Readers Insight
Publisher of open access books and journals
PJMLS OPEN ACCESS
Print ISSN: 2707-4471. Online ISSN: 2707-448X

Research Article	Pak-Euro Journal of Medical and Life Sciences
DOI: 10.31580/pjmls.v8iSp3.3528	Copyright © All rights are reserved by Corresponding Author
Vol. 8 No. Special 3, 2025-26: pp. S215-S222	
www.readersinsight.net/pjmls	**Revised:** March 12, 2026 **Accepted:** March 21, 2026
Submission: December 23, 2025	**Published Online:** March 31, 2026

OUTCOME OF NASOLACRIMAL DUCT SILICONE INTUBATION IN CHILDREN AGED 1-4 YEARS WITH CONGENITAL NASOLACRIMAL DUCT OBSTRUCTION

Lyla Shamim[1], Qamar Zaman Hafeez[1], Sahibzada Adnan[2]*, Qazi Maaz[1], Awais Ahmad Khan[1], Rameesha Habib[1]

[1]**Department of Ophthalmology,** Ayub Medical College, Abbottabad, Pakistan
[2]**Department of Anesthesia,** Hayatabad Medical Complex, Peshawar, Pakistan

***Corresponding Author:** Sahibzada Adnan. E. mail: lylashamim@gmail.com

Abstract

Background: *The most common cause of epiphora in infants is congenital nasolacrimal duct obstruction; the two most common surgical treatment options are probing and silicone intubation. The purpose of this descriptive case series was to ascertain the success rate of nasolacrimal duct silicone intubation in children with congenital nasolacrimal duct obstruction (NLDO) aged 1-4 years.*

Material and method: *This study was carried out in the Department of Ophthalmology, Ayub Teaching Hospital, Abbottabad, from 20 June 2016 to 20 November 2017. A total of 36 children (age 4 and under) who qualified for the study were enrolled. All the participants were silicone intubated and followed up for six months after a detailed history taking and physical examination.*

Result: *A total of 36 children diagnosed with congenital nasolacrimal duct obstruction (CNLDO) were included, with an average age of 2.31 ± 1.19 years. Out of these, 27 (75.0%) were male, and 9 (25.0%) were female. Overall, silicone intubation was effective for 21 patients (58.3%; 95% CI: 42.2%–72.9%). The success of the treatment was higher among children aged ≤2 years (21/22, 95.5%) than in those aged >2 years (0/14, 0%) (Fisher's exact test, $p < 0.001$). No significant association was found between the gender of the child and treatment success, with success rates of 55.6% in males and 88.9% in females (Fisher's exact test, $p = 0.56$).*

Conclusion: *Silicone intubation shows moderate success, with significantly better outcomes in children under 2 years.*

Keywords: *Dacryocele, Epiphora, Intubation, Nasolacrimal duct obstruction, Probing*

INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) is the most common disorder affecting the pediatric lacrimal drainage system, resulting from failed canalization of the valve of Hasner at the distal end of the duct. In the largest population-based cohort to date, comprising 17,713 live births, the prevalence was reported to be 1%, with a significant association identified between CNLDO and premature birth (1). Additional risk factors derived from primary cohort studies include craniofacial and nasal anatomic abnormalities (2), as well as the mode of delivery (3). The natural history of this condition is generally favorable, as evidenced by a classic longitudinal investigation demonstrating that most obstructions resolve spontaneously without surgical intervention within the first year of life, coinciding with the completion of normal canalization, leaving only a small proportion of cases persistent beyond that period (4). Furthermore, a large randomized trial conducted by a major eye disease investigator group confirmed high resolution rates with nonsurgical measures, specifically massage combined with antibiotics used only when secondary infection was present, among infants younger than 10 months (5).

For the 10–20% of infants who continue to exhibit symptoms beyond infancy, primary probing remains the routine first-line surgical procedure. However, outcomes from this intervention have been shown to deteriorate with increasing age at the time of the procedure (6). This age-dependent decline was subsequently corroborated in children older than one year (7), and further confirmed in cases of late and very late probing (8). More recent data from a large contemporary cohort of 2,434 children demonstrated a success rate of 87.9% for those aged 0–2 months, which fell sharply to 65.4% beyond 24 months (9). A pooled

meta-analysis similarly revealed success rates of 90.7% at 0–6 months, decreasing to 63.5% in children older than 48 months (10). Beyond age alone, bilateral obstruction, complex anatomical variants, and the presence of Down syndrome have been identified as independent variables associated with probing failure (11), a finding that was reinforced by an office-based probing trial conducted under topical anesthesia, which showed similarly diminished success in more complex and older cases (12).

Given these age-related and complexity-related limitations of probing, there has been a growing shift toward the use of silicone intubation and balloon catheter dilation as either first- or second-line treatment alternatives. A prospective multicenter study reported a 91% success rate for nasolacrimal duct intubation in children less than 4 years of age (13), while another study demonstrated that balloon catheter dilation is equally effective when employed as primary treatment (14). Earlier series achieved success rates as high as 97% with silicone intubation combined with inferior turbinate infracture (15), and subsequent investigations have confirmed good outcomes with intubation in children presenting with more complex or recurrent obstruction (16). Intubation performed under topical anesthesia in an office setting has also been shown to yield meaningful success rates when executed appropriately (17). This approach may be particularly advantageous in children with Down syndrome, who are at increased risk for bilateral CNLDO and have inherently lower probing success rates; this has been documented in evaluations of failed probing in this population (18), as well as in analyses specifically examining the use of monocanalicular stents (19). Additional studies have similarly endorsed intubation as the next logical step in this higher-risk subgroup following failed probing (20).

Despite this extensive body of literature, the majority of outcome data concerning silicone intubation originate from tertiary referral centers located in North America, Europe, and the Middle East, with comparable data from other settings remaining conspicuously absent. This geographic gap poses a significant challenge in formulating locally relevant prognostic advice regarding expected success rates and potential complications of intubation in the context of persistent or complex CNLDO. Therefore, the present study was designed to assess the clinical results of silicone intubation in children with persistent or complex CNLDO at a 6-month follow-up, with the specific aims of determining its success rate, evaluating its safety profile, and identifying factors associated with treatment outcomes. It is hypothesized that silicone intubation will achieve a high success rate exceeding 85%at 6 months, with acceptable complication rates, particularly in children older than 12 months, a group in which probing alone has been shown to be less successful.

METHODOLOGY

This descriptive case series was carried out in the Department of Ophthalmology at Ayub Teaching Hospital, Abbottabad from 20th June 2016 to 20th November 2017 after obtaining approval from the Hospital Ethics Committee. The sample consisted of 36 children aged 1–4 years that were diagnosed clinically with congenital nasolacrimal duct obstruction (CNLDO) and who were recruited by a non-probability consecutive sampling technique method. The sample size was computed with the WHO sample size calculator with a 95% confidence level, an anticipated success rate of 62% and an absolute precision of 16%. Congenital NLDO children with age 1-4 years were included regardless of gender. Acute infection/inflammatory diseases of the lacrimal drainage system, like acute dacryocystitis or canaliculitis, were excluded. These were identified as clinical conditions that differed from uncomplicated CNLDO. Patients with epiphora and a mild mucoid discharge and no evidence of acute inflammation (erythema, swelling, tenderness or fever) were included in the study as having uncomplicated CNLDO. Patients who had received previous surgical treatment for nasolacrimal duct obstruction (except probing or syringing) and patients with nasal pathology which could affect silicone tube intubation were also excluded. Parents/legal guardians gave informed consent prior to enrollment. A thorough ocular and systemic history was taken and then a complete ophthalmic examination was performed comprising examination of the visual acuity, slit-lamp examination, eyelid examination and assessment of the lacrimal drainage system. In addition, all patients were seen by an otorhinolaryngologist to rule out nasal pathology that might preclude the procedure. Standard blood and chest X-ray tests were performed preoperatively. Patients were

appropriately fasted prior to surgery in general anesthesia as per institutional anesthesia protocols. The consultant ophthalmologist performed all the surgeries under general anesthesia, and silicone intubation of the nasolacrimal duct was performed in any case that required assistance from an otorhinolaryngologist. Probing was done by the superior and inferior puncta. The silicone tube was inserted into the superior and inferior canaliculi and retrieved via inferior meatus and tied in place securely in the nasolacrimal duct. The silicone tube was left in place for 3-6 months and then removed. Patients were followed up after surgery at about 1 week, 1 month, 3 months and 6 months to determine the position of the tube, symptom improvement, and complications after surgery. Surgical success was considered as the complete resolution of epiphora and discharge with removal of silicone tube, and persistence of a patent lacrimal drainage system during clinical examination and lacrimal irrigation. A structured proforma was used in collecting data and the data were analyzed using SPSS version 20.0. All continuous variables were summarized as mean with SD and categorical variables like gender, and treatment success were summarized as frequencies and percentages. Primary outcome of nasolacrimal duct patency was stratified according to age and gender. The chi-square test was used to assess associations; if the number of expected cells is less than five, the Fisher's exact test was used. A p value of < 0.05 was deemed to be statistically significant.

RESULTS

DESCRIPTIVE CHARACTERISTICS OF STUDY PARTICIPANTS

There were 36 children with congenital nasolacrimal duct obstruction (CNLDO) included in the study. There were 27 (75.0%) males and 9 (25.0%) females in the study population. The male predominance of the samples most probably reflects the pattern of patients who presented during the study period and may not be indicative of a gender bias towards CNLDO. The children were spread across the eligible age range with a mean age of 2.31 ± 1.19 years. In all, 21 of 36 patients (58.3% [95% CI: 42.2%–72.9%]) were successfully intubated with a silicone tube and 15 patients (41.7%) failed (Table I).

Table I. Baselines characteristics and overall outcomes

Variable	n (%) / Mean ± SD	95% CI*
Gender		
Male	27 (75.0%)	–
Female	9 (25.0%)	–
Age (years)	2.31 ± 1.19	Range: 1–4
Treatment outcome		
Success	21 (58.3%)	42.2%–72.9%
Failure	15 (41.7%)	27.1%–57.8%

OUTCOME OF SILICONE INTUBATION IN THE STUDY POPULATION

In the study, 21 of 36 patients (58.33%) had a successful outcome, while 15 (41.67%) failed treatment. Findings indicate that silicone intubation was effective in over 50% of the patients in this study, indicating that the procedure was effective for most of the patients during the study period. The results of silicone intubation are summarized in Fig. 1.

COMPARISON OF SUCCESS IN DIFFERENT AGE GROUPS OF THE STUDY POPULATION

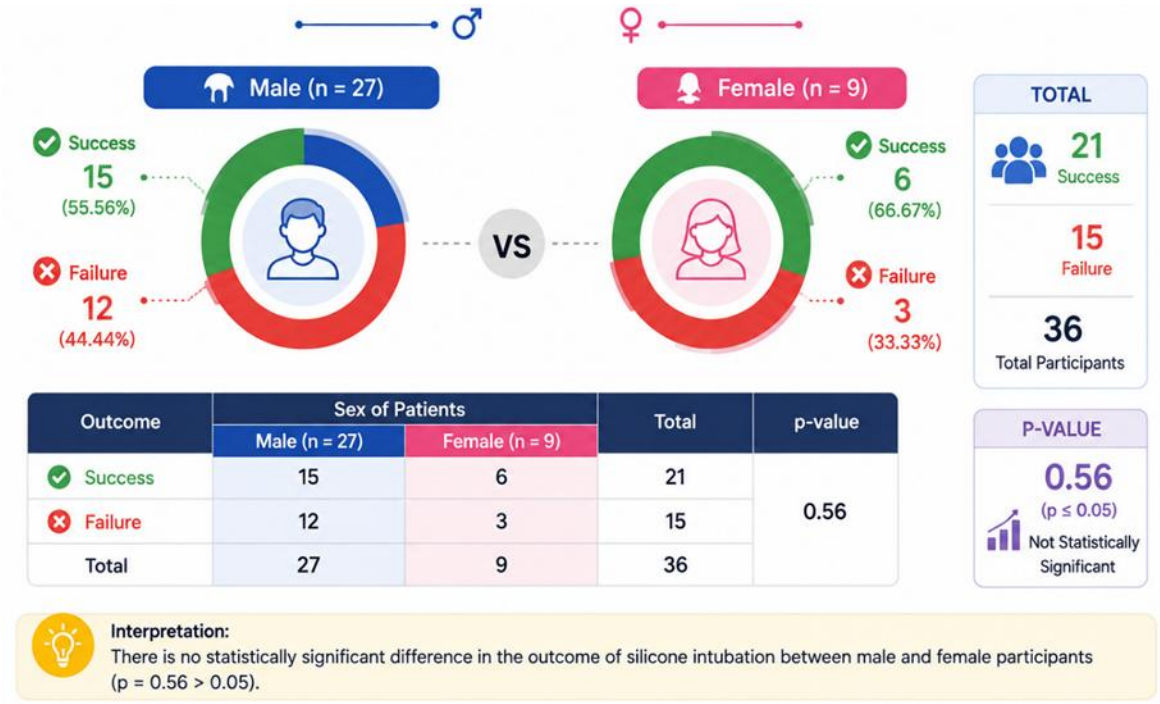
Among the 22 children aged ≤2 years, successful treatment was achieved in 21 (95.5%; 95% CI: 78.2%–99.2%), while 1 (4.5%) experienced treatment failure. None of the 14 children older than 2 years had a successful outcome (0%; 95% CI: 0.0%-21.5%) with all 14 (100%) failing treatment. Since data on one or more of the expected cell counts were less than 5, the association between age group and treatment outcome was analyzed using Fisher's exact test, which indicated a statistically significant association ($p < 0.001$). The results indicate that younger age was a risk for success in silicone intubation, although the finding in the older age group should be treated with caution due to the small number of cases. The results of silicone intubation according to age are shown in Fig. 2.

Fig. 1. Outcome of silicone intubation in the study population

Fig. 2. Comparison of success in different age groups of the study population

COMPARISON OF OUTCOME OF SILICONE INTUBATION ACCORDING TO GENDER

Of the 27 male patients, 15 (55.6%; 95% CI: 37.3%–72.4%) had a successful outcome and 12 (44.4%) experienced treatment failure. Among the 9 female patients, 8 (88.9%; 95% CI: 56.5%–98.0%) had a successful outcome, while 1 (11.1%) experienced treatment failure. Fisher's exact test was used for assessing the association between gender and treatment outcome due to the small, expected cell counts. There was no statistically significant difference in success of silicone intubation between the two genders ($p = 0.56$), suggesting that gender did not significantly impact the success of silicone intubation in the present study. Treatment outcomes according to gender are shown in Fig. 3.



Outcome	Sex of Patients		Total	p-value
	Male (n = 27)	Female (n = 9)		
Success	15	6	21	0.56
Failure	12	3	15	
Total	27	9	36	

Fig. 3. Comparison of outcome of silicone intubation according to gender

DISCUSSION

Overall success rate for silicone intubation in the present study was 58.3% as compared to majority of published series. Earlier studies have shown a wide range of success with silicone intubation for congenital nasolacrimal duct obstruction (CNLDO) and patient age, disease severity, surgical technique, length of tube retention, length of follow-up and study design have all been cited as factors that affect success rates. This relatively poor success rate reported in the present study could be due to the characteristics of the patients included in the study and the treatment setting, and not to the lack of effectiveness of silicone intubation. A study by the Turkish group in primary nasolacrimal duct intubation in older children found a success rate of 73.3%. Children were included in the study aged 7-15 years, with a mean follow-up of 8.8 months and a mean silicone tube removal period of 4.6 months. The higher success rate as compared to the present study is attributed to the differences in patient characteristics, follow-up period, tube retention period, and the surgical management. Further, the Turkish study was conducted in older children and in a particular surgical technique and a well-defined postoperative follow-up procedure. These disparities highlight the importance of not assessing treatment results just by percentages overall, but by patient age, disease characteristics, surgical competence and postoperative management (21). Also, in a prospective, randomized comparative study comparing probing to bicanalical silastic intubation, overall success rate for bicanalical intubation was 89.2%. Important to note is the investigators' categorization of CNLDO into simple and complex types and the marked differences in success rates with silastic intubation compared to probing, 85.2% and 47.4% respectively. In the current study, the classification system used was not comparable to differentiating simple from complex obstruction. This difference may have played a role in the differences in treatment outcomes, since the complexity of the disease is an important factor in determining the choice and success of surgical treatment (22). The results of the present study can also be contrasted with previous studies showing good outcomes associated with silicone intubation for children with chronic CNLDO. Dortzbach et al. reported excellent outcomes in 82.5% of children intubated with silicone who failed to pass a probe (congenital and acquired obstruction included) (23). Successful silicone intubation results have also been reported in Indian series in children with CNLDO with varying rates reported between different studies, depending on the technique used and the population studied. A retrospective review of 152 eyes demonstrated a 95% success rate after silicone intubation with Ritleng and a modified fixation technique after a mean of ~3.5 years of follow-up. The higher success rate of this study compared to the current study could be due to variations in surgical technique, sample size, follow-up period, and patient selection. Thus, conclusions about comparisons with other studies should be drawn

judiciously (24). A Pakistani study comparing the success rate of primary nasolacrimal intubation in children aged 2–4.8 years with artificial tears alone gave a success rate of 89.2%. Success rates were 92% for children under 2 years, 90% for children between 2–3 years and 71% for children between 3–4 years. The age group and the clinical setting in the current study were also similar to the findings from this study. There are several potential differences that could explain the lower success rate found in the present study when compared with others, including differences in number of patients, inclusion criteria, severity of the disease, surgical procedure, tube retention time, postoperative care, and postoperative follow-up. However, both studies suggest there is a relationship between younger age and better treatment outcomes (25).

The age seems to be a significant consideration in the treatment of CNLDO. In the current study, children under 2 years of age were significantly more likely to be cured than older children. The number of participants over 2 years of age was very small and thus the findings of this age group do not have the statistical power necessary to draw a definitive age-specific conclusion; but the observed trend is clinically relevant. The same has been shown in the past with the older age group. Some studies reported by Mannor et al. showed that the success rate for nasolacrimal duct probing decreased over time from 92% at 12 months to 42% at 60 months. Other studies have also indicated that older age is associated with lower success rate, indicating that age may be an important predictor of treatment failure (26).

The current results are not to be considered as proof that silicone intubation should routinely be carried out at the age of 24 months. Instead, they advocate the use of early surgical intervention in young children with chronic obstruction, especially when non-surgical management has not been successful, and when there is a falling likelihood of spontaneous resolution. Conservative treatment may be indicated if clinically appropriate in younger children, but in older children, if there is persistent obstruction, discussion of surgical options should be encouraged, including probing, silicone intubation, balloon catheter dilation, or other lacrimal surgery depending on clinical and anatomical factors.The findings of this study add to the list of evidence on the efficacy of silicone intubation for CNLDO, but there are some methodological drawbacks to be noted. First, the sample size was relatively small, and thus limited in its statistical power and generalizability of the findings. Second, consecutive sampling from one institution may have included selection bias and it may not have been representative of the wider population of children with CNLDO. Third, the relatively short follow-up might have underpowered the study to detect late recurrence or delayed complications. Earlier work have employed significantly longer follow-up periods, and changes in the length of the period of follow-up can affect the reported success rates.

Therefore, larger multicenter prospective studies with longer follow-up are recommended in the future. These investigations should include a standardised definition of the treatment success, formalisation in defining the severity and complexity of CNLDO, documentation of previous interventions, as well as the standardized silicone tube retention time and evaluation of postoperative complications. Another stratification by age would also be relevant as age seems to affect treatment results. These methodological enhancements would enable better comparison of the studies and prompt the choice of the optimal time and surgical technique for each clinical entity of CNLDO.

CONCLUSION

Silicone intubation is moderately effective for CNLDO, with success rates significantly higher in children under 2 years.

Study limitations:

1. The study used non-probability consecutive sampling, which may have introduced selection bias.
2. This was a hospital-based study with a small sample size and hence the results cannot be generalized.
3. Factors affecting the outcome of the procedure other than age of patients were not studied.
4. Intervention 24 months is strongly recommended.

Conflict of interest:

The authors report no conflicts of interest

Author's contributions:

LS Conducted the experimental work and data collection; QZH Contributed to the study design, methodology and data interpretation; SA Supervision and project administration; QM Data analysis and manuscript preparation; AAK Literature review, data interpretation and manuscript editing; RH Experimental work, data collection and manuscript revision. All authors reviewed and approved the final manuscript.

Declaration of generative AI-Assisted Tools:

No AI-assisted tools were used.

References:

1. Sathiamoorthi S, Frank RD, Mohney BG. Incidence and clinical characteristics of congenital nasolacrimal duct obstruction. Br J Ophthalmol. 2019;103(4):527–529.
2. Aldahash FD, Al-Mubarak MF, Alenizi SH, Al-Faky YH. Risk factors for developing congenital nasolacrimal duct obstruction. Saudi J Ophthalmol. 2014;28(1):58–60.
3. Mohney BG. Association between congenital nasolacrimal duct obstruction and mode of delivery at birth. J AAPOS. 2019;23(2):125.
4. Petersen RA, Robb RM. The natural course of congenital obstruction of the nasolacrimal duct. J Pediatr Ophthalmol Strabismus. 1978;15(4):246–250.
5. Pediatric Eye Disease Investigator Group. Resolution of congenital nasolacrimal duct obstruction with nonsurgical management. Arch Ophthalmol. 2012;130(6):730–734.
6. Katowitz JA, Welsh MG. Timing of initial probing and irrigation in congenital nasolacrimal duct obstruction. Ophthalmology. 1987;94(6):698–705.
7. Robb RM. Success rates of nasolacrimal duct probing at time intervals after 1 year of age. Ophthalmology. 1998;105(7):1307–1309.
8. Kashkouli MB, Beigi B, Parvaresh MM, Kassaee A, Tabatabaee Z. Late and very late initial probing for congenital nasolacrimal duct obstruction: what is the cause of failure? Br J Ophthalmol. 2003;87(9):1151–1153.
9. Świerczyńska M, Tobiczyk E, Rodak P, Barchanowska D, Filipek E. Success rates of probing for congenital nasolacrimal duct obstruction at various ages. BMC Ophthalmol. 2020;20(1):403.
10. Sultanbayeva Z, Dzhumabekov A, Aldasheva N, Issergepova B, Kuanyshbekov Y, Taushanova M, Karibayeva I. A systematic review and meta-analysis of the success rate of the primary probing in pediatric patients with congenital nasolacrimal duct obstruction in different age groups. Medicina (Kaunas). 2025;61(8):1432.
11. Al-Faky YH, Al-Sobaie N, Mousa A, Al-Odan H, Al-Huthail R, Osman E, Al-Mosallam AR. Evaluation of treatment modalities and prognostic factors in children with congenital nasolacrimal duct obstruction. J AAPOS. 2012;16(1):53–57.
12. Miller AM, Chandler DL, Repka MX, Hoover DL, Lee KA, Melia M, et al; Pediatric Eye Disease Investigator Group. Office probing for treatment of nasolacrimal duct obstruction in infants. J AAPOS. 2014;18(1):26–30.
13. Pediatric Eye Disease Investigator Group, Repka MX, Melia BM, Beck RW, Atkinson CS, Chandler DL, et al. Primary treatment of nasolacrimal duct obstruction with nasolacrimal duct intubation in children younger than 4 years of age. J AAPOS. 2008;12(5):445–450.
14. Pediatric Eye Disease Investigator Group, Repka MX, Melia BM, Beck RW, Chandler DL, Fishman DR, et al. Primary treatment of nasolacrimal duct obstruction with balloon catheter dilation in children younger than 4 years of age. J AAPOS. 2008;12(5):451–455.
15. Migliori ME, Putterman AM. Silicone intubation for the treatment of congenital lacrimal duct obstruction: successful results removing the tubes after six weeks. Ophthalmology. 1988;95(6):792–795.
16. Lim CS, Martin F, Beckenham T, Cumming RG. Nasolacrimal duct obstruction in children: outcome of intubation. J AAPOS. 2004;8(5):466–472.
17. Miller AM, Chandler DL, Repka MX, Hoover DL, Lee KA, Melia M, et al; Pediatric Eye Disease Investigator Group. Office probing for treatment of nasolacrimal duct obstruction in infants. J AAPOS. 2014;18(1):26–30.
18. Landau Prat D, Tadros S, Revere KE, Katowitz JA, Katowitz WR. Management of congenital nasolacrimal duct obstruction in Down syndrome. Eye (Lond). 2023;37(4):739–743.

19. Landau Prat D, Munroe CE, Revere K, et al. Outcome of primary monocanalicular stent placement in pediatric Down syndrome patients with congenital nasolacrimal obstruction. Ophthalmic Plast Reconstr Surg. 2023;39(6):579–582.
20. Baran F, Kelly JP, Finn LS, Manning S, Herlihy E, Weiss AH. Evaluation and treatment of failed nasolacrimal duct probing in Down syndrome. J AAPOS. 2014;18(3):226–231.