

Article

Outpatient Ductal Steroid Irrigations as an Adjuvant Treatment to Sialendoscopy in Recurrent Inflammatory Obstructive Sialadenitis

Sara Torretta ^{1,2,*} , Lorenzo Pignataro ^{1,2}, Antonio Libonati ¹, Michele Gaffuri ^{1,2}  and Pasquale Capaccio ^{3,4}

¹ Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico di Milano, 20122 Milan, Italy; lorenzo.pignataro@unimi.it (L.P.); antonio.libonati@unimi.it (A.L.); michele.gaffuri@unimi.it (M.G.)

² Department of Clinical Sciences and Community Health, University of Milan, 20122 Milan, Italy

³ Department of Biomedical Surgical Dental Science, University of Milan, 20122 Milan, Italy; pasquale.capaccio@unimi.it

⁴ ASST Fatebenefratelli Sacco, 20121 Milan, Italy

* Correspondence: sara.torretta@unimi.it

Abstract: The aim of this study is to retrospectively investigate the effectiveness of outpatient ductal steroid irrigations (DSIs) as an adjuvant treatment in recurrent inflammatory obstructive sialadenitis (RIOS). A retrospective chart review of prospectively recruited RIOS patients was randomly assigned to group A (i.e., interventional sialendoscopy) or group B (i.e., interventional sialendoscopy with outpatient DSIs). The statistical analysis detected any postoperative difference between groups in terms of the number and severity (attested by 0–10 VAS pain) of episodes of swelling. Interventional sialendoscopy and DSIs were effective and well tolerated in all 122 patients, and a significantly reduced number of salivary gland swelling episodes (p -value = 0.01) was documented in group B compared to group A at any follow-up assessment. When the specific aetiology was considered, repeated DSIs were more effective than interventional sialendoscopy alone in patients with type 1 or 3 stenoses and in those without mucous plugs. Our results confirm the safety and effectiveness of interventional sialendoscopy (both as a single-modality and a multimodal approach) in a large series of adult patients with RIOS at short-, medium-, and long-term analyses. The superiority of a combined therapeutic protocol, with a positive effect still detectable 12 months after the end of the treatment, was attested as well.

Keywords: sialendoscopy; sialadenitis; salivary gland; infection



Citation: Torretta, S.; Pignataro, L.; Libonati, A.; Gaffuri, M.; Capaccio, P. Outpatient Ductal Steroid Irrigations as an Adjuvant Treatment to Sialendoscopy in Recurrent Inflammatory Obstructive Sialadenitis. *Appl. Sci.* **2024**, *14*, 11982. <https://doi.org/10.3390/app142411982>

Academic Editor: Roger Narayan

Received: 1 November 2024

Revised: 17 December 2024

Accepted: 19 December 2024

Published: 20 December 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Recurrent sialadenitis is a relatively uncommon disorder characterized by repeated and painful salivary gland inflammatory swellings, mainly occurring near meals and related to any impairment in saliva outflow due to stones, ductal strictures/stenoses/kinkings/ab extrinseco compression, mucous plugs, or post-actinic/post-radioiodine sequelae [1,2].

Current therapeutic management of these patients mainly exploits minimally invasive and gland-sparing techniques, including interventional sialendoscopy and video-assisted transoral or transcervical surgical approaches, which are amenable to achieving a conspicuous success rate, especially when they are used in a combined modality [3–6].

Among these, (interventional) sialendoscopy is now considered a cornerstone in the management of RIOS, not only as a refined diagnostic modality able to provide detailed etiological insights for a tailored approach, but also as a therapeutic modality when combined with interventional manoeuvres such as stone removal, intracorporeal lithotripsy, and ductal dilatation/stretching [7–9]. Besides being highly effective, the morbidity and safety of interventional sialendoscopy are optimal, given the high tolerability of the procedure, which can be performed under sedation even in paediatric patients [10], and the reduced

rate of untoward effects [11]. In addition, (interventional) sialendoscopy has been also proven to be economically viable, as it has been found to be more cost-effective both as a diagnostic and therapeutic option compared with multiple combined diagnostic modalities and traditional medical management in patients with radioiodine-induced sialadenitis [12].

Interventional sialendoscopy combined with repeated ductal steroid irrigations (DSIs) can be used in an integrated therapeutic protocol for the treatment of patients with recurrent inflammatory obstructive sialadenitis (RIOS) [7,9,13], but the actual therapeutic gain offered by DSIs compared to interventional sialendoscopy alone is difficult to quantify. Based on this, we previously documented the positive effect of interventional sialendoscopy combined with DSIs in 54 adult patients with recurrent sine causa sialadenitis, with the finding of better results in terms of reduction in the mean number of salivary gland swelling episodes 6 months after the procedure in the group receiving combined treatment compared to patients undergoing interventional sialendoscopy alone [7].

The aim of this retrospective study is to evaluate the impact of outpatient DSIs as an adjuvant treatment to interventional sialendoscopy in a larger cohort of patients with RIOS and its effectiveness in the medium- and long-term.

2. Materials and Methods

2.1. Study Design and Setting

This retrospective chart review of prospectively recruited patients with RIOS who were treated between January 2019 and December 2020 was carried out at Milan University's Department of Clinical Sciences and Community Health and Department of Biomedical Surgical Dental Science.

The protocol was approved by our local Ethics Committee of Milano Area 2, and it was conducted in accordance with the principles of good clinical practice.

2.2. Study Subjects

The study involved the charts of all adult patients who had attended their first examination at our tertiary outpatient clinic of salivary gland diseases between January 2019 and December 2020 for RIOS, defined as at least two episodes/year of salivary gland swelling and/or pus discharge and inflammatory changes [14].

The patients had been referred to the clinic by their family doctors or other otorhinolaryngological institutes that had dealt with their initial episodes of salivary gland swelling but were unable to manage recurrences effectively.

The exclusion criteria were as follows: previous salivary gland surgery; iatrogenic post-surgical salivary duct stenoses; detection of ductal kinking or type 2 stenoses (including megaducts) according to Koch's classification [15] at diagnostic sialendoscopy; clinical or ultrasonographic detection of salivary gland or ductal stones; and complete distal stenoses not liable to be dilated.

2.3. Interventions

The patients had been managed as previously described [7,13] and according to the protocol shown in Figure 1. On T3, i.e., two weeks since patient allocation to groups as formerly reported [7], the patients underwent diagnostic/interventional sialendoscopy under local anaesthesia with sedation (based on the previously described protocol) [13] (Figure 2). In the event of sialendoscopic detection of type 2 ductal stenoses according to Koch's classification (i.e., stenoses associated with abnormalities within the ductal system, including circular or web-like changes and megaducts) [15], the patient was excluded. Otherwise, patients with evidence of type 1 (i.e., stenoses associated with inflammatory changes in the stenotic area) or type 3 (i.e., stenoses characterized by diffuse fibrotic reaction) stenoses [15] were recruited.

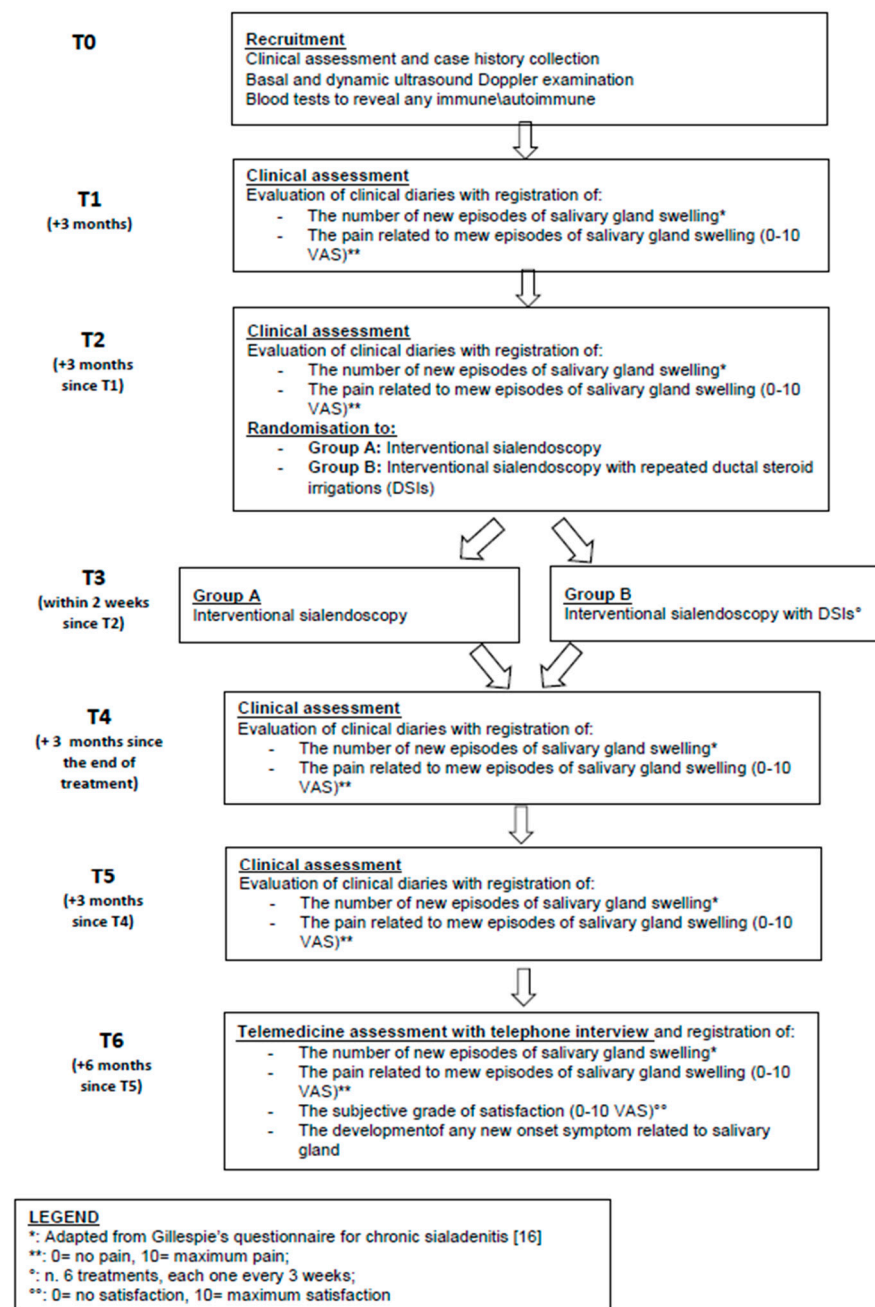


Figure 1. Study flow-chart.

At this point, patients had been randomly assigned in a 1:1 ratio to group A (i.e., interventional sialendoscopy alone) or group B (i.e., interventional sialendoscopy with outpatients DSIs) on the basis of a randomisation list generator.

Patients belonging to group B started DSIs (six treatments as a whole; one session every three weeks) on an outpatient basis about two weeks after interventional sialendoscopy. Based on our earlier protocol [7], the orifice of the duct was dilated by means of a lacrimal probe, and the duct was cannulated with a No. 22–26 G peripheral venous catheter (Venflon, BD Medical, Franklin Lakes, NJ, USA) or a lacrimal cannula (Eagle Labs, Rancho Cucamonga, CA, USA) connected to a 5 mL syringe containing a 2 mL solution of betamethasone, corresponding to two vials of 4 mg/1 mL each.

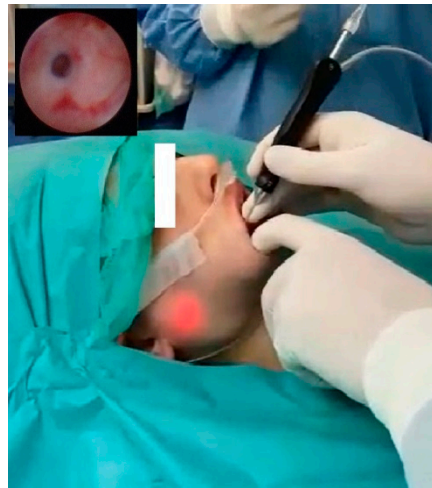


Figure 2. Intra-operative view during a right parotid sialendoscopy (main picture) performed in a patient with recurrent sine causa parotitis; in the small picture, the endoscopic finding of diffuse sialodochitis involving the Stensen's duct.

Post-operative assessment by means of clinical evaluation and examination of clinical diaries was planned three (T4) and six months (T5) after the end of the treatments; a twelve-month post-operative telemedicine evaluation (T6) was also performed to assess the steadiness of results over time and the patients' grade of satisfaction by means of a telephonic interview.

The retrospective chart review considered the patients' demographic and clinical data; the latter included the following: the aetiology of RIOS; the affected gland and side; intra-operative findings at interventional sialendoscopy; the number of episodes, the pain related to episodes of salivary gland swelling before and after treatment (by means of a 0 to 10 visual analogue scale VAS pain), and the subjective grade of satisfaction after treatment (by means of a 0 to 10 VAS satisfaction) (adapted from Gillespie et al.) [16].

2.4. Statistical Analysis

The sample size was computed based on our previous paper documenting the effectiveness of interventional sialendoscopy and DSIs in 54 patients (36 undergoing interventional sialendoscopy alone, and 18 undergoing sialendoscopy and DSIs) with recurrent sine causa sialadenitis, in terms of the reduction in the number of salivary gland swellings [13]. Based on the published data regarding the mean 6-month post-operative number of salivary gland swelling episodes (about 21 and 11, respectively, in the control and study groups) [13], assuming a variance of 10 in the general population, it was calculated that 37 subjects for each group would lead to an alpha value of 0.05 and a power of 99%.

The statistical analysis was mainly designed to detect any possible postoperative differences between group A and B in terms of the number and severity (attested by a 0–10 VAS pain scale) of episodes of salivary gland swelling after treatment.

The results are given as absolute numbers and percentages, or arithmetic mean values $\pm$ standard deviation. Dichotomous outcomes were analysed using contingency table analysis and the Chi-squared test, and continuous variables were analysed using the Wilcoxon–Mann–Whitney test. Multivariate regression analysis was used to test the effect of possible confounders on the outcome. The data were analysed using STATA 10.0 software (StataCorp, College Station, TX, USA); a p -value of <0.05 was considered statistically significant. A Bonferroni-adjusted p -value of 0.0125 was considered for multiple test comparisons.

3. Results

The final analysis was based on the data from 122 charts, which included 43 males (34.1%) and 79 females (65.9%) with a mean age of 55.5 ± 14.2 years, including 60/122 and 62/142 patients belonging, respectively, to group A and B. All patients successfully completed the study, and no dropouts occurred during the follow-up period.

The two study groups were comparable at baseline in terms of demographic and clinical variables, as well as the main intraoperative findings obtained during interventional sialendoscopy (Table 1).

Table 1. Baseline demographic/clinical characteristics and intraoperative findings in the study groups.

	Characteristics	Group A (No. = 60)	Group B (No. = 62)	<i>p</i> -Value	Tot. (No. = 122)
BASELINE FEATURES	Mean age $\pm$ SD, years	56.1 ± 11.4	54.4 ± 18.6	n.s.	55.5 ± 14.2
	Males	27 (45.0%)	16 (25.8%)	n.s.	43 (34.1%)
	Affected gland: parotid	21 (35.0%)	13 (20.9%)		34 (27.9%)
	Affected gland: submandibular	36 (60.0%)	43 (69.3%)	n.s.	79 (64.7%)
	Affected gland: both	6 (6.7%)	6 (9.7%)		10 (8.2%)
	Side: left	29 (48.3%)	29 (48.8%)	n.s.	58 (47.5%)
SIALENDOSCOPIC FINDINGS	Mucous plug	30 (45.2%)	22 (35.5%)		55 (45.1%)
	Sialodochitis	19 (31.7%)	24 (38.7%)	n.s.	43 (35.2%)
	Type 1 or 3 stenoses	13 (21.7%)	15 (24.2%)		28 (22.9%)
	None	6 (10.0%)	9 (14.5%)		15 (12.3%)
	Mean no. of pathological findings	1.3 ± 0.5	1.4 ± 0.5	n.s.	1.3 ± 0.5

Legend: no. = number; SD = standard deviation; n.s. = not significant.

Interventional sialendoscopy was well tolerated in all patients as attested by the mean VAS pain = 3.1 ± 2.3 and the lack of any untoward effects; in no case was the procedure stopped due to the occurrence of unexpected technical difficulties. The most frequent sialoendoscopic finding was a mucous plug (55/122, 45.1%), followed by sialodochitis (43/122, 35.2%), and stenosis (28/122, 22.9%) (Table 1); more than one intraoperative pathological finding was detected in 43/122 (35.2%) of patients. Among the most frequently detected aetiologies were *sine causa* sialadenitis (81/122, 66.4%), sialadenitis related to Sjögren's disease or other autoimmune disease (30/122, 24.6%), and post-actinic/radioiodine sialadenitis (11/122, 9.0%).

DSIs were well tolerated, as documented by the mean VAS pain = 2.1 ± 1.1 ; no complications occurred during the procedure.

Postoperatively, a significantly reduced number of salivary gland swelling episodes (*p*-value = 0.01) was documented in patients belonging to group B compared to those belonging to group A at any follow-up assessment (Table 2 and Figure 3). No significant differences in pain related to episodes of salivary gland swelling were detected between groups (mean VAS pain ranging between 5.9 and 7.1).

Table 2. Mean number of episodes of salivary gland swelling in the study groups in the study period.

Mean No. of Episodes $\pm$ SD	Group A	Group B	<i>p</i> -Value *	Tot.
T1	27.3 ± 38.8	22.1 ± 33.5	n.s.	25.5 ± 37.0
T2	39.5 ± 67.5	43.9 ± 10.3	n.s.	41.0 ± 67.1
T4	10.4 ± 24.5	0.6 ± 0.7	0.011	7.1 ± 20.5
T5	21.9 ± 52.6	1.1 ± 0.9	0.010	15.0 ± 44.0
T6	33.9 ± 87.5	0.6 ± 0.70	0.010	22.8 ± 73.0

Legend: No. = number; SD = standard deviation; n.s. = not significant; *: statistical significance set at 0.0125 based on Bonferroni correction for multiple test comparisons.

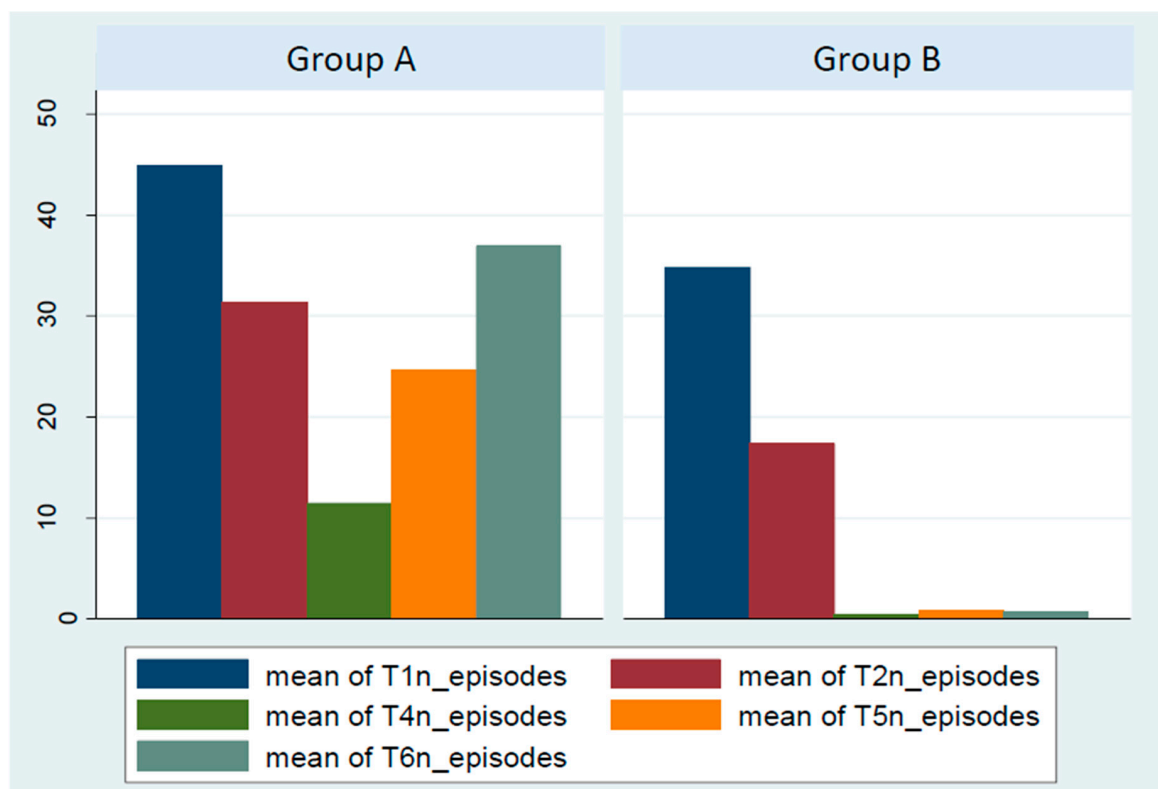


Figure 3. Graphical representation of the mean number of episodes of salivary gland swelling over time.

When subgroup analysis was performed by considering the main diagnostic groups, a significantly reduced number of postoperative episodes of salivary gland swelling after repeated DSIs compared to interventional sialendoscopy alone was found in patients with sialendoscopic evidence of type 1 or 3 stenoses and in those without mucous plugs, at any T (Table 3). These findings were confirmed by multivariate logistic regression analysis, while all the other clinical and demographic variables tested (i.e., age, gender, the affected gland and side, and the number of pathological findings detected at interventional sialendoscopy) were not confounders of the postoperative number of salivary gland swelling episodes (Table 4).

Table 3. Mean number of episodes of salivary gland swelling in the study groups during the study period according to sialendoscopic findings.

Time	Sialendoscopic Finding		Group A	Group B	p-Value
T1	Mucous plugs	Yes	35.7 ± 11.7	13.0 ± 1.0	n.s.
		No	55.6 ± 14.6	36.9 ± 13.1	n.s.
	Sialodochitis	Yes	27.0 ± 12.6	26.9 ± 14.0	n.s.
		No	52.0 ± 11.8	43.5 ± 20.4	n.s.
	Type 1 or 3 stenoses	Yes	42.8 ± 22.1	38.6 ± 17.4	n.s.
		No	39.7 ± 10.1	30.0 ± 16.8	n.s.
T2	Mucous plugs	Yes	25.1 ± 6.7	7.0 ± 0.2	n.s.
		No	38.7 ± 8.3	13.4 ± 6.6	n.s.
	Sialodochitis	Yes	23.8 ± 9.2	13.3 ± 7.1	n.s.
		No	34.4 ± 6.5	21.8 ± 10.2	n.s.
	Type 1 or 3 stenoses	Yes	43.2 ± 12.5	29.2 ± 8.7	n.s.
		No	28.0 ± 5.8	15.0 ± 8.5	n.s.

Table 3. Cont.

Time	Sialendoscopic Finding		Group A	Group B	p-Value
T4	Mucous plugs	Yes	6.9 ± 3.4	1.0 ± 0.1	n.s.
		No	16.9 ± 5.6	0.4 ± 0.1	0.01
	Sialodochitis	Yes	3.5 ± 1.8	0.4 ± 0.1	n.s.
		No	14.7 ± 4.3	0.4 ± 0.2	n.s.
	Type 1 or 3 stenoses	Yes	16.7 ± 7.4	0.4 ± 0.2	0.04
		No	10.0 ± 3.5	0.5 ± 0.1	n.s.
T5	Mucous plugs	Yes	15.7 ± 8.1	0.5 ± 0.3	n.s.
		No	35.1 ± 11.8	0.9 ± 0.2	0.01
	Sialodochitis	Yes	5.7 ± 3.6	0.7 ± 0.2	n.s.
		No	32.3 ± 9.6	1.0 ± 0.2	n.s.
	Type 1 or 3 stenoses	Yes	38.5 ± 16.7	1.0 ± 0.2	0.03
		No	20.7 ± 7.7	0.6 ± 0.2	n.s.
T6	Mucous plugs	Yes	25.5 ± 13.9	1.5 ± 0.5	n.s.
		No	50.5 ± 18.8	0.6 ± 0.1	0.02
	Sialodochitis	Yes	7.0 ± 4.0	0.8 ± 0.2	n.s.
		No	49.0 ± 15.7	0.5 ± 0.2	n.s.
	Type 1 or 3 stenoses	Yes	56.7 ± 28.3	0.6 ± 0.2	0.05
		No	31.4 ± 12.4	0.8 ± 0.2	n.s.

Legend: n.s. = not significant.

Table 4. Results of multivariate regression analysis assessing the impact of sialendoscopic findings on the mean number of postoperative episodes of salivary gland swelling at any T ((A) at T3 assessment, (B) at T4 assessment, and (C) at T5 assessment).

(A)					
Confounders	Coef.	Std. Err.	P > t	[95% Conf. Interval]	
Study group	−13.41	5.76	0.02	−24.88	−1.94
Stenoses	−0.53	5.57	0.04	−11.63	10.57
Sialodochitis	−8.9	5.01	0.08	−18.93	1.02
No mucous plugs	−10.23	5.44	0.05	−21.04	0.64
_cons	19.70	4.93	0.00	9.88	29.53
(B)					
Confounders	Coef.	Std. Err.	P > t	[95% Conf. Interval]	
Study group	−28.56	12.68	0.03	−53.82	−3.31
Stenoses	1.99	12.28	0.05	−22.45	26.44
Sialodochitis	−20.28	11.03	0.07	−42.25	1.69
No mucous plugs	−19.48	11.99	0.04	−43.35	4.39
_cons	40.58	10.87	0.00	18.94	62.22
(C)					
Confounders	Coef.	Std. Err.	P > t	[95% Conf. Interval]	
Study group	−41.56	20.81	0.04	−82.99	−0.13
Stenoses	2.80	20.14	0.04	−37.31	42.91
Sialodochitis	−31.23	18.10	0.09	−67.28	4.81
No mucous plugs	−25.56	19.67	0.03	−64.72	13.60
_cons	59.19	17.83	0.01	23.69	94.69

(A) Dependent variable: no. of episodes on T3; Prob > F = 0.03; R-squared = 0.13; Adj R-squared = 0.08;

(B) Dependent variable: no. of episodes on T4; Prob > F = 0.04; R-squared = 0.12; Adj R-squared = 0.08;

(C) Dependent variable: no. of episodes on T5; Prob > F = 0.05; R-squared = 0.11; Adj R-squared = 0.05.

Overall, a good level of subjective satisfaction was reported by the patients as a whole at the end of treatments (T6), as attested by a mean VAS satisfaction = 7.5 ± 2.8 , with a better outcome attested in patients belonging to group B compared to those in group A (8.4 ± 1.1 vs. 6.9 ± 3.2 ; p -value < 0.01). In addition, the postoperative occurrence of new-onset salivary gland-related complaints was more frequently detected in patients belonging to group A than in those belonging to group B (35/60, 58.3% vs. 16/62, 25.8%; p -value = 0.01).

4. Discussion

Our results confirm the safety and effectiveness of interventional sialendoscopy (both as a single-modality treatment and also when performed as a multimodal approach integrated with repeated DSIs) in a large series of adult patients with RIOS in a short-, medium-, and long-term analysis.

Tolerability of interventional sialendoscopy under local anaesthesia was good, as attested by the mean VAS pain (3.1 ± 2.3) and the non-occurrence of any complications in the whole population. In addition, the surgeons were able to complete the procedure in all cases. Despite it being largely accepted that the morbidity of interventional sialendoscopy is low, some untoward events may occur, including major events such as avulsion of the duct (2%) or, more frequently, minor complications (23%) such as minor ductal lesions, papillary stenoses, or failure to proceed due to ductal stenoses or masseteric blend [17]. In addition, it is known that a progressive learning curve is required both to optimise clinical effectiveness and to reduce the operative time [18]. In fact, it has been reported that some technical difficulties may be encountered in up to 25% of cases when the procedure is performed by non-highly experienced personnel, i.e., those surgeons who have performed no more than 100 sialendoscopic procedures [18]. On the contrary, the occurrence rate of procedural impediments and the mean operative time progressively decrease as the number of patients treated increases. Under these conditions, it is not surprising that, in the present case series, we did not experience any failure, as we have long-term experience with this operation (more than 860 procedures performed by our senior surgeon P.C. in the last 10 years) in our highly specialised second-level facility for the management of patients with obstructive salivary disease (an average of 300 patients treated every year).

Our results document a certain effect of interventional sialendoscopy alone in patients with RIOSs as a whole, as documented by a transient decrease in the number of residual gland swelling episodes in the short term (T4) compared to the baseline, but with a tendency toward worsening over time.

On the contrary, a combined therapeutic protocol (interventional sialendoscopy plus adjuvant DSIs) was found to be superior to interventional sialendoscopy alone in the management of adult patients with RIOS, as attested by a significant difference in the mean number of residual salivary swelling episodes between groups at any time, with a long-lasting positive effect still detectable 12 months after the end of the treatments. These results are particularly remarkable if we consider that our case series included a large portion of patients with complicated disease, as about 34% of the patients treated suffered from repeated inflammation due to systemic autoimmune disease or post-actinic/radioiodine treatment, and that a sialendoscopic pattern suggestive of severe inflammatory and scarring anatomic ductal subversion was detected in most patients, including the presence of multiple intraoperative pathological findings in about 35% of cases.

The documented effectiveness of (interventional) sialendoscopy with DSIs in patients with RIOS has been previously attested [7,9,13,19] in limited case series of patients. In fact, we have reported that (interventional) sialendoscopy with DSIs significantly reduced the number of painful episodes of sialadenitis and subjective symptoms related to oral discomfort in 22 patients with Sjögren's syndrome [13]. In addition, we have also found that the addition of DSIs increased the therapeutic value of (interventional) sialendoscopy in the medium term (i.e., 6 months after the end of the procedure) in 44 adult patients

with recurrent *sine causa* sialadenitis, even though the two procedures were comparable in terms of effectiveness immediately after the end of treatment [7].

In addition, we found that the combined therapeutic approach is considerably more effective than interventional sialendoscopy alone in a peculiar subset of patients, i.e., those with sialendoscopic evidence of type 1 or 3 stenoses, and in those without mucous plugs. This could be related to the fact that a single procedure may be effective in completely removing salivary ductal obstruction in the case of mucous plugs, while in the case of more severe conditions such as salivary duct stenoses, repeated therapeutic sessions may be required to completely rehabilitate salivary patency. The first beneficial effect of DSIs is due to the simple mechanical irrigation of the ducts, which is able to flush out inflammatory mediators, debris, or mucous plugs in the retained salivary secretion. In addition, the larger clinical effectiveness of a combined procedure is probably related to the anti-inflammatory effect of the steroid compound, capable of medicating the ductal mucosa subject to a chronic and persistent inflammatory stimulus and blocking immune stimulation in patients with underlining immune disorder. Reduction in local inflammation involving the salivary duct system would result in decreased oedema of the ductal system, further enhancing salivary outflow.

On the basis of this experience, we now consider the adoption of a combined therapeutic strategy, at least in patients presenting constitutional features or intraoperative findings (i.e., autoimmune disease, post-actinic sequelae, type 1 or 3 stenoses) predisposed to post-operative recurrences. Otherwise, the therapeutic gain derived from a multi-modal therapeutic approach should be weighed against certain unneglectable limits related to DSIs; first of all, the fact that repeated outpatient visits (six sessions, each performed every three weeks) are required—this could be particularly troublesome for some patients, especially during the ongoing COVID-19 pandemic.

Despite these encouraging results, some scientific effort should be used to study, if possible, modifications in the therapeutic plan (i.e., number of sessions, temporal distancing among them, duration) could enhance the effectiveness and stability of the clinical outcomes.

5. Conclusions

Our results confirm the safety and effectiveness of interventional sialendoscopy (both as a single-modality treatment and also when performed as a multimodal approach integrated with repeated DSIs) in a large series of adult patients with RIOS in a short-, medium-, and long-term analysis. Moreover, we have documented the superiority of a combined therapeutic protocol, as attested by a significant difference in the mean number of residual salivary swelling episodes between groups at any time, with a positive effect still detectable 12 months after the end of the treatments. Future studies are welcome to confirm the stability of the results obtained in patients undergoing combined approach over time through the implementation of the follow-up period at 24 months after the end of treatment.

Despite this, the real feasibility of this integrated protocol during the ongoing COVID-19 pandemic could be questionable.

Author Contributions: P.C.: designed the study and reviewed the paper for important intellectual considerations; A.L. and M.G.: data collection; S.T.: data analysis and drafted the paper; L.P.: reviewed the paper for important intellectual considerations. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Milano Area 2 (approval no. 4381 on 24 January 2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available on request due to privacy/ethical restrictions.

Acknowledgments: The paper was granted by the Italian Ministry of Health-Ricerca Corrente 2024 grant.

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

1. Wilson, K.F.; Meier, J.D.; Ward, P.D. Salivary gland disorders. *Am. Fam. Physician* **2014**, *89*, 882–888.
2. Bhatta, M.A.; Piggot, T.A.; Soames, J.V.; McLean, N.R. Chronic non-specific parotid sialadenitis. *Br. J. Plast. Surg.* **1998**, *5*, 517–521. [\[CrossRef\]](#) [\[PubMed\]](#)
3. Capaccio, P.; Torretta, S.; Ottaviani, F.; Sambataro, G.; Pignataro, L. Modern management of obstructive salivary diseases. *Acta Otorhinolaryngol. Ital.* **2007**, *27*, 161–172. [\[PubMed\]](#)
4. Iro, H.; Zenk, J.; Escudier, M.P.; Nahlieli, O.; Capaccio, P.; Katz, P.; Brown, J.; McGurk, M. Outcome of minimally invasive management of salivary calculi in 4,691 patients. *Laryngoscope* **2009**, *119*, 263–268. [\[CrossRef\]](#)
5. Capaccio, P.; Torretta, S.; Pignataro, L. The role of adenectomy for salivary gland obstructions in the era of sialendoscopy and lithotripsy. *Otolaryngol. Clin. N. Am.* **2009**, *42*, 1161–1171. [\[CrossRef\]](#) [\[PubMed\]](#)
6. McGurk, M.; Escudier, M.P.; Brown, E. Modern management of obstructive salivary gland disease. *Ann. Australas. Coll. Dent. Surg.* **2004**, *17*, 45–50.
7. Capaccio, P.; Torretta, S.; Di Pasquale, D.; Rossi, V.; Pignataro, L. The role of interventional sialendoscopy and intraductal steroid therapy in patients with recurrent sine causa sialadenitis: A prospective cross-sectional study. *Clin. Otolaryngol.* **2017**, *42*, 148–155. [\[CrossRef\]](#) [\[PubMed\]](#)
8. Plonowska, K.A.; Ochoa, E.; Ryan, W.R.; Chang, J.L. Sialendoscopy in Chronic Obstructive Sialadenitis Without Sialolithiasis: A Prospective Cohort Study. *Otolaryngol. Head Neck Surg.* **2021**, *164*, 595–601. [\[CrossRef\]](#) [\[PubMed\]](#)
9. Lele, S.J.; Hamiter, M.; Fourrier, T.L.; Nathan, C.A. Sialendoscopy with Intraductal Steroid Irrigation in Patients with Sialadenitis Without Sialoliths. *Ear Nose Throat J.* **2019**, *98*, 291–294. [\[CrossRef\]](#) [\[PubMed\]](#)
10. Capaccio, P.; Palermo, A.; Lucchinelli, P.; Marchesi, T.; Torretta, S.; Gaffuri, M.; Marchisio, P.; Pignataro, L. Deep Sedation for Pediatric Parotid Sialendoscopy in Juvenile Recurrent Parotitis. *J. Clin. Med.* **2021**, *10*, 276. [\[CrossRef\]](#)
11. Jokela, J.; Tapiovaara, L.; Lundberg, M.; Haapaniemi, A.; Bäck, L.; Saarinen, R. Prospective Observational Study of Complications in 140 Sialendoscopies. *Otolaryngol. Head Neck Surg.* **2018**, *159*, 650–655. [\[CrossRef\]](#) [\[PubMed\]](#)
12. Kowalczyk, D.M.; Jordan, J.R.; Stringer, S.P. Cost-effectiveness of sialendoscopy versus medical management for radioiodine-induced sialadenitis. *Laryngoscope* **2018**, *128*, 1822–1828. [\[CrossRef\]](#)
13. Capaccio, P.; Canzi, P.; Torretta, S.; Rossi, V.; Benazzo, M.; Bossi, A.; Vitali, C.; Cavagna, L.; Pignataro, L. Combined interventional sialendoscopy and intraductal steroid therapy for recurrent sialadenitis in Sjogren’s syndrome: Results of a pilot monocentric trial. *Clin. Otolaryngol.* **2018**, *43*, 96–102. [\[CrossRef\]](#)
14. Wang, S.; Marchal, F.; Zou, Z.; Zhou, J.; Qi, S. Classification and management of chronic sialadenitis of the parotid gland. *J. Oral Rehabil.* **2009**, *36*, 2–8. [\[CrossRef\]](#)
15. Koch, M.; Iro, H. Salivary duct stenosis: Diagnosis and treatment. *Acta Otorhinolaryngol. Ital.* **2017**, *37*, 132–141. [\[CrossRef\]](#) [\[PubMed\]](#)
16. Gillespie, M.B.; O’Connell, B.P.; Rawl, J.W.; McLaughlin, C.W.; Carroll, W.W.; Nguyen, S.A. Clinical and quality-of-life outcomes following gland-preserving surgery for chronic sialadenitis. *Laryngoscope* **2015**, *125*, 1340–1344. [\[CrossRef\]](#)
17. Walvekar, R.R.; Razfar, A.; Carrau, R.L.; Schaitkin, B. Sialendoscopy and associated complications: A preliminary experience. *Laryngoscope* **2008**, *118*, 776–779. [\[CrossRef\]](#)
18. Al Hawat, A.; Vairel, B.; De Bonnecaze, G.; Sadeler, A.; Vergez, S. Sialendoscopy learning curve: Comparing our first and last 100 procedures. *B-ENT* **2015**, *11*, 281–285. [\[PubMed\]](#)
19. Schwarz, D.; Stuerme, K.J.; Luers, J.C. The Positive Effect of Sialendoscopy with Irrigation Lavage for Sialadenitis without Sialolithiasis or Stenoses. *ORL J. Otorhinolaryngol. Relat. Spec.* **2018**, *80*, 271–276. [\[CrossRef\]](#) [\[PubMed\]](#)

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.