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Original Article / *Özgün Makale*

# Results of conjunctiva-Müller muscle resection and external levator resection techniques for ptosis repair

## Pitozis tamirinde konjunktiva-Müller kası rezeksiyonu ve eksternal levator rezeksiyonu yöntemlerinin sonuçları

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***ABSTRACT***

**Objectives:** This study aims to evaluate the results of levator aponeurosis surgery (LS) and conjunctiva-Müller muscle resection (CMR) operations for correction of upper eyelid ptosis.

**Patients and methods:** Eighty-five patients with ptosis who underwent either LS or CMR between January 2015 and May 2016 were prospectively included in the scope of the study. Detailed information including age, gender, etiology, type of surgery, laterality of surgery, preoperative levator function, pre- and postoperative palpebral fissure height (PFH), postoperative PFH change, postoperative day 1 pain, edema, ecchymosis, cosmetic outcome, reoperation rate and operating time from initial maneuver to wound closure was documented. Patients with good levator function (over 12 mm) were included in the study scope. Six-month postoperative measurements at follow-up were used for analysis.

**Results:** Of the surgical procedures, 67% (57/85) were LS and 33% (28/85) were CMR. In patients who underwent LS, preoperative PFH was statistically lower compared to CMR patients (p=0.016). Postoperative PFH and PFH changes were not statistically significant between the two methods (p=0.1 for postoperative PFH, p=0.073 for PFH change). Postoperative PFH change in both groups was statistically significant compared to preoperative values (p=0.001 for both operations). There was no statistically significant difference between the two groups in terms of reoperation (p=0.027), first-day postoperative pain, edema, ecchymosis (p=0.128), and cosmetic outcome (p=0.724). In the LS group, operative time (28.9±5.1 min) was statistically significantly longer compared to the CMR group (17.71±3.11 mins) (p=0.001).

**Conclusion:** Although the CMR operation group has shorter operative time, CMR and LS yielded similar results in terms of cosmetic outcome, reoperation and first-day postoperative pain, edema, and ecchymosis.

***Keywords:*** Conjunctiva-Müller muscle resection, levator aponeurosis surgery, ptosis surgery, ptosis.

***ÖZ***

**Amaç:** Bu çalışmada üst kapak pitozis düzeltilmesinde, levator aponevroz cerrahisi (LC) ve konjonktiva-Müller kası rezeksiyonu (KMR) ameliyat sonuçları değerlendirildi.

**Hastalar ve yöntemler:** Pitozisi bulunan LC veya KMR geçiren 85 hasta, Ocak 2015 ile Mayıs 2016 tarihleri arasında prospektif olarak çalışma kapsamına alındı. Yaş, cinsiyet, etyoloji, cerrahi yöntem, taraf, ameliyat öncesi levator kası fonksiyonu, ameliyat öncesi ve sonrası göz kapağı kapak aralığı (KA), ameliyat sonrası KA değişimi, ameliyat sonrası birinci gün ağrı, ödem, ekimoz, kozmetik sonuç, tekrar ameliyat oranı ve ameliyat süreleri içeren ayrıntı bilgi kayıt edildi. Levator fonksiyonu iyi (12 mm üzerinde) olan hastalar çalışma kapsamına alındı. Ameliyat sonrası altıncı ay ölçümleri değerlendirme için kullanıldı.

**Bulgular:** Cerrahi yöntemlerin %67'si (n=57) LC ve %33'ü (n=28) KMR idi. Levator aponevroz cerrahisi geçiren hastalarda, ameliyat öncesi KA, KMR uygulanan hastalardan istatistiksel olarak daha düşüktü (p=0.016). Ameliyat sonrası KA ve KA değişimleri iki yöntem arasında istatistiksel fark göstermiyordu (ameliyat sonrası KA için p=0.1, KA değişimi için p=0.073). İki grupta da, ameliyat sonrası KA değişimleri, ameliyat öncesi değerlerle karşılaştırıldığında istatistiksel olarak anlamlılık göstermekteydi (her iki cerrahi için p=0.001). İki grup arasında, tekrar ameliyat (p=0.027), ameliyat sonrası birinci günde ağrı, ödem, ekimoz (p=0.128) ve kozmetik sonuç (p=0.724) açısından istatistiksel anlamlı fark saptanmadı. Ameliyat süreleri, LC grubunda (28.9±5.1 dk), KMR grubuyla (17.7±3.1 dk) karşılaştırıldığında, istatistiksel anlamlı olarak daha uzundu (p=0.001).

**Sonuç:** Konjonktiva-Müller kası rezeksiyonu ameliyat süresi açısından daha kısa olsa da, KMR ve LC ile kozmetik sonuç, tekrar ameliyat ve ameliyat sonrası birinci günde ağrı, ödem, ekimoz açısından benzer sonuçlar elde edildi.

***Anahtar sözcükler:*** Konjonktiva-Müller rezeksiyonu; levator aponevroz cerrahisi; ptozis cerrahisi; ptosis.

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Ptosis is a condition characterized by drooping of the upper eyelid. The descended upper eyelid results in partial or complete obscuration of the superior visual field. Ptosis repair is one of the most common and challenging procedures in oculoplastic practice. The appropriate surgical technique is determined according to the levator function, severity of ptosis and result of the phenylephrine test.[1-10] Surgical repair can be done by both posterior or anterior surgical approaches in patients with good levator function. During anterior approach through an eyelid crease incision, the levator aponeurosis, with or without shortening, is usually reattached to the anterior tarsal plate.[5-11]

Posterior approach by transconjunctival resection of Müller's muscle and conjunctiva has been used to correct mild to moderate ptosis; its widespread use requires positive response to the phenylephrine test.[11-15]

In the literature and oculoplastic practice, the appropriate surgical decision is still controversial. There are limited number of studies evaluating this issue. According to these studies, the surgeon can use various techniques based on the severity of ptosis and the levator function measurements.[2,5,7,16] Therefore, our study aims to prospectively examine the patients who have had either a levator aponeurosis surgery (LS) or a conjunctiva-Müller muscle resection (CMR) surgery for ptosis. We evaluated their functional and cosmetic outcome following these surgeries.

## PATIENTS AND METHODS

The patient population was selected from an ophthalmology clinic oculoplastic department prospectively. Eighty-five consecutive patients (45 males, 40 females; mean age 48.5±21.9; range, 8 to 80) who underwent either LS or CMR operation for ptosis repair by the same oculoplastic surgeon during the year January 2015 and May 2016 were included in the study.

Information included age, gender, method of surgery, preoperative and postoperative palpebral fissure height (PFH), PFH change, preoperative levator function, etiology, laterality of surgery, postoperative day 1 pain, edema and ecchymosis, cosmetic outcome, reoperation rate and operating time from initial maneuver to wound closure. Patients were examined on the 1st day, 1st week and 1st, 3rd and 6th months postoperatively. Postoperative measurements at the 6th month visit were used for analysis.

Patients were excluded if they had levator function under 12 mm, undergone prior ptosis surgery, concomitant eyelid or brow surgery, cases with neurogenic and mechanical ptosis. The study was conducted in compliance with the principles of the Declaration of Helsinki and complies with the policies of the local institutional review board.

Cosmetic outcome was graded on the basis of final eyelid position, symmetry and eyelid crease, on a scale of good, moderate and poor. Results is checked and were considered good when final intereyelid height asymmetry ≤1 mm, with good eyelid contour and crease. If there was a problem with one of these parameters, cosmetic score was considered moderate. If outcome was unsatisfactory and required reoperation, cosmetic outcome was considered poor.

Before the operation, all patients underwent phenylephrine test. Elevation of the eyelid to the desired level after instillation of one drop of topical 5% phenylephrine hydrochloride (mydfrin 5% ophthalmic solution, Alcon®) within 10 to 15 minutes of instillation is considered a positive response, indicating that CMR can be successfully executed. The operations were done under local anesthesia unless the patients' age were under 18 years.

### Surgical technique

Two curved hemostats were placed at the superior tarsal border after the desired level of tissue was engaged. 6-0 polypropylene suture (Prolene®) was passed back and forth proximal to the hemostats in a horizontal mattress fashion. The tissue in the hemostats were excised and 6-0 polypropylene suture was used to close the wound. The ends of the sutures, medial and lateral, were directed through the wound edges on the conjunctiva side out through the lid crease. Each end of the suture was tied on itself to the skin. 4 mm of conjunctiva-Müller resection was performed for each 1 mm of desired elevation.

The patients without response to the phenylephrine test were applied external LS. A central upper eyelid skin crease incision was marked at the natural crease 8-10 mm from

the ciliary margin. After incising the orbicularis muscle and opening the orbital septum, the preaponeurotic fat pad was retracted to observe the levator aponeurosis. The levator aponeurosis was released and sutured to the tarsus with three 6-0 polyglactin (Vicryl®) sutures. First the central suture was adjusted until the height and contour were optimal, and the nasal and temporal ones are placed afterwards. At last the skin was closed with 6-0 polyglactin suture. For the levator resection, especially for the local anesthesia patients the eyelid level was adjusted when the patient is at the sitting position. For the general anesthesia patients, resection was done according to the level of ptosis.

### Statistical analysis

For the statistical evaluation of the data, NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) software was used. Measurable data of our study were presented as mean±SD. The range of the variable data was measured using Mann Whitney U test. When comparing the two groups, quantitative data were analyzed with independent samples using a Mann Whitney-U test. Intergroup quantitative data were analyzed using a Wilcoxon Signed Ranks test. Qualitative data were analyzed using a Pearson chi-square test, Fisher's exact test, Yates' continuity correction test and Fisher Freeman Halton test. The values of $p<0.01$ and $p<0.05$ were considered statistically significant.

## RESULTS

There were no statistically significant differences considering age (p=0.215) and gender (p=0.283) between the two groups. Of the surgical procedures, 67% (57/85) were LS, 33% (28/85) were CMR operation. Patient demographics are summarized in Table 1.

Patients who underwent LS had more ptotic eyelids preoperatively (mean preoperative PFH was 6.19±1.41 for LS group and 6.75±1.14 for CMR group). Postoperative PFH (8.58±1.31 for LS vs. 8.79±0.92 for CMR) and PFH change (2.39±0.73 for LS vs. 2.04±0.79 for CMR) between two operation groups were not statistically significant (p=0.127 for PFH and p=0.073 for PFH change). In both groups, mean postoperative PFH change was 2.42±0.73 mm in LS group, 2.04±0.79 mm in CMR group.

**Table 1.** Patient demographics related to operation technique

| | Total | | | | | LS group (n=57) | | | | CMR group (n=28) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | Mean±SD | Min-Max | Median | n | % | Mean±SD | Min-Max | Median | n | % | Mean±SD | Min-Max | Median | *p* |
| Age (year) | | | 48.5±21.9 | 8-80 | 54 | | | 45.8±22.2 | 8-79 | 35 | | | 54.1±20.6 | 20-80 | 62 | 0.215* |
| Gender | | | | | | | | | | | | | | | | 0.283† |
| Female | 40 | 47.1 | | | | 24 | 42.1 | | | | 16 | 57.1 | | | | |
| Male | 45 | 52.9 | | | | 33 | 57.9 | | | | 12 | 42.9 | | | | |

LS: Levator aponeurosis surgery; CMR: Conjunctiva-Müller Muscle Resection; SD: Standard deviation; Min: Minimum; Max: Maximum; * Mann-Whitney U test; †Yates Continuity Correction Test.

**Table 2.** Preoperative PF and change in PF for patients operated on LS or CMR

| | Total | | | LS group (n=57) | | | CMR group (n=28) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean±SD | Min-Max | Median | Mean±SD | Min-Max | Median | Mean±SD | Min-Max | Median | *p* |
| Preoperative PF (mm) | 6.4±1.3 | 3-9 | 6 | 6.2±1.4 | 3-9 | 6 | 6.8±1.1 | 4-9 | 7 | 0.016*† |
| Postoperative PF (mm) | 8.7±1.1 | 7-12 | 8 | 8.6±1.3 | 7-12 | 8 | 8.8±0.9 | 7-10 | 9 | 0.127† |
| PF Change (mm) | 2.3±0.7 | 1-4 | 2 | 2.4±0.7 | 1-4 | 2 | 2.0±0.7 | 1-3 | 2 | 0.073† |
| *p* | | | | | 0.001**‡ | | | 0.001**‡ | | |

PF: Palpebral fissure height; LS: Levator aponeurosis surgery; CMR: Conjunctiva-Müller muscle resection; * p<0.05; ** p<0.01; † Mann-Whitney U test; ‡ Wilcoxon signed ranks test.

PFH change in both groups was statistically significant compared with the preoperative PFH values (p=0.001 for both group) (Table 2). For both group levator palpebrae muscle function ranged between 12 and 18 mm (mean 16 mm). In both operation groups, there was no significant difference between etiology and laterality.

Of the patients in the LS group, pain, edema and ecchymosis on postoperative day one was noted in 22.8% of patients, compared to 7.1% of the patients in the CMR group. But the difference was statistically insignificant (p=0.125). In LS group, 11 patients (19.2%) presented with surgical failure, including eight under-corrections, three over-corrections. Of them, six patients (10.5%) had undergone reoperation; five patients for under correction, one patient for overcorrection. In CMR group one patient (3.5%) presented with under correction. None of the patients for this group had a reoperation. But in both groups, reoperation rates (p=0.171; p>0.05) were statistically insignificant. (Table 3, Figure 1).

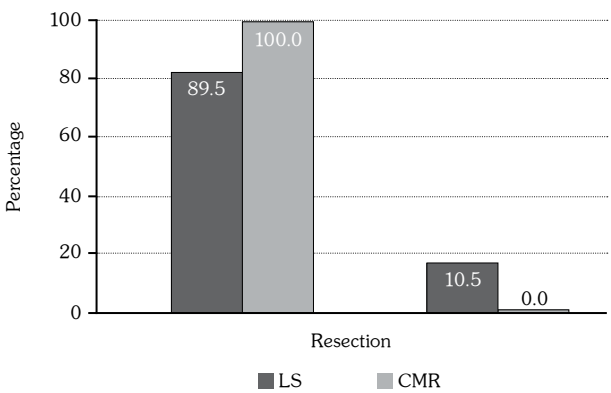


**Figure 1.** Reoperation percentage for the operation techniques levator aponeurosis surgery (LS) and conjunctiva-Müller muscle resection (CMR).

In patients who underwent LS, good cosmetic outcome was 73%, for the CMR group good cosmetic outcome was 78%. Additionally, lower percentage of the CMR patients attained a poor outcome (0%) compared to LS patients (5.3%). But in both groups, there was no significant difference according to final cosmetic outcome (p=0.724, p>0.05) (Table 3).

When evaluating the operating time for each procedure, the mean time from the beginning of the procedure to wound closure was 28.86±5.09 minutes in levator resection group, 17.71±3.11 minutes in CMR group. In levator resection group the operation time was statistically significantly higher than CMR group (p=0.001; p<0.01) (Figure 2, Table 3).

## DISCUSSION

When ptosis is identified, and operation is planned, the decision on which surgical procedure to perform is important. There are several different techniques that a surgeon can use based on the severity of ptosis, the amount of levator function, and the phenylephrine test result. The amount of levator function is the major determinant of

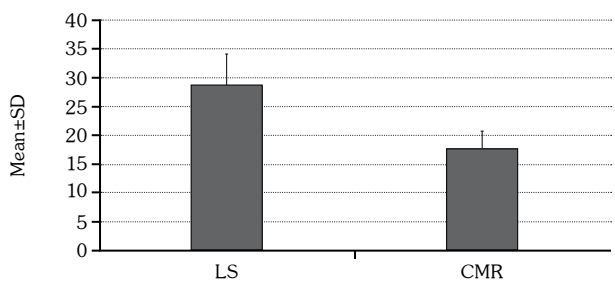


**Figure 2.** Operation time (minutes) for the operation techniques levator aponeurosis surgery (LS) and conjunctiva-Müller muscle resection (CMR).

**Table 3.** Outcome of 85 patients who underwent LS or CMR for laterality, etiology, reoperation, cosmetic outcome, operating time from skin incision to wound closure, postoperative day 1 pain, edema, ecchymosis

| | Total | | | | | LS group (n=57) | | | | | CMR group (n=28) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | Mean±SD | Min-Max | Median | n | % | Mean±SD | Min-Max | Median | n | % | Mean±SD | Min-Max | Median | *p* |
| Laterality | | | | | | | | | | | | | | | | 0.102† |
| Right | 30 | 35.3 | | | | 24 | 42.1 | | | | 6 | 21.4 | | | | |
| Left | 55 | 64.7 | | | | 33 | 57.9 | | | | 22 | 78.6 | | | | |
| Etiology | | | | | | | | | | | | | | | | 0.078‡ |
| Congenital | 43 | 50.6 | | | | 33 | 57.9 | | | | 10 | 35.7 | | | | |
| Senil | 41 | 48.2 | | | | 23 | 40.4 | | | | 18 | 64.3 | | | | |
| Traumatic | 1 | 1.2 | | | | 1 | 1.8 | | | | 0 | 0.0 | | | | |
| Postoperative day 1 pain, edema, ecchymosis | | | | | | | | | | | | | | | | 0.128¶ |
| No | 70 | 82.4 | | | | 44 | 77.2 | | | | 26 | 92.9 | | | | |
| Yes | 15 | 17.6 | | | | 13 | 22.8 | | | | 2 | 7.1 | | | | |
| Reoperation | | | | | | | | | | | | | | | | 0.027*¶ |
| No | 75 | 88.2 | | | | 51 | 89.5 | | | | 28 | 100.0 | | | | |
| Yes | 10 | 11.8 | | | | 6 | 10.5 | | | | 0 | 0.0 | | | | |
| Cosmetic outcome | | | | | | | | | | | | | | | | 0.724‡ |
| Good | 64 | 75.3 | | | | 42 | 73.7 | | | | 22 | 78.6 | | | | |
| Moderate | 18 | 21.2 | | | | 12 | 21.1 | | | | 6 | 21.4 | | | | |
| Poor | 3 | 3.5 | | | | 3 | 5.3 | | | | 0 | 0.0 | | | | |
| Surgery duration (min) | | | 25.2±6.9 | 15-40 | 25 | | | 28.9±5.1 | 20-40 | 30 | | | 17.7±3.1 | 15-25 | 16.5 | 0.001**§ |

LS: Levator aponeurosis surgery; CMR: Conjunctiva-Müller muscle resection; LS: Levator aponeurosis surgery; SD: Standard deviation; Min: Minimum; Max: Maximum; ‡ Fisher Freeman Halton test; † Yates continuity correction test; ¶ Fisher's exact test; § Mann-Whitney U test; * $p<0.05$; ** $p<0.01$.

surgical approach. Which procedure is better is up for debate and depends on the preference of the surgeon. LS and CMR operations are two standard ways to correct upper eyelid ptosis with good levator function. There are retrospective studies comparing both techniques to evaluate the success of these surgeries.[1-15]

Ben Simon et al.[10] retrospectively compared standard LS and CMR in 272 upper eyelid ptosis patients, in which 141 undergoing concurrent blepharoplasty. The LS group had lower preoperative MRD1 compared to the CMR group (MRD1: 0.33±1.5 mm for LS vs. 1.0±0.9 mm for CMR; p<0.001) but attained similar postoperative MRD1 (2.3±1.6 mm LS vs. 2.4±1.0 mm CMR; p=0.6). Postoperative MRD1 change (1.9±1.7 mm vs. 1.4±1.3 mm; p=0.02) was also significantly higher in the LS group. These results were similar with our study in that patients selected for LS had more severe ptosis according to lower MRD1 to begin with. However, the 20% reoperation rates are differed from our study with reoperation rate of 11.8%.

Levator aponeurosis surgery is an effective and more complex procedure, requiring a detailed knowledge of eyelid anatomy to establish good eyelid contour and position. However, the surgery involves dissection of the layers of the eyelid, is time consuming, and requires patient participation. On the other hand, there are several advantages of this procedure: it is effective for severe ptosis, it can be done for the phenylephrine-negative patients, and it can be adjustable during surgery.[2,5-11,16] The outcome of LS has varied in previous reports with reported success rates of 70 to 95% with the reoperation rates 8.7 to 12%. In our study, the reoperation rate for LS was 10.5%.[2,7,16-22]

McCulley et al.[17] studied 828 patients who had LS for ptosis, their reoperation rates were 8.7% overall, 5.2% of unilateral, and 13% of bilateral cases. Eighty percent of the patients attained satisfactory results, defined as postoperative MRD1 was between 2.0-4.5 mm with less than 1 mm of asymmetry between two eyelids. Additionally, they reported that patients with bilateral or severe ptosis have increased risk of under correction. Ben Simon et al.[10] reported that 18% of their LS patients and 3% of CMR patients had reoperation. Our reoperation rates were 10.5% for the levator resection group, 0% for CMR group, but in both groups reoperation rates (p=0.171; p>0.05) were statistically insignificant. These results show that CMR group had a lower reoperation rate but we must keep in mind that the patients selected for the LS procedure were the severe ptosis patients with lower MRD1.

Conjunctiva-Müller muscle resection surgery is quick, easier than LS, requires no skin incision, yields generally expected results, and requires no patient cooperation. However, cutting a portion of Müller's muscle does not allow intraoperative adjustment of lid height, and presumably carries risk of dry eye. In the literature, excellent results have been reported with CMR for ptosis.[7,8,10,11,16,23-29] Ben Simon et al.[10] reported that higher percentage of CMR patients attained excellent and good results (51% and 33% respectively) as compared with external LS patients (43% and 25%). In our study, although none of the CMR patients had poor outcome compared with the 5.3% in the LS group, this was statistically insignificant (p=0.724, p>0.05).

In several studies for the CMR procedure, show that excision of the tarsal conjunctiva may aggravate dry eye symptoms.[28] Others found no significant effect on tear production measured by Schirmer testing, so there is no consensus about the progress of dry eye.[26] There is a suggestion that excision of conjunctiva close to the tarsal border that barns several glands may cause dry eyes; however histopathological studies never confirmed this hypothesis.[26] In our study, we did not see any dry eye patient in our series.

In the literature, there is currently no consensus among oculoplastic surgeons relating to a gold standard preoperative assessment for ptosis. Cetinkaya and Brannan[5] describes ptosis algorithm with two parameters: levator function and MRD 1 measurements. For the patients with good levator function and 2 mm droop from normal position CMR is the viable option. With moderate ptosis levator surgery is usually preferred. Aakalu and Setabutr[15] administered a national survey to assess the current practice patterns for management of ptosis by American Society of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS) members. Nearly 100% of members performed some variant of LS for

ptosis, 74% of respondents perform some type of internal levator aponeurosis advancement surgery (i.e. Fasanella Servat, Müller's Muscle-conjunctival resection). Two-thirds of ASOPRS members utilized a phenylephrine test in their preoperative testing protocol. In particular, new graduates from fellowship are more prone to using internal levator advancement surgery types. Mota and Norris[30] assessed the current practice using phenylephrine test by British Oculoplastic Surgery Society (BOPSS) consultants for ptosis surgery. 76% perform levator advancement as first line surgery.Additionally, 40% routinely use phenylephrine test; the majority use posterior approach if the test is positive.

The limitation of our current study was that two dissimilar groups were compared for ptosis surgery. The severity of the ptosis differed between the two groups. However our aim was not only to compare but also to prospectively evaluate the results of two surgeries.

In conclusion, postoperative cosmetic outcome, surgical failure and reoperation rates, postoperative pain, edema, ecchymosis for CMR group seems lower than LS group, but it was statistically insignificant. The operation time and preoperative PFH for CMR was statistically lower than LS. As a result, our study supports that LS and CMR operations both yield good results for ptosis. The best surgical method is the one that the surgeon is most comfortable with.

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