator lengthening.⁴ One of the techniques that has been adopted recently by some oculoplastic surgeons and showed favorable results is the full thickness anterior blepharotomy procedure. This technique is relatively quick to perform and attempts to address the full-thickness fibrosis of the eyelid caused by TED.

The aim of this literature review is to evaluate the outcome of anterior blepharotomy in correcting eyelid retraction in patients with TED compared to Müller muscle recession and levator recession, and Müllerectomy.

METHODS

Literature search was conducted from MEDLINE database through PubMed, Google scholar and ClinicalKey for articles by entering keywords: "eyelid retraction", "Grave's ophthalmopathy", "Grave's orbitopathy", "thyroid eye disease", "surgery". Inclusion criteria were all studies reported surgical treatment to correct upper eyelid retraction in TED that met the aim of this review. Exclusion criteria were studies in non-human subjects, articles that could not be fully accessed, and articles published not in English. Successful surgery is defined as outcomes that meet the criteria of "perfect" and "good/acceptable" based on criteria by Mourits and Sasim⁵, or by criteria defined by each study.

RESULTS

After selection process and evaluation for eligibility, 16 articles were

reviewed in this paper. The mean follow-up time in these studies varied, ranging from 6 to 61 months. The mean age of the patients from the studies ranged between 42.2 and 55.4 years old with female predominance. Out of 16 articles, 6 articles evaluated full thickness anterior blepharotomy, 7 studies evaluated anterior approach Müller muscle and/or levator recession, and 3 studies evaluated the posterior approach Müller muscle and levator recession. The outcome parameters varied including margin reflex distance (MRD), palpebral fissure height, and upper eyelid margin-superior limbus distance. Characteristic data of the reviewed articles are presented in Table 1.

Only study by Gonçalves et al.¹⁰ that compared the outcome of the anterior and posterior approach, while Evans et al.¹¹ compared three anterior approach techniques. Elner et al.⁶, Goncalves et al.¹⁰, and Evans et al.¹¹ used the same blepharotomy technique, while Hintschich and Haritoglou⁷, Nimitwongsakul et al.⁸ and Lee et al.⁹ modified the technique by leaving a central bridge of conjunctiva intact in the central part of the eyelid.

The studies by Elner et al.⁶, Lee et al.⁹, and Ben Simon et al.¹⁹ divided the number of eyelids into groups based on the severity of upper eyelid retraction as measured by the distance of the upper eyelid margin from the center of the pupil (severe, ≥ 7 mm; moderate, $>$ to < 7 mm; and mild, ≤ 5 mm). The preoperative and postoperative mean MRDs in studies that used MRD as the primary outcome are showed in Table 2.

There were several different success criteria used by the authors. The most thorough success criteria were developed by Mourits and Sasim.⁵ Only studies by Hinstchich and Haritoglou⁷, Ueland et al.¹⁶, and Shortt et al.¹⁷ used Mourits and Sasim's criteria to define their success. Other studies used either normal MRD or palpebral fissure height or eyelid margin to limbus distance or symmetry as success criteria. Table 3 shows the success rate of

each procedure performed in the reviewed studies.

Common complications occur following the surgery include undercorrection, overcorrection/ secondary ptosis, recurrence, and wound dehiscence in some studies. The complication rates in 14 studies were less than 20%.

DISCUSSION

Upper eyelid retraction is a functional and cosmetic disease process that can pose a threat to vision and can be psychologically debilitating to patients. In TED, the upper eyelid is more commonly retracted than the lower eyelid, though both may be affected. The eyelid surgery performed when the patient is in euthyroid state and all signs and symptoms of TED have been stable for at least 6 months was mentioned in 13 articles. This is in accordance with EUGOGO's recommendation.²¹ If surgery is performed in the acute phase of the disease process, it often results in unpredictable eyelid levels, short-lasting results, and occasionally a more complex postoperative course.

The primary indication for the surgical correction of eyelid retraction is to produce a functional eyelid that protects the globe and vision, which may also secondarily improve the cosmetic appearance. The numerous surgical techniques employed indicate the difficulty in both treating this disease process and identifying the best interventional procedure. The ideal procedure should yield the desired postoperative eyelid level while maintaining or creating a normal contour, eyelid crease, and eyelid fold while maintaining eyelid function and should have a predictable and reliable technical approach, preferably under local anesthesia. Moreover, the procedure should address the anatomical and pathophysiological causes of eyelid

retraction, especially the diffuse nature of eyelid retraction secondary to thyroid-related orbitopathy, which may involve all layers of the eyelid in varying degrees.

Many techniques proposed for the correction of upper eyelid retraction in patients with TED can be categorized into two approaches: anterior (transcutaneous) and posterior (transconjunctival). The advantages of the anterior approach are shorter duration of surgery, better visualization of anatomic structure, and a more direct posterior dissection. While the posterior one has the benefit of no visible skin scar.¹⁹

This review evaluated several surgical techniques. Although there were some modifications to each technique, the basic principles of the surgical procedure were the same. There were ten articles published from 2004 to date, with six studies reporting the anterior blepharotomy technique. It shows that in the last decade, this procedure has been more popular to correct eyelid retraction than other previously chosen technique.

Compared with posterior approaches, the anterior blepharotomy technique permits better control of the eyelid contour and height because the eyelid is not deformed by inversion or stretching. Elner et al.⁶ was the first who published the results using this technique in 2004. The studies by Elner et al.⁶ and Lee et al.⁹ showed that full thickness blepharotomy is applicable for patients with any degree of upper eyelid retraction.

The modification of the procedure by Hintschich and Haritoglou⁷, Nimitwongsakul et al.⁸ and Lee et al.⁹ by leaving a central bridge of conjunctiva intact in the central part of the eyelid was performed to better ensure natural postoperative eyelid contour and avoid nasal ptosis.

Table 1. Characteristic Data of the Reviewed Studies

No	Author	Year	LoE	No. of eyelid s/ patients	Surgical Technique	Surgical Approach	Follow Up Duration (months)	Gender		Mean Age (years)	Outcome Parameters
								M	F		
1	Elner et al. ⁶	2004	IV	50/32	FTB	anterior	8.5±8.1 (2-35)	2	30	52±14 (20-82)	MRD, post-operative symptoms, lagophthalmos
2	Hintschich and Haritoglu ⁷	2005	IV	60/41	FTB	anterior	6 (2-36)	N/A	N/A	55.4 (32-75)	PFH, SC, scleral show, eyelid margin contour
3	Nimitwongsakul et al. ⁸	2013	IV	78/53	Modified FTB	anterior	15.22±13 (1-51)	8	45	53.47±12 (30-83)	symmetry
4	Lee et al. ⁹	2015	IV	22/18	Modified FTB	anterior	15.22 ± 6 (9-22)	6	12	53.47±12 (30-83)	MRD, post-operative symptoms
5	Gonçalves et al. ¹⁰	2017	II	47/27	FTB vs Transconjunctival MMR and graded levator disinsertion	anterior vs posterior	6	8	19	42.2 ± 9.0	MRD, Schirmer's test 1, tear breakup time (BUT), Ocular Surface Disease Index (OSDI)
6	Evans et al. ¹¹	2017	III	121/74	Septum opening LR+Müllerectomy, septum preserving LR+Müllerectomy, FTB	anterior	24.2	10	64	51	MRD, temporal-to nasal ratio, tarsal platform show, brow fat span
7	Uccello et al. ¹²	1994	IV	98/60	Free levator complex recession	anterior	18 (6-40)	12	48	44 (21-64)	MLD
8	Ceisler et al. ¹³	1995	IV	72/37	Müllerotomy and levator aponeurosis transposition	anterior	N/A	N/A	N/A	N/A	MLD, symmetry
9	Tucker and Collin ¹⁴	1995	III	120/N/A*	Adjustable LR vs Non-adjustable LR	anterior	N/A	N/A	N/A	N/A	MRD, symmetry, eyelid margin contour
10	Woog et al. ¹⁵	1996	IV	13/10	Adjustable LR	anterior	8 (3-12)	0	10	44 (29-72)	MRD, PFH
11	Ueland et al. ¹⁶	2014	IV	86/80	LR with adjustable sutures	anterior	56 (6-123)	6	74	49(32-72)	PFH, symmetry, eyelid contour
12	Mourits and Sasim ⁵	1999	IV	78/50	Lateral LR, MMR	anterior	9	3	47	47 (26-76)	MLD, symmetry, SC
13	Shortt et al. ¹⁷	2011	IV	52/32	Lateral Müllerectomy, LR and partial division of the lateral horn	anterior	12	N/A	N/A	53 (32-75)	MRD, SC, upper lid skin fold

14	Olver and Fells ¹⁸	1995	IV	33/22	Henderson procedure: MMR and levator aponeurosis recession	posterior	54 (6-240)	3	9	49.9 (35-69)	PFH, lid retraction
15	Ben Simon et al. ¹⁹	2005	IV	107/78	MMR and graded levator disinsertion	posterior	16.7 (6-84)	15	63	49 (33-62)	MRD, eyelids asymmetry, lagophthalmos, exposure keratopathy
16	Looi et al. ²⁰	2006	IV	161/99	Modified MMR and levator aponeurosis recession	posterior	61 (6-139)	17	82	47 (21-82)	MRD, asymmetry, repeat surgical rate

Abbreviations: *LoE*: Level of Evidence; *FTB*: Full thickness blepharotomy; *MMR*: Müller muscle recession; *LR*: levator recession; *MRD*: margin-reflex distance; *MLD*: upper eyelid margin-limbus distance; *PFH*: palpebral fissure height; *SC*: skin crease

Table 2. Preoperative and postoperative mean MRD in reviewed studies

No	Author	Mean MRD (mm)	
		Preoperative	Postoperative
1	Elner et al. ⁶	7.73±0.62*	3.57±1.29*
		5.98 ± 0.40**	3.33±0.70**
		4.46 ± 0.50 [^]	3.07±0.51 [^]
2	Lee et al. ⁹	5.23±0.89	3.26±1.23
3	Gonçalves et al. ¹⁰	6.37±1.07	4.51±0.78
		6.02±1.07	3.73±1.11
4	Evans et al. ¹¹	6.68	3.67
		7.03	4.72
		6.59	4.08
5	Tucker and Collin ¹⁴	Not stated	Not stated
6	Woog et al. ¹⁵	7.21	4
7	Shortt et al. ¹⁷	7	3.8
8	Ben Simon et al. ¹⁹	6±1.9	3.4±1.6
9	Looi et al. ²⁰	7.3	4.3

The study by Evans et al.¹¹ compared three anterior approach techniques and showed that those techniques were equally efficacious in restoring a physiologic upper eyelid height and contour. Based on this study, there were no significant differences seen between the septum-preserving levator recession and blepharotomy. Each of the three anterior approach techniques evaluated demonstrated comparable functional and aesthetic postoperative outcomes.

Ben Simon modified Henderson's technique by removing a Müller's muscle stripe instead of myotomy and releasing the lateral horn of levator aponeurosis and

avoiding conjunctiva suturing in order correct lateral flare that remained in patients operated with Henderson's technique. The authors suggest that the posterior approach can repair even moderate to severe retraction. The same technique used by Ben Simon et al.¹⁹ was also applied in the study by Gonçalves et al.¹⁰ Both studies showed satisfactory results with comparable success rates.

Posterior-approach Müller muscle recession avoids an external upper eyelid scar and leaves the anterior eyelid structures intact, thus facilitating, if necessary, revision by an external lid approach. However, this procedure may be associated with a decrease in aqueous

tear film production, leading to dry eyes, but there is a low risk for aggravating pre-existing dry eye syndrome. The study by Gonçalves et al.¹⁰ showed no difference in Schirmer's test and BUT results preoperatively and postoperatively.

From 8 studies evaluating preoperative and postoperative MRD, the MRDs measured mostly were within normal limit. It seems that if successful outcome is only defined based on MRD, the target of normal lid position was achieved anatomically, therefore giving an indication that either technique used in those studies was effective. However, some studies used the same success criteria while others had their own criteria.

There are some key points that can be obtained from the reviewed studies that should be considered and included in the surgery to improve the outcome of surgery. First, a graded approach is used for any technique and intraoperative individual adjustment is needed to increase predictability. Therefore, active cooperation of the patients was necessary for the proper adjustment, so that the best intraoperative correction could be made and this setting could be done in local anesthesia. Second, the lateral aspect of the upper eyelid is frequently more retracted than the medial aspect. Since lateral retraction (flare) is the most important aspect of upper lid retraction in patients with TED, cutting or division of the lateral horn of the levator aponeurosis is necessary in most cases. Third, evaluation of the conjunctival substantia propria for fibrosis and its removal and/or release also improves the outcomes. Last, maintaining or preserving central portion of the eyelid (central pedicle of levator or conjunctiva or suture connecting the tarsus to the levator) is useful to achieve a better contour and prevent ptosis in the visual axis.

When comparing the results from different studies, it is important to bear in mind that the studies vary regarding the number of patients studied, the severity of

eyelid retraction and the criteria used for evaluating the outcome. The reviewed studies showed considerable success rate (more than 80%) of all techniques, but it is difficult to determine which one is the best technique. Moreover, it is compounded by the lack of general agreement on a definition of success. Different authors have used varying outcome criteria to report their results. Mourits and Sasim⁵ used strict and rigorous criteria and several studies applied the same criteria as well. Based only on Mourits and Sasim's criteria, the blepharotomy technique performed by Hintschich⁷ and Lee et al.⁹ showed higher success rate than levator and Müller recession performed by Mourits and Sasim. However, the study by Shortt et al.¹⁷ that used graded anterior approach involving lateral Müllerectomy, levator recession and partial division of the lateral horn showed high success rate based on Mourits' criteria for "perfect result".

Limitations of this literature review are the lack of high level of evidence studies, disparity regarding surgical techniques, outcome measures, and duration of follow ups. Research on surgical treatments of TED mainly focused on orbital decompression techniques and to a lesser extent on eyelid correction.³³ Future studies with higher level of evidence are needed, supported with objective measurement of standardized outcome parameters. Consensus on definition of success is also necessary for evaluation of surgical techniques.

Table 3. Success rate of each procedure

No	Author	Surgical Technique	Success Rate (%)		
			Perfect/Good	Acceptable	Unacceptable
1	Elner et al. ⁶	FTB	75	Not stated	Not stated
2	Hintschich and Haritoglou ⁷	FTB	71.67	23.33	5.00
3	Nimitwongsakul et al. ⁸	Modified FTB	75.5	9.4	15.1
4	Lee et al. ⁹	Modified FTB	59.0	31.8	9.0
5	Gonçalves et al. ¹⁰	FTB Transconjunctival MMR and graded levator disinsertion	93 85	Not stated	Not stated
6	Evans et al. ¹¹	Septum opening LR+Müllerectomy, septum preserving LR+Müllerectomy, FTB	63.8	Not stated	Not stated
7	Uccello et al. ¹²	Free levator complex recession	Not stated	75	25
8	Ceisler et al. ¹³	Müllerotomy and levator aponeurosis transposition	Not stated	98	Not stated
9	Tucker and Collin ¹⁴	Adjustable LR Non-adjustable LR	75 34	Not stated	Not stated
10	Woog et al. ¹⁵	Adjustable LR	71	15	14
11	Ueland et al. ¹⁶	LR with adjustable sutures	62.79	29.07	8.14
12	Mourits and Sasim ⁵	Lateral LR, MMR	50	32.05	17.95
13	Shortt et al. ¹⁷	Lateral Müllerectomy, LR and partial division of the lateral horn	86.5	0	13
14	Olver and Fells ¹⁸	Henderson procedure: Müller muscle and levator aponeurosis recession	50	36	14
15	Ben Simon et al. ¹⁹	Transconjunctival MMR and graded levator disinsertion		91	9
16	Looi et al. ²⁰	Transconjunctival Müller muscle and levator aponeurosis recession		90	10

Abbreviations: FTB: Full thickness blepharotomy; MMR: Müller muscle recession; LR: levator recession

CONCLUSION

Full thickness anterior blepharotomy, Müller muscle and levator recession are safe and effective in correcting upper eyelid retraction in patients with TED. The technique to be applied in eyelid surgery depends on a surgeon's preference. The anterior blepharotomy is relatively quick and simple. This technique can be an alternative surgical option for correcting upper eyelid retraction in patients with TED. While traditional MRD can be used as a parameter, eyelid contour should be also considered as an outcome from aesthetic standpoint. Despite good results yielded by both techniques, occasionally undesirable eyelid height and contour occur, suggesting that the technique needs further improvement.

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