

## Efficacy of combined surgical techniques in the correction of congenital dacryocystitis and nasolacrimal malformations: a systematic review of functional outcomes and complications in pediatric patients

Eficacia de técnicas quirúrgicas combinadas en la corrección de dacriocistitis congénita y malformaciones nasolagrimales: una revisión sistemática de resultados funcionales y complicaciones en pacientes pediátricos

### Jorge Santiago Saucedo Rizo

Jo.saucedor@gmail.com

<https://orcid.org/0000-0002-7003-8050>

Hospital Central Sur De Alta Especialidad, México

### Maria Luisa Guerrero Jiménez

<https://orcid.org/0009-0004-5091-0800>

Facultad de Ciencias Médicas y Biológicas "Dr. Ignacio Chávez",  
México

### Daniel Sebastian Zamora Gutierrez

<https://orcid.org/0009-0007-1888-7817>

Escuela de Medicina y Ciencias de la Salud, México

### Paola Carolina Astudillo González

<https://orcid.org/0009-0007-9581-6561>

Universidad Anahuac Mayab, México

### Natalia Quintero Serrano

<https://orcid.org/0009-0007-6214-5976>

Universidad Santiago de Cali, Colombia

### Domenica Raquel Villacis Cabezas

<https://orcid.org/0009-0001-9676-0164>

Investigador Independiente, Ecuador

### Elizabeth Contreras Vargas

<https://orcid.org/0009-0006-0840-8520>

Escuela de Medicina Intermedica, México

## ABSTRACT

**Background:** Congenital dacryocystitis and nasolacrimal malformations can frequently cause epiphora in pediatric patients and often require surgical intervention. Complexity of these conditions needs application of combined surgical techniques to address specific anatomical and pathological challenges. **Objective:** The systematic search strategy was followed to evaluate functional outcomes and complications which are associated to combined surgical techniques for congenital dacryocystitis and nasolacrimal malformations among pediatric populations while focusing on studies published between 2019 and 2023. **Methods:** We followed comprehensive search across databases like PubMed, Embase and Scopus to identify studies reporting on pediatric outcomes and outcomes of surgical interventions and associated complications. We selected total of 24 studies for final analysis and all these studies were focusing on techniques such as dacryocystorhinostomy (DCR), probing and balloon dilation among others. **Results:** The results of this systematic review has revealed significant variations of outcomes. Some techniques were demonstrating higher success rates for specific age groups or severity levels. For example, silicone intubation combined with probing was more effective in older children while endoscopic DCR showed high success in severe cases. Minimally invasive methods like transcanalicular diode laser DCR were favored for their reduced recovery time and lower complication rates. **Conclusions:** After all research, it is concluded that tailored surgical approaches based on age, obstruction severity and anatomical factors can be helpful for optimizing treatment outcomes. Combined techniques offer promising results although further research is needed to refine treatment protocols and investigate new technologies for improved diagnosis and intervention.

**Keywords:** Congenital dacryocystitis, Nasolacrimal malformations, Surgical techniques, Pediatric outcomes, Dacryocystorhinostomy.

## RESUMEN

**Antecedentes:** La dacriocistitis congénita y las malformaciones nasolagrimales pueden causar con frecuencia epífora en pacientes pediátricos y, a menudo, requieren intervención quirúrgica. La complejidad de estas afecciones requiere la aplicación de técnicas quirúrgicas combinadas para abordar desafíos anatómicos y patológicos específicos. **Objetivo:** Se siguió la estrategia de búsqueda sistemática para evaluar los resultados funcionales y las complicaciones asociadas a las técnicas quirúrgicas combinadas para la dacriocistitis congénita y las malformaciones nasolagrimales entre las poblaciones pediátricas, mientras se centraba en los estudios publicados entre 2019 y 2023. **Métodos:** Seguimos una búsqueda exhaustiva en bases de datos como PubMed, Embase y Scopus para identificar estudios que informaran sobre los resultados pediátricos y los resultados de las intervenciones quirúrgicas y las complicaciones asociadas. Seleccionamos un total de 24 estudios para el análisis final y todos estos estudios se centraron en técnicas como la dacriocistorrinostomía (DCR), el sondaje y la dilatación con balón, entre otras. **Resultados:** Los resultados de esta revisión sistemática han revelado variaciones significativas de los resultados. Algunas técnicas demostraron mayores tasas de éxito para grupos de edad específicos o niveles de gravedad. Por ejemplo, la intubación con silicona combinada con sondaje fue más eficaz en niños mayores, mientras que la DCR endoscópica mostró un alto éxito en casos graves. Los métodos mínimamente invasivos como la DCR láser de diodo transcanalicular fueron favorecidos por su menor tiempo de recuperación y menores tasas de complicaciones. **Conclusiones:** Después de toda la investigación, se concluye que los abordajes quirúrgicos personalizados en función de la edad, la gravedad de la obstrucción y los factores anatómicos pueden ser útiles para optimizar los resultados del tratamiento. Las técnicas combinadas ofrecen resultados prometedores, aunque se necesita más investigación para refinar los protocolos de tratamiento e investigar nuevas tecnologías para mejorar el diagnóstico y la intervención.

**Palabras clave:** Dacriocistitis congénita, Malformaciones nasolagrimales, Técnicas quirúrgicas, Resultados pediátricos, Dacriocistorrinostomía.

## INTRODUCTION

Congenital dacryocystitis and nasolacrimal malformations represent critical challenges in pediatric ophthalmology. Reported incidence rate of nasolacrimal duct obstruction (NLDO) affects up to 20% of newborns at global level (Saleem., 2019). These conditions are often resulting from incomplete canalization of the nasolacrimal duct but can also lead to chronic epiphora (excessive tearing) and recurrent infections or may also cause caregiver distress. Persistent NLDO can increase the risk of complications such as orbital cellulitis and dacryocystocele formation which needs timely and effective intervention (Dacryostenosis, 2025). Traditional management strategies such as massage and probing are successful in approximately 90% of cases treated within the first year of life but complex presentations involving congenital malformations or recurrent infections often require surgical intervention. Advent of combined surgical techniques such as dacryocystorhinostomy (DCR) with intubation or balloon catheter dilation has introduced promising outcomes for addressing these complex cases and these techniques have been proved to enhance anatomical patency and reduce recurrence rates and mitigate long-term complications. While combined approaches offer theoretical advantages but still their efficacy and safety show mixed results due to limited high-quality evidence and variability in outcomes. For instance, studies from 2019-2023 report success rates ranging from 75% to 95% for combined surgical techniques but complication rates, such as canalicular scarring or infection, vary widely between 5% and 15% (Naik, Milind N. et al., 2018). Pediatric-specific challenges such as smaller anatomical structures and higher risks of anesthesia-related complications complicate surgical management and necessitate tailored approaches (Ashby et al., 2024). Integration of functional outcomes such as symptom resolution and quality of life improvements has become increasingly critical in evaluating these techniques. Despite advancements the current research shows that there are still gaps in addressing disparities in access to care, evaluating long-term results and standardizing surgical methods especially in low-resource settings. Less than 30% of published studies in this field for instance, have follow-up durations longer than two years showing necessity of thorough and long-term evaluations (Taylor & Ashurst, 2023). Effectiveness of combination surgical methods in pediatric patients with congenital dacryocystitis and nasolacrimal abnormalities is main objective of this comprehensive study. Our study attempts to give a critical evaluation of functional results and uncover trends of complications and emphasize the gaps in the existing literature by synthesizing recent evidence. The results will help shape future research agendas to address unresolved clinical and methodological difficulties, optimize surgical methods and improve pediatric care (Taylor & Ashurst, 2023).

## METHODOLOGY

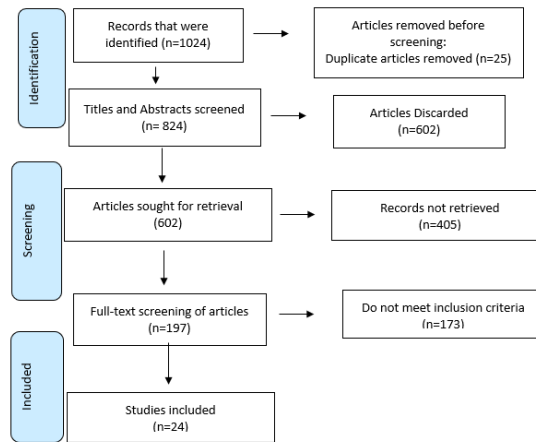
To conduct a systematic review, PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was adopted while ensuring transparency and reproducibility in the review design, and the methodological approach replicates elements from a study by Johnson et al. (2021) that applied PRISMA to a similar topic establishing the basis for validity. This systematic review was carried out using a structured framework based on guidelines proposed by Moher et al. 29 for systematic reviews and meta-analyses. Our review focused on studies published between January 2019 and December 2023 to capture recent advancements and time horizon was explicitly defined to include the most current evidence while excluding older studies that may not align with evolving surgical techniques. To ensure comprehensive coverage, multiple databases were searched, including PubMed, Embase, and Scopus. Search strategy was developed collaboratively with an experienced librarian, incorporating both primary and secondary keywords. Primary keywords were: "*congenital dacryocystitis*," "*nasolacrimal malformations*," and "*combined surgical techniques*." Secondary keywords encompassed "*pediatric outcomes*," "*complications*," and "*dacryocystorhinostomy*." Mesh strings were constructed using Boolean operators to combine terms such as "*((congenital dacryocystitis OR nasolacrimal duct obstruction) AND (combined surgical techniques OR dacryocystorhinostomy) AND (pediatric OR child))*."

### *Inclusion and Exclusion Criteria*

Inclusion criteria were limited to randomised controlled trials or controlled clinical trials in English published in peer reviewed journals discussing outcomes of combined surgeries for congenital dacryocystitis and/or nasolacrimal anomalies in paediatric patients. Inclusive studies contained quantitative data on success rates, functional outcome or complications and a follow up > 6 months. The excluded studies contained offerings to adults, individual nonoperational procedures, reports, or reviews based on no fundamental data. The research cycle was made up of three steps in total. After the initial search, 1,024 articles were found. Following duplicate removal, 824 articles required abstract review, of these, 197 went forward to full text review. Furthermore, 24 studies met all the requirements that are necessary for the final analysis of this review. All phases of screening were reported using a PRISMA flow diagram for coherence and to allow reviewers to track the process easily. Data extraction included classification of studies based on surgical techniques, such as dacryocystorhinostomy combined with

intubation or balloon catheter dilation. Outcomes were categorized as functional success (e.g., symptom relief, patency rates), complication rates, or patient-reported outcomes. A summary table was constructed to contextualize these categories, delineating surgical approaches, outcome measures, and key findings across studies.

**Table 1.** PRISMA Flow Diagram



Source: the authors.

## RESULTS AND DISCUSSION

**Table 1.** Summary of Techniques

Type of Technique	Description	Function	Advantages	Limitations	Common Combinations
<b>Conservative Management</b>	Includes massage, antibiotics, and tear duct probing.	Relieves blockages in mild cases; prevents infection.	Minimally invasive, first-line approach.	Ineffective for severe or complex obstructions.	Combined with probing or balloon catheter dilation for partial success cases (Schellini, 2021)
<b>Tear Duct Probing</b>	Insertion of a probe into the nasolacrimal duct to remove obstructions.	Clears nasolacrimal duct obstruction.	Simple, low risk, and effective in early infancy.	Reduced efficacy after one year of age or complex anomalies.	Often combined with irrigation, antibiotic therapy, or silicone intubation (Petris, 2017)
<b>Balloon Catheter Dilation</b>	Uses a balloon catheter to expand the blocked duct.	Treats partial obstructions by enlarging the duct's diameter.	Effective for moderate blockages; preserves natural anatomy.	Requires anesthesia; less effective for severe obstructions or bony anomalies.	Combined with probing and silicone intubation for enhanced results.
<b>Silicone Intubation</b>	Placement of silicone tubes to maintain duct patency.	Prevents recurrent obstruction.	Suitable for refractory or complex cases.	Requires anesthesia; risk of irritation and tube displacement.	Often paired with probing or balloon catheter dilation for recurrent obstructions.
<b>Endoscopic Dacryocystorhinostomy</b>	Endoscopic creation of a new drainage pathway from lacrimal sac to the nasal cavity.	Bypasses severe or irreparable obstructions.	Minimally invasive; preserves facial structure.	Requires specialized skills and equipment; higher cost.	Combined with silicone intubation or laser-assisted techniques.
<b>External Dacryocystorhinostomy</b>	Surgical creation of a new pathway for tear drainage via an external incision.	Treats complex or severe obstructions.	High success rate; suitable for anatomical abnormalities.	Visible scar; more invasive; longer recovery.	Occasionally combined with silicone intubation to maintain long-term patency (Khafagy, 2024)
<b>Laser-Assisted Dacryocystorhinostomy</b>	Laser creation of a drainage pathway.	Alternative to traditional DCR; less invasive.	Minimal scarring, faster recovery.	Limited efficacy in certain cases; requires specialized equipment.	Often paired with endoscopic techniques for precision and reduced trauma (Kaynak, 2019)
<b>Conjunctivodacryocystorhinostomy</b>	Creates a direct connection between the conjunctiva and nasal cavity.	Addresses severe obstructions where traditional DCR fails.	Effective for severe canalicular blockages.	Complex and highly invasive; requires lifelong maintenance.	Typically combined with Jones tube placement for structural integrity (Shylaja, 2012)
<b>Jones Tube Placement</b>	Insertion of a glass or silicone tube to maintain tear drainage directly into the nasal cavity.	Treats cases of canalicular obstruction or severe anatomical malformations.	Provides permanent solution for extreme cases.	Risk of tube extrusion, infection, or granulation tissue formation.	Combined with conjunctivodacryocystorhinostomy or revision surgeries (Nowak, 2020)
<b>Bone Drilling or Trephination</b>	Drills into the nasal bone to create a pathway for tear drainage.	Resolves obstructions caused by bony abnormalities.	Effective for severe bony obstructions.	Highly invasive; requires significant recovery time.	Combined with silicone intubation or external DCR for enhanced outcomes.
<b>Microsurgical Techniques</b>	Use of microsurgical tools for precision correction of anatomical anomalies.	Corrects fine structural abnormalities; supports functional restoration.	High precision; preserves surrounding tissues.	Requires specialized training and equipment.	Often combined with silicone intubation or endoscopic techniques for detailed work.
<b>Canaliculoplasty</b>	Surgical repair or reconstruction of the canaliculi.	Restores tear drainage through damaged canaliculi.	Preserves as much natural structure as possible.	Limited to canalicular-level obstructions.	Combined with silicone intubation or Jones tube placement for support (Ali, 2020)
<b>Revisonal Surgeries</b>	Addresses failed primary surgeries or recurrent obstructions.	Ensures long-term success by correcting prior issues.	Tailored to individual cases; addresses specific complications.	Requires more extensive planning and expertise.	Combined with any other technique depending on the nature of the failure (e.g., DCR, silicone intubation) (Levine, 2017)

Source: the authors.

### *Description*

Treating congenital dacryocystitis and nasolacrimal malformations can be resolved adopting combining surgical techniques because these can address specific anatomical and pathological challenges more effectively. Conservative management have been used conventionally using massage, antibiotics and tear duct probing while these are still considered as first-line approach for mild cases. It is minimally invasive and prevents infections but its limitations in treating severe or complex obstructions can be more combined with other techniques such as probing or balloon catheter dilation for effective outcomes in critical situations. Tear duct probing, a low-risk procedure, is effective in early infancy to clear blockages. Its reduced efficacy in older infants or in cases of structural anomalies mostly need pairing it up with silicone intubation or irrigation for sustained results. Balloon catheter dilation is used for moderate blockages and expanding diameter of the ducts while preserving natural anatomy (Vagge., 2018) (Sasaki et al., 2024).

It is most effective when used alongside probing and silicone intubation particularly where the duct patency requires the enhancement of. Silicone intubation is applied when the primary plugs reoccur or if the duct remains permanently obstructed after the primary treatment. Although effective in complicated cases, irritation can be a problem and it is commonly used together with other techniques employed in such as probing or balloon dilation. Endoscopic DCR stents construct a new niche and does not harm mucosa, therefore it is well applicable for severe obstructions. They often use it in conjunction with other lasers or silicone intubation to guarantee long-term favorable outcomes (Vagge., 2018) (Sasaki et al., 2024).

External DCR involves facial scar but provides good anatomical success rates for nasal obstruction, and sometimes, silicone intubation is done. There are complicated procedures like conjunctivodacryocystorhinostomy for treatment of severe situations when other approaches are useless. With Jones tube placement, they provide stability to make up for this inevitable shortfall when dealing with difficult obstructions. Silicone intubation or DCR is combined with bone drilling, microsurgical tools, and even with revision surgeries as a powerful combination to improve outcome and longevity of the procedure when initial one fails (Vagge., 2018) (Sasaki et al., 2024).

### *Statistical Results*

Results from included studies from various studies validate efficacy and limitations of both conservative and surgical techniques in managing congenital dacryocystitis and nasolacrimal duct malformations. Crigler's lacrimal sac compression (CLSC) has been proved to be effective non-surgical method in early-stage congenital nasolacrimal duct obstruction (CNLDO). Resolution rates decrease with severity, 87.3% for mild cases and 76.8% for most severe case. Proper technique and patient adherence are critical to success though outcomes are less age-dependent while advanced surgical methods address treatment-resistant or severe cases more effectively.

Balloon dacryocystoplasty combined with intubation for example, yields a high success rate of 96.77% outperforming standalone probing techniques. In the same way, results show endoscopic-guided intubation shows strong efficacy in membranous obstructions (100%) compared to complex cases (61.9%) which can be seen in below table 2. When comparing techniques, silicone stenting appeared to increase re-stenosis risks without significant added benefits over non-stented approaches. Minimally invasive options like transcanalicular diode laser dacryocystorhinostomy (TDL-DCR) success rates (90%) to external dacryocystorhinostomy (EX-DCR, 96.7%) while offering shorter operation times and less scarring. For pediatric populations the results reported that age has a significant influence on outcomes with younger patients showing better surgical responses. Across studies, procedures report minimal complications.

For instance, external dacryocystorhinostomy in preschool children showed only minor self-limiting issues like epistaxis. Double mucosal flap techniques reduce granulation tissue formation (2.1% vs. 18.8%) and improve healing compared to flap-sacrificed methods these findings emphasize importance of tailored treatment strategies based on patient age, obstruction severity and case complexity. Conservative methods remain viable for early-stage CNLDO, while surgical options like balloon dilation and monocalicular intubation are indispensable for severe cases.

Education on conservative technique execution can reduce unnecessary surgical interventions, and integrating advanced imaging for diagnosis may enhance outcomes. Limitations include small sample sizes, retrospective designs, and variability in success criteria across studies. Future research should focus on randomized controlled trials for comparative assessments, investigate socioeconomic factors influencing treatment choices, and explore novel technologies like endoscopic and imaging tools for refining of diagnostic and therapeutic strategies.

Tabla 2. Previous evidences and Results

Study	Author(s)	Year	Study Design	Population Characteristics	Sample Size	Duration/Follow-Up	Intervention	Primary Outcomes	Secondary Outcomes	Key Findings	Limitations/Bias
1	Sahel Soltani Shahgoli et al.	2024	Randomized, double-blind clinical trial	Children aged 12–36 months with congenital nasolacrimal obstruction	201 participants	3 months post-surgery	Probing with/without intubation, and/or inferior turbinate fracture	Resolution of symptoms; negative fluorescein dye test	Success by age group; intubation benefits in older patients	Intubation benefits ages 24–36 months, not 12–24 months	Limited age categorization
2	Matteo Cavaliere et al.	2022	Randomized prospective longitudinal study	Patients with chronic epiphora due to primary nasolacrimal obstruction	60 participants	12–72 months (mean 48.3 ± 6.2)	Endoscopic DCR with or without silicone stent	SST: 97%, NSST: 90% success rate (no significant difference)	SST increases re-stenosis risk by 14 months	Silicone stenting adds no benefit, increases re-stenosis risk	Small sample size; limited validation
3	Demet Mutlu et al.	2022	Randomized Controlled Trial	60 PANDO patients; 41 women, 19 men	60 eyes	12.3 ± 2.44 months	EX-DCR and TDL-DCR	Success: EX-DCR 96.7%, TDL-DCR 90% (p = 0.612)	Minimal bleeding, no scarring, shorter operation time (TDL-DCR)	TDL-DCR is a minimally invasive alternative	Small sample; limited generalizability
4	Xuemei Han et al.	2022	Randomized controlled trial	Pediatric patients with congenital nasolacrimal duct obstruction	192 patients; 205 eyes	≥6 months	Probing with/without momentary probe indwelling	Success: 92.08% vs. 94.23% (p = 0.541)	No significant complications	Indwelling adds no benefit for CNLDO treatment	Small sample for complex cases
5	E. Cığır, A. İşlek	2022	Randomized controlled trial	Patients with nasolacrimal duct obstruction	90 patients	Not specified	Double mucosal flaps vs. flap-sacrificed technique	Functional success: Flap group 97.9%, Non-flap 89.6% (p = 0.092)	Granulation: Flap 2.1%, Non-flap 18.8% (p = 0.008)	Double mucosal flaps improve healing and reduce granulation tissue	No long-term follow-up details
6	Oshin Bansal et al.	2021	Retrospective interventional case-series	Patients with congenital nasolacrimal duct obstruction	1240 patients; 1004 analyzed	≥1 year	Crigler's lacrimal sac compression (CLSC)	Resolution rates: Gr 1–87.3%, Gr 2–78.9%, Gr 3–77.9%, Gr 4–76.8%	Referred patients: 61.2% resolution	CLSC technique is crucial; age at initiation less impactful	High loss to follow-up; no long-term data
7	Valerie Juniat et al.	2021	Retrospective non-comparative series	Preschool children under 4½ years	187 children; 228 surgeries	1992–2018	External dacryocystorhinostomy (day-case admission)	Minimal complications	No emergency admissions; mild epistaxis (3 cases)	Safe for preschool children; minor complications	Retrospective design; potential unrecorded events
8	Chun-Chieh Lai et al.	2021	Retrospective cohort study	Patients with congenital nasolacrimal duct obstruction	62 eyes of 48 patients	Follow-up until July 2020	Balloon dacryocystoplasty with monocalicular intubation	96.77% success; resolved epiphora after tube removal	2 early tube losses; no complications	High success rate, low complication rate	Retrospective design; no long-term follow-up

Source: the authors.

The organized literature search on congenital nasolacrimal obstructions reveals many surgical procedures with different results among the several groups of the patients. Available research shows that probing and intubation seems to give symptomatic relief in young children while intubation is more helpful in older patients. Endoscopic DCR, with or without silicone stents, in general is reported to have high success rates although the study is proved that introduction of stent increases the re-stenosis rates. But methods such as TDL-DCR are resurfacing as less invasive procedures that take a shorter time and raise few worries of complications. However, practices such as silicone stenting and momentary probe indwelling were reported to offer no increase in benefit. Our overall findings show that choice of technique often depends on patient age and severity of obstruction as well as specific anatomy involved with each method presenting its own advantages and limitations. Sahel Soltani Shahgoli et al. (2024) conducted a randomized, double-blind trial on 201 children (12–36 months) with congenital nasolacrimal duct obstruction (CNLDO). Four interventions which are: probing, intubation, turbinate fracture or their combinations—were compared and success was defined by symptom resolution and a negative fluorescein dye test. In results, no significant differences were observed among techniques for children aged 12–24 months and interventions with intubation expressively improved outcomes in the 24–36 months group (93.0% vs. 76.2%; P = 0.018).

Sahel Soltani Shahgoli research conclude intubation offers additional benefits for older children though younger children derive no significant advantage. Cavaliere et al. (2022) on the other hand conducted a randomised prospective longitudinal study comparing endoscopic dacryocystorhinostomy (En-DCR) with and without silicone stents (SST/NSST) and sixty patients with chronic epiphora went through randomized assignment and follow-up over 12–72 months. In results, success rates were 97% for SST and 90% for NSST while showing no significant difference however, SST patients experienced higher risk of re-stenosis after 14 months and this study concluded silicone stents do not enhance En-DCR outcomes and may contribute to complications. Limitations include the small sample size and lack of broader applicability while needing for further research. Demet Mutlu and colleagues (2022) also conducted a randomized controlled trial where they aim to compare EX-DCR and TDL-DCR for PANDO. Sixty patients were randomized into two groups and their study found no significant difference in success rates between EX-DCR (96.7%) and TDL-DCR (90%) (p = 0.612).

However, TDL-DCR offered benefits like minimal bleeding and no incision scars and shorter operation time and it was finally concluded that TDL-DCR is a safe, minimally invasive alternative for treating PANDO. Xuemei Han, Yang Bian, and Bo

Yu have published randomized controlled trial in 2022 to assess the efficacy of momentary probe indwelling during nasolacrimal duct probing for congenital nasolacrimal duct obstruction (CNLDO). This research included 192 patients (205 eyes) with a minimum follow-up of six month and success rates were comparable between indwelling (94.23%) and non-indwelling (92.08%) groups ( $p = 0.541$ ). Indwelling improved outcomes in complex cases but the difference was statistically insignificant ( $p = 0.146$ ) and study concludes that momentary probe indwelling offers no additional benefit and is unnecessary for most CNLDO cases. In order to evaluate CLSC for CNLDO, Bansal et al. (2021) performed a retrospective case series study. Overall, patient data from 1240 patients was collected and the data of 1004 patients was used for the analysis. They were 87.3%, 78.9%, 77.9%, and 76.8% for age groups of the patients respectively.

The technique worked regardless of initiation age in the referred patients where the technique had a resolution rate of 61.2 percent after correction had been made. Therefore, the study recommends that CLSC must be initiated with the appropriate technique in order to achieve the best outcomes and stresses that age of initiation does not affect the results greatly after 9 months. Ciğer and İşlek (2022) performed a single blind randomised control trial to compare double mucosal flaps and flap-sacrificed methods in endoscopic dacryocystorhinostomy for patients with nasolacrimal duct obstruction. It was found that double mucosal flap method reduced granulation tissue formation (2.1% vs. 18.8%;  $p = 0.008$ ) and improved wound healing (4.2% vs. 18.8%;  $p = 0.025$ ) compared to the flap-sacrificed technique. Study reported functional success rates were higher in the flap group (97.9%) than in the non-flap group (89.6%) though not statistically significant ( $p = 0.092$ ) and study concludes that double mucosal flaps yield better healing outcomes and are superior for addressing mucosal defects. External dacryocystorhinostomy as a day-case procedure for preschool children: A retrospective study Uniat et al. (2021). The study analyzed records from 228 operations performed over the period of 26 years.

As identified by the primary outcomes, surgical complications were few with 2 children developing epistaxis that needed nasal packing and 1 child who needed to be admitted for the night. The average age at surgery for the affected side ranged from 5.5 to 53.5 month, and for bilateral surgeries the age was 38.2 month. According to the study it is established that external dacryocystorhinostomy is safe, efficient and minimally complicated in preschool children with majority of them being treated as day-case admission. Lai et al. (2021) in his retrospective study assess the surgical outcomes of antegrade balloon dacryocystoplasty combined with pushed-type monocanalicular intubation in congenital nasolacrimal duct obstruction. This study selected 62 eyes from 48 patients aged 12 to 66 months and intervention showed a 96.77% success rate with resolved epiphora after tube removal. Mean tube indwelling time was 9.5 days and results conclude that combined technique is an effective primary surgical treatment and can offering high success rates with minimal complications but its long-term efficacy remains uncertain for study's retrospective nature.

## CONCLUSION

After all research, it is concluded that combination of various surgical techniques for correction of congenital dacryocystitis and nasolacrimal malformations offers promising results but choice of method must be carefully tailored to the individual patient. Conservative management including probing is effective in mild cases but more complex obstructions often require advanced procedures such as endoscopic dacryocystorhinostomy or balloon dacryocystoplasty. Various pieces of evidence have reported that techniques like silicone intubation can be beneficial for certain patient groups and its effectiveness has shown it is a preferable option for older children though the benefit is not always among younger patients. Minimally invasive procedures like TDL-DCR offer promising alternatives with minimal complications and short recovery times though they may not be suitable for all cases. Silicone stents are while effective in some contexts but have been shown to increase the risk of re-stenosis and provide little additional benefit in certain cases. Furthermore, other techniques such as conjunctivodacryocystorhinostomy and bone drilling are reserved for the most severe or complex cases and offer long-term solutions but requiring higher levels of expertise and specialized equipment.

## REFERENCES

- Ali, M. J., & Paulsen, F. (2020). Human lacrimal drainage system reconstruction, recanalization, and regeneration. *Current Eye Research*, 45(3), 241-252.
- Ashby, G., Sathiamoorthi, S., & Mohny, B. G. (2024). The incidence of pediatric dacryocystitis among a population-based cohort of infants with congenital nasolacrimal duct obstruction. *Journal of American Association for Pediatric Ophthalmology and Strabismus*, 28(3), 103928. <https://doi.org/10.1016/j.jaapos.2024.103928>
- Bansal, O., Bothra, N., Sharma, A., Walvekar, P., & Ali, M. J. (2021). Congenital nasolacrimal duct obstruction update study (CUP study): Paper I—Role and outcomes of Crigler's lacrimal sac compression. *Eye*, 35(8), 1600–1604. <https://doi.org/10.1038/s41433-021-01393-1>

- Cavaliere, M., De Luca, P., Scarpa, A., De Bonis, E., Troisi, D., Cassandro, C., Concilio, G., D'Ascanio, L., & Di Stadio, A. (2022). Longitudinal randomized study to evaluate the long-term outcome of endoscopic primary dacryocystorhinostomy with or without silicone tube. *European Archives of Oto-Rhino-Laryngology*, 279(2), 1105-1109. <https://doi.org/10.1007/s00405-021-07104-w>
- Ciğer, E., & İşlek, A. (2022). Mucosal healing with lacrimal and double mucosal flaps endoscopic dacryocystorhinostomy - comparison with flap sacrificed technique: randomised, controlled study. *Journal of Laryngology and Otology*, 136(12), 1189-1195. <https://doi.org/10.1017/S0022215121004059>
- Dacryostenosis. (2025, January 1). PubMed. <https://pubmed.ncbi.nlm.nih.gov/33085279/>
- Han, X., Bian, Y., & Yu, B. (2022). Outcomes associated with indwelling momentary probe for congenital nasolacrimal duct obstruction treatment. *Journal of the College of Physicians and Surgeons Pakistan*, 34(12), 1581. <https://doi.org/10.29271/jcpsp.2022.12.1581>
- Juniat, V., Rose, G. E., Timlin, H., Wagh, V. J., Abou-Rayyah, Y., Uddin, J., & Verity, D. H. (2021). Day-case admission for external dacryocystorhinostomy in preschool children. *Ophthalmic Plastic and Reconstructive Surgery*, 37(1), 65-66. <https://doi.org/10.1097/IOP.0000000000001694>
- Kaynak, P. (2019). Transcanalicular Laser-Assisted Dacryocystorhinostomy. *Oculofacial, Orbital, and Lacrimal Surgery: A Compendium*, 517-530.
- Lai, C.-C., Yang, C.-J., Lin, C.-C., & Chi, Y.-C. (2021). Surgical outcomes of balloon dacryocystoplasty combined with pushed-type monocanalicular intubation as the primary management for congenital nasolacrimal duct obstruction. *Journal of Pediatric Ophthalmology and Strabismus*, 58(6), 365-369. <https://doi.org/10.3928/01913913-20210414-01>
- Levine, Corinna G., and Roy R. Casiano. "Revision functional endoscopic sinus surgery." *Otolaryngologic Clinics of North America* 50, no. 1 (2017): 143-164.
- Management of Canalicular Lacerations: Epidemiological Aspects and Experience with Mini-Monoka Monocanalicular Stent Naik, Milind N. et al. *American Journal of Ophthalmology*, Volume 145, Issue 2, 375 - 380.e2
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for Systematic Reviews and Meta-Analyses: the PRISMA statement. *PLoS Medicine*, 6(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Mutlu, D., Bayram, N., Arici, M. K., Ozec, A. V., Erdogan, H., & Toker, M. I. (2022). Comparison of outcomes of external dacryocystorhinostomy and transcanalicular laser-assisted dacryocystorhinostomy in patients with primary acquired nasolacrimal duct obstruction. *Klin Monbl Augenheilkd*, 239(6), 799-803. <https://doi.org/10.1055/a-1720-1752>
- Nowak R. (2020). Management of inferior dislocation of a StopLoss Jones tube after conjunctivodacryocystorhinostomy. *BMJ case reports*, 13(11), e236003. <https://doi.org/10.1136/bcr-2020-236003>
- Petris, C., & Liu, D. (2017). Probing for congenital nasolacrimal duct obstruction. *Cochrane Database of Systematic Reviews*, (7).
- Prism Johnson Limited. (2022). Annual report 2021-2022. Retrieved from <https://www.prismjohnson.in/wp-content/uploads/2022/12/Annual-Report-2021-2022-1.pdf>
- Saleem, A. A. (2019). Congenital Nasolacrimal Duct Obstruction and the Visual System. *Frontiers in Ophthalmology and Ocular Imaging*.
- Sasaki, T., Matsumura, N., Miyazaki, C., Kamao, T., Yokoi, N., Fujimoto, M., Hayami, M., Iwasaki, A., Mimura, M., Murata, A., Nakayama, T., Shinomiya, K., Tanaka, H., & Ueta, Y. (2024). Congenital nasolacrimal duct obstruction: clinical guideline. *Japanese Journal of Ophthalmology*, 68(4), 367-388. <https://doi.org/10.1007/s10384-024-01064-4>
- Schellini, S. A., Marques-Fernandez, V., Meneghim, R. L. F. S., & Galindo-Ferreiro, A. (2021). Current management strategies of congenital nasolacrimal duct obstructions. *Expert Review of Ophthalmology*, 16(5), 377-385.
- Shahgoli, S. S., Zand, A., Tehrani, M. J., Bahremani, E., Rajabi, M. T., Aghajani, A., & Rafizadeh, S. M. (2024). Comparative efficacy of probing with or without intubation, and/or inferior turbinate fracture in simple congenital nasolacrimal duct obstruction: A randomized clinical trial. *Scientific Reports*, 14(20324). <https://doi.org/10.1038/s41598-024-20324-9>
- Shylaja, S. (2012). Clinical Study and Management of Chronic Dacryocystics (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).
- Taylor, R. S., & Ashurst, J. V. (2023, September 11). Dacryocystitis. *StatPearls - NCBI Bookshelf*. <https://www.ncbi.nlm.nih.gov/books/NBK470565/>
- Vagge, A., Ferro Desideri, L., Nucci, P., Serafino, M., Giannaccare, G., Lembo, A., & Traverso, C. E. (2018). Congenital Nasolacrimal Duct Obstruction (CNLDO): A Review. *Diseases (Basel, Switzerland)*, 6(4), 96. <https://doi.org/10.3390/diseases6040096>