

Minimally Invasive Salivary Gland Surgery

Raymond Kung, MD
Caruso Dept of Otolaryngology Head & Neck Surgery
Keck School of Medicine of USC
Mar 25, 2020

Keck School of Medicine of USC

- No financial disclosures

Keck School of Medicine of USC

Outline

- Obstructive salivary pathology
- Why sialendoscopy?
- Anatomy
- Sialendoscopy setup & technique
- Management strategies
- Cases

Keck School of Medicine of USC

Gland obstruction is the most common non-neoplastic salivary disorder

- Gland obstruction → Sialadenitis
 - Sialolithiasis 60-70%
 - Submandibular 80%
 - Parotid 20%
 - Anomalies
 - Stricture
 - Ductal Polyp
 - Autoimmune, JRP, RAI

Keck School of Medicine of USC

Cause of Sialolithiasis?

- Salivary stasis
- Retrograde bacterial contamination
- Tobacco use
- Diuretics
- No link with hypercalcemia or hard water

Keck School of Medicine of USC

Incidence/Prevalence of Stones

NEPHROLITHIASIS 10:1 SIALOLITHIASIS

11-7% prevalence by age 70 (a)	1 per 10-20,000 population per year (1)
10% lifetime risk in U.S. (and increasing) (b)	1 per 15-30,000 population per year (2)
Est. annual cost of 5.3 billion in US (c)	1.2% Prevalence in postmortem study (0.45% symptomatic prevalence) (3)
Lifetime risk 13%(male) 7%(female) (d)	lifetime risk of 1-2%
	0.1 to 1.0% of adult population

(a) Brenner and Rector's the Kidney Ch 39
 (b) Stamatelou KK, Francis ME, Jones CA et al. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. Kidney Int. 2003; 63:1847
 (c) Saigal CS et al Urologic Disease in America Project: Direct and indirect costs of nephrolithiasis. Kidney Int 2005; 68:998-1004
 d. Preminger GM, Tiselius HG, Assimos DG, et al. Guideline for the management of ureteral calculi. J Urol 2007; 177:2418-24

(1) Marchal F, Dulguerov P. Sialolithiasis management: the state of the art. Arch Otolaryngol Head Neck Surg 2003; 129: 951-956.
 (2) Escudier MP, McGurk M. Symptomatic sialoadenitis and sialolithiasis in the English population: an estimate of the cost of hospital treatment. Br Dent J 1999; 186: 463-466
 (3) McGurk M, Escudier MP, Brown JE. Modern management of salivary calculi. Br. J. Surg. 2005; 92: 107-112

Keck School of Medicine of USC

Why Sialendoscopy?

- Efficacious
 - 80% success purely endoscopic
 - 92% success combined endoscopic and open
- Safe
- Gland preserving
 - SMG excision rate of 5% now, 35% before

Atienza G, Lopez-Cedrun JL. Management of obstructive salivary disorders by sialendoscopy: a systematic review. *Br J Oral Maxillofac Surg* 2015;53:507-519

Strychowski JE, Sommer DQ, Gupta MK, Cohen N, Nahlieli O. Sialendoscopy for the management of obstructive salivary gland disease: a systematic review and meta-analysis. *Arch Otolaryngol Head Neck Surg* 2012;138:543-547.

Kopec T, Wierzbicka M, Szyfter W, et al. Algorithm changes in treatment of submandibular gland sialolithiasis. *Eur Arch Otorhinolaryngol* 2013;270:2089-93

Keck School of Medicine of USC

Why Sialendoscopy?

- Minimally invasive
- Faster recovery
- Low complications
- Nerve sparing
- Less xerostomia
- Cost saving

Keck School of Medicine of USC

Uses for sialendoscopy

- Diagnostic
- Instrumentation
 - Stone removal, fragmentation
- Confirm stone removal
- Assist in open approach to sialolithotomy

Keck School of Medicine of USC

Stones can be missed on imaging

- Dental artifact can obscure CT
- Sialendoscopy after negative U/S revealed parotid stones 63% and SMG stones 32%
- Stones are likely underdiagnosed

Nahlieli O, Baruchin AM. Long-term experience with endoscopic diagnosis and treatment of salivary gland inflammatory diseases. *Laryngoscope* 2000;110:988-93.

Keck School of Medicine of USC

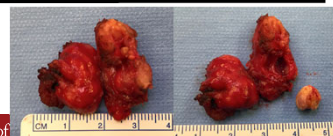
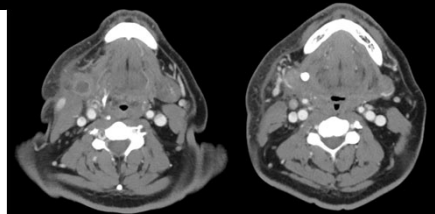
Sialendoscopy may prevent retained stones after sialadenectomy

- Hoffman et al: 4 of 7 would have missed stones
- Marchal et al: 1 of 9 pts who failed combined approach had retained stone → reoperation
- Milton et al: 3 of 57 pts with retained stones after SMG excision
- 17-32% of stones missed w/o sialendoscopy

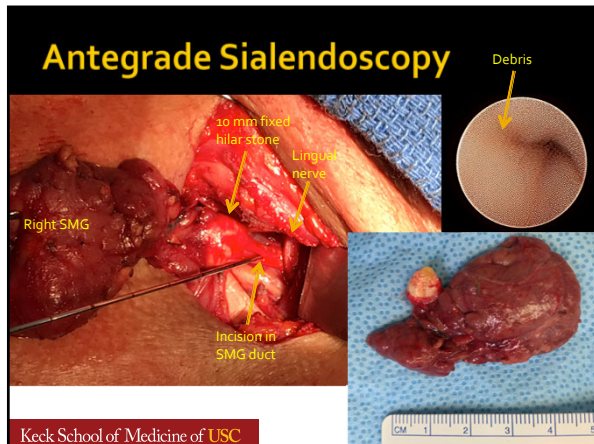
Potash A, Hoffman HT. Retrograde sialendoscopy: a new technique for avoiding retained ductal stones. *Annals of Otolaryngology & Laryngology*. 2012 Jan;121(1):38-43.

Keck School of Medicine of USC

Retained stone after SMG excision



Keck S



Complications of sialendoscopy are unusual and not severe

- Sialendoscopy only
 - Postop swelling 88% (few days)
 - Infection- papilla 23%, gland 2.5%
 - Duct laceration 5% (unlikely to → long term fistula)
 - Stricture <2% (usu stones >5mm)
 - Intraductal tool breakage/blockage (rare)
- Combined approach
 - Same as above plus:
 - FOM pain 8%
 - Lingual nerve paresthesia- temporary 4%, permanent <1%
 - Ranula 3%
 - FN paralysis 0%
- May have to ligate the duct- gland atrophies 50% of the time

Keck School of Medicine of USC

Barriers

- Cost
 - \$40K for a complete set
 - \$3K to rent
- Equipment
- Learning Curve (50 procedures)
- Few patients (though likely under-referred)

Keck School of Medicine of USC

Indications:

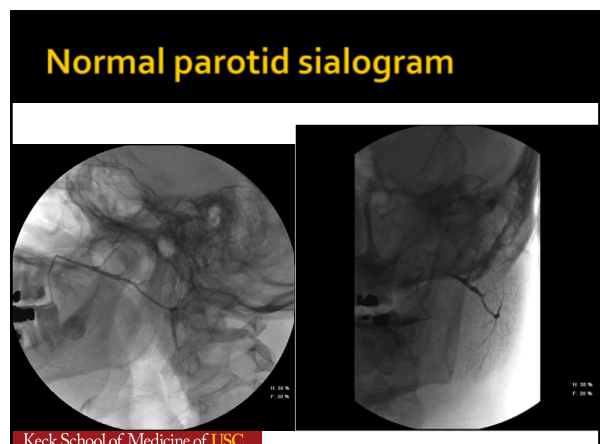
- For sialendoscopy & sialography
 - Chronic or recurrent sialadenitis
 - Stones, strictures, autoimmune, JRP, RAI
 - Rule out cause of atypical facial pain
 - Preoperative planning
- Contraindication
 - Acute sialadenitis – higher risk perforation

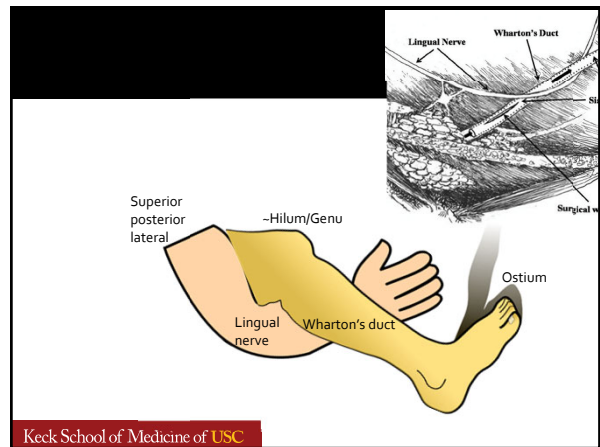
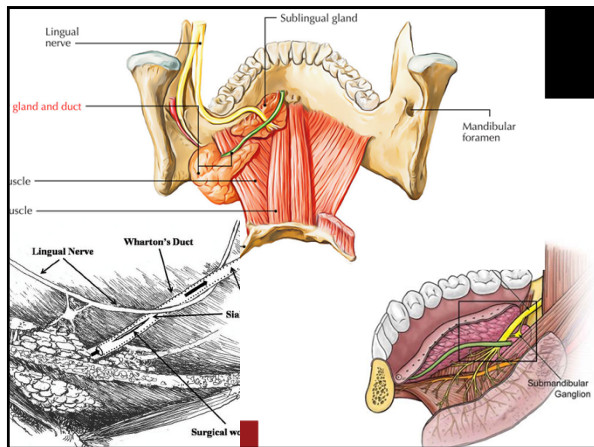
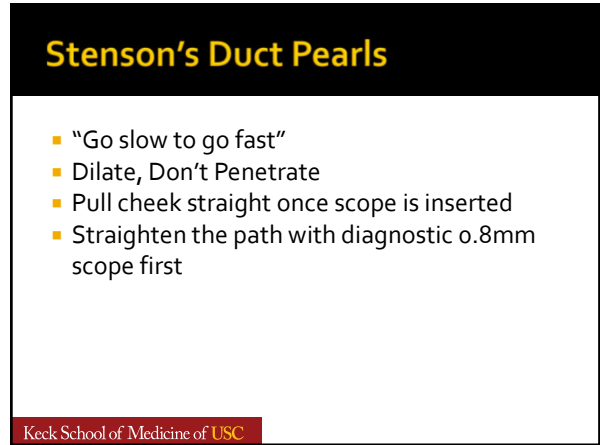
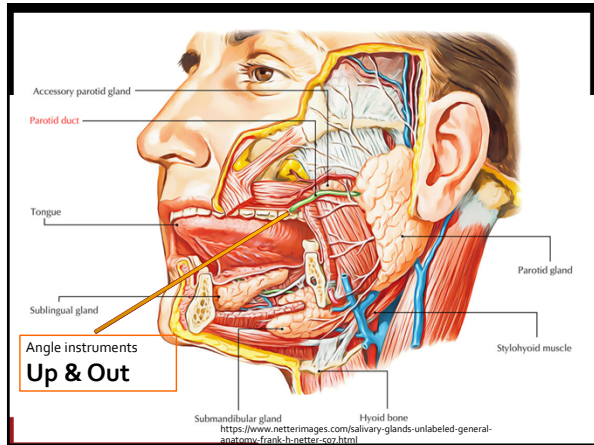
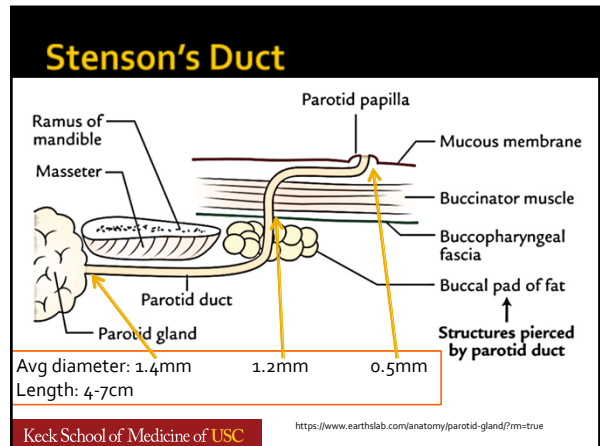
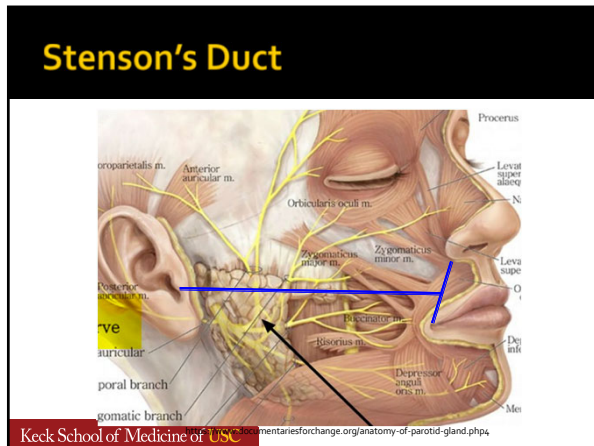
Keck School of Medicine of USC

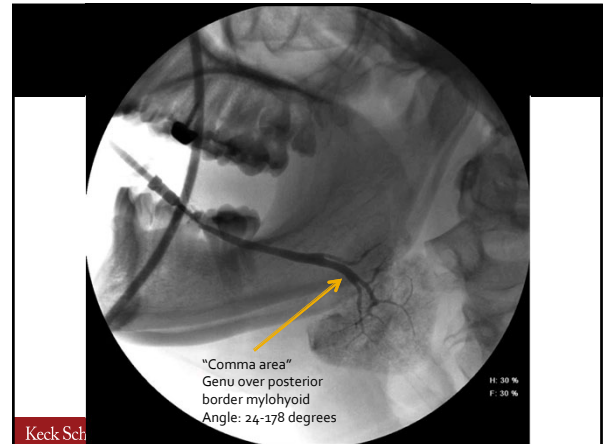
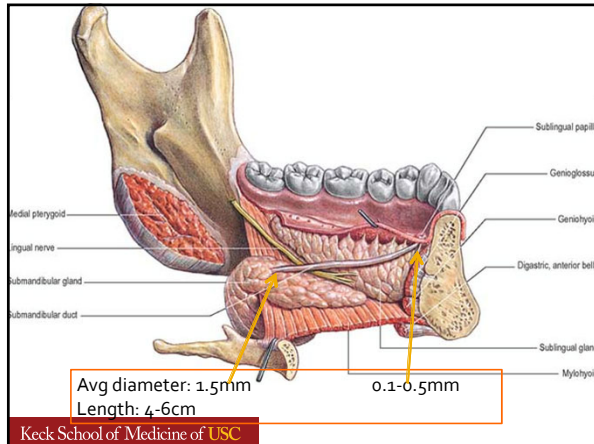
Uses of Sialography

- Identify strictures not seen on CT or U/S
- Identify acinar pathology
- Therapeutic by dilating, irrigating, concurrent balloon dilation, steroid
- Preop planning
 - Patent duct?
 - Endoscopic vs open

Keck School of Medicine of USC



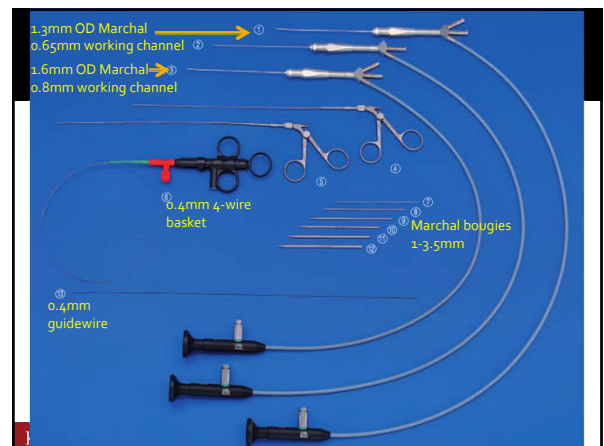


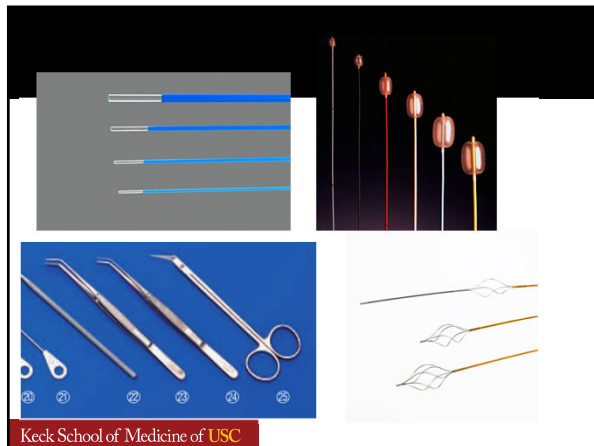


Wharton's Duct Pearls

- Kittner retraction
- Angle Instruments Down & Out
- External neck pressure
- Smaller opening than parotid, may need Turner needle to cannulate


Sialendoscopes






Sialodochoplasty (complex) for right submandibular sialolithiasis with sialadenitis

Options for exposure of the floor of mouth include cutting one flange of the plastic spandex Retractor and securing it to the bite block. Another approach identified with use of Army-Navy



Spandex Lip and Cheek Retractor

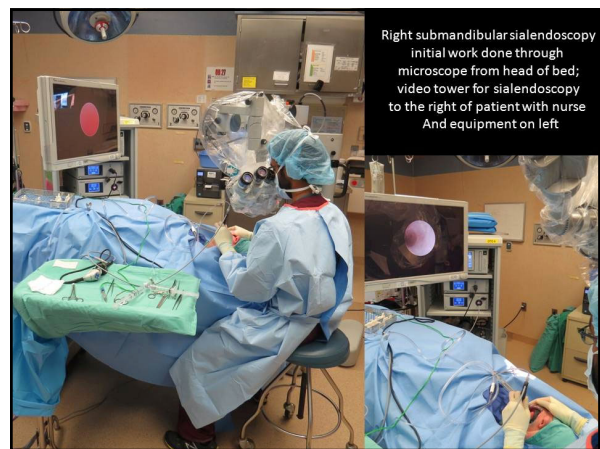
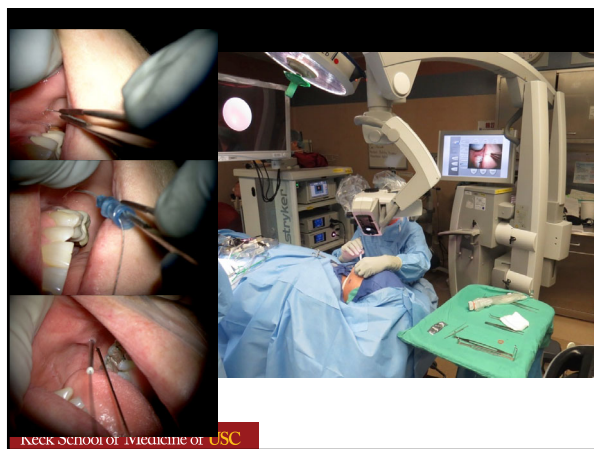


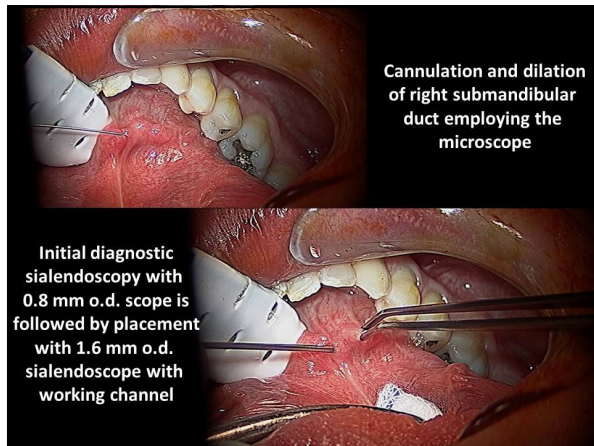
Molt Mouth Gag

Cannulation Dilatation Technique

- 0.015 inch (0.4mm) guidewire
- Marchal hollow bore dilators
- 24g 22g angiocath
- Turner needle
- 6% cannot be cannulated

Keck School of Medicine of USC





Approaches to minimally invasive salivary surgery

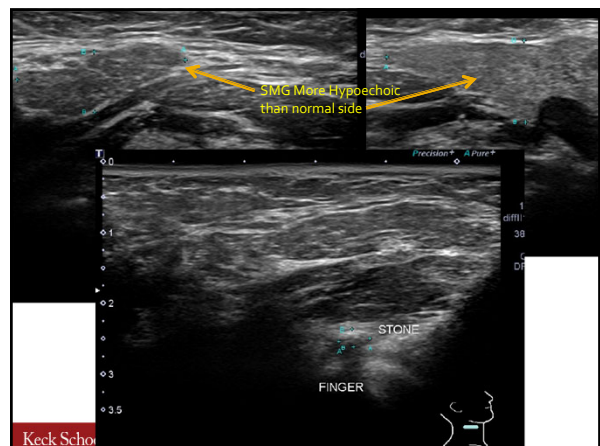
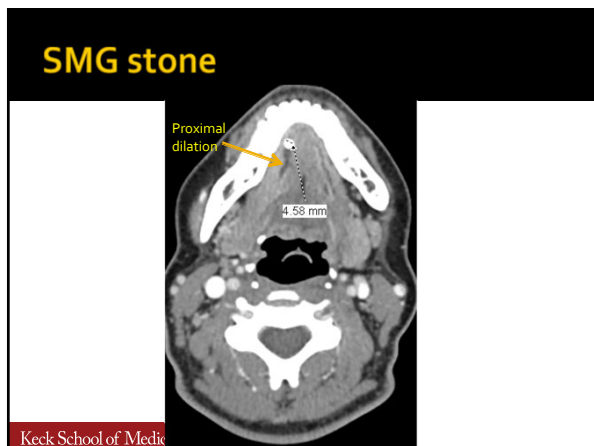
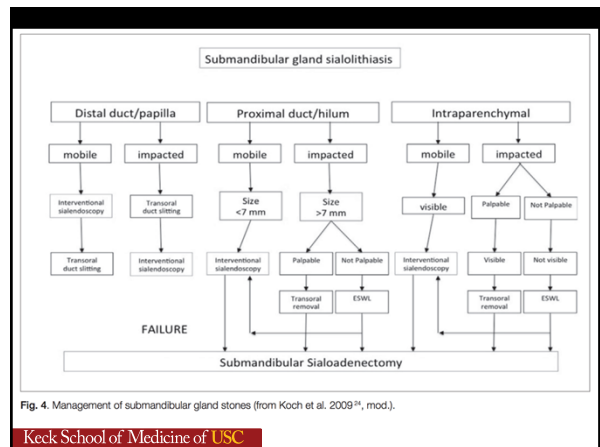
- Endoscopic
- Endoscopic + Fragmentation
- Endoscopic + Open (Combined)
 - Open Ductoplasty
 - Transoral
 - SMG-FOM
 - Parotid-Transbuccal
 - Transfacial-parotid
- Sialadenectomy

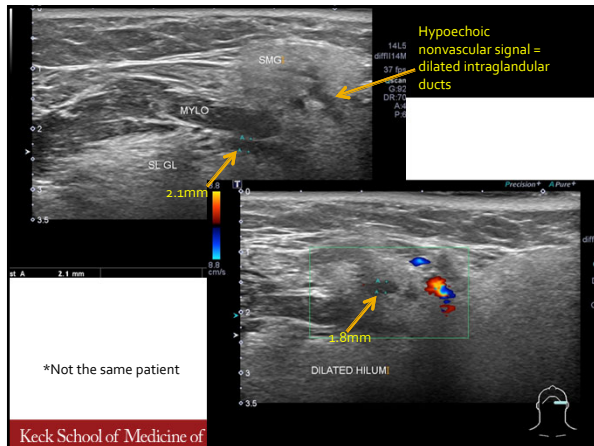
Keck School of Medicine of USC

Factors to decide approach to sialolithiasis

- Size
- Location
- Palpable?
- Parotid vs SMG
- Stricture
- Mobility
- Number
- Density
- Xerostomia

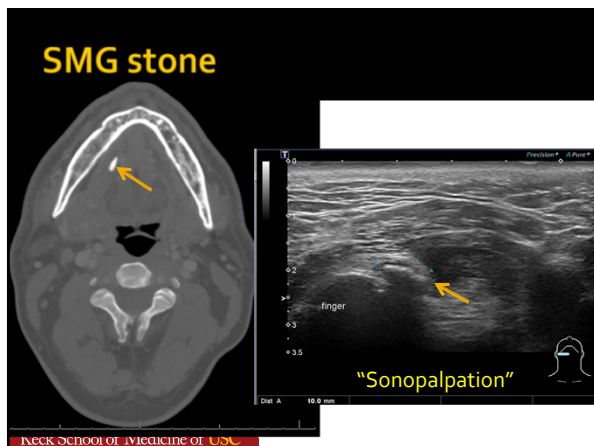
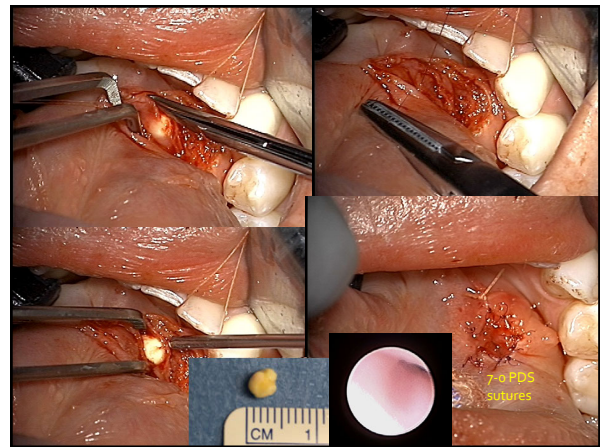
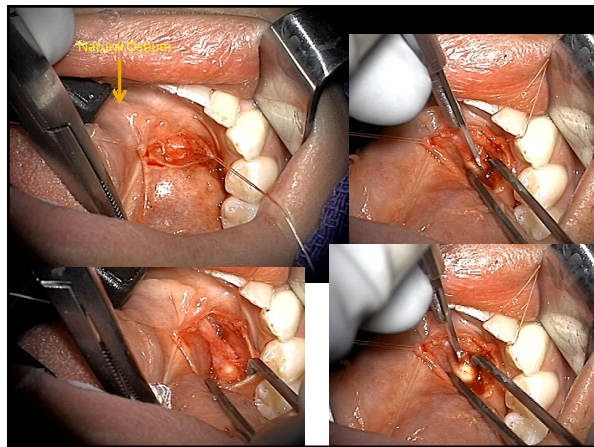
Keck School of Medicine of USC





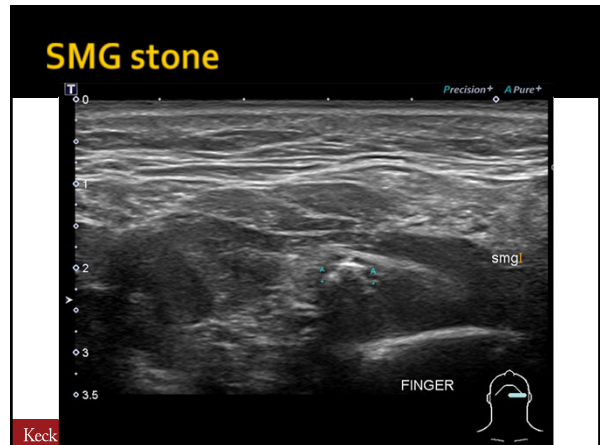
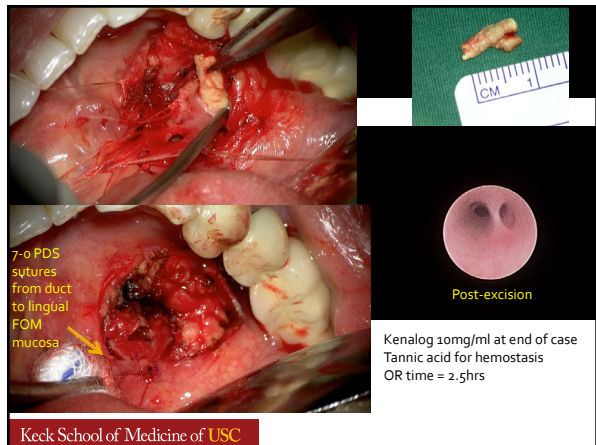
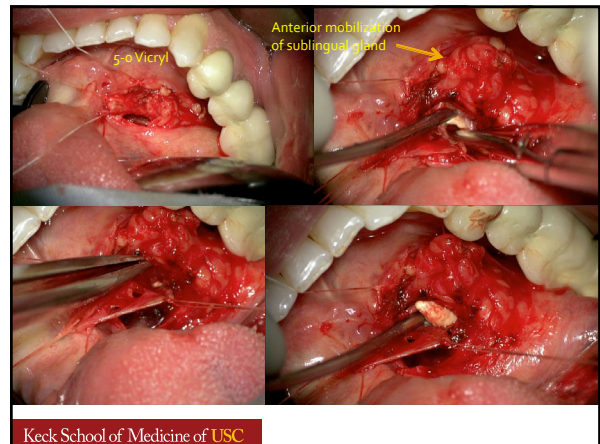
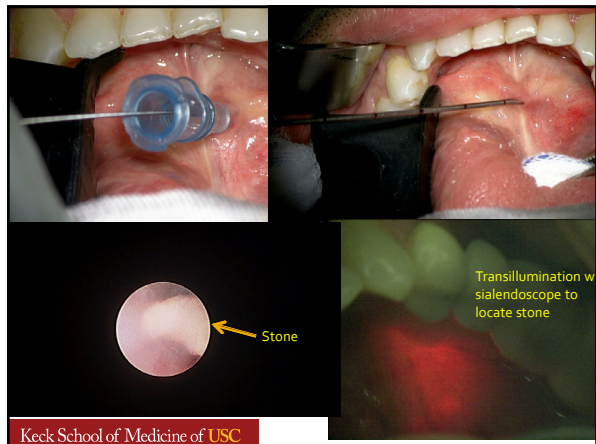
■ Plan: transoral open ductoplasty via cutdown directly onto palpable stone, then sialendoscopy. Pt against SMG excision

Keck School of Medicine of USC



■ Plan: sialendoscopy, possible ductoplasty, pt against SMG excision

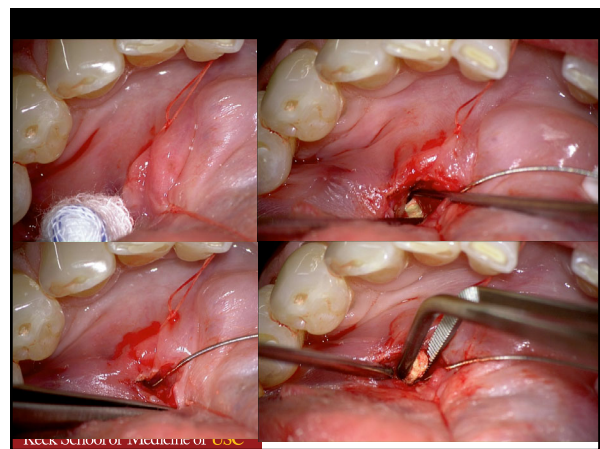
Keck School of Medicine of USC

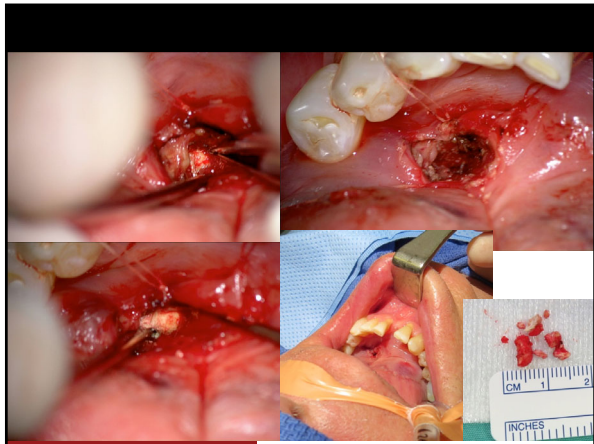


Plan: sialendoscopy, possible ductoplasty, possible SMG excision

Keck School of Medicine of USC

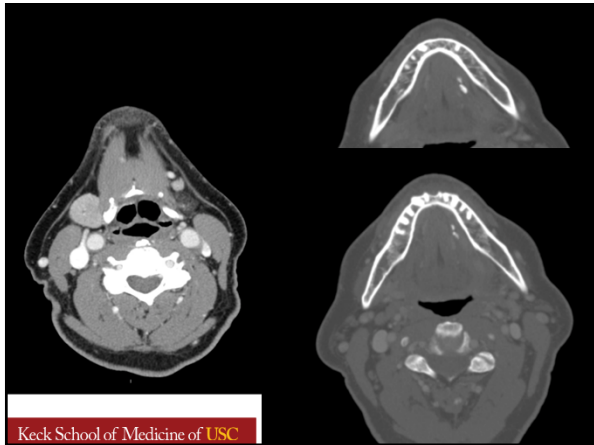
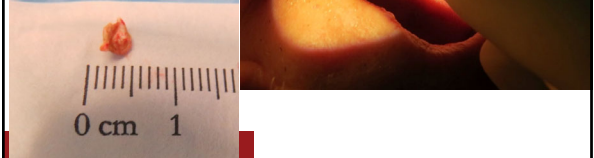
This text block contains the surgical plan for the patient: sialendoscopy, possible ductoplasty, and possible SMG excision. The Keck School of Medicine of USC logo is visible in the bottom left corner.





1 year later

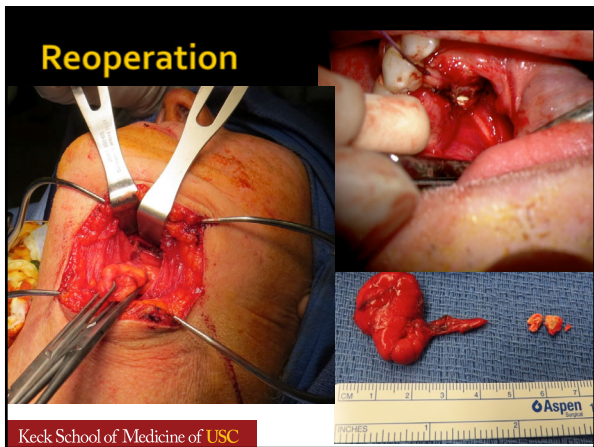
- In office sialolithotomy
- More palpable stones



Keck School of Medicine of USC

- Plan: repeat sialendoscopy, possible ductoplasty, possible SMG excision

Keck School of Medicine of USC



Reoperation

Keck School of Medicine of USC

Parotid Stone

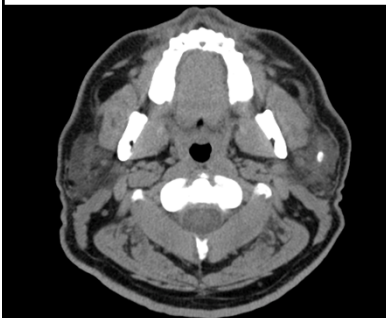


Figure 1. Radiopaque 5mm left parotid sialolith proximal to the hilum measuring 238 Hounsfield units

Keck School of Medicine of USC

- Plan: sialendoscopy, possible laser

Keck School of Medicine of USC

Intraductal laser fiber fracture

Keck School of Medicine of USC

Single-use 200-micron Holmium Laser fiber fragment retrieved by micro-forceps thru 1.6mm Zenk sialendoscope

Goates AJ, Kung RW, Tracy CR, Hoffman HT. Intraductal Laser Fiber Tip Fracture and Retrieval During Sialendoscopic Laser-Assisted Lithotripsy. *Annals of Otolaryngology, Rhinology & Laryngology*. 2017 Nov;126(11):774-7

Keck School of Medicine of USC

- 1 year later had recurrent sialadenitis requiring hospitalization
- 2 years later recurrent sialadenitis, able to express 3mm stone in clinic
- 3 years later asymptomatic

Keck School of Medicine of USC

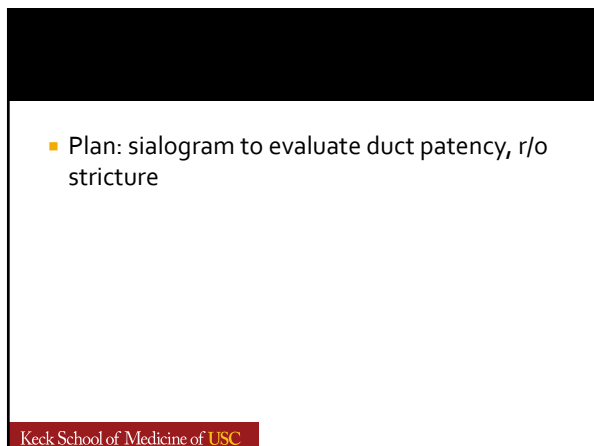
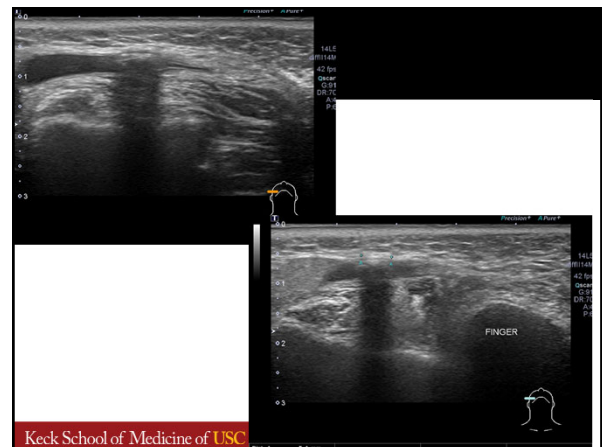
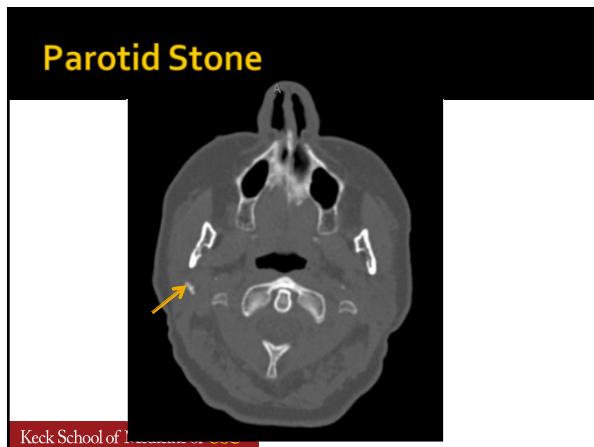
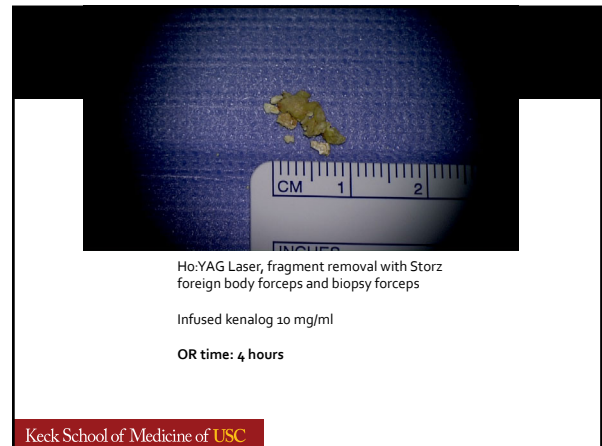
Parotid stone

Dense stone with high heterogeneity index

Keck School of Medicine of USC

- Plan: sialendoscopy, laser lithotripsy, possible transoral ductoplasty, pt against parotidectomy

Keck School of Medicine of USC



- Plan: sialendoscopy, possible laser fragmentation, likely transfacial open approach, possible parotidectomy

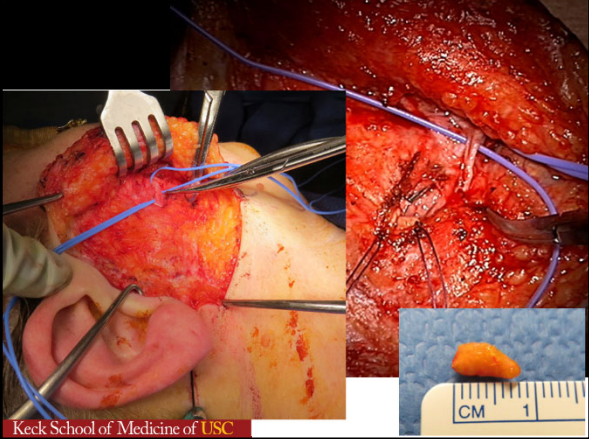
Keck School of Medicine of USC



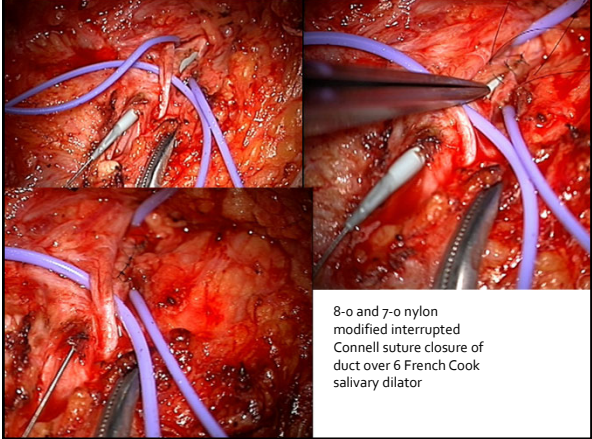
Stone visible only with posterior pressure on the tail of the parotid = Not amenable to laser fragmentation

<https://medicine.uiowa.edu/iowaprotocols/sialendoscopy-after-parotid-stone-fragmentation-transillumination-composite>

Keck School of Medicine of USC



Keck School of Medicine of USC



8-0 and 7-0 nylon modified interrupted Connell suture closure of duct over 6 French Cook salivary dilator

Keck School of Medicine of USC



Keck School of Medicine of USC

Hi success, Low complication rates with Parotid endoscopic & open approach

- Combined endoscopic + transfacial open approach
 - Success 97%
 - Complications 6%
 - 0% FN paralysis in combined endoscopic & open VS
 - 30% temporary, 1% permanent FN paralysis in superficial parotidectomy

Roland LT, Skillington SA, Ogden MA. Sialendoscopy-assisted transfacial removal of parotid sialoliths: A systematic review and meta-analysis. The Laryngoscope. 2017 Nov;127(11):2510-6.

Keck School of Medicine of USC

Transfacial approach is better than parotidectomy

- Less costly
 - Savings up to 15%
- Shorter operative time
- Lower morbidity
- Must be appropriately selected
 - Large, proximal, adherent stone, inability to see endoscopically
- May end up needing parotidectomy

Ong AA, Carroll WW, Nguyen SA, Gillespie MB. Cost-effectiveness of transfacial gland-preserving removal of parotid sialoliths. The Laryngoscope. 2017 May;127(5):1080-6.

Keck School of Medicine of USC

Parotid Stone

Keck School of Medicine of USC

- Failure to remove stone via sialendoscopy
- Significant postop pain swelling → sialadenitis
- Required Augmentin x4 weeks
- Planned for repeat sialendoscopy, likely transfacial approach → but able to get to stone and remove endoscopically with basket only!
- Basket fragmentation technique:** keep basket open, one hand on basket, other hand on scope, pull stone into tip of scope with basket

Keck School of Medicine of USC

Keck School of Medicine of USC

Stone too large to get past stricture so fragmented stone using basket as 'cheese wire' and tip of scope as 'cutting board' (**Basket Fragmentation Technique**)

Keck School of Medicine of USC

Pre Post

Fragments removed one at a time

Complete removal of stone fragments, dilated duct where stone was


Minor trauma to duct mucosa

Normal duct distally


Deep parotid stone removed without incisions!

Keck School of Medicine of USC


Extracorporeal Shockwave Lithotripsy



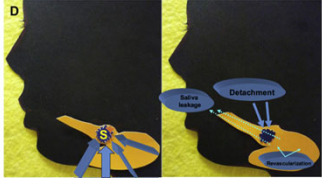
A



B



C



D

Nahlieli O. Extracorporeal Lithotripsy. Atlas of the oral and maxillofacial surgery clinics of North America. 2018 Sep 1;26(2):159-67

Keck School of Medicine of USC

Conclusions

- Continually evolving treatment of obstructive salivary gland disease
- Minimally invasive strategies are safe, effective, gland preserving, nerve sparing
- Sialolithiasis treatment includes sialography, sialendoscopic removal, combined endoscopic & open approaches, sialadenectomy

Keck School of Medicine of USC

References

- Atienza G, Lopez-Cedrun JL. Management of obstructive salivary disorders by sialendoscopy: a systematic review. Br J Oral Maxillofac Surg 2015;53:507-519
- Strychowsky JE, Sommer DO, Gupta MK, Cohen N, Nahlieli O. Sialendoscopy for the management of obstructive salivary gland disease: a systematic review and meta-analysis. Arch Otolaryngol Head Neck Surg 2012;138:541-547.
- Kopec T, Wierzbicka M, Szyfter W, et al. Algorithm changes in treatment of submandibular gland sialolithiasis. Eur Arch Otorhinolaryngol 2013;270:2089-93
- Roland LT, Skillington SA, Ogden MA. Sialendoscopy-assisted transfacial removal of parotid sialoliths: A systematic review and meta-analysis. The Laryngoscope. 2017 Nov;127(11):2510-6.
- Ong AA, Carroll WW, Nguyen SA, Gillespie MB. Cost-effectiveness of transfacial gland-preserving removal of parotid sialoliths. The Laryngoscope. 2017 May;127(5):1080-6.
- Gillespie B. Sialendoscopy for gland preservation: A Case-Based Approach. Presentation at AAOHNS, Dallas TX 2015

Keck School of Medicine of USC


References

- Gallo A, Benazzo M, Capaccio P, De Campora L, De Vincenzi M, Fusconi M, Martellucci S, Paludetti G, Pasquini E, Puxeddu R, Speciale R. Sialoendoscopy: state of the art, challenges and further perspectives. Round Table, 101st SIO National Congress, Catania 2014. Acta Otorhinolaryngologica Italica. 2015 Oct;35(4):217.
- Marchal F, Dulguerov P. Sialolithiasis management: the state of the art. Arch Otolaryngol Head Neck Surg 2003;129:951-6
- Koch M, Iro H, Zenk J. Sialendoscopy-based diagnosis and classification of parotid duct stenoses. The Laryngoscope. 2009 Sep;119(9):1696-703.
- Nahlieli O, Baruchin AM. Long-term experience with endoscopic diagnosis and treatment of salivary gland inflammatory diseases. Laryngoscope 2000;110:988-93.
- Potash A, Hoffman HT. Retrograde sialendoscopy: a new technique for avoiding retained ductal stones. Annals of Otolaryngology & Laryngology. 2012 Jan;121(1):38-43.
- Nahlieli O. Extracorporeal Lithotripsy. Atlas of the oral and maxillofacial surgery clinics of North America, 2018 Sep 1;26(2):159-67.
- Nahlieli O, Shacham R, Zaguri A. Combined external lithotripsy and endoscopic techniques for advanced sialolithiasis cases. Journal of Oral and Maxillofacial Surgery. 2010 Feb 1;68(2):347-53.

Keck School of Medicine of USC

Special Thanks

- Dr. Henry Hoffman
 - Salivary Gland Specialist at the University of Iowa
 - Dept of Otolaryngology Head & Neck Surgery
- University of Iowa Protocols
 - <https://medicine.uiowa.edu/iowaprotocols/>



Keck School of Medicine of USC

Questions?

Keck School of Medicine of USC

Autoimmune salivary disease

- IgG4 related disease
 - Mikulicz syndrome, Kuttner tumor, chronic sclerosing sialadenitis
- Sjogren's- lymphocytic infiltrate of exocrine glands
 - Sialendoscopy- mucus plugs
 - Early- marked vascular reticulation, hyperemia
 - Late (sclerosis)- pale poorly vascularized
- Sialogram/Sialendoscopy +/- steroid infusion may be therapeutic and diagnostic

Keck School of Medicine of USC

Juvenile Recurrent Parotitis

- 2nd most common ped parotid dz (mumps 1st)
- 3-6 years of age, usu resolves at puberty
- Bilateral non-obstructive non-suppurative inflammation
- Acute unilateral pain & swelling days-weeks
- Sialendoscopy- Lack of natural vascularization
- Sialogram/Sialendoscopy +/- steroid infusion may be therapeutic and diagnostic
- Symptom free 78%, partial resolution 22%

Keck School of Medicine of USC

RAI Sialadenitis

- NaI Sodium Iodide symporter in Ductal cells
- Salivary iodine: 20-100x serum concentration
- Up to 24% RAI secreted into saliva
- Periductal inflamm, infiltrate → obstruction → Ascending infection
- Increased capillary permeability → parenchymal damage
- Vicious cycle may → chronic sclerosis
- Pain, swelling, dysgeusia, xerostomia

Keck School of Medicine of USC

RAI Sialadenitis

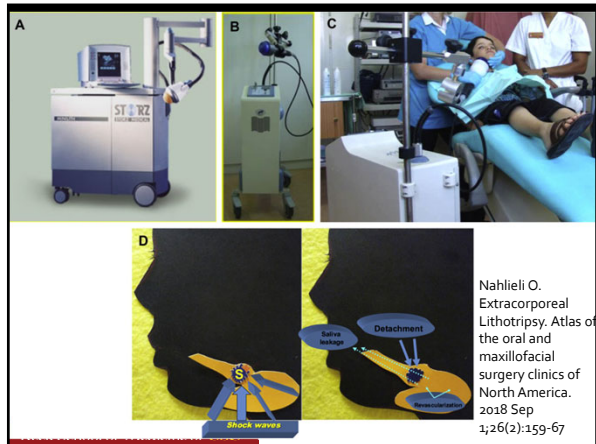
- Sialogram/Sialendoscopy +/- steroid infusion may be therapeutic and diagnostic
- Meta analysis 33pts had 50-100% success rate
- 50% of pts unable to cannulate
- **Intervene before unable to cannulate**
- Sialadenectomy in 9%

Keck School of Medicine of USC

Extracorporeal shockwave lithotripsy (NOT available in the US)

- Indicated for small-medium mid-proximal stones
- 3 sessions 1 month apart
- Not painful, no sedation needed
- Contraindications
 - Significant ductal stenosis- Need sialogram first!
 - Pregnancy
 - S/p stapedectomy
- Rare complications

Keck School of Medicine of USC



Extracorporeal shockwave lithotripsy

- ESWL disconnects stones from duct walls and allows antegrade migration facilitating endoscopic removal
- Success rate:
 - ESWL only- 32%
 - ESWL + pure endoscopic- 29%
 - ESWL + combined endoscopic & open- 39%

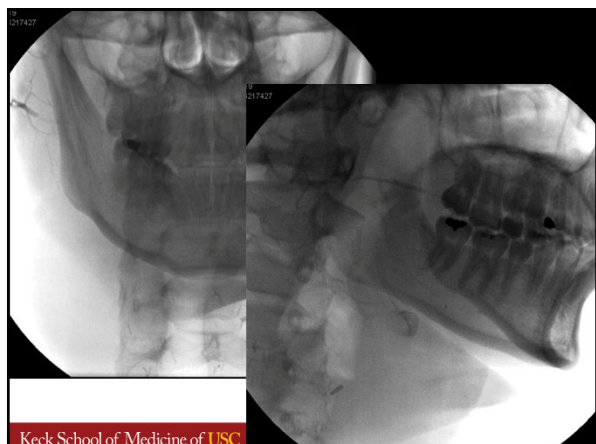
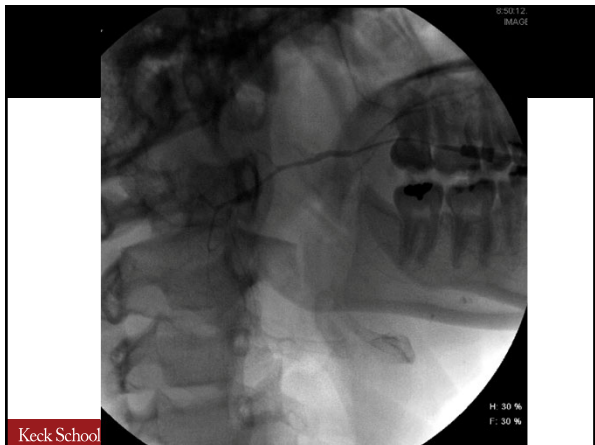
Nahlieli O, Shacham R, Zaguri A. Combined external lithotripsy and endoscopic techniques for advanced sialolithiasis cases. Journal of Oral and Maxillofacial Surgery. 2010 Feb 1;68(2):347-53.

Keck School of Medicine of USC

RAI

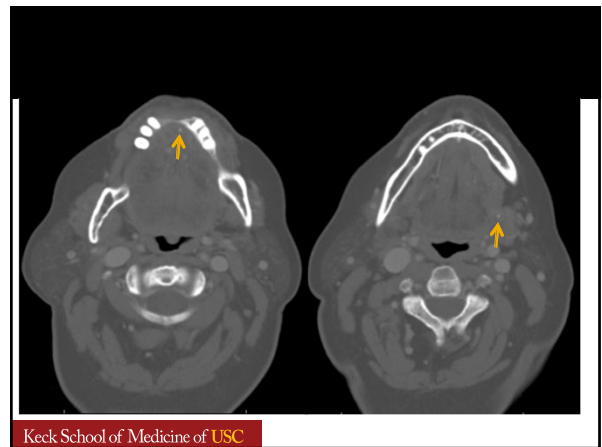
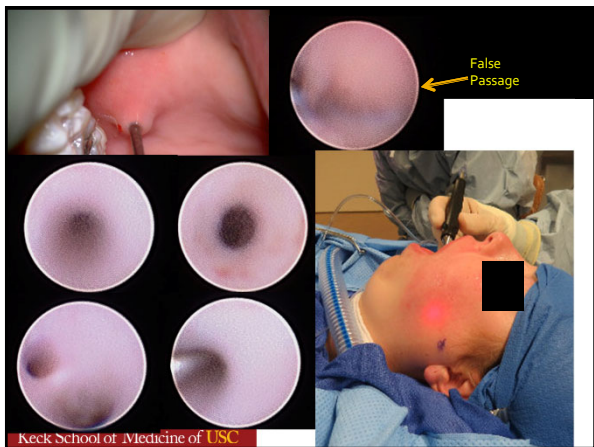
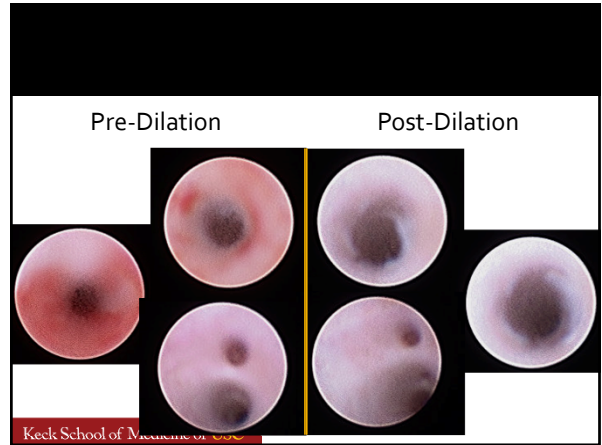
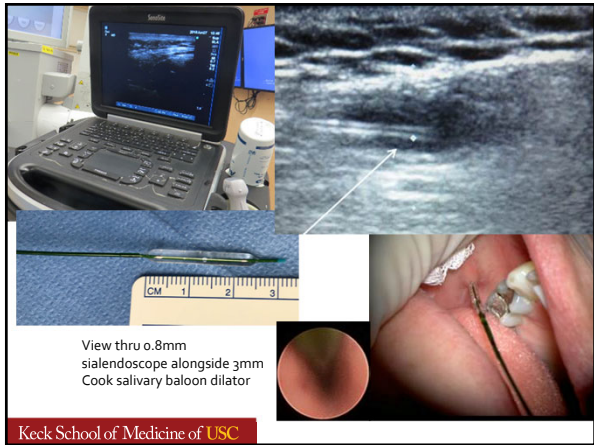
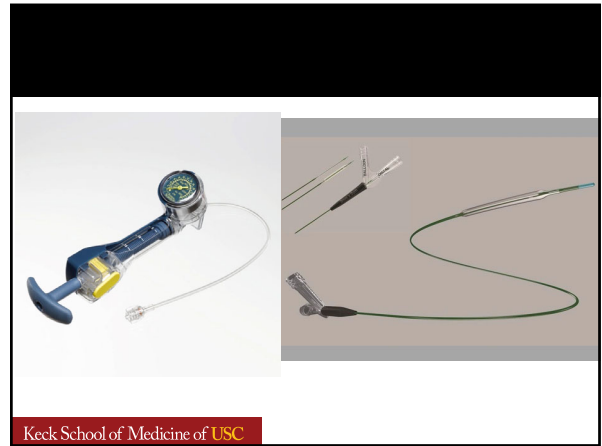
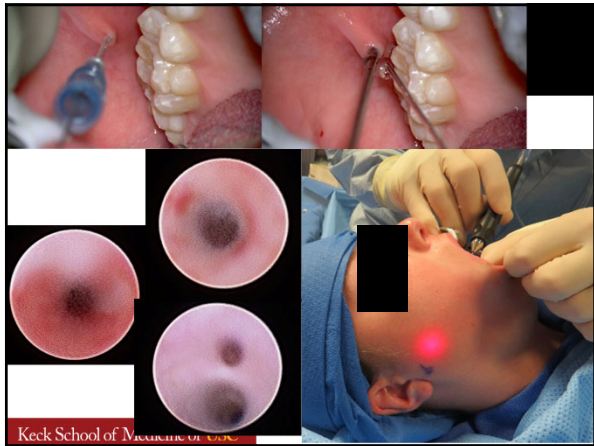
- 19yo F s/p total thyroidectomy and RAI for papillary thyroid ca
- 156.7 mCi I131
- R>L parotid pain, swelling w meals
- No saliva expressed from all 4 glands
- Plan: sialogram, possible steroid, possible balloon dilation

Keck School of Medicine of USC



- Plan: Sialendoscopy, balloon dilation, steroid infusion

Keck School of Medicine of USC



- Plan: sialogram to eval for strictures and stones

Keck School of Medicine of USC

Filling defects can be air bubbles OR stones
Stone visible at papilla & dilated duct on ultrasound = stone

Keck School of Medicine of USC

- Plan: sialendoscopy, possible ductoplasty

Keck School of Medicine of USC

0.4mm 4-Wire basket thru 1.3mm sialendoscope

Keck School of Medicine of USC

Keck School of Medicine of USC

3 hours postop

Keck School of Medicine of USC