Original Article

Technique and efficacy of sialendoscopy in the management of recurrent sialadenitis: the Melbourne experience

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Background: The purpose of sialendoscopy is to provide a minimally invasive endoscopic diagnostic and therapeutic intervention as a gland-sparing option to an otherwise open salivary surgical therapy. This paper seeks to review the safety and efficacy of sialendoscopy in the management of salivary gland disease and subsequently outlines the surgical technique for endoscopic evaluation and treatment of recurrent sialadenitis.

Methods: This is a retrospective case series of sialendoscopy and sialendoscopy-assisted procedures performed in the only Victorian centre for sialendoscopy. Demographic data of all adult patients who underwent sialendoscopy between January 2015 and January 2022 at St Vincent's Hospital, Melbourne were obtained. Electronic charts were reviewed for preoperative, intraoperative and follow up measures. Data regarding indications, technique, complication and outcomes were collected.

Results: There were 80 eligible sialendoscopic procedures performed on 75 patients including 55 parotid and 25 submandibular glands. The most common indication was sialolithiasis 54/80 (67.5%), followed by stricture 30/80 (37.5%). Sialendoscopy was used as an adjunct to open techniques in two cases. Transient complications occurred in 13/80 (16.3%) procedures, most commonly creation of a false passage 9/80 (11.3%), all with spontaneous resolution. Mean operative time was 49 minutes. In the 54 patients with radiological evidence of sialolithiasis, 38 (70.4%) were located intraoperatively, and 24 (63.2%) of these had stones successfully retrieved. Just 50/75 patients attended follow up with a mean of 17.2 months. At conclusion of follow up, 21/50 (42%) patients had complete resolution of symptoms and 39/50 (78%) had improved symptoms.

Conclusions: The institutional experience of St Vincent's Hospital, Melbourne over the first 7 years of sialendoscopy would suggest that sialendoscopy is a safe and efficacious procedure in the first instance for stones, strictures, and recurrent sialadenitis. It does not make open surgery obsolete but provides a safe, minimally invasive, gland-preserving alternative for many patients.

Keywords: Sialendoscopy; sialadenitis; sialolithiasis; endoscopic

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Introduction

Background and rationale

Sialendoscopy was introduced for salivary gland ductal disorders in the 1990s and originally used flexible endoscopes, later followed by rigid endoscopes. The technique allows for a minimally invasive approach to the major salivary gland, both parotid and submandibular, by introduction of an advanced optical system transorally into the duct to visually inspect the anatomy and simultaneously intervene if appropriate. Sialendoscopy also has the distinct benefit of gland preservation. Due to the expense of this specialised and delicate equipment, it has been sporadically adopted by the otolaryngological community (1-5). Sialendoscopy is not only of use diagnostically, but can be of therapeutic benefit when combined with other techniques such as stone wire basket retrieval, dilatation of strictures, lithotripsy (external shockwave or transductal laser), minimally invasive intraoral surgery, and as an adjunct to external open approaches (4-8). Indications for sialendoscopy were initially limited to sialolithiasis which are estimated to contribute to 50–66% of presentations of sialadenitis (9), but have expanded to include stenoses/synechiae, polyps, juvenile recurrent parotitis, post radiation sialadenitis, mucus or fibrin plugs, kinks, and radioiodine induced sialadenitis, amongst others (3,8). Sialendoscopy is contraindicated in the setting of acute sialadenitis due to the risk of perforation (1). Multiple systematic reviews have been published on sialendoscopy in the management of salivary gland pathologies, and the broader literature concludes that sialendoscopy is a safe and effective procedure (1,7). St Vincent's Hospital, Melbourne, remains currently the only Victorian sialendoscopy service, fulfilling an area of therapeutic need in the management of salivary gland disorders.

Research question

This paper aims to examine the safety and efficacy of sialendoscopy in the management of salivary gland disease over the first 7 years of the technique's use in Victoria, Australia.

Methods

Study setting and eligibility criteria

This article is presented in accordance with the STROBE reporting guidelines (available at https://www.theajo.com/article/view/10.21037/ajo-24-36/rc). With approval from the Research and Ethics Committee, this is a retrospective case series of adult patients undergoing sialendoscopy procedures at St Vincent's Hospital (Melbourne, Australia) by the two senior authors (B.L., and E.L.).

The hospital database was searched from 1 January 2015 to 1 January 2022 for all patients undergoing diagnostic or therapeutic sialendoscopy. Patients identified were then screened against inclusion and exclusion criteria, as detailed in *Table 1*. Patients were age ≥18 years, sialadenitis was the indication for sialendoscopy, and no previous sialendoscopy had been undertaken.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Human Research Ethics Committee of St Vincent's Hospital, Melbourne (Code: EC00343). Because of the retrospective nature of the research, the requirement for informed consent was waived.

Procedural technique

All procedures were performed under general anaesthesia with oral or nasal intubation, and were given prophylactic cephalexin. The 1.6 mm Sialendoscope (Karl Storz, Tuttlingen, Germany) was used for submandibular duct cases and the 1.1 mm endoscope for parotid duct cases. The papilla of the duct was cannulated and sequentially dilated using the Kolenda introduction system (Cook Medical, Indiana, USA). This process often required the use of loupes or a microscope to clearly visualise the papilla, and saline irrigation assisted in hydrodilatation of the ducts. Once the ducts were accessed, duct pathology was assessed. Dilatation with or without installation of steroids was therapeutic for stenosis. If a stone was located, stone extractors (NCircle® or NGage® nitinol baskets, Cook Medical) were used to grip and withdraw the stone under vision. Preferably, papillotomy was avoided. If the stone was not able to be removed without a papillotomy, it was withdrawn to within about 1 cm of the papilla. A forcep or a 4-0 nylon suture behind the stone assists with a cutdown technique. The stones were removed with the basket still engaged. The sialendoscope was then reintroduced to reinspect the ductal system for residual or synchronous disease and to irrigate. The gland was massaged to clear retained debris or wash. Intraductal steroids, 1 mL of 4 mg/mL dexamethasone, was instilled to reduce postoperative pain and swelling. Papillotomies were not closed, and patients went home on

Table 1 Criteria for patient selection for retrospective sialendoscopy case series

Inclusion criteria
Age ≥18 years old
First sialendoscopy at St Vincent's Hospital, Melbourne
Sialadenitis ≥1 episode
Exclusion criteria
Age <18 years old
Insufficient data in the medical record
Indication was not recurrent sialadenitis
No sialendoscopy attempted (e.g., gland excision only)

Table 2 Characteristics of patients undergoing sialendoscopy

Variable	Value (n=75)
Age (years)	50.1±16
Gender	
Female	43 (57.3)
Male	32 (42.7)
Comorbidities	
Radiation exposure	1 (1.3)
Autoimmune disease	10 (13.3)

Data are presented as mean ± standard deviation or n (%).

the day of surgery.

Data management and statistical methods

All patients included in the study were deidentified using a unique project identification code. The research protocol was consistent with the NHMRC Ethical Considerations in Quality Assurance and Evaluation Activities [2014] guidelines.

STATA 17BE was used for statistical analysis. Fisher's exact test was used for categorical variables, where a P value <0.05 is statistically significant. In patients undergoing both parotid and submandibular duct sialendoscopy, each event was treated as a separate event. Data collected included demographic data, medical history deemed relevant to salivary gland disease, preoperative imaging, intraoperative findings, complications, and postoperative follow up.

Descriptions from operation reports were interpreted, where able, into discrete data points. For instance, the endoscopic views obtained were respectively labelled 'good views' or 'inadequate views', depending on whether the report noted that the ductal lumen was able to be clearly evaluated to at least the first division of the duct, or where the pathology was thought to exist. Cases where the scope was unable to be passed were included in the 'inadequate views' group. If clinical notes from follow-up appointments after sialendoscopy described a subjective reduction in intensity or frequency of patients' symptoms of sialadenitis then they were said to have an 'improvement in symptoms'.

Table 3 Preoperative disease characteristics of patients undergoing sialendoscopy

Variable	Value
Symptom laterality	
Unilateral	70 (93.3)
Bilateral	5 (6.7)
Gland symptoms	
Parotid gland	55 (68.8)
Submandibular gland	27 (33.8)
Imaging	
CT	48 (60.0)
Ultrasound	35 (43.8)
MRI	9 (11.3)
Sialogram	6 (7.5)
Radiological pathology	
Sialolithiasis	54 (67.5)
Size (mm)	4.61±2.1

Data are presented as mean ± standard deviation or n (%). CT, computed tomography; MRI, magnetic resonance imaging.

Results

Eighty sialendoscopic procedures were performed in a total of 75 patients. Patient demographics are detailed in *Table 2*, with patient ages ranging from 18 to 86 years with a mean age ± standard deviation (SD) of 50.1±16 years, a 57.3% female predilection, and 11 patients with comorbidities that affect salivary function (1 previous radiation exposure, and 10 with autoimmune disease). Preoperative disease characteristics are detailed in *Table 3*. All patients had radiological investigation preoperatively; 48 by computed

Table 4 Intraoperative parotid and submandibular gland pathology of patients undergoing sialendoscopy

Gland (n=80)	Number (%)
Parotid (n=55, 68.75%)	
Stone (radiologically)	30 (54.5)
Stone (intraoperatively)	20 (36.4)
Distal duct	6 (30.0)
Proximal duct/hilum	8 (40.0)
Intraparenchymal	6 (30.0)
No stone (intraoperatively)	35 (63.6)
Stricture	28 (50.9)
Sialectasis	3 (5.5)
Sludge/debris	7 (12.7)
Mass	1 (1.8)
No pathology seen	2 (3.6)
Submandibular gland (n=25, 31.25%)	
Stone (radiologically)	24 (96.0)
Stone (intraoperatively)	18 (72.0)
Distal duct	7 (38.9)
Proximal duct/hilum	9 (50.0)
Intraparenchymal	2 (11.1)
No stone (intraoperatively)	7 (28.0)
Stricture	2 (8.0)
Sialectasis	0
Sludge/debris	3 (12.0)
Mass	0
No pathology seen	2 (8.0)

tomography (CT), 35 by ultrasound, 9 by magnetic resonance imaging (MRI), and 6 by sialogram. The stone size, as determined radiologically, varied from 2 to 10 mm with a mean ± SD of 4.61±2.1 mm; 70 (93.3%) patients had unilateral symptoms, with 55 (68.8%) of those being parotid rather than submandibular gland. Intraoperative pathology is detailed in *Table 4*; 54/80 (67.5%) patients had sialendoscopy performed for a radiological history of stones, and 16 of those patients (29.63%) did not have stones located intraoperatively. When stones were located, they were most frequently encountered in the proximal end of the duct or in the gland hilum (40% in parotids versus 50% in the submandibular gland). Strictures were found in 28 parotids (50.9%) versus 2 submandibular glands (8%), sialectasis was found in 3 parotids (5.5%) versus no submandibular glands, and no pathology was found in 2 parotids (3.6%) versus 2 submandibular glands (8%). *Table 5* demonstrates intraoperative factors for patients who had stones identified during sialendoscopy. Of 38 patients who had stones seen intraoperatively, 24 patients (63.16%) had stones successfully retrieved. Stone size was not significantly associated with successful retrieval, and the largest stone retrieved was 10 mm in size. Good views during sialendoscopy were significantly associated with higher rates of stone retrieval (P=0.018), and, as one would expect, an inability to cannulate or pass the scope is significantly associated with lower rates of stone retrieval (P=0.002). Papillotomy or cut down were significantly associated with improved retrieval outcomes (P<0.0001) and were undertaken in 21/24 (87.5%) of successful stone retrievals.

Intraoperative surgical factors are detailed in *Table 6*. Operative time was a mean of 49.3 minutes, but was highly variable (SD 30 minutes). Interventions included instillation of steroid for 14 (17.5%) cases, papillotomy or cut down in 26 (32.5%) cases, and attempted basket retrieval in 25 (31.3%) cases. Good views were achieved in 49/80 (61.3%) of the procedures which were undertaken, and 26/80 (32.5%) did not result in the scope successfully being passed into the duct. These latter cases were either abandoned, or more often proceeded to at least dilatation of the papilla; undertaken in 71 cases (88.8%). False passages were made in 9 (11.3%) cases, or tears to the papilla or duct in 2 (2.5%) cases, which had no lasting consequences; 2/80 cases converted to gland excision intraoperatively, and 6/80 glands (7.5%) went on to be removed with open surgery at a later date.

Follow up

Thirty-four patients were planned for follow up in St Vincent's Hospital, Melbourne, and 41 were planned for private follow up. 50 patients (26 public, 24 private) had reliable documentation of their outcomes at follow up. The mean follow up duration for those who were seen was 17.2±12.3 months.

At the end of follow up there was a complete resolution of symptoms in 21/50 (42%), at least some improvement of symptoms in 39/50 (78%), and ongoing symptoms of sialadenitis requiring additional appointments or

Table 5 Associated intraoperative factors for patients who had stones identified while undergoing sialendoscopy

Variables	Stones identified intraoperatively (n=38)	Retrieved (n=24)	Not retrieved (n=14)	P value[1]
Stone size (mm)	4.75±2.26	4.57±1.86	4.86±2.51	0.716
Sialendoscopy: parotid	19 (50.0)	12 (50.0)	7 (50.0)	>0.99
Sialendoscopy: submandibular gland	19 (50.0)	12 (50.0)	7 (50.0)	0.737
Good views	31 (81.6)	23 (95.8)	8 (57.1)	0.018*
Unable to cannulate/pass scope	8 (21.1)	1 (4.2)	7 (50.0)	0.002*
Dilation	33 (86.8)	21 (87.5)	12 (85.7)	>0.99
Papillotomy or cut down	23 (60.5)	21 (87.5)	2 (14.3)	<0.0001*
Basket	25 (65.8)	17 (70.8)	8 (57.1)	0.486
Aborted	5 (13.2)	0	5 (35.7)	0.004*

Data are presented as mean ± standard deviation or n (%). [1], Fisher's exact test; *, P value <0.05 is statistically significant.

Table 6 Intraoperative surgical factors for patients undergoing sialendoscopy

Surgical factors	Value
Operative time (minutes)	49.3±30
Endoscopic views achieved	
Good views	49 (61.3)
Inadequate views	31 (38.8)
Unable to pass scope	26 (32.5)
Interventions	
Dilation	71 (88.8)
Steroid instilled	14 (17.5)
Papillotomy or cut down	26 (32.5)
Basket	25 (31.3)
Conversion to gland excision	2 (2.5)
Complications	
False passage	9 (11.3)
Tear	2 (2.5)
Mechanical complication	2 (2.5)
Aborted	10 (12.5)
Lingual nerve injury	0

Data are presented as mean ± standard deviation or n (%).

intervention in 23/80 (28.75%). There was no significant difference in symptomatic outcome between the two glands, with 11/14 (78.6%) of submandibular procedures and 28/36 (77.8%) of parotid procedures resulting in a symptom improvement (P>0.05).

Discussion

This was a retrospective study of the first 7 years of the adoption of sialendoscopy at St Vincent's Hospital, Melbourne. Like any new technique, a learning curve is scaled and a review of the data sheds light on the safety and efficacy of this procedure.

Sialolithiasis is typically more common in the submandibular gland rather than the parotid gland, and only rarely seen in the minor salivary glands (2%) (9,10). Inflammation has traditionally been managed by either conservative medical treatment or open techniques requiring an incision or excision and subsequent risk to important neurovascular structures; in particular the lingual, hypoglossal, and marginal mandibular nerves for the submandibular gland, and the facial nerve, auriculotemporal nerve branches, and great auricular nerve for the parotid gland. Despite the relatively high incidence of submandibular sialolithiasis (*Table 4*), more parotid sialendoscopies were performed at St Vincent's Hospital, Melbourne. This could be due to many reasons but the authors postulate that submandibular diseases are still widely treated with open procedures effectively in the community and hence the technically more difficult parotid diseases are being more commonly referred for tertiary care. Scar, rather than stone disease, is the more common aetiology in the parotid (75%) (3).

It was observed that papillotomy or cut down was required in 21/24 (87.5%) of successful stone retrievals. The reason for this requirement is the size of the salivary ducts, with one published study demonstrating a maximum diameter of 2.3 mm for the parotid duct, and 2.2 mm for the submandibular duct, and both ducts having their minimum width located at the ostium (11). This, in comparison to the mean ± SD stone size of 4.75±2.26 mm which was encountered in this study, suggests that it is unlikely that basket retrieval without further adjuncts would have been possible. There is a statistically significant association with papillotomy or cut down procedure with a successful stone retrieval in this study, but rather than suggesting they should be performed more frequently, this likely reflects that when these techniques were used a stone was able to be visualised, have a basket deployed around it, or the stone was palpable. The experience of this study is consistent with required rates of papillotomy or duct intervention in the literature, but is higher than that of many published rates where lithotripsy techniques were available, with one such study reporting a requirement in 55/110 (44.6%), half the rate of this series (12). It is likely that with the ability to fragment stones to smaller sizes using lithotripsy, fewer papillotomies or cut downs would have been required in this study, and thus some publications recommend use of fragmentation techniques in stones of size 3–6 mm (6,13). Dexamethasone irrigation has evidence in reducing intraglandular inflammation and in reducing severity of recurrent parotid sialadenitis (14), but was only used in 17.5% of cases in this study, owing to the fact that the interventions were personalized for each patient. This can make conclusions about the efficacy of a standardized treatment difficult to draw.

In this study, 16/54 (29.63%) patients who were suspected to have calculi radiologically did not have stones identified or extracted intraoperatively, which is likely due to difficult access (inability to pass scope, or cannulation of smaller secondary or tertiary ducts), or previously passed stones. An ability to cannulate or pass the scope, and good intraoperative views of the ductal system were factors which had statistically significant associations with successful stone retrieval in this study. A less likely reason for inability to locate radiologically present stones would be diagnostic inaccuracy with the specificity of MRI, ultrasound, and sialography for sialolithiasis all reported to be above 80% (15). Given public health demands, preoperative imaging was performed at multiple different centres in the community and the duration between imaging and actual operation may have been many months. On the other hand, 63.2% of patients who had calculi identified intraoperatively had successful removal, which is lower than other published data of around 70–90% (3,8). This may be in part due to lack of access to lithotripsy. Despite an unsuccessful stone extraction, some patients had symptom relief, while others went on to have gland removal surgery (6/80, 7.5%).

Regarding symptom improvement, the literature reports 84–89% improvement (8,16) after sialendoscopy, in comparison to the findings of this study which is 78%. This symptom relief is most certainly significant for a patient who has undergone a minimally invasive sialendoscopic treatment, given the fact that the alternative is an incision and drainage or open excision of the diseased gland or duct. Symptom improvements for submandibular gland disease versus parotid disease were not significantly different. A study population with 1.3% radiation exposure and 13.3% rates of autoimmune disease (*Table 2*) should be generalisable to the broader population suffering from sialadenitis.

The initial management of sialadenitis due to obstructive pathologies typically begins with conservative therapies. If these are ineffective, sialendoscopy should be considered the next step, and if necessary, more invasive open surgical techniques may be pursued. In situations with large obstructing calculi (>10 mm) proceeding to open techniques after the acute inflammation has settled may be pragmatic, however in this series, stones up to 10 mm were successfully removed with the assistance of a sialendoscope and papillotomy.

Sialendoscopy is unlikely to replace the role of open procedures in all situations. However, in the right patient with the right pathology, sialendoscopy can be an effective gland-preserving intervention. The procedure was found to be safe and effective for the majority of this cohort of patients. Although there was a 16.25% intraoperative complication rate (13/80), they were transient and minor, such as a false passage or ductal tear, which are both easily identified and self-resolving. Of note, there was no bleeding, haematoma, infection, traumatic ranulas or neuropraxia/neuropathy.

Limitations of the study include its retrospective nature, a relatively low sample size, and poor rate of long term follow up. Patients often did not attend follow up, or were discharged from clinic if their symptoms resolved after the first postoperative visit, which further lessens the sample size and makes association with symptom-improvement more difficult to derive. Being symptom-free in the short term

does not always predict being symptom-free long term (8). Standardised validated follow up questions were not available or utilised, leading to subjective interpretation of patient symptoms. With a 78% symptom-improvement rate (39/50) it was assumed therefore that at time of follow up, they did not necessitate further therapies. These patients were spared open ablative procedures and their associated morbidities.

Conclusions

With a mean operative time of 49 minutes, a transient self-resolving minor complication rate of 16% and a symptom relief rate of 78%, the experience of St Vincent's Hospital, Melbourne, over the first 7 years of sialendoscopy would suggest that sialendoscopy is a safe and efficacious procedure in the first instance for stones, strictures and recurrent sialadenitis. It does not make open surgery obsolete in any way but provides a safe, minimally invasive, gland-preserving alternative for many patients.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://www.theajo.com/article/view/10.21037/ajo-24-36/rc

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://www.theajo.com/article/view/10.21037/ajo-24-36/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Human Research Ethics Committee of St Vincent's Hospital, Melbourne (Code: EC00343). Because of the retrospective nature of the research, the requirement for informed consent was waived.

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