Sialendoscopy combined with transoral sialodochoplasty for treatment of parotid duct stenosis with megaduct

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Abstract

Objectives: Despite advances in the surgical treatment of parotid duct stenosis, it remains a surgical challenge. This study aimed to analyze the surgical outcomes of sialendoscopy combined with transoral sialodochoplasty for the treatment of patients with parotid duct stenosis with megaduct in parotid glands. Design: Retrospective cohort study Setting: Academic tertiary medical center Participants: This study included 13 patients with chronic obstructive sialadenitis caused by type 2 parotid duct stenosis who underwent sialendoscopy with transoral sialodochoplasty. Main Outcomes and Measures: All patients completed a three-point Likert-type rating scale 3 months postoperatively. Radiologic evaluation using magnetic resonance (MR) sialography was performed to evaluate megaduct diameter. Thirteen glands underwent sialendoscopy combined with transoral sialodochoplasty. Results: At 3 months after surgery, six (46.2%) glands showed complete resolution, and seven (53.8%) showed partial resolution of obstructive symptoms. Megaduct diameter between pre- and postoperative MR sialography significantly decreased after transoral sialodochoplasty (8.05 ± 2.675 vs. 4.15 ± 2.400, P = 0.028). Saliva excretion was improved after the transoral sialodochoplasty, as the distal ducts were visualized with sialagogues postoperatively. Conclusions: Type 2 parotid duct stenosis can be successfully treated with sialendoscopy combined with sialodochoplasty. In cases of large megaduct, transoral sialodochoplasty appears to offer benefits of reducing the diameter of dilated megaducts and improving salivary outflow.

INTRODUCTION

Salivary duct stenosis is the second most common (15 to 50%) cause of chronic obstructive sialadenitis following sialolithiasis.[1] It is associated with chronic inflammatory changes induced by allergy, stones, post-retrieval of stones, trauma, autoimmune, and radioiodine therapy.[2,3] These conditions often lead to reduced salivary flow, ascending duct infection, and formation of mucous or fibrous plaques and stricture in salivary gland ducts.[4] Patients with salivary duct stenosis typically present with recurrent swelling, pain, or discomfort of the affected glands that is frequently aggravated during or between meals.[5]

Salivary duct stenosis commonly involves the parotid glands (67 to 75%).[6] Sialendoscopy allows direct examination of the tissue characteristics of stenotic lesions in the parotid ducts. Koch*et al* . described three types of stenosis as follows: inflammatory (type 1), web-like or circular (type 2), and fibrotic or diffuse (type 3) luminal narrowing.[7,8] Type 1 appears to be a precursor of type 3 stenosis, showing a progressive diffuse narrowing in the segmental or entire duct.[7] In contrast, type 2 stenosis typically tends to form a focal stricture accompanied by a megaduct with a thin wall due to dilation secondary to mechanical obstruction. Patients with type 2 stenosis often feel their cheek swelling while eating, owing to the pooling of saliva

in the reservoir-like megaduct. The stenotic duct can also be classified into grade 1 (swollen but minimal narrowing), grade 2 (luminal narrowing < 50%), and grade 3 (luminal narrowing [?] 50%) according to the luminal narrowing severity based on sialendoscopic visualization.[9] The stenotic lesions of type 2 stenosis accompanied by a megaduct commonly show higher grades of narrowing, while types 1 and 3 exhibit varying grades of stenosis.[7,10]

Dilation of the stenotic duct is the primary treatment goal for relieving patients from obstructive symptoms, although conservative care with sialagogue and gland massage sometimes benefit patients with chronic obstructive sialadenitis caused by autoimmune or radioiodine therapy.[11,12] The sialendoscopic approach is safe and effective for treating patients with salivary duct stenosis, with satisfactory clinical outcomes for relieving symptoms.[4,13,14] However, resolving the stenotic ducts remains a surgical challenge when sialendoscopy fails to dilate the stenotic lesions mechanically. The so-called transoral (pull-through) sialodochoplasty, a surgical technique to remove the stenotic portion of an involved duct and connect the remaining duct to the buccal mucosa, has been described in several reports.[15-17] However, the efficacy of transoral sialodochoplasty has not yet been investigated. This study aimed to analyze the surgical outcomes of sialendoscopy combined with transoral sialodochoplasty through the evaluation of changes in obstructive symptoms, characteristics in the stenotic lesion with a megaduct, and excretory salivary flow of patients with type 2 stenosis in parotid glands.

MATERIALS AND METHODS

Ethical considerations

The institutional review board approved this retrospective study and waived the requirements for informed patient consents.

Participants

Patients who underwent salivary ductal surgery (sialendoscopy with sialodochoplasty) from March 2017 to March 2019 were retrospectively identified from our database. Stenosis of salivary gland ducts was objectively confirmed by either ultrasonography or magnetic resonance (MR) sialography. Patients with type 2 stenosis in the Stensen duct, which indicates a focal stricture and accompanying megaduct on preoperative radiologic evaluations, were then selected. Patients who did not respond to conservative care, including gland massage, pain medications, and sialagogues, received salivary ductal surgery. Among them, patients with accompanying sialolithiasis or any other underlying causes, such as Sjogren's or previous radioiodine therapy, were excluded; only cases of idiopathic salivary duct stenosis were finally enrolled in this study. Patients who underwent sialendoscopy or any other salivary gland surgery within the past 1 year were also excluded.

Surgical techniques

The surgical procedures were performed under general anesthesia with nasotracheal intubation. A mouth prop was inserted in the contralateral side of the lesion, and a cheek retractor was placed to provide a full view of the buccal space. Salivary dilators were used to locate and dilate the orifice of the Stensen duct. Then, a 1.3-mm (diameter) sialendoscope (Tuttlingen, German, Karl Stroz, Germany) was inserted into the duct. The duct was irrigated with normal saline to flush debris, dilate the duct, and identify any areas of ductal obstruction. When the stenosis was identified, mechanical bougination was attempted using the sialendoscope itself and any other available microinstruments, such as baskets or balloons. The sialendoscope could be advanced into the portion of the megaduct when the stenotic lesion was successfully dilated. However, the transoral sialodochoplasty was combined with sialendoscopy when sialendoscopic findings suggested high-grade strictures at high risk of recurrence or complication, and the stenotic portion was distally located so that the dilated duct could be pulled to connect with the oral mucosa. A circumferential incision was made around the orifice after checking the type and stenosis grade using a sialendoscope. Dissection was performed with Metzenbaum scissors to identify the duct and to skeletonize the distal part of the Stensen duct from the buccinators muscle and surrounding soft tissues. After finding the stenotic lesion and accompanying megaduct, dissection was performed carefully to avoid perforating the dilated ductal wall and to release the

duct from the buccal space (Fig. 1A). The megaduct was then pulled into the oral cavity. The duct was incised with a #15 blade onto the megaduct wall, forward in the longitudinal direction (Fig. 1B). The duct distal to the stenotic area was excised, and the wall of the megaduct was then sutured to the surrounding buccal mucosa with 4.0 Vicryl sutures (Fig. 1C and 1D). Sialendoscopy confirmed the integrity of the duct, and a salivary stent was inserted and sutured with adjacent buccal mucosa. A salivary duct stent was placed through a neo-orifice and was maintained for 2 weeks post-operation. After stent removal, all patients were instructed to massage the parotid glands after stimulation with sialagogues.

Assessment of symptoms

Pre-operative symptoms were assessed by interviews during each patient's first visit and were documented in the medical records. Post-operative symptoms related to obstructive symptoms, such as swelling and discomfort or pain during or between meals, were assessed based on a three-point Likert-type scale 3 months postoperatively. Treatment outcomes were classified into three scales as follows: obstructive symptoms completely subsided (complete resolution), symptoms partially improved (partial resolution), or symptoms not changed or worsened (non-resolution).

Radiological and functional evaluation

MR examinations were performed using a 3.0T MRI scanner (Discovery 750W; GE Healthcare, Milwaukee, WI) equipped with a quadrature head coil. The MR sialographic visualization of salivary ducts was performed on each parotid gland before and after stimulation with a sialagogue. The MR sialography findings including duct visualization, sialectasis, main duct stenosis, and gland volume were reviewed using defined criteria. The largest diameter of the megaduct portion was measured on pre- and postoperative MR images, and the pre- and postoperative values were compared. Pre- and postoperative salivary excretory flow was compared between the two groups. The postoperative visualization of the distal duct beyond the stenotic portion was considered as improved excretory flow through the site of stricture. However, if the distal duct was not visualized with a sialagogue after surgery, it was considered as no improvement in saliva excretion.

Statistical analysis

Statistical analysis was performed using SPSS (SPSS Inc. Released in 2009, PASW Statistics for Windows, Version 18.0. Chicago). Two-way repeated measures of ANOVA were used to assess variables associated with postoperative patient satisfaction. Mann-Whitney U test and Wilcoxon singed rank test were used to compare pre- and post-MR sialography. The null hypotheses of no difference were rejected if P values were less than 0.05 or equivalently if the 95% confidence intervals (CIs) of risk point estimates were excluded.

RESULTS

Of the 349 patients who underwent sialendoscopy from March 2017 to July 2019, 27 patients (35 glands) had type 2 stenosis of the Stensen duct. Among them, 13 patients (13 glands) underwent combined transoral sialodochoplasty and were finally enrolled. Patient ages ranged from 13–68 years (median 52 years), and there were seven males (54%) and six female patients (46%). All 13 patients presented with swelling of the affected salivary gland, which was accompanied by pain in one patient and discomfort in two patients. At 3 months post-operation, six (46.2%) patients reported no remaining symptoms (complete resolution), and seven (53.8%) patients reported partial improvement of symptoms (partial resolution). All of the patients were observed to have neo-papillae that became epithelized on the buccal mucosa. The size of neo-orifices decreased over time, but was patent as a neo-orifice during follow-up (Fig. 2). At 3 months post-operation, MR sialography was performed again to evaluate changes in the stenotic portion and accompanying megaduct (Fig. 3). Megaduct diameters between pre- and postoperative MR sialography significantly decreased after transoral sialodochoplasty (8.05 ± 2.675 vs. 4.15 ± 2.400, $P = 0.028$). In addition, we found that saliva excretion was improved after the combined sialodochoplasty, as the distal ducts were visualized with sialagogues postoperatively (Fig. 3). However, saliva stasis mostly remained in the dilated ducts, probably because the thin walls of the megaducts could not fully recover their contraction ability, even after the operation.

DISCUSSION

Sialendoscopy has enabled the assessment of ductal features and disease status of diverse obstructive sialadenitis and changed the therapeutic modality in salivary duct stenosis to gland-preserving minimally invasive surgery.[4,8] In a previous study, we evaluated the prognostic factors related to sialendoscopy in 47 patients with parotid duct stenosis who underwent sialendoscopic dilation as an initial treatment.[13] We found that sialendoscopy was clinically satisfactory in relieving the symptoms of patients with parotid duct stenosis. However, stenosis type and grade were significantly associated with the success of the sialendoscopic procedure. For instance, some patients with type 2 stenosis did not respond to the sialendoscopic treatment and received revision surgery. These results prompted us to investigate the therapeutic efficacy of sialendoscopy combined with sialodochoplasty for treatment of type 2 stenoses and to clarify the indications for each surgery in type 2 stenosis.

In this study, we included type 2 stenosis cases that were radiologically diagnosed, and all cases were confirmed as having type 2 stenosis based on sialendoscopic findings during operations. Parotid duct stenoses encompass different types of stenosis in the duct, in which type 2 stenosis features a focal web-like stricture and accompanying megaduct.[7] Whereas type 1 inflammatory stenosis may be a precursor form of type 3 fibrotic stenosis, a focal web-like stenosis accompanying megaduct appears to be a distinct type with a different underlying pathogenesis that is not yet fully understood.[7] MR sialography is now being considered a preferred technique for the detection of salivary duct stenosis, owing to its non-invasive nature and non-exposure of radiation.[18] Sialendoscope-based visualization is also needed because tissue characteristics of the residual duct are important for defining different types of stenosis in addition to the feature of stenotic portion. Furthermore, the radiologically diagnosed stenosis may not always correspond with sialendoscope-based stenosis, as MR sialography cannot exclude false-positive findings, such as physiologic narrowing.

Different treatment strategies have been proposed for various types of stenosis and sialendoscopic dilation has become the first-line treatment for type 2 stenosis. In contrast, types 1 and 3 stenoses allow for conservative care, including sialagogue, gland massage, intraductal saline or steroid instillation, and botulinum toxin injection.[10] Salivary duct stenosis can be treated by dilation using the sialendoscope itself by increasing the diameter of the sialendoscope, and also by using various instruments, such as dilators, balloons, and bougies.[19] Focally-located, low-grade strictures, and strictures in the distal duct may be the best indications for sialendoscopic dilation. However, diffuse stenoses, high-grade strictures, or inaccessible stenoses in the proximal to mid-duct remain a sialendoscopic challenge.[13] An attempt can be made to create an opening using a micro drill with a guide wire in high-grade stenoses in which endoscope fails to enter the proximal lumen over the stricture. However, it often poses a high risk of recurrence and sometimes complications, such as ductal perforation.

Transoral sialodochoplasty can be an additional treatment option if the stricture is located in the distal duct based on preoperative radiologic examinations and if sialendoscopic findings are suggestive of high-grade strictures with a high risk of failure or complication.[16,19] In this study, excision of the distal duct, including the stenotic portion, and the creation of a neo-orifice allowed obstructive symptom improvement (complete resolution in 46.2% and partial resolution in 53.8%) in patients, and no recurrence was observed during follow-up. Moreover, widened neo-papilla decreased in size over time and remained well-maintained during follow-up without re-stricture (Fig. 2). We also compared pre- and postoperative changes in the megaduct diameter and excretory salivary flow. Intriguingly, postoperative MR sialography showed that the diameter of megaducts significantly decreased after the transoral sialodochoplasty, and some of the patients (71.4%) returned to almost normal levels. MR sialography showed salivary gland ducts more clearly after the operation, owing to the increases in saliva excretion after stimulation with sialagogues. Although the distal duct beyond the stenotic portion could be visualized after the transoral sialodochoplasty, most patients still showed saliva stasis, probably as the thin walls of the megaducts could not fully recover the naïve contraction ability.

Sialendoscopic dilation is the only feasible technique when the stenotic portion is proximally located and when the dilated duct cannot be pulled to connect with the oral mucosa. Recently, an external combined approach using excision with end-to-end anastomosis or excision with an intervening vein graft has been introduced

to treat cases of long segments of type 3 stenosis or when sialendoscopic dilation fails.[20] Further studies are needed to investigate the efficacy of combined techniques (transoral or transfacial sialodochoplasty) for gland-preserving management of salivary duct stenosis.[21]

This study had some limitations. First, due to its nonrandomized retrospective design, the study could not prevent selection bias related to the indications of the procedure. Second, the low number of patients and short follow-up period of this study did not allow for a conclusive analysis regarding the efficacy and recurrence of procedures, although, to date, we have not found any recurrences in our sialodochoplasty cohort. Nevertheless, we have demonstrated that transoral sialodochoplasty is a useful procedure for improving salivary excretory flow and repairing dilated duct, especially in type 2 parotid duct stenosis with a megaduct.

In conclusion, we suggest that type 2 parotid duct stenosis can be successfully treated with sialendoscopy combined with transoral sialodochoplasty, which is recommended for patients with severe degrees of distal stricture accompanying a large megaduct and consequently decreased excretory salivary outflow. Further long-term, randomized studies are required to compare the benefits and drawbacks of sialendoscopy versus sialodochoplasty for the treatment of various types of stenosis.

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FIGURE LEGENDS

Figure 1. Surgical procedure of transoral sialodochoplasty. A. Stenotic portion and accompanying megaduct (asterisk) are pulled into the oral cavity after circumferential incision around the papilla and dissection along the parotid duct. B. Stenotic lesion (arrow) is exposed with an incision onto the ductal wall. C. Excised distal duct with stenotic lesion. D. Creation of neo-orifice by suturing the wall of the megaduct onto the buccal mucosa.

Figure 2. Post-operative changes in a neo-orifice after transoral sialodochoplasty. A. Immediately after operation. B. Post-operative 1 month. C. Post-operative 3 months. Arrow indicates formation of neo-papilla.

Figure 3. Pre- and postoperative magnetic resonance (MR) sialographic findings of parotid duct stenosis with secondary dilated megaducts between pre- and post-transoral sialodochoplasty. A. Pre-operative MR sialographic image depicts parotid duct stricture with an accompanying megaduct (asterisk). B. Arrow indicates visualization of the distal duct after operation, suggesting improvement in saliva excretion through the previous stricture site.