

Meta-Analysis of Flaps Management in External Dacryocystorhinostomy

SHERIFF ELWAN, M.D.; OSSAMA NADA, M.D. and NANCY H.M. YOUSSEF, M.Sc.

The Department of Ophthalmology, Faculty of Medicine, Ain Shams University

Abstract

Background: Dacryocystorhinostomy (DCR) describes the creation of a functional pathway from the canaliculi into the nose through creating an osteotomy and opening the nasolacrimal sac into the nose. It can be performed via an external or endonasal approach.

Aim of Study: To evaluate the outcomes of external DCR by using two different patterns of flap anastomosis; one only with anterior flap anastomosis and the other with both anterior and posterior flap anastomosis.

Material and Methods: We followed the PRISMA statement guidelines Error! Bookmark not defined during this systematic review and meta-analysis preparation. All steps were performed according to the Cochrane handbook of systematic reviews of intervention.

Results: The initial search resulted in 468 articles from five databases including PubMed, Cochrane, Scopus, Web of Science (WOS), Embase, and Science Direct. A total of ten studies were finally included for the final qualitative synthesis and the quantitative analysis. We identified ten studies comparing double anterior and posterior mucosal flaps anastomosis versus single anterior mucosal in the surgical procedure of external dacryocystorhinostomy. The included studies focused on the outcomes of postoperative success rate, post-operative failure rate, perioperative complications including Intraoperative bleeding, Nasal mucosal tear, and Cheese wiring of punctum, we also focused on the postoperative bleeding score, Epiphora score, patency score, wound gaping, recurrence, mean surgical time, and the risk of watering eye.

Conclusion: There was no difference in surgical success between single/double flap applications performed in external DCR operations. Also, Success rates were comparable between both techniques, and that the posterior mucosal flap has no role in the outcome of external DCR. Single flap anastomosis, external DCR can be implemented as a standard technique, without significantly compromising the final success rate. Anterior suspended flap external DCR is a simple, safe technique with a very high success rate and a satisfactory surgical time. No significant difference in terms of recurrence is seen in comparison to two flap anastomosis. Future randomized controlled trials (RCTs) with uniformity of the surgical components are warranted to validate these findings.

Correspondence to: Dr. Nancy H.M. Youssef,
The Department of Ophthalmology, Faculty of Medicine,
Ain Shams University

Key Words: Dacryocystorhinostomies – Dacryocystostomy – Dacryocystostomies.

Introduction

THE precocular tear film is essential for the physiological and optical function of the eye it protects and lubricate the ocular surface, allowing for consistent clarity of vision. It is drained through the puncti, passing by the canaliculi into the lacrimal sac and finally through the nasolacrimal duct to drain into the inferior nasal meatus [1].

Nasolacrimal duct obstruction (NLDO) is the commonest disorder of lacrimal system. One study found an annual incidence rate of 20.24 people with NLDO per 100,000 with higher prevalence among older people and women. The male to female ratio was about 1:3 due to the smaller diameter of the bony nasolacrimal canal and the mean age 60 years [2].

NLDO can be congenital or acquired, Acquired NLDO can be classified as either primary acquired nasolacrimal duct obstruction (PANDO) when it is idiopathic or secondary acquired lacrimal duct obstructions (SALDO) when it is secondary to various etiologies [3].

NLDO prevent the normal flow of the tears. The commonest symptoms and signs of NLDO are epiphora, regurge through the puncti and swelling of the lacrimal sac. Epiphora (which is a common ophthalmologic problem) due to NLDO will cause blurring of vision due to retained altered tear meniscus, mucopurulent discharge and eczema of the lower lid skin in chronic cases leading to cicatricial ectropion which in turn exacerbate the symptoms of epiphora [4].

Untreated epiphora will lead to acute or chronic dacryocystitis associated with inflammation in the surrounding area [5].

Conservative treatments only achieve temporary relief of symptoms, thus surgery is the treatment of choice [6].

Dacryocystorhinostomy (DCR) is the surgical treatment of choice for primary acquired NLDO. The aim of performing a DCR is to create a fistula between the nasolacrimal sac and the nose, thus bypassing any obstruction and allowing passage of tears directly into the nose by means of creating an osteotomy and opening the nasolacrimal sac into the nose. It can be performed via an external or endonasal approach [7].

The traditional procedure and still a gold standard for the treatment of nasolacrimal duct obstruction is the external-approach dacryocystorhinostomy (DCR) was first described at the beginning of the 20th century by the Florentine professor of otolaryngology, AddeoToti in 1904 in the Italian literature, and later modified by Dupuy-Dutemps and Bourguet. Whom introduced the technique of anastomosing lacrimal and nasal mucosal flaps which remains the foundation of the external dacryocystorhinostomy performed today [8].

In 1893 Caldwell came with an idea of performing the operation through the nasal cavity without skin incision. He used an endonasal electric burr to remove the bone once a metal probe had been passed through the canaliculus and into the lacrimal sac, This technique was unpopular at the beginning due to technical difficulties and poor visualization. After the introduction of fiberoptic in the field of sinus surgery, the endoscopic DCR gained popularity late in 1990s [9].

The advantages of external DCR include direct visualization of the lacrimal sac for identification of the sac pathology, no need for expensive instruments, the allowance of secure flaps creation, and sutures to form a fine anastomosis between lacrimal sac and nasal mucosa, which is one of the key factors to surgical success.

The main disadvantages of external DCR are the scar formation and interference of the lacrimal pumping function due to disruption of medial canthal tendon, orbicularis muscle, or superficial branch of facial nerve. On the contrary the endoscopic DCR has benefits of preserving lacrimal pumping function without eyelid anatomy disruption, no risk of external scar, and the ability to access any intranasal pathology in one surgery. The drawbacks of the endoscopic DCR include high cost of the instrument, steep learning curve of the endoscope technique for ophthalmologist,

and difficulty of lacrimal sac-nasal mucosal flaps suturing and manipulation [8].

Nevertheless, the external DCR remain the gold standard procedure in NLDO to which the success of other techniques is compared [10].

Both endoscopic and external DCRs provide satisfactory outcomes in acquired partial NDO. Although The success rate is higher in external DCR compared with endoscopic DCR. The success rate of the external DCR varies widely in literature around 70% to 95% [10]. Error! Bookmark not defined.

The main causes of DCR failure are nasal polyps, sinus disease, canalicular stenosis, inadequate bone removal, adhesions to the middle turbinate, intranasal adhesions/granulation and cicatricial lacrimal ostium scarring. These pathologies can result in blockage of the osteotomy. Also, there rates vary between endoscopic and external DCR. Cicatricial closure of the lacrimal ostium and intranasal adhesions are regarded as the most common causes of primary DCR failure [11].

For the success of DCR, nasal mucosa and lacrimal sac flaps must have adequate suturing with an appropriate size of nasolacrimal clearance. The application of External DCR is not easy and requires surgical experience. The difficult suturing of the mucosal flaps during surgery, the blockage of the newly formed path with granulation tissue, and the adhesion of the flaps are the main reasons for the failure of the operation. To overcome, various modifications are made in traditional external DCR surgery. Alterations in the formation of mucosal flaps are applied nowadays [12].

The external approach DCR procedure used nowadays is still very similar to the one described about one hundred years ago when it had been proposed to suture posterior lacrimal sac and nasal mucosal flaps together and to do the same with anterior mucosal flaps. In endonasal DCR, a procedure that only became popular more recently, the lacrimal sac and nasal mucosae flaps are either left not sutured or are to some extent excised. This raises the question whether, during external DCR, fashioning and suturing together the posterior and together the anterior nasal and lacrimal sac mucosal is really necessary [13].

Therefore, one of the most important keys for the success and durability of the operation is maintaining a patent path. So this study will review all studies reporting the outcome of different flaps in DCR.

Aim of the study:

To review literature and combine studies of results in a meta analytic review of flap management in external DCR.

Material and Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines [14] during this systematic review and meta-analysis preparation and performed all steps according to the Cochrane handbook of systematic reviews of intervention [15].

Search strategy and study selection: We searched PubMed, Scopus, Cochrane, Web of Science, Embase, and Science Direct till September 2021 relevant keywords. We used the following search strategy for searching different databases: (“External Dacryocystorhinostomy” OR Dacryocystorhinostomies OR Dacryocystostomy OR Dacryocystostomies) AND (Flap OR flaps OR “surgical flaps” OR “mucosal flaps” OR “flap anastomosis” OR “flaps, surgical” OR “surgical flap” OR “flap, surgical” OR “island flaps” OR “island flap” OR “flap, island” OR “flaps, island” OR “pedicled flap” OR “flap, pedicled” OR “flaps, pedicled” OR “pedicled flaps”). All the references of the included studies were searched for relevant studies.

Eligibility criteria and study selection:

We included studies that followed these criteria: Clinical comparative studies which assess clinical outcomes after primary external DCR and silicone intubation with anterior and posterior mucosal flap anastomosis, versus primary DCR and silicone intubation with anterior flap anastomosis. Patients diagnosed of acquired nasolacrimal duct obstruction, or chronic dacryocystitis. Double or single arm study designs were accepted for inclusion as well as no restriction regarding participants' gender. Clinical studies describing the clinical postoperative results and follow-up assessment of after DCR. All studies must have been written in English as a full-text manuscript. All included studies are restricted to human studies. Follow-up duration up to a minimum of four months. The included clinical comparative study can be either prospective or retrospective with early postoperative results. Studies published from May 2000 till December 2020. Studies designs included randomized controlled trials (RCTs) or non RCTs including Cohort, Case controls, and case series either prospective or retrospective. Any demographic characteristics were accepted for inclusion. Any outcomes were accepted especially the success rates of each group,

based on subjective report of resolution of epiphora and lacrimal drainage system patency, confirmed by lacrimal irrigation.

The exclusion criteria were as follow:

Different study designs as Case report studies; Cross-sectional studies; Case series or unpublished data were excluded. Experimental studies and animal studies. Studies including less than five cases. Studies that did not meet the inclusion criteria. History of previous lacrimal surgery, physical scars, lower lid malposition including ectropion or entropion. Suspicion of malignancy. Post-traumatic bony deformity or previous facial fracture or nasal diseases, such as polyps and chronic sinusitis. Duplicated articles by the same author unless those with longer follow-ups studies.

All published articles were screened with no restrictions for data of search. Titles and abstracts were done in two parts, followed by full-text screening. Reference lists of the included studies were manually screened to find any other eligible studies that may be omitted from previous steps.

Quality assessment:

Risk of bias was evaluated by the Cochrane handbook of systematic reviews of interventions 5.1.016, which included the following risks: Selection bias "through random sequence generation and allocation concealment", selective reporting, attrition bias, performance bias through blinding of participants, and personnel, detection bias through blinding of outcome assessment. Each bias domain is recorded as one of the following: Low risk, high risk, or unclear risk. Also, the cohort and case controls of the included studies is prospective or retrospective cohort which was evaluated by Quality assessment of cohort and case controls studies by NIH tool Data extraction.

Data extraction:

We obtained data from text, tables, figures (using graph grabber version 2.0), and supplementary data. We focused on the following outcome measures: Postoperative success rate, post-operative failure rate, perioperative complications including Intraoperative bleeding, Nasal mucosal tear, and Cheese wiring of punctum, we also focused on postoperative bleeding score, Epiphora score, patency score, wound gapping, recurrence, mean surgical time, and the risk of watering eye with discharge.

Statistical analysis:

We conducted this meta-analysis by using Open Meta [Analyst] (Computer program) (Version 5.4.

Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). Regarding the study outcomes, risk ratio (RR) with 95% confidence interval (CI) was used for dichotomous variables, while the mean difference (MD) and 95% CI were presented for continuous variables. We interpreted *p*-value of significance as follow:

p-value: level of significance: *p*>0.05: Non-significant. *p*≤0.05: significant. *p*≤0.01: Highly significant.

Testing for heterogeneity:

Cochrane's *p*-values and I^2 were tested to examine heterogeneity among the studies. High heterogeneity most likely existed due to the clinical and methodological factors, so the random effect model was adopted in this meta-analysis even I^2 was small. Funnel plots and the Egger regression test was performed to assess the publication bias between the include studies. Besides, a sensitivity analysis was performed by sequentially deleting trials to check the stability of the primary outcomes.

Results

Literature search results:

The initial search resulted in 468 articles from five databases including PubMed, Cochrane, Scopus, Web of Science (WOS), Embase, and Science Direct. 16 studies are retrieved from Google Scholar, Research Gate, Clinical trial.gov. of these 484 articles. We excluded 29 articles due to duplication. 455 articles underwent title and abstract screening, and 422 were excluded because they did not meet the inclusion criteria. The remaining 33 articles underwent full-text screening. A total of ten studies were finally included for the final qualitative synthesis and the quantitative analysis. Exclusion from the full text screening was based on the following reasons: 13 papers did not follow the inclusion criteria, five papers were reviews, two papers were case reports, two of the papers were conference abstract with non-eligible data for extraction, and the last one was not found.

Fig. (1) PRISMA flow diagram showing the literature search results.

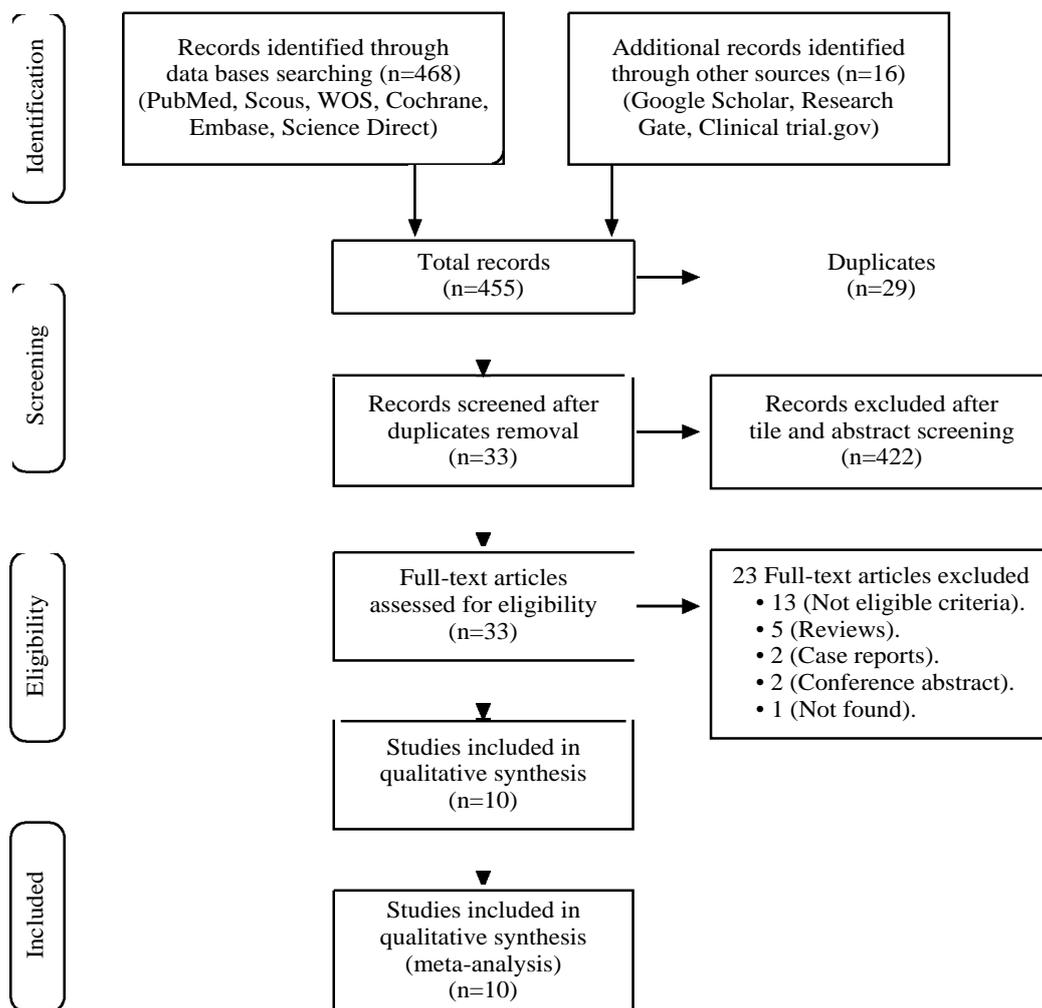


Fig. (1): PRISMA flow diagram of the literature search results.

Table (1): Quality assessment of cohort studies by national institute of health (NIH) tool.

Domains	Çubuk et al., 2020 [17]	Pandya et al., 2013 [18]	Khan et al., 2010 [19]	Verma et al., [20]	Baldeschi et al., 2004 [21]
1- Was the research question or objective in this paper clearly stated?	Yes	Yes	Yes	Yes	Yes
2- Was the study population clearly specified and defined?	Yes	Yes	Yes	Yes	Yes
3- Was the participation rate of eligible persons at least 50%?	Yes	Yes	Yes	Yes	Yes
4- Were all the subjects selected or recruited from the same or similar populations? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	Yes	Yes	Yes	Yes	Yes
5- Was a sample size justification, power description, or variance and effect estimates provided?	NR	NR	Yes	Yes	NR
6- For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	NA	NA	NA	NA	NA
7- Was the time frame sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	NR	Yes	NR	NR	NR
8- For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	NA	Yes	NA	NA	NA
9- Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	NR	Yes	NR	NR	NR
10- Was the exposure(s) assessed more than once over time?	NA	NA	NA	NA	NA
11- Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes	Yes	Yes	Yes
12- Were the outcome assessors blinded to the exposure status of participants?	Yes	Yes	Yes	Yes	Yes
13- Was loss to follow-up after baseline 20% or less?	Yes	Yes	Yes	Yes	Yes
14- Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) an outcome(s)?	NA	NA	NA	NA	NA
Total scores (Yes = 1, No = 0.5, NR & NA & CD = 0)	13	9	10	10	9
Quality rating: Good (14-13 point) or fair (9-12 point) or poor (8-0 points)	Good quality	Fair quality	Fair quality	Fair quality	Fair quality

NA: Not applicable.
 CD: Cannot determine.
 NR: Not reported.

Quality assessment of the comparative studies.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Damle et al., 2020	-	-	?	?	+	+	+
Elwan et al., 2003	+	+	+	+	+	+	+
Katuwal et al., 2013	+	+	+	+	+	+	?
Serin et al., 2007	?	?	+	+	+	+	?
Turkcu et al., 2012	?	?	+	+	+	+	+

Fig. (2): Risk of bias summary of the included comparative studies.

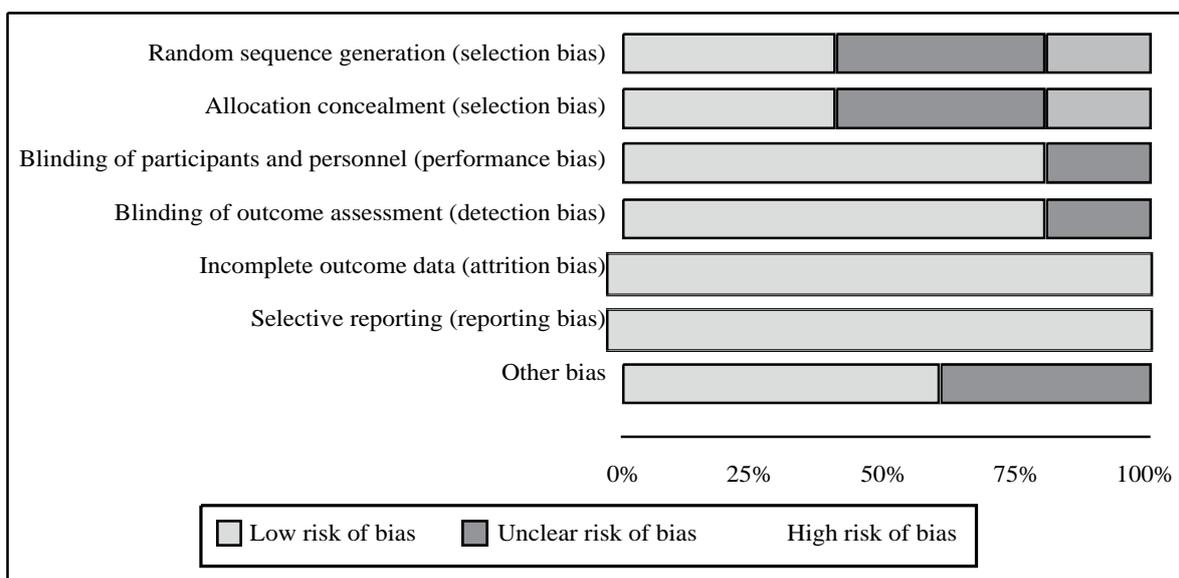


Fig. (3): Risk of bias graph of the included comparative studies.

Characteristics of the included studies:

We identified ten studies comparing double anterior and posterior mucosal flaps anastomosis versus single anterior mucosal in the surgical procedure of external dacryocystorhinostomy. The included studies focused on the outcomes of post-operative success rate, post-operative failure rate, perioperative complications including Intraoperative bleeding, Nasal mucosal tear, and Cheese wiring of punctum which means soft tissue presentation in the eye especially in the cornea, we also focused on postoperative bleeding score, Epiphora score, patency score, wound gapping,

recurrence, mean surgical time, and the risk of watering eye with discharge. Cheese wiring is one of the most common complications after surgical intubation procedures due to excessive tension in the tubing.

Regarding the success rate and epiphora score, surgical success was defined as an epiphora score of 0 or 1 with a patency score of 0 (indicating free passage of the irrigation fluid) or an epiphora score of 0 with a patency score of 1 (indicating absence of symptoms despite some resistance in the new pathway).

Table (2): Studies characteristics.

Study ID	Year	Setting	Study Design
Verma et al., [20]	2021	India	Prospective randomized comparative study
Damle et al., [22]	2020	India	Prospective randomized comparative study
Çubuk et al., [17]	2019	Turkey	Retrospective case control
Katuwal et al., [23]	2013	Nepal	Prospective comparative study
Pandya et al., [18]	2010	Australia	Retrospective cohort study
Elwan, [24]	2003	Egypt	Prospective randomized comparative study
Turkcu et al., [25]	2012	Turkey	Prospective comparative randomized study
Khan et al., [19]	2010	Pakistan	Prospective comparative study
Baldeschi et al., [21]	2004	Netherlands	Prospective consecutive case series
Serin et al., [26]	2007	Turkey	Prospective randomized comparative study

Table (3): Patients' characteristics.

Study ID	Age (mean, range)	Sample size			Follow-up period (months)
		Total	Both flaps	Ant flap only	
Verma et al., 2021	18-60	100	50	50	6
Damle et al., 2020	53.56	46	23	23	8
Çubuk et al., 2019	48.2	156	86	70	18.2
Katuwal et al., 2013	44.2	83	43	40	13.5
Pandya et al., 2010	>16	260	104	138	11
Elwan, 2003	54.9	80	40	40	11.05
Turkcu et al., 2012	46.87	160	79	85	12
Khan et al., 2010	Not reported	70	35	35	4
Baldeschi et al., 2004	46.8	64	35	29	11
Serin et al., 2007	53.9	36	32	30	10.87

Table (4): Success rate outcome.

Study ID	Success rate outcome (%)		p-value
	Both flaps	Ant flap	
Verma et al., 2021	84.0%	98.0%	<0.05
Damle et al., 2020	95.65%	91.3%	<0.001
Çubuk et al., 2019	96.6%	95.8%	No significance
Katuwal et al., 2013	90.7%	87.5%	0.37
Pandya et al., 2010	73.0%	79.0%	0.51
Elwan, 2003	85.0%	90.0%	0.68
Turkcu et al., 2012	89.8%	89.4%	<0.05
Khan et al., 2010	97.1%	94.3%	0.555
Baldeschi et al., 2004	98.0%	100.0%	0.429
Serin et al., 2007	93.8%	96.7%	No significance

Table (5): Findings of the included studies.

Study ID	Findings
Verma et al., 2021	- DCR surgery with anterior flaps anastomosis and excision of posterior flaps has a higher success rate than anterior and posterior flaps anastomosis.
Damle et al., 2020	- Only anterior flap suturing with trimming of posterior flaps in comparison to double flap anastomosis makes external DCR an easy and less time-consuming procedure.
Çubuk et al., 2019	- There was no difference in surgical success in patients undergoing single and double flap external DCR surgery.
Katuwal et al., 2013	- Excision of the posterior flap and anastomosis of only the anterior flap is not disadvantageous to the outcomes of external DCR surgery when compared with the more traditional approach of anastomosis of both flaps.
Pandya et al., 2010	- There was no statistical difference in symptom outcome between patients in whom both mucosal flaps were sutured, those who had only the anterior flap sutured, or those who did not have either flap sutured at the time of surgery.
Elwan, 2003	- Excision of the posterior sac mucosa may improve the success rate of external DCR.
Turkcu et al., 2012	- Anastomosis of posterior flaps does not seem to affect success rate of external DCR. Creating only the anterior anastomosis is technically simpler and does not seem to negatively influence the outcome of DCR surgery.
Khan et al., 2010	- The surgical success of DCR with suturing of the posterior flaps is statistically insignificant to DCR without suturing of the posterior flaps.
Baldeschi et al., 2004	- Different patterns of mucosal dissection in external DCR create a different number and extent of unsutured mucosal margins which do not appear to adversely affect the success rate of external DCR.
Serin et al., 2007	- The study suggests that DCR with double-flap anastomosis has no advantage over DCR with only anterior flaps. Anastomosis by suturing only anterior flaps and excision of the posterior flaps is easier to perform and does not appear to adversely affect the outcome of DCR surgery.

Outcomes:

Post-operative success rate:

The pooled analysis of the included studies showed no significant difference between dacryocystorhinostomy either with both anterior and

posterior mucosal flap anastomosis and the anterior mucosal flap only (RR=0.99, 95% CI: [0.95, 1.02], $p=0.42$). The pooled studies were homogenous, and no heterogeneity was detected between the pooled included studies ($I^2=0\%$, $p=0.52$). Fig. (4).

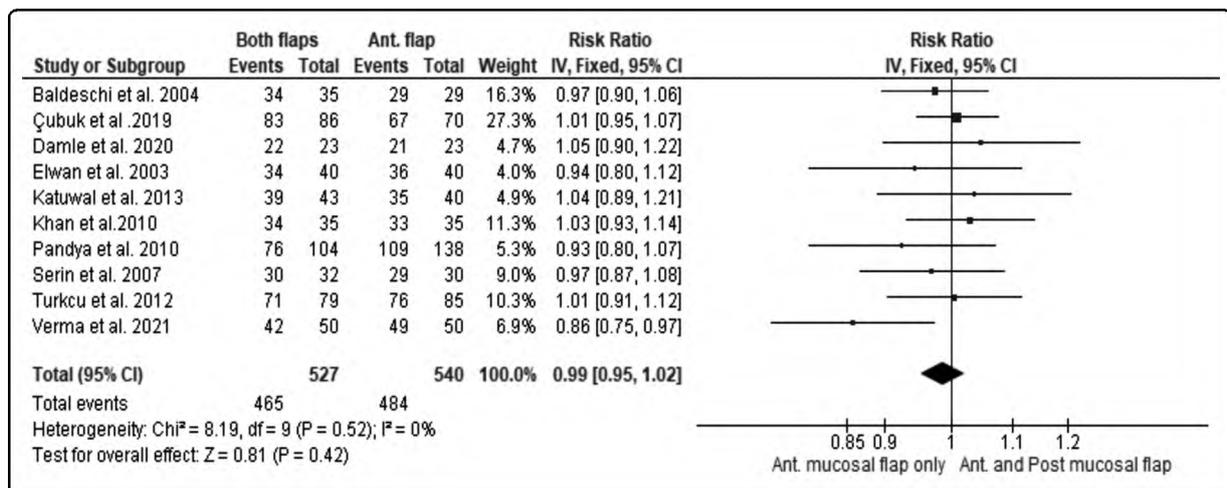


Fig. (4): Forest plot of risk ratio (RR) in postoperative success rate.

Post-operative failure rate:

The pooled analysis of the included studies showed no significant difference between dacryocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior

mucosal flap only in terms of failure rate postoperatively (RR=1.22, 95% CI: [0.86, 1.69], $p=0.28$). The pooled studies were homogenous and no heterogeneity was detected between the pooled included studies ($I^2=0\%$, $p=0.74$). Fig. (5).

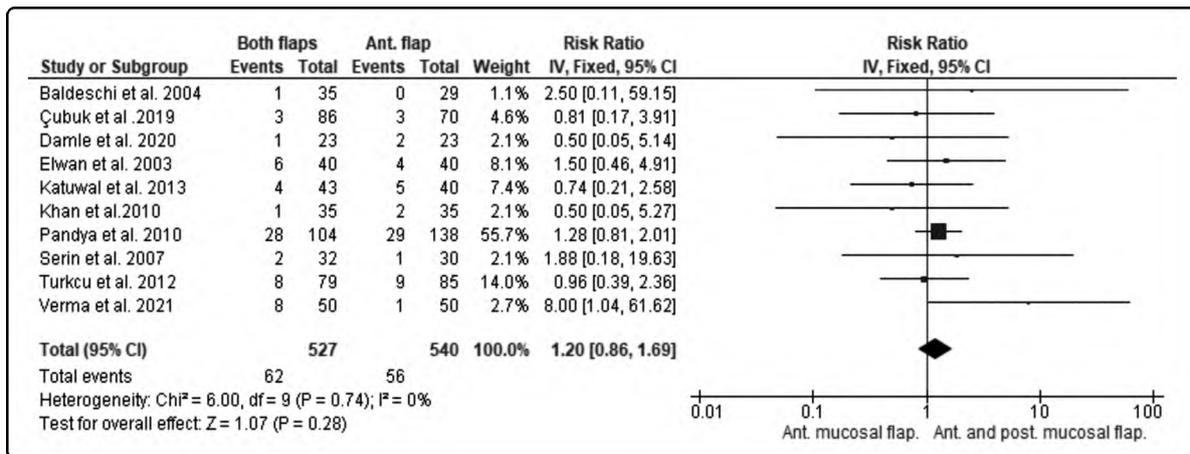


Fig. (5): Forest plot of risk ratio (RR) in postoperative failure rate.

Perioperative complications:

The pooled analysis of the included studies showed no significant difference between dacryocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap only regarding the risk of complication

including intraoperative bleeding, Nasal mucosal tear, and Cheese wiring of punctum (RR=1.01, 95% CI: [0.56, 1.8], p=0.98). The pooled studies were homogenous and no heterogeneity was detected between the pooled included studies (I² = 0%, p=0.80). Fig. (6).

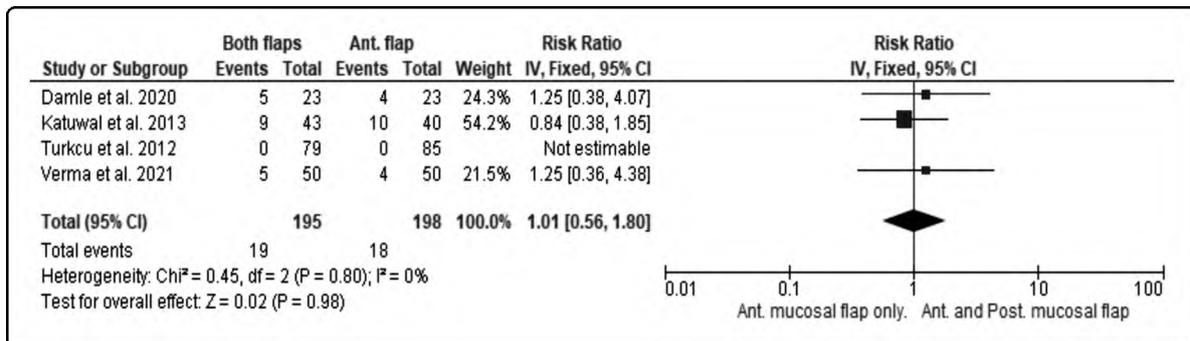


Fig. (6): Forest plot of risk ratio (RR) in postoperative complication.

Postoperative bleeding score:

Only one study (Serin et al., 2007) [26] reported the outcome of the bleeding score postoperatively between dacryocystorhinostomy either with both

anterior and posterior mucosal flap anastomosis and the anterior mucosal flap only showing no significant difference between both groups postoperatively (MD=-0.13, 95% CI: [-0.49, 0.23], p=0.48). Fig. (7).

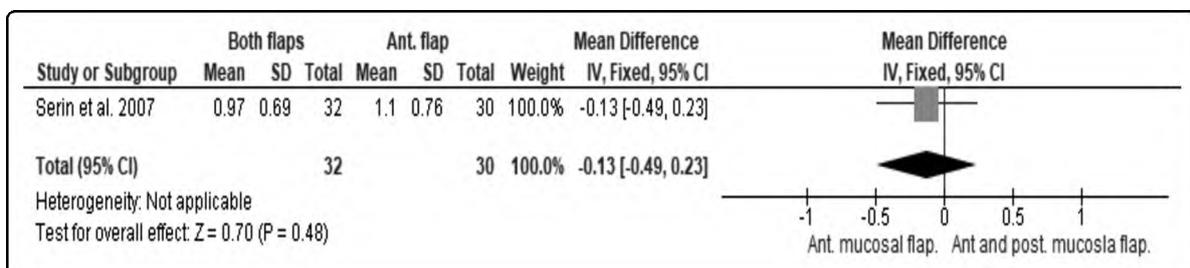


Fig. (7): Forest plot of mean difference (MD) in postoperative bleeding score.

Epiphora score:

The study of (Serin et al., 2007) [26] Error! Bookmark not defined. Reported the outcome of the epiphora score postoperatively between dacry-

ocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap only showing no significant difference between both groups postoperatively (MD=0.02, 95% CI: [-0.14, 0.18], $p=0.81$). Fig. (8).

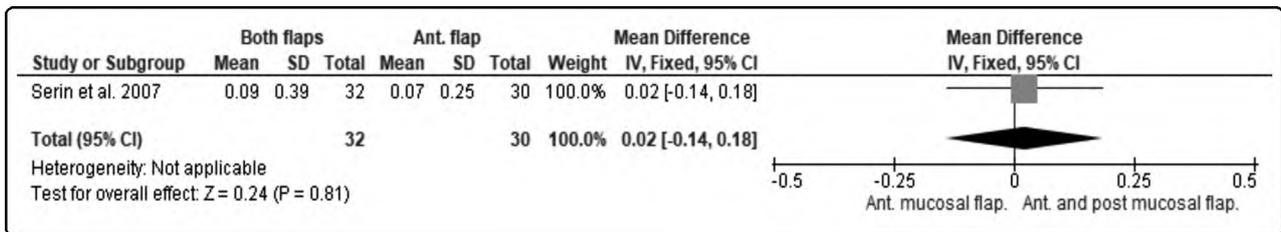


Fig. (8): Forest plot of mean difference (MD) in postoperative epiphora score.

Risk of watering eye with discharge:

The study of Verma et al., 2021 [20] reported the assessed the outcome of risk of watering eye postoperatively between dacryocystorhinostomy

either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap showing no significant difference between both groups (RR=0.80, 95% CI: [0.34, 1.86], $p=0.06$). Fig. (9).

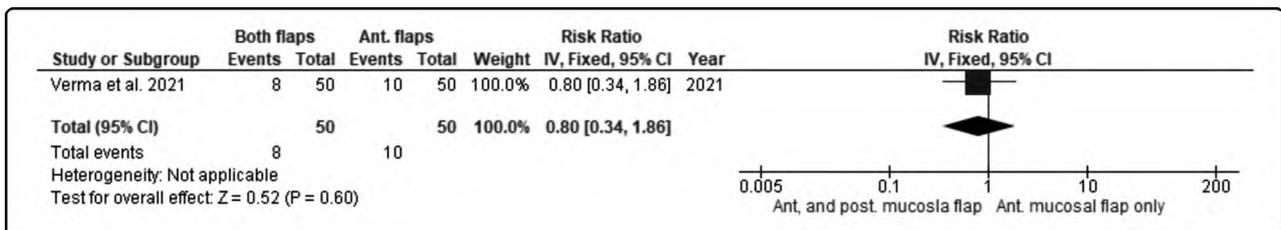


Fig. (9): Forest plot of risk ratio (RR) in postoperative risk of watering eye.

Patency score:

The study of (Serin et al., 2007) [26] Error! Bookmark not defined. reported the outcome of the patency score postoperatively between dacry-

ocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap only showing no significant difference between both groups postoperatively (MD=0.06, 95% CI: [-0.09, 0.21], $p=0.43$). Fig. (10).

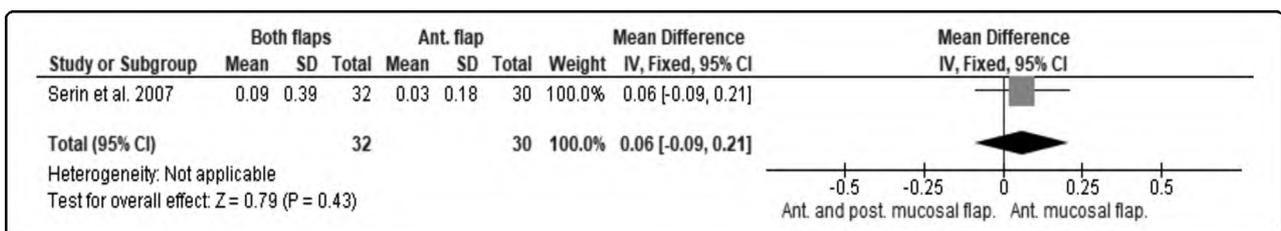


Fig. (10): Forest plot of mean difference (MD) in patency score.

Wound gapping:

The study of Damle et al., 2020 [22] Error! Bookmark not defined. Reported the assessed the outcome of risk of wound gapping postoperatively

between dacryocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap showing no significant difference between both groups (RR=1.00, 95% CI: [-0.15, 6.51], $p=1.00$). Fig. (11).

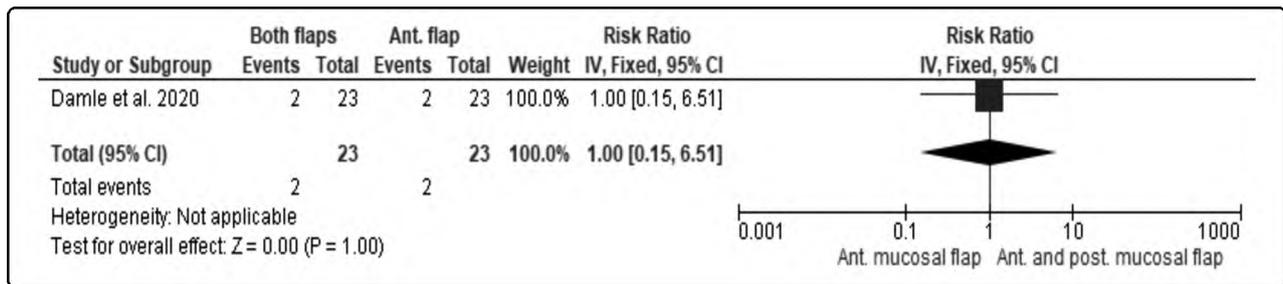


Fig. (11): Forest plot of risk ratio (RR) in wound gapping.

Recurrence:

The study of Damle et al., 2020 [22] Error! Bookmark not defined. Reported the assessed the outcome of risk of wound gapping postoperatively

between dacryocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap showing no significant difference between both groups (RR=0.50, 95% CI: [-0.05, 5.14], p=0.56). Fig. (12).

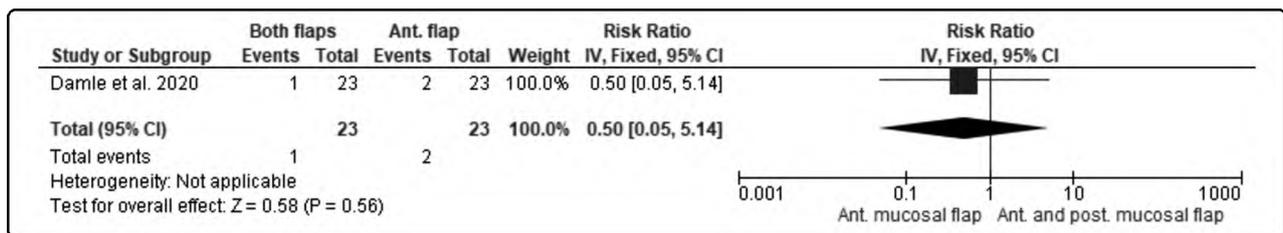


Fig. (12): Forest plot of risk ratio (RR) in recurrence.

Mean surgical time:

Only one study of (Damle et al., 2020) [22] Error! Bookmark not defined. reported the outcome of surgical operative time between dacryocystorhinostomy either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal

flap showing a significant difference between both groups (MD=7.31, 95% CI: [6.48, 8.14], p< 0.00001) favoring dacryocystorhinostomy with ant. Flap over the double flap, meaning that the anterior flap anastomoses consume lesser time than double flap anastomosis. Fig. (13).

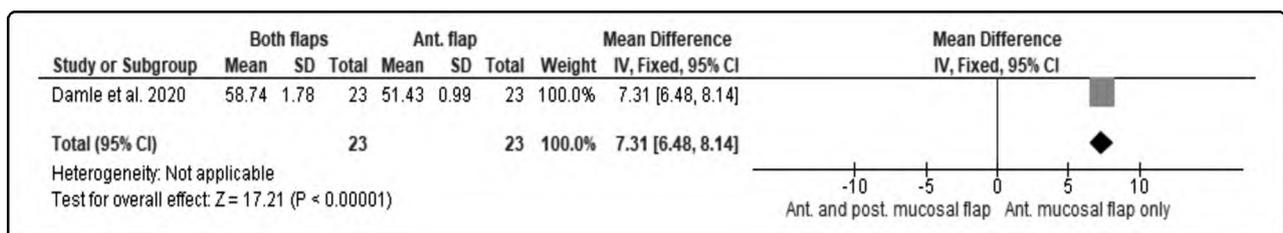


Fig. (13): Forest plot of mean difference (MD) in surgical time.

Publication bias assessment of the studies included in the outcome of success rate:

Publication bias assessment via funnel plot of the Cochrane tool showed a relative symmetrical distribution on both sides of the funnel plot between the included studies regarding the outcome of

success rate between the pooled studies. This symmetrical distribution gave us a higher quality of evidence regarding the efficacy of different types of flaps in all published trials in external DCR. Fig. (14).

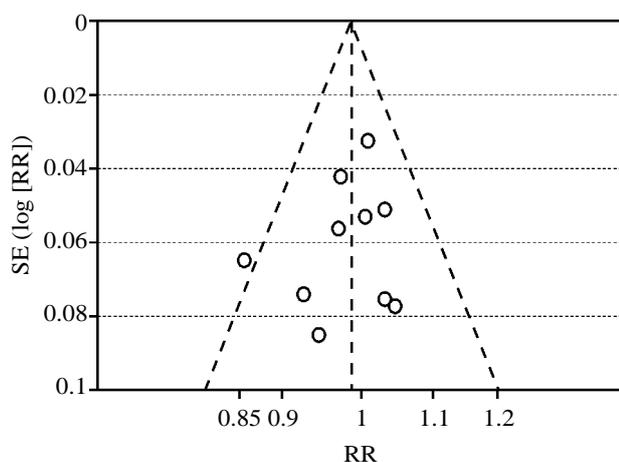


Fig. (14): Funnel plot of the included studies regarding the outcome of success rate.

Publication bias assessment of the studies included in the outcome of failure rate:

Publication bias assessment via funnel plot of the Cochrane tool showed a relative symmetrical distribution of the studies on both sides of the funnel plot between the included studies regarding the outcome of failure rate between the pooled studies. This symmetrical distribution gave us a higher quality of evidence regarding the efficacy of different types of flaps in all published trials in external DCR. Fig. (15).

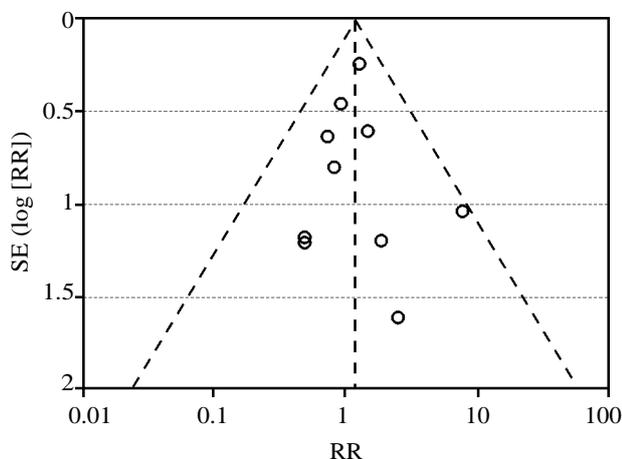


Fig. (15): Funnel plot of the included studies regarding the outcome of failure rate.

Discussion

This study conducted this work to assess the efficacy of different types of flaps in all published trials in external DCR. Postoperative success and failure rate as well as perioperative complications including Intraoperative bleeding, Nasal mucosal tear are the most common outcomes in our study. Also, we assessed the outcomes of postoperative bleeding score, Epiphora score and other secondary outcomes.

The results of our study nearly showed no significant difference between anterior, posterior, and both flap in DCR regarding the postoperative success rate, the incidence of complications, bleeding score, Epiphora score, watering eye with discharge, Patency score, Wound gapping, Recurrence rate, and mean surgical time.

The results of risk ratio (RR) in the postoperative success rate between external DCR either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap only showed no significant clinical difference with a p -value of 0.42. Similar results were shown regarding the outcome of postoperative failure rate and no significant difference was detected from the pooled estimate of the pooled analysis.

The results of risk ratio (RR) in the postoperative complications including intraoperative bleeding, nasal mucosal tear, and Cheese wiring of punctum between anterior and both flaps in DCR showed no significant clinical difference with a p -value of 0.98. Similar results were detected regarding the outcome of bleeding and epiphora score.

The mean difference (MD) of the surgical operative time between DCR either with both anterior and posterior mucosal flap anastomosis and the anterior mucosal flap showed that anterior flap in DCR consumes lesser time than both flaps in DCR with a significant p -value of less than 0.0001.

The results of risk ratio (RR) in the Wound gapping and recurrence between anterior and both flaps in DCR showed no significant clinical difference between both techniques. Similar results were showed regarding the patency score as well as the risk of watering eye with discharge.

These results of our meta-analysis were in agreement with some trial in the previous literature including [21,23,26-31].

A previous meta-analysis conducted by Bukhar A. [31] assessed the effect of posterior mucosal flap anastomosis in primary external DCR. They included seven studies with anterior and posterior flap anastomosis on 368 eye while primary external DCR with anterior flap anastomosis was performed on 397 eyes.

Their results were similar to ours and there was no significant difference in the success rates of both techniques (risk ratio: 0.987; 95% confidence interval 0.946-1.030). No significant difference in the resolution of epiphora, and patency of the lacrimal system after a minimum of four months duration of follow-up assessment.

Regarding the success rate, no significant difference was detected between both groups. Error! Bookmark not defined. That included 50 eyes of 47 patients reported that The success rate of 50 surgeries was 96%. In 37 eyes, no problems were reported during the surgery and the modified external DCR was performed successfully. The success rate of the modified external DCR was 100% in those patients. The average operation time was 34 ± 8.2 minutes. Error! Bookmark not defined. However, The findings of a comparative study of endoscopic dacryocystorhinostomies (EDCRs) conducted by Zloto et al., [32] with and without mucosal flap preservation in a large patient population revealed no differences in the surgical success or complications rates between the two procedures and, therefore, no benefit for adding flap preservation to conventional EDCRs.

On the other hand, Pandya et al., [12] Error! Bookmark not defined. Compared the success rates of three different techniques, namely: External DCR with anterior flap anastomosis, with both anterior and posterior flap anastomosis, and with neither anterior nor posterior mucosal flap anastomosis. The authors did not find any significant difference in success rates between the three techniques. Yazici et al., [27] Error! Bookmark not defined. obtained similar results, they used digital subtraction macro dacryocystography to evaluate the nasolacrimal ostium, 6 months after successful external DCR. They found that the lacrimal sac reforms after surgery and the final ostium develops at the inferior part of the regenerated sac, which confirms the irrelevance to the final ostium size of suturing the posterior and anterior flaps.

In many studies, the success of DCR depends on a properly sized and located patent, and mucosal-lined anastomosis between the lacrimal sac and the nose [32]. Error! Bookmark not defined. Ji et al., reported significantly higher success rates in the mucosal flap group compared to the non-flap group [29]. Error! Bookmark not defined. Only three studies compared flap preservation to non-preservation EDCRs, and there was no consensus regarding the preferred method. Also, regarding the gender difference, Mark et al., [28] Error! Bookmark not defined. Reported that there was a gender difference between groups, but gender was reportedly not a prognostic factor for the outcome of an EDCR. We do not agree with their results [33]. Error! Bookmark not defined.

Regarding the risk of postoperative complications, we found no significant difference between either anterior, posterior, or both flaps. Similar

results were obtained by Katuwal et al., [23] Error! Bookmark not defined, they reported that the frequency of complications was not statistically different between groups A and B ($p=0.79$). Any complications during surgery were noted. The complications encountered included excessive intraoperative bleeding, nasal mucosal tear, and cheese wiring of the punctum [33]. Error! Bookmark not defined.

On the other hand, Khan et al., [19] Error! Bookmark not defined. Showed that during the follow-up period, no complications were encountered in 97.1% of cases, and the tube was tolerated well except in 2.8% of cases. In Türkcü et al., [25] Error! Bookmark not defined, postoperative complications did not occur in any of the study patients.

Epiphora due to the blockage of the lacrimal drainage system and recurrent infection attacks in the sac is both uncomfortable and dangerous for the patient. No significant difference was detected regarding the resolution of the epiphora score postoperatively. Similar results were also obtained by Bukhari [31]. Error! Bookmark not defined. in his previous meta-analysis [33] there was no significant difference in the resolution of epiphora, and patency of the lacrimal system, between those who underwent external DCR with anterior and posterior mucosal flap anastomosis, and those who had dacryocystorhinostomy with anterior flap anastomosis. Also, postoperative bleeding, epiphora and patency scores were also found to be not statistically different between the two groups [23]. Error! Bookmark not defined.

Patency scores were also found to be not statistically different between the two groups. We agree with the results of [23] Error! Bookmark not defined, Yazici & Yazici, [27] showed similar results, there was no significant difference in the final size of the bony ostium, a factor which is thought to influence postoperative patency and surgical success.

According to our results, the recurrence rate showed no significant difference between both groups, however, in Cubuk et al., [35], recurrence was observed in three (3.4%) of 86 patients who underwent double flap DCR. Recurrence was observed in 3 of 70 patients (4.2%) who underwent a single flap DCR.

Previously, the disadvantages of endoscopic dacryocystorhinostomies (EDCR) are the need for expensive instrumentation and the provision of meticulous hemostasis during surgery. Moreover, the learning curve of the endoscopic approach is

challenging for the oculoplastic surgeon, since it is difficult and sometimes impossible to suture the adjacent flaps of the lacrimal sac and nasal mucosa [33,35].

Baldeschi et al., [21] Error! Bookmark not defined. first described a modified technique of external DCR in an attempt to simplify and reduce the operating time of the procedure, in a prospective, non-comparative study of 45 consecutive cases. The technique involved creating large mobile anterior flaps that were sutured and suspended onto the orbicularis muscle to avoid adhesions with underlying tissues [36].

Finally, healing with primary intention, from careful end-to-end anastomosis of both anterior and posterior flaps, is considered a vital step in preventing massive granulation and fibrosis, one of the causes of failure of the procedure [32,37].

Conclusion:

There was no difference in surgical success between single/double flap applications performed in external DCR operations. Success rates were comparable between both techniques, and that the posterior mucosal flap has no role in the outcome of external DCR. Single flap anastomosis, external DCR can be implemented as a standard technique, without significantly compromising the final success rate. Many studies suggest that anterior suspended flap external DCR is a simple, safe technique with a very high success rate and a satisfactory surgical time. No significant difference in terms of recurrence is seen in comparison to two flap anastomosis. We must confidently show any modifications to external DCR do not adversely affect success rates and complications of the procedure. Hence, future randomized controlled trials (RCTs) with uniformity of the surgical components are warranted to validate these findings.

References

- 1- PAULSEN F., GARREIS F., SCHICHT M., BRAUER L., ALI M.J. and SEL S.: Anatomy and physiology of the nasolacrimal ducts. *Hno*, 64 (6): 354-66, 2016.
- 2- PHELPS P., ABARIGA S., COWLING B., SELVA D. and MARCET M.: Antimetabolites as an adjunct to dacryocystorhinostomy for nasolacrimal duct obstruction. *Cochrane Library*, (4): 6, 2020.
- 3- KAMAL S. and ALI M.: Primary Acquired Nasolacrimal Duct Obstruction (PANDO) and Secondary Acquired Lacrimal Duct Obstructions (SALDO). *Principles and Practice of Lacrimal Surgery*, 2: 163, 2018.
- 4- HEINDL L.M., HOLBACH L.M., JÜNEMANN A., GUTHOFF R.F., CURSIEFEN C., KRUSE F.E., et al.: Surgical Anatomy and Pathology in Surgery of the Eyelids, Lacrimal System, Orbit and Conjunctiva. *Applied Pathology for Ophthalmic Microsurgeons*: Springer, 29-75, 2008.
- 5- YIM M., WORMALD P.J., DOUCET M., GILL A., KINGDOM T., ORLANDI R., CRUM A., MARX D. and ALT J.: Adjunctive Techniques to Dacryocystorhinostomy: An evidence-based review with recommendations. *International Forum of Allergy and Rhinology*, May 11 (5): 885-893, 2021.
- 6- PENTTILA E., SMIRNOV G., TUOMILEHTO H., KAARNIRANTA K. and SEPPA J.: Endoscopic Dacryocystorhinostomy as treatment for lower lacrimal pathway obstructions in adults: Review article. *Allergy & Rhinology*, 6 (1): e12-e19, 2015.
- 7- ULLRICH K., MALHOTRA R. and PATEL B.: Dacryocystorhinostomy. *Statpearls*, May 2022.
- 8- SU P.Y.: Comparison of endoscopic and external dacryocystorhinostomy for treatment of primary acquired nasolacrimal duct obstruction. *Taiwan Journal of Ophthalmology*, 8 (1): 19-23, 2018.
- 9- WATKINS L.M., JANFAZA P. and RUBIN P.A.: The evolution of endonasal dacryocystorhinostomy. *Survey of Ophthalmology*, 48 (1): 73-84, 2003.
- 10- ZAIDI F.H., SYMANSKI S. and OLVER J.M.: A clinical trial of endoscopic vs external dacryocystorhinostomy for partial nasolacrimal duct obstruction. *Eye*, 25 (9): 1219-24, 2011.
- 11- GHASEMI H., ASGHARI ASL S., YARMOHAMMADI M.E., JAFARI F. and IZADI P.: External Dacryocystorhinostomy; Success Rate and Causes of Failure in Endoscopic and Pathologic Evaluations. *Iran J. Pathol.*, 12 (3): 189-194, 2017.
- 12- PANDYA V.B., LEE S., BENDER R., DANKS J.J., KOURT G., MARTIN P., LERTSUMITKUL S., MCCLUSKEY P. and GHABRIAL R.: The Role of Mucosal Flaps in External Dacryocystorhinostomy. *Orbit.*, 29 (6): 324-327, 2010.
- 13- HAEFLIGER I.O., TSCHOPP M. and PIMENTEL A.-R.: Mucosal Excision Instead of Fashioning Nasolacrimal Mucosal Flaps During External Dacryocystorhinostomy: A Pilot Study, 229 (4): 387-390, 2012.
- 14- MOHER D., LIBERATI A., TETZLAFF J., et al.: Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med.*, 6 (7): e1000097, 2009.
- 15- HIGGINS J.P. and GREEN S.: *Cochrane Handbook for Systematic Reviews of Interventions*: Cochrane Book Series. Vol. Version 5, 2008.
- 16- GREEN S., HIGGINS P., T. J., ALDERSON P., CLARKE M., MULROW D.C. and OXMAN D.A.: *Cochrane Handbook: Cochrane Reviews*: Ch 8: Assessing risk of bias in included studies. In: *Cochrane Handbook for: Systematic Reviews of Interventions*, Vol. 6: 3-10, 2011.
- 17- CUBUK M., BARDAK H., CETINKAYA S. and GUVENMEZ O.: Results of Single and Double Flap Anastomosis in External Dacryocystorhinostomy Surgery. *Ulutas Med. J.*, 5 (2): 166, 2019.
- 18- PANDYA V.B., LEE S., BENDER R., et al.: The role of mucosal flaps in external dacryocystorhinostomy. *Orbit.*, 29 (6): 324-327, 2010.

- 19- FAISAL AZIZ KHAN, MUHAMMAD AMER YAQUB M.F.: The Importance of Excising or Suturing, 69-73, 2010.
- 20- VERMA S., MIDYA U. and GUPTA S.: The success rate of external dacryocystorhinostomy with and without suturing the posterior mucosal flaps. *Ophthalmol. J.*, 6 (0): 23-26, 2021.
- 21- BALDESCHI L., MANDIE K. and HINTSCHICH C.R.: The length of unsutured mucosal margins in external dacryocystorhinostomy. *Am. J. Ophthalmol.*, 138 (5): 840-844, 2004.
- 22- DAMLE V. and CHAND AGARWAL P.: A study to compare outcome of anterior flap suturing versus double flap anastomosis in external dacryocystorhinostomy. *Indian J. Clin. Exp. Ophthalmol.*, 6 (1): 80-83, 2020.
- 23- KATUWAL S., AUJLA J.S., LIMBU B., SAIJU R. and RUIT S.: External dacryocystorhinostomy: Do we really need to repair the posterior flap? *Orbit.*, 32 (2): 102-106, 2013.
- 24- ELWAN S.: A randomized study comparing DCR with and without excision of the posterior mucosal flap. *Orbit.*, 22 (1): 7-13, 2003.
- 25- TÜRKÇÜ F.M., ÖNER V., TAŞ M., ALAKUŞ F. and İS CAN Y.: Anastomosis of both posterior and anterior flaps or only anterior flaps in external dacryocystorhinostomy. *Orbit.*, 31 (6): 383-385, 2012.
- 26- SERIN D, ALAGÖZ G, KARSLÖLU Ş, ÇELEBİ S. and KÜKNER S: External dacryocystorhinostomy: Double-flap anastomosis or excision of the posterior flaps? *Ophthal. Plast. Reconstr. Surg.*, 23 (1): 28-31, 2007.
- 27- TETIKOĞLU M., SAGDIK H.M., OZCURA F. and AKTAS S.: Assessment of Anterior Suspended Flaps Modification for External, 2015.
- 28- YAZICI B. and YAZICI Z.: Final nasolacrimal ostium after external dacryocystorhinostomy. *Archives of Ophthalmology*, 1211: 76-80, 2003.
- 29- MAK, S.T., IO I.Y. and WONG A.C.: Prognostic factors for outcome of endoscopic dacryocystorhinostomy in patients with primary acquired nasolacrimal duct obstruction. *Graefe's Archive for Clinical and Experimental Ophthalmology*, 2515: 1361-1367, 2013.
- 30- JI Q.-S., ZHONG J.-X., TU Y.-H. and WU W.-C.: New mucosal flap modification for endonasal endoscopic dacryocystorhinostomy in Asians. *International Journal of Ophthalmology*, 56: 704, 2012.
- 31- DAMLE V. and CHAND AGARWAL P.: A study to compare outcome of anterior flap suturing versus double flap anastomosis in external dacryocystorhinostomy. *Indian J. Clin. Exp. Ophthalmol.*, 61: 80-83, 2020.
- 32- BUKHARI A.: Meta-analysis of the effect of posterior mucosal flap anastomosis in primary external dacryocystorhinostomy. *Clinical Ophthalmology*, 2281, 2013
- 33- ZLOTO O., KOVAL T., YAKIREVICH A., BEN SIMON G.J., WEISSMAN A., BEN ARTSI E., BEN SHOSHAN J. and PRIEL A.: Endoscopic dacryocystorhinostomy with and without mucosal flap-is there any difference? *Eye London, England*, 348: 1449-1453, 2020.
- 34- LEONG S.C., MACEWEN C.J. and WHITE P.S.: A Systematic Review of Outcomes after Dacryocystorhinostomy in Adults. *American Journal of Rhinology & Allergy*, 241, 81-90, 2010.
- 35- CUBUK M., BARDAK H., CETINKAYA S. and GUVENMEZ O.: Results of Single and Double Flap Anastomosis in External Dacryocystorhinostomy Surgery. *Ulutas Med. J.*, 5 (2): 166, 2019.
- 36- ZİLELİOĞLU, G., TEKELİ, O. Y. A., UĞURBAŞ S.H., AKINER M., AKTÜRK T. and ANADOLU Y.: Results of endoscopic endonasal non-laser dacryocystorhinostomy. *Documenta Ophthalmologica*, 1051: 57-62, 2002.
- 37- TSIRBAS A. and WORMALD P.J.: Endonasal dacryocystorhinostomy with mucosal flaps. *American Journal of Ophthalmology*, 1351, 76-83, 2003.
- 38- WELHAM R.A. and WULC A.E.: Management of unsuccessful lacrimal surgery. *British Journal of Ophthalmology*, 712: 152-157, 1987.

دراسة تحليلية عن نقل الأنسجة في مفاغرة كيس الدمع بالأنف

الخلفية: يوصف مفاغرة كيس الدمع بالأنف بإنشاء مسار وظيفي من القنوات إلى الأنف من خلال إنشاء قطع العظم وفتح الكيس الأنفي الدمعي في الأنف. يمكن إجراؤها عبر مقارنة خارجية أو داخلية.

الأهداف: لتقييم نتائج مفاغرة كيس الدمع الخارجي بالأنف باستخدام نمطين مختلفين من مفاغرة السديلة. واحد فقط مع مفاغرة رفراف أمامي والآخر مع كل من مفاغرة رفراف أمامي وخلفي.

قمنا بتضمين الدراسات التي اتبعت هذه المعايير تضمنت: تصاميم دراسات التجارب العشوائية المضبوطة، والمرضى البالغين الذين لديهم تشخيصات مؤكدة لانسداد القناة الأنفية الدمعية المكتسبة، والتدخل باعتباره مفاغرة كيس الدمع بالأنف خارجياً ومدة متابعة تصل إلى أربعة أشهر على الأقل، والخصائص الديموغرافية مقبولة.

النتائج: أسفر البحث الأولي عن مقالة من خمس قواعد بيانات بما في ذلك مجموعة عشر دراسات للتوليف النوعي النهائي والتحليل الكمي. حددنا عشر دراسات تقارن مفاغرة السديلة المخاطية الأمامية والخلفية المزدوجة مقابل الغشاء المخاطي الأمامي الفردي في الإجراءات الجراحية لفغر كيس الدمع الخارجي. ركزت الدراسات المشمولة على نتائج معدل النجاح بعد العملية الجراحية، ومعدل الفشل بعد الجراحة، والمضاعفات المحيطة بالجراحة بما في ذلك النزيف أثناء العملية، وتمزق الغشاء المخاطي للأنف، وتوصيلات الجين في منطقة البطن، وركزنا أيضاً على درجة النزيف بعد الجراحة، ودرجة التدفق التلقائي للدموع ودرجة السالكية، وفجوة الجرح، وحدوثها مرة أخرى، ومتوسط وقت الجراحة، وخطر غمر العين.

أظهرت نتائجنا تقريباً عدم وجود فروق ذات دلالة إحصائية بين السديلة الأمامية والخلفية وكلاهما في مفاغرة كيس الدمع بالأنف فيما يتعلق.

الخلاصة: لم يكن هناك فرق في النجاح الجراحي بين التطبيقات المفردة المزدوجة التي يتم إجراؤها في عمليات مفاغرة كيس الدمع بالأنف الخارجية. أيضاً، كانت معدلات النجاح قابلة للمقارنة بين كلا التقنيتين، وأن السديلة المخاطية الخلفية ليس لها دور في نتيجة مفاغرة كيس الدمع الخارجي بالأنف. مفاغرة رفراف واحد، يمكن تنفيذ مفاغرة كيس الدمع الخارجي بالأنف كأسلوب قياسي، دون المساومة بشكل كبير على معدل النجاح النهائي. يُعد مفاغرة كيس الدمع الخارجي بالأنف لسديلة معلقة أمامية تقنية بسيطة وأمنة مع معدل نجاح مرتفع للغاية ووقت جراحی مرض. لا يوجد فرق كبير من حيث التكرار بالمقارنة مع اثنين من مفاغرة السديلة. هناك ما يبرر التجارب المعشاة ذات الشواهد المستقبلية (RCTs) مع توحيد المكونات الجراحية للتحقيق من صحة هذه النتائج.