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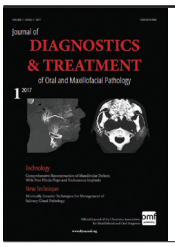

Minimally Invasive Techniques for Management of Salivary Gland Pathology

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ABOUT ARTICLE

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ABSTRACT

Purpose.
The goal of this article is to describe the technique used at our institution and highlight potential pitfalls during sialendoscopy.
Discussion.
Indication for sialendoscopy, sialendoscopy technique are discussed.
Results.
Despite the high reported success rates with sialendoscopy, the procedure is deemed to be technically challenging and correlation between success rates and operator experience has been shown.
Conclusion.
Sialendoscopy is a minimally invasive technique that is gradually replacing the classic open surgical approach to the treatment of obstructive salivary gland diseases as the standard of care.

Introduction

Obstructive salivary gland disease is common and regardless of etiology historically it has been treated with gland excision. Although removal of the gland results in complete symptom resolution, the surgery itself carries inherent risks. Depending on which major salivary gland is involved the risks range from minor cosmetic defects to major complications such as facial nerve damage or airway compromise. These considerations encouraged the development of minimally invasive approaches in order to avoid surgical gland resection.

Sialendoscopy takes advantage of the naturally present salivary gland duct orifice thus obviating the need for surgical incisions. Small endoscopes may be utilized to examine and assess the pathologic process within the ductal system, i.e. diagnostic sialendoscopy, as well as intervene as indicated, i.e. therapeutic sialendoscopy. Use of endoscopes to remove a sialolith was first described by Katz in 1991 (Katz, 1991) [1]. Following the introduction of this technique numerous authors have reported success utilizing sialendoscopy for a wide range of indications. In addition to removal of sialoliths, it has been used for retrieval of foreign objects (Nahlieli, Nakar, Nazarian, & Turner, 2006) [2], breaking up of adhesions (Ardekian, Shamir, Trabelsi, & Peled, 2010) [3], treatment of juvenile recurrent parotitis (Singh & Gupta, 2014) [4], and radio-iodine induced and autoimmune sialadenitis (Atienza & Lopez-Cedrun, 2015) [5].

The purpose of this article is to describe the technique used at our institution and highlight potential pitfalls during sialendoscopy.

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Discussion

Sialendoscopy is indicated in any situation where there is a physical obstruction to the salivary outflow that eventually results in inflammatory or infectious processes within the gland parenchyma. Therefore, patients most commonly present with complaints of painful facial or submandibular swelling that may also be associated with overlying skin erythema and systemic fever, especially during or after meals. Complete assessment consists of history, physical exam, including an attempt to "milk" a salivary gland, and imaging. The imaging modalities used include plain radiographs, ultrasound, non-contrast CT (Fig 1), and MRI (Hitti, Salloum, & Mufarrij, 2014) [6]. Plain radiographs and US are adequate to assess a minimally symptomatic patient with no suspicion of retrotropharyngeal or parapharyngeal abscess formation. Non-contrast CT allows visualization of deep neck spaces as well as provides sufficient gland tissue detail, has 100% sialolith detection sensitivity (Hitti et al., 2014) [6] and can be quickly obtained, thus making it a good choice of imaging in

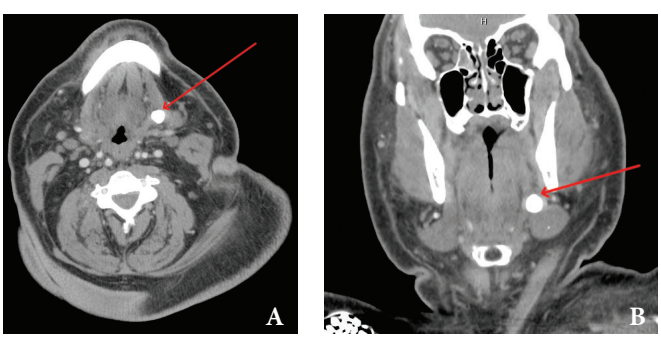

FIGURE 1. Non-contrast CT images (**A**, **B**) with *arrows* pointing to sialolith in the left submandibular gland duct (Wharton's duct).

patients who are suspected to have more extensive disease.

Several different types of etiologies lead to the same obstructive symptomology but may require different therapeutic approaches. Intraluminal obstruction of the salivary gland ductal system most frequently is due to sialolithiasis (Marchal et al., 2001) [7] with submandibular gland being affected 80% of the time and parotid gland involved in 20% (Zenk et al., 2012) [8]. Small size of the sialolith, oval shape, mobility and distal location within the duct were determined to be positive prognostic factors for simple removal (Luers, Grosheva, Stenner, & Beutner, 2011) [9]. Specifically, it has been shown that simple removal of 3mm stones from parotid gland and 4mm stones from submandibular gland can be easily achieved with wire baskets, mini graspers, or forceps (Marchal et al., 2001) [7]. Where a stones of larger diameter, up to 8-9mm, require fragmentation by either direct instrumentation or lithotripsy (Zenk et al., 2012) [8]. Ductal mucous plugs and less commonly foreign bodies such as tea leaves and hair were reported (Nahlieli et al., 2006) [2]. Ductal strictures have also been implicated as a cause of recurrent sialadenitis and their incidence was thought to be underestimated (Ardekian et al., 2010) [3]. Etiology of ductal strictures is not well defined, although it is assumed to be the result of epithelial healing after traumatic, infectious, or recurrent inflammatory insults (Ardekian et al., 2010) [3].

Sialendoscopy Technique

After appropriate patient selection and review of relevant pre-operative images, parotid and submandibular sialendoscopy can be performed either under general endotracheal anesthesia (GETA), intravenous sedation, or local anesthesia. It has been shown that patients with no co-morbidities and small sialoliths tolerate sialendoscopy under local anesthesia well (Luers, Stenner, Schinke, Helmstaedter, & Beutner, 2012) [10]. The authors prefer nasal GETA due to improved access, patient cooperation, and risk of airway compromise if inadvertent fluid extravasation into the floor of mouth during submandibular procedures.

The basic set up includes the following armamentarium:

- IV tubing and extension with 3-way stopcock
- 60cc syringe
- 500cc bag of 0.9% NaCl solution
- Endoscopy tower and monitor
- Salivary probes and dilators (Figure 2)
- COOK® Kolenda Introducer Set (Figure 3)
- Karl Storz® ALL-IN-ONE Sialendoscopes, ERLANGEN model (Figure 4):
  - All endoscopes are 0°angle
  - 0.8mm diameter for diagnostic sialendoscopy
  - 1.1mm and 1.6mm diameter for therapeutic sialendoscopy
- Karl Storz® Foreign Body Forceps
- Disposable Items:
  - Karl Storz® Stone Extractors (wire baskets)
    - 0.4mm or 0.6mm diameters
  - Karl Storz® Balloon Catheter
    - 0.7mm diameter
  - COOK® NGage Stone Extractor

The procedure, both for parotid and submandibular sialendoscopy, is initiated by serial dilatation of the salivary gland ducts. In case of difficulty with visualizing salivary gland papilla milking of the gland or use of methylene blue was suggested in the literature (Kent, Walvekar, & Schaitkin, 2016) [11]. Schaitkin salivary gland dilators can be used, or serial dilation with standard salivary gland dilators from size 0000 to 8. Marchal bougies can then be used to further dilate the ducts (Fig 2).

FIGURE 2: Sialendoscopy dilation set. Standard dilators No. 0000 to 8, conical bougie, Marchal dilators, papillotomy scissors, grasping forceps. (From top left to bottom left in clockwise orientation).

Once appropriate dilation has been performed, COOK® Kolenda Introducer Set can be placed in the duct to secure ductal access (Fig 3).

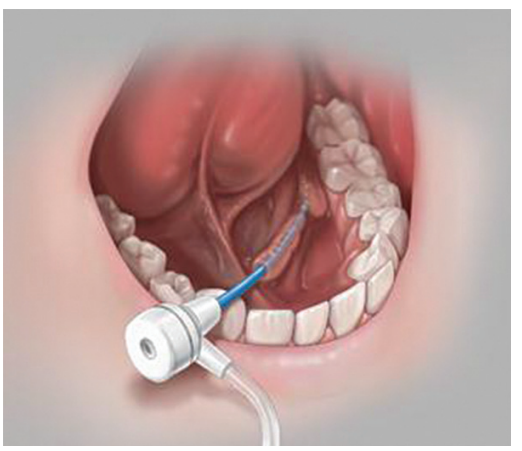

FIGURE 3. COOK® Kolenda Introducer Set.

Local anesthesia (1% lidocaine with 1:100,000 epinephrine) is injected into the duct with an flexibile angiocatheter tip. Diagnostic sialendoscopy is then performed with the Karl Storz® ALL-IN-ONE Sialendoscopes (Fig 4), ERLANGEN model 0.8mm diameter endoscope.

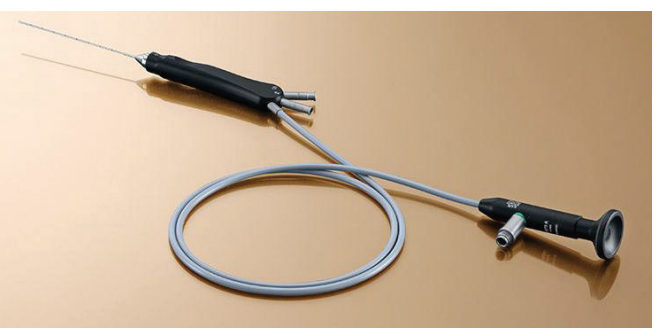

FIGURE 4. Karl Storz® ALL-IN-ONE Sialendoscopes, ERLANGEN model.

Following diagnostic sialendoscopy, therapeutic endoscopy can then be performed with either the 1.1mm or 1.6mm diameter endoscopes. If possible, the authors prefer to use the 1.6mm diameter scope for improved ability to perform stone extraction. It is important to maintain a constant and steady flow of fluid insufflation during the entire procedure to prevent ductal collapse and improve visualization (Figs 5-7). A three-way stopcock is attached to a 60cc syringe to allow the assistant to apply controlled insufflation during the procedure.

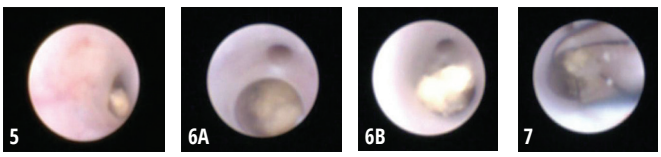

FIGURE 5. Sialolith visualiziation.
FIGURE 6A. Sialolith proximal to duct bifurcation.
FIGURE 6B. Sialolith distal to ductal bifurcation.
FIGURE 7. Wire basket applied to sialolith.

If performed this procedure for stone extraction, wire baskets are then used to attempt stone removal (Fig 7). They are introduced in the closed position through the working port of the endoscopy and passed beyond the stone. Once beyond the stone, the wire basket can be opened and rotated until it is engaging the stone. The basket and the endoscope are then retracted from the duct together, keeping visualization on the stone. For stones larger than 3mm or 4mm, parotid or submandibular respectively, papillotomy may need to be performed to allow for stone retrieval. For more advanced techniques and larger stones, laser lithotripsy can be performed to fragment the stone.

After stone extraction, 0.8mm endoscopy is used again to evaluate the salivary gland system to ensure that all stones have been removed and to irrigate all remaining debris and mucous plugs.

If performed for salivary duct strictures, similar initial procedures are performed with the exception of using wire baskets. Using the 1.6mm diameter endoscope, balloon catheters can be introduced through the working port in a closed position. Once the area or areas of strictures are encountered, the balloon is opened and held in place for roughly one to two minutes. The balloon catheter is then retracted and the stricture evaluated. If adequate dilation has not been achieved, catheter inflation can be performed again.

Once the procedure is completed, the endoscopes and COOK® Kolenda Introducer Set can be removed. Minor papillotomy can be performed at this time if needed. Compressive head dressing is then placed followed by patient emergence from general anesthesia and extubation.

Post-operative care includes instructing the patient to perform frequent warm compress massages over the involved salivary gland and appropriate hydration. Post-operative antibiotic use is not indicated, only the standard peri-operative prophylactic dose. In the literature, practice of prescribing antibiotics appears to be center or surgeon specific, although reported post-operative rates of glandular infection are around 2.5% (Nahlieli, Bar, Shacham, Eliav, & Hecht-Nakar, 2004) [12]. Local infection of papilla has been reported around 23%, thus suggesting that use of antiseptic mouth rinse, such as chlorhexidine, maybe warranted in the immediate post-operative period.

Pearls and Pitfalls

There are several technical problems and complications that can occur during sialendoscopy. Some technical errors are maceration of the papilla, which can be avoided by decreasing the amount of traction or force placed on the endoscope. Over insufflation or excessive pressure while irrigating can lead to significant edema, it is important to maintain a controlled level of pressure during irrigation to avoid this. This is monitored by the assistant using a 60cc syringe attached to a three-way stopcock, and only irrigating fluid with enough pressure to maintain duct patency for visualization. False passages and ductal perforation can also be created with using excessive force during dilation or blindly passive instruments through the working port. The most severe or life-threatening complication can occur during submandibular gland sialendoscopy, which is floor of mouth edema leading to airway compromise. The reported incident of upper airway obstruction occurred in the setting of irrigating solution extravasation after excessive pressures resulted in ductal tear (Baptista, Gimeno, Salvinelli, Rinaldi, & Casale, 2009) [13]. If this occurs, it is imperative to keep the patient intubated until the edema has subsided. The most common complication described in one study was failure of procedure due to peculiar duct anatomy, distal ductal stenosis or retained stone (Walvekar, Razfar, Carrau, & Schaitkin, 2008) [14]. Multiple other studies have validated sialendoscopy as a safe method with minor complications such as ductal tears, papillary infection, and facial swelling that usually self-resolve with minimal to now additional interventions (Marchal & Dulguerov, 2003) [15]. Possibility of lingual nerve damage exists, however it is seldom mentioned in the available reports.

Despite the high reported success rates with sialendoscopy, the procedure is deemed to be technically challenging and correlation between success rates and operator experience has been shown (Walvekar et al., 2008) [14]. In order to achieve the success rates of >90% as reported in literature, completion of 50 cases appears to be the benchmark (Steck, Stabenow, Volpi, & Vasconcelos, 2016) [16]. The most commonly cited difficulties surgeons new to sialendoscopy experience are difficulty canalizing the papilla, creation of false passage and duct lacerations (Steck et al., 2016) [16], (Farneti et al., 2015) [17]. Catheterization of the papilla is deemed the rate limiting step, since failure to achieve this step precludes completion of either diagnostic or therapeutic sialendoscopy (Farneti et al., 2015) [17]. Use of magnifying loops or even microscope, if available, may be beneficial in identifying and canalizing the papilla. There appears to be a consensus that surgeons experienced with endoscopic sinus surgery or dacryocystorhinostomy have no trouble with this aspect of the procedure. It has been suggested that practicing this skill on fresh cadavers of human or pig heads should be part of standardized training (Steck et al., 2016) [16] (Farneti et al., 2015) [17]. Laceration of the duct is undesirable due to potential of future ductal stenosis thus increasing patient's chance for recurrent obstructive symptoms and possible need for eventual gland removal. Moreover, false passage can be created through the laceration increasing the risk for irrigant extravasation and making completion of the procedure more arduous. Definitive papilla identification, clear visualization of the intraductal lumen, and gentle instrument manipulation

and irrigation reduce the likelihood of duct laceration. Even though sialendoscopy can be performed under local anesthesia, general anesthesia is recommended until adequate level of comfort and confidence is achieved by the operator.

There is a steep learning curve when beginning the practice of sialendoscopy. In the authors' experience, several challenges have been encountered that have led to implementing changes in our technique. First, to prevent trauma to the ductal papilla by entering the duct repeatedly with the endoscopes, use of the COOK® Kolenda Introducer Set was implemented. This device allows one to maintain passage of the endoscopes and instruments into the duct without having to reenter the papilla. Second, use of the 0.8mm scope initially is essential. This allows you to visualize the ductal anatomy, locate sialoliths and mucous plugs, and measure the approximate depth or distance a sialolith is prior to using the therapeutic sialoscopes. Finally, when attempting to remove a large sialolith, if one encounters difficulty encircling the stone, do not hesitate to use instrumentation, i.e. Karl Storz® Foreign Body Forceps, to break the stone apart into smaller fragments. Attempting to force a wire basket around the stone can lead to inadvertent laceration of the salivary gland duct.

Conclusion

Sialendoscopy is a minimally invasive technique that is gradually replacing the classic open surgical approach to the treatment of obstructive salivary gland diseases as the standard of care. Although the initial challenges to the implementation of sialendoscopy into routine practice include high cost and need for specialized training, benefits have proven to be substantial. Ability to perform sialendoscopy in an outpatient setting and, in appropriate situations, under local anesthetic dramatically reduces patient's financial burden, post-operative morbidity, and recovery time. As cited in literature and per author's experience serious complications are rare and minor complications that do occur, frequently resolve on their own with no need for additional surgical intervention. In addition to providing an overall better experience for patients and allowing for quicker return to normal daily life, an overall reduction in patient care time per patient provides a surgeon with an opportunity to take care of greater number of patients. Thus, inclusion of sialendoscopy in surgeon's arsenal of practical skills is most definitely recommended.

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Мінімально інвазивні методики лікування патології слинних залоз

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Конкременти
Слинокам'яна хвороба
Обладнання для сіалендоскопії
Розсічення під'язикового сосочку
Стеноз протоку
Внутрішньопротокові пробки із слизу

РЕЗЮМЕ

Мета. Мета данної роботи – описати метод, який використовується в нашому закладі та висвітлити потенційні труднощі під час сіалендоскопії.
Обговорення. Обговорюються показання до сіалендоскопії і методики її проведення
Результати. Незважаючи на зафіксований в світі високий рівень успішних сіалендоскопій, процедура вважається технічно складною і частота успіху залежить від досвіду хірурга в даній методиці.
Висновки. Сіалендоскопія – це мінімально інвазивна методика, яка по поступово заміняє традиційний відкритий хірургічний доступ в лікуванні обструктивних захворювань слинних залоз, як стандарта лікування.

Минимально инвазивные методики лечения патологии слюнных желез

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Сиалэндоскопия
Конкременты
Слюнокаменная болезнь
Оборудование для сиалэндоскопии
Рассечение подъязычного сосочка
Стеноз протока
Внутрипротоковые пробки из слизи

РЕЗЮМЕ

Цель. Цель данной работы – описать методику, которая используется в нашем учреждении и осветить потенциальные сложности во время сиалэндоскопии.
Обсуждение. Обсуждаются показания к сиалэндоскопии и методики ее проведения.
Результаты. Невзирая на зафиксированный в мире высокий уровень успешных сиалэндоскопий, процедура считается технически сложной и частота успеха зависит от опыта хирурга в данной технике.
Выводы. Сиалэндоскопия – это минимально инвазивная методика, которая по наростающей замещает традиционный открытый хирургический доступ при лечении обструктивных заболеваний слюнных желез, как стандарта лечения.