

# Comparison of the results between monocanalicular and bicanalicular silicone tube intubation in children with congenital nasolacrimal duct obstruction

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## Abstract

**Aim:** In this study we aimed to compare the retrospective results of the success rates in children with congenital nasolacrimal duct obstruction undergoing monocanalicular and bicanalicular silicone tube intubation.

**Materials and Methods:** Bicanalicular (Group 1) and monocanalicular (Group 2) silicone tube intubation was performed in 48 eyes of 42 patients using the Ritleng method. Sixteen of the patients were boys and 26 were girls. Bicanalicular silicone tube intubation was performed in 26 eyes of 22 patients, and monocanalicular silicone tube intubation was performed in 22 eyes of 20 patients.

**Results:** The mean age of patients was  $5.68 \pm 1.83$  years (2-9 years) in the first group, and  $5.05 \pm 1.76$  years (3-9 years) in the second group. The period of leaving the silicone tube was  $3.61 \pm 1.38$  months (1-6 months) in the first group, and  $3.18 \pm 1.00$  months (1-6 months) in the second group. The mean follow up period of the patients was found to be 11.8 months (6-36 months) in the bicanalicular group and 14.0 months (6-36 months) in the monocanalicular group. The success rate was 92.30% (22 of 26 eyes) in the first group and 95.45% (21 of 22 eyes) in the second group.

In the first group, 2 patient's bicanalicular tube was removed spontaneously 2 months ago, 2 patients were performed dacryocystorhinostomy, 1 patient developed pyogenic granuloma and laceration occurred in the lower canaliculus of 1 patient. In the second group, the tubes of 2 patients were removed spontaneously 2 months ago and silicone tube intubation was performed again with the same method. In this group, 1 patient was then performed dacryocystorhinostomy and 1 patient developed conjunctivitis. There were no corneal or conjunctival complications in either group.

**Conclusion:** There was no statistically significant difference in success rates between the groups ( $p > 0.05$ ).

**Keywords:** Bicanalicular intubation; congenital nasolacrimal duct obstruction; monocanalicular intubation

## INTRODUCTION

Congenital nasolacrimal duct obstructions are common in the pediatric age group. It is seen in 6-20% of the first year of life. It regresses spontaneously over 90% before 12 months. Surgery is required for the remaining children. Probing is performed in cases that do not regress spontaneously or do not improve despite lacrimal sac massage. Probing success rate is 92-98% before the age of 2. Nasolacrimal silicone tube intubation is a preferred treatment method in cases where probing and lavage fail. Bicanalicular and monocanalicular silicone tube applications are usually preferred (1-4).

Comparative studies are limited in patients undergoing bicanalicular and monocanalicular silicone tube implantation due to congenital nasolacrimal duct obstruction. The aim of this retrospective study is to compare the advantages and disadvantages of these two

methods which include, success rates, ease of application, ease of tube removal and complications.

## MATERIALS and METHODS

In our study, all patients' notes were retrospectively reviewed. Patients with congenital nasolacrimal duct obstruction were compared and their clinical results were reported. This study was performed in accordance with the Declaration of Helsinki and approved by local ethics committee (Inonu University Clinical Researchs Ethics Committee). Number: 2017/22-6. Written informed consent is obtained routinely in our hospital from all parents before the initiation of any procedure after thorough explanation. Patients who applied to our outpatient clinic between March 2016 and August 2019 at Inonu University Faculty of Medicine, Department of Ophthalmology and were diagnosed with congenital nasolacrimal duct obstruction

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and then had silicone tube intubation were included in the study.

The diagnosis of congenital nasolacrimal duct obstruction was made according to the history and examination findings of the patients. Patients had complaints of watering and burring in the eyes from birth. On ophthalmic examination, the tear meniscus was observed thicker than normal. In cases with suspected nasolacrimal duct obstruction, significant dye retention was observed in the 2% fluorescein dye disappearance test. All patients received antibiotic drop and lacrimal massage treatment before silicone tube therapy.

Patients with nasolacrimal duct obstruction were retrospectively evaluated in 2 separate groups, cases who underwent monocular and bicanalicular silicone tube intubation between March 2016 and August 2019. Children with punctal or canalicular anomalies, who had previous nasolacrimal duct intubation or dacryocystorhinostomy, who were exposed to nasolacrimal trauma to the nasolacrimal system, those with craniofacial abnormalities, and children less than 6 months follow-up were excluded from the study.

Bicanalicular and monocular silicone tube intubation was performed in 48 eyes of 42 patients. Sixteen of the patients were boys (mean age  $5.28 \pm 1.78$ ) and 26 were girls (mean age  $5.44 \pm 1.85$ ). Patients were between the ages of 2 and 9. Bicanalicular (Group 1) silicone tube intubation was performed in 26 eyes of 22 patients, and monocular (Group 2) silicone tube intubation was performed in 22 eyes of 20 patients.

The data were analyzed with the SPSS statistical package version 25.0 program. The normality test of numerical variables was checked with Kolmogorov-Smirnov test. Chi-square test (Fisher exact test) was used for categorical variables of the patients. Mann-Whitney U test was used for comparison of two independent groups and in cases where numerical variables did not show normal distribution. For all statistical tests with p-value of  $\leq 0.05$  was considered statistically significant.

A cotton pad moistened with 2% lidocaine and 1/100.000 adrenaline was placed in the lower meatus under general anesthesia. The lacrimal sac contents were emptied by massage. The upper punctum was dilated. The canaliculus was entered with the Ritleng metal probe. The occlusion was passed by advancing the probe and the lower meatus was entered. Cotton pad removed and to check that the Ritleng metal probe is in the lower meatus, the Bowman probe was entered into the lower meatus and metal-to-metal contact was achieved. The prolene tip was advanced from the upper end of the Ritleng probe to the lower end, and the nasal cavity was reached through the lower opening of the probe. After the prolene tip was taken to the nasal cavity, the Ritleng probe was completely removed from the lacrimal canal. The silicone tube was inserted into the lacrimal canal by

pulling the prolene from the nose. The same process was repeated by passing through the lower punctum. The two ends of the silicone tube were tied in the nose and fixed to the lateral wall of the nose with 6/0 vicryl. Before the monocular silicone tube implantation, the lower punctum was dilated with a Bowman cannula. The monocular silicone tube was passed through the lower canaliculus using the Ritleng method and removed from the nasal cavity. It was fixed to the lateral wall of the nose with 6/0 vicryl. The plug of the silicone tube was placed in the punctum. Then, corticosteroid and antibiotic drop therapy was recommended for 10 days, 4 times a day. Patients were called for control in the 1st week, 1st month and 3rd month. After the tubes were removed, the patients were called for control in the 1st week, 3rd month and 6th month. The silicone tube was removed under general anesthesia in cases where bicanalicular silicone tube intubation was performed. Silicone tubes of cases who underwent monocular silicone tube intubation were removed under topical anesthesia.

The treatment was accepted to be successful if the patient's complaints of watering and burring were resolved, no tear pooling was observed on examination and significant dye retention was not observed in the 2% fluorescein dye disappearance test. The cases where the silicone tube was insufficient and subsequently performed dacryocystorhinostomy were reported as failures.

## RESULTS

Silicone tube intubation was successfully performed in all eyes. The mean age of patients who underwent bicanalicular silicone tube intubation was  $5.68 \pm 1.83$  years (2-9 years), and the mean age of patients who underwent monocular silicone tube intubation was  $5.05 \pm 1.76$  years (3-9 years). The period of leaving the silicone tube was  $3.61 \pm 1.38$  months (1-6 months) in the bicanalicular tube intubation group, and  $3.18 \pm 1.00$  months (1-6 months) in the monocular silicone tube intubation group. The mean follow up period of the patients was found to be 11.8 months (6-36 months) in the bicanalicular group and 14.0 months (6-36 months) in the monocular group.

In the first group, 2 patient's bicanalicular tube was removed spontaneously 2 months ago. In the second group, who underwent monocular silicone tube intubation, the tubes of 2 patients were removed spontaneously 2 months ago. When epiphora complaints persisted in cases whose tubes were removed spontaneously, silicone tube intubation was performed again with the same method. Dacryocystorhinostomy was performed in 2 patients after bicanalicular silicone tube intubation. In the second group, 1 patient was then performed dacryocystorhinostomy. In the first group, 1 patient developed pyogenic granuloma and laceration occurred in the lower canaliculus of 1 patient. In the second group 1 patient developed conjunctivitis, and the patient who developed conjunctivitis was given antibiotic treatment for 10 days. There were no corneal or

conjunctival complications in either group. There was no significant difference in the success rate between groups ( $p>0.05$ ). No statistical difference was found between the right or left eye of the bicanalicular and monocalicular

silicone tube intubation. In addition, it was observed that there was no statistically significant difference in gender and age differences (Table 1-2).

Groups	Bicanalicular (Group 1)	Monocalicular (Group 2)	p value
<b>Number of cases</b>	26/48 (%54.2)	22/48 (%45.8)	0.564 <sup>a</sup>
<b>Gender</b>			
Male	6/26 (23.07%)	10/22 (45.45%)	0.130 <sup>a</sup>
Female	16/26 (61.54%)	10/22 (45.45%)	
<b>Mean age (Year)</b>	5.68±1.83	5.05±1.76	0.216 <sup>b</sup>
<b>Mean time of the tube staying in nasolacrimal channel (Month)</b>	3.61±1.38	3.18±1.00	0.392 <sup>b</sup>
<b>Eye laterality of the tube implanted to nasolacrimal channel</b>			
Right	13/26 (50%)	11/22 (50%)	0.585 <sup>a</sup>
Left	5/26 (19.2%)	7/22 (31.8%)	
Right and left	4/26 (15.4%)	2/22 (9.09%)	

Groups	Bicanalicular (Group 1)	Monocalicular (Group 2)	p value
<b>Number of cases whose tubes were removed spontaneously (Before 2 months)</b>	2/26 (7.69%)	2/22 (9.09%)	0.659 <sup>a</sup>
<b>Number of cases developing conjunctivitis</b>	0/26	1/22 (4.54%)	0.476 <sup>a</sup>
<b>Number of cases developing pyogenic granuloma</b>	1/26 (3.84%)	0/22	0.524 <sup>a</sup>
<b>Number of patients with dacryocystorhinostomy</b>	2/26 (7.69%)	1/22 (4.54%)	0.537 <sup>a</sup>
<b>Silicone tube implantation success rates</b>	24/26 (92.30%)	21/22 (95.45%)	0.537 <sup>a</sup>

<sup>a</sup>Chi-Square Test (Fisher Exact Test), <sup>b</sup>Mann-Whitney U Test

## DISCUSSION

Lacrimal massage and probing are treatment methods with high success rates in infants with congenital duct obstruction, but the effectiveness of these treatments decreases as the age increases. Nasolacrimal canal silicone tube intubation is a treatment method used in patients with congenital nasolacrimal duct obstruction, older than 24 months, who have undergone probing and irrigation and failed (4,5). Silicone tube intubation without dacryocystorhinostomy was first described in 1968 by Keith et al. Since then, the technique has been modified and applied (6,7). Silicone tube intubation creates a normal anatomical path rather than a bypass. The silicone is well tolerated by the surrounding tissues and complications are minimal if the tube is well placed. Silicone is non-irritating

and easily knotted as it is flexible (8,9). In our study, treatment success and complications were compared between the groups that underwent bicanalicular and monocalicular silicone tube intubation.

In the Ritleng method, the silicone tube is connected to the monofilament prolene suture material and it is easier and less traumatic to remove the prolene from the nose compared to the silicone tubes to which the metal probes were attached at the end of the previously applied. The most important disadvantage of silicone tube intubation with the Ritleng method is that the prolene tips point towards the nasopharynx due to the posterior angle of the nasopharynx. In our study, the prolene that did not come out of the nose and directed to the nasopharynx was caught with the help of a hook. Yazıcı et al., reported 98%

success in bicanalicular silicone tube intubation using the Ritleng method without endonasal imaging in 50 eyes of 42 patients with congenital nasolacrimal duct obstruction (5).

When the patient groups we applied bicanalicular and monocanalicular silicone tube intubation were compared, no significant difference was observed in the success rates of the treatment between the groups. Fayet et al., in their study of 120 eyes of 85 patients, reported success rate of 67.7% in patients who underwent bicanalicular silicone tube intubation and 62.4% in patients who underwent monocanalicular silicone tube intubation (10). In the study reported by Kominek et al., in which bicanalicular and monocanalicular silicone tube intubations were compared in groups of 35 patients, they achieved 97.14% success in monocanalicular silicone tube intubation and 88.57% in bicanalicular silicone tube intubation (11). In the study reported by Lee et al., in 60 eyes of 46 patients, they reported success of 93.3% in the bicanalicular group and 90.0% in the monocanalicular group (12). Engel et al., reported 96% success in a study where they performed monocanalicular silicone tube intubation in 803 eyes of 635 patients (13).

Bicanalicular and monocanalicular silicone tube intubation techniques have advantages and disadvantages when compared with each other. In bicanalicular silicone tube intubation, the nose is reached by passing from both the upper and lower punctum to the lacrimal system. In monocanalicular silicone tube intubation, only one punctum is passed to the lacrimal system (11).

Bicanalicular silicone tube intubation is better tolerated on the corneal side than monocanalicular silicone tube intubation. Corneal abrasion and ulcer may occur by the last part of the silicone tube in the eye in treatment with a monocanalicular silicone tube (11). In a study by Fayet et al., reported in 120 eyes of 85 patients, in 39 of 43 patients who underwent monocanalicular silicone tube intubation into the upper canaliculus, superficial corneal erosion occurred in only 1 patient (2.3%). No corneal complications were seen in the bicanalicular group (10). In our study, all monocanalicular silicone tubes were placed in the lower canaliculus, and no corneal complications were observed in either group. In the study of Engel et al., 2% conjunctival and corneal abrasion was observed. In order to prevent corneal and conjunctival complications, it is recommended to apply ointment to the eye after the operation and to avoid rubbing the patient's eye (13).

Abdalla et al., reported in their study of 24 patients that laceration developed in the canaliculus in 1 patient in the bicanalicular group. (14). In our study, laceration of the canaliculus developed in 1 patient in the group in which we performed bicanalicular silicone tube intubation.

Another complication that may occur is the early dislocation of the silicone tube in silicone tube intubations. In the study reported by Engel et al., in 803 eyes, it was found that the tube was removed early in 116 eyes (14.5%). Engel et al., reported that the patient would be exposed to

manipulations less than the lower canaliculus, since they placed the monocanalicular tube in the upper canaliculus (13). In our study, all monocanalicular silicone tubes were placed in the lower canaliculus. In the group where bicanalicular silicone tube intubation was performed, the tube was dislocated before 2 months in 2 patients. Since epiphora continued in one of these patients, silicone tube intubation was performed again with the same method. In the group that underwent monocanalicular silicone tube intubation, the silicone tube was dislocated before 2 months in 2 patients. Since the epiphora complaints continued, silicone tube intubation was performed again with the same method. In the study reported by Ozgur et al., early dislocation of the tubes was detected in 13% in the monocanalicular silicone tube intubation group, 8% in the bicanalicular silicone tube intubation group. It has been stated that the low tolerance of children to foreign bodies may be the reason for the dislocation of silicone tubes and the incidence of this complication can be reduced by fixing the silicone tube to the nasal mucosa with an absorbable suture (15).

The duration of silicone tube residence in the nasolacrimal canal is approximately 2-6 months in studies. It was reported that the success rate decreased in patients who were kept in the canal for less than 3 months, especially in older children (16). In our study, silicone tubes were left in the nasolacrimal canal for an average of 3 months in both groups.

In our study, pyogenic granuloma developed in 1 patient in the group in which bicanalicular silicone tube intubation was applied. The pyogenic granuloma regressed spontaneously 2 months after the tube was removed. Fayet et al., reported in their study that pyogenic granuloma occurred at a rate (4.7%)(10). Ozgur et al., observed pyogenic granuloma formation in 1 patient in the group in which they performed monocanalicular silicone tube intubation (15). Yalaz et al., reported that granuloma developed in 1 patient in their study (17).

In our study, conjunctivitis developed in 1 patient in the group in which bicanalicular silicone tube intubation was performed. 10 days of antibiotic ointment treatment was recommended to the patient. In a study by Kaufman et al., reported that preseptal cellulitis developed in 1 patient who performed monocanalicular silicone tube intubation (18).

Dacryocystorhinostomy treatment is applied in patients in whom silicone tube intubation is insufficient (1). In our study, 2 patients with bicanalicular silicone tube intubation and 1 patient in the group in which we performed monocanalicular silicone tube intubation later underwent dacryocystorhinostomy.

Chen et al., reported a success rate of 90% in 32 eyes of 24 patients who underwent monocanalicular silicone tube intubation with the Ritleng method. They reported that it is an effective treatment method in patients with congenital nasolacrimal duct obstruction and that the method can be easily applied by surgeons with little experience (19).



## CONCLUSION

In our study, when the advantages and disadvantages of the two groups were compared, no significant difference was observed between the success rates. The success rates and complication rates in both groups were found to be similar to the previous studies. It was observed that the technique was easier to apply and the tube was removed more easily in the group in which monocalicular silicone tube intubation was applied. General anesthesia is usually used to remove the bicanalicular silicone tube. In the group in which monocalicular silicone tube intubation was applied, the silicone tube can also be removed with topical anesthesia. Although it is passed through both upper and lower canaliculi in bicanalicular silicone tube intubation, in monocalicular silicone tube intubation, only one canaliculus is passed. The duration of monocalicular silicone tube intubation is relatively shorter than bicanalicular silicone tube intubation. Due to these advantages, we believe that monocalicular silicone tube intubation is a preferred method in patients with congenital nasolacrimal duct obstruction.

Comparative studies of bicanalicular and monocalicular silicone tube intubation applications in congenital nasolacrimal duct obstructions are limited. Increasing the number of comparative studies will help physicians about the advantages and disadvantages of the method and which of the two methods can be preferred.

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*Ethical Approval: This study was approved by local ethics committee (Inonu University Clinical Researchs Ethics Committee. Number: 2017/22-6.*

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