Sialoendoscopically Assisted Open Sialolithectomy for Removal of Large Submandibular Hilar Calculi

Yu-xiong Su, MD, DDS, PhD, Gui-qing Liao, MD, DDS, PhD,†*
Guang-sen Zheng, MS,‡ Hai-chao Liu, DDS,§ Yu-jie Liang, MS,‖
and De-ming Ou, DDS¶

Purpose: The management of large hilar calculi is a technically challenging issue during sialoendoscopic surgery. The aim of the present study was to evaluate the clinical efficacy of sialoendoscopically assisted open sialolithectomy for the removal of large submandibular hilar calculi to avoid sialoadenectomy.

Patients and Methods: The present study was undertaken among patients with sialolithiasis scheduled for sialoendoscopic surgery from August 2005 to October 2008. When we failed to remove large submandibular hilar stones intraductally, we performed sialoendoscopically assisted open sialolithectomy. The clinical characteristics, pre- and intraoperative data, and outcomes were documented in a prospective fashion.

Results: Of 78 consecutive patients with submandibular sialolithiasis, 18 were treated with sialoendoscopically assisted open sialolithectomy immediately after failure of intraductal removal of calculi by sialoendoscopy. For 17 patients, large hilar sialoliths were successfully removed using this surgical technique. The surgery failed in 1 patient with multiple sialoliths, and the procedure was converted to open sialoadenectomy. Temporary numbness of the tongue for 1 week postoperatively was documented in 3 patients. The patients were followed up for a median period of 18 months without any symptoms or signs of recurrence.

Conclusion: Our results suggest that sialoendoscopically assisted open sialolithectomy is an effective and safe surgical technique to remove large submandibular hilar calculi.

J Oral Maxillofac Surg 68:68-73, 2010

Obstructive salivary gland disease is one of the most common problems afflicting the salivary glands and a major cause of salivary gland dysfunction and sialoadenectomy. A sialolith located in Wharton's duct is the most frequent cause of submandibular obstruction and consequent acute or chronic infection. Conservative therapeutic approaches, including gland massage, sialagogues (eg, chewing gum, sour drops) and antibiotics, can only ease the symptoms. Traditionally, sialoadenectomy was always indicated for these patients. During the past decade, sialoendoscopy has been introduced as a minimally invasive surgical procedure for the diagnosis and treatment of salivary ductal diseases.[1-5] With the advantages of this new technique, surgeons can visualize the duct lumen and the pathologic features, making the diagnosis according to the endoscopic findings. Also, interventional approaches can then be performed, aiming to elimi-

*Assistant Professor, Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, Guangzhou, China.

†Professor and Director, Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, Guangzhou, China.

‡Dental Student, Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, Guangzhou, China.

§Assistant Professor, Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, Guangzhou, China.

‖Dental Student, Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, Guangzhou, China.

¶Assistant Professor, Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, Guangzhou, China.

Address correspondence and reprint requests to Dr Liao: Department of Oral and Maxillofacial Surgery, Sun Yat-sen University Guanghua School of Stomatology, 56 Lingyuanxi Road, Guangzhou 510055 China; e-mail: drliaoguiqing@hotmail.com

0278-2391/10/6801-0012$36.00/0
doi:10.1016/j.joms.2009.06.031

nate the obstruction or dilate the duct. Sialoendoscopy enables preservation of the salivary gland with relief of symptoms in most patients.[1-5]

However, the field of sialoendoscopy is still in its infancy.[6] It is a technically demanding procedure and has some limitations. One of the most difficult issues in the sialoendoscopic surgery is the management of large hilar calculi. A sialolith larger than 1 cm is always impossible to remove intraductally using sialoendoscopy and is the main cause of surgical failure.[7] The aim of the present study was to investigate the clinical efficacy of sialoendoscopically assisted open sialolithectomy for removal of large submandibular hilar calculi to avoid sialoadenectomy.

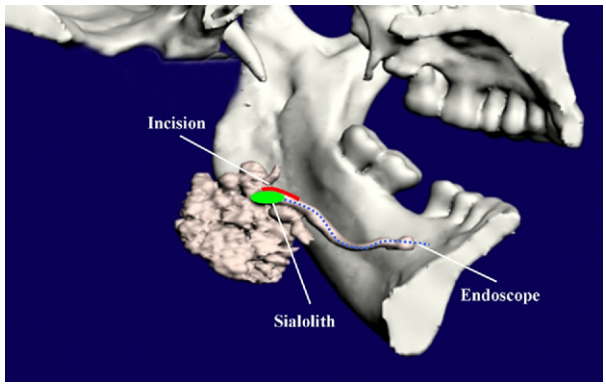

FIGURE 1. Schematic diagram of sialoendoscopically assisted open sialolithectomy for removal of large submandibular hilar stone.

Su et al. Sialoendoscopically Assisted Open Sialolithectomy. J Oral Maxillofac Surg 2010.

Patients and Methods

ENROLLMENT AND PATIENT CHARACTERISTICS

From August 2005 to October 2008, 78 consecutive patients with submandibular sialolithiasis underwent sialoendoscopic surgery at the Department of Oral and Maxillofacial Surgery, Sun Yat-Sen University Guanghua School of Stomatology, Guangzhou, China. When we failed to remove large submandibular hilar stones intraductally, we performed sialoendoscopically assisted open sialolithectomy. The institutional ethics board approved the study protocol, and all participants provided informed consent. The clinical characteristics, pre- and intraoperative data, outcomes, and complications were evaluated prospectively.

SURGICAL TECHNIQUE

The sialoendoscopic procedures were performed with the patient under local anesthesia. We used semirigid, moderately flexible sialoendoscopes (model Nos. 11575 and 11577 telescopes; Karl Storz, Tuttlingen, Germany) for the surgery. After expansion of the duct orifice, the endoscope was introduced into the duct with persistent irrigation. Interventional sialoendoscopy was performed to identify and locate the pathologic features. The first-choice treatment of sialoliths was intraductal extraction using a wire basket, grasping forceps, and/or balloon catheter.

Large stones, especially those located in the hilum, were always connected to the ductal wall and could not be released intraductally using sialoendoscopy. Sialoendoscopically assisted open sialolithectomy was then performed immediately. Figure 1 shows the schematic diagram of sialoendoscopically assisted open sialolithectomy for removal of large submandibular hilar stones.

The surgical procedures included the following steps: *1*) inserting the endoscope; *2*) identifying and locating the stone intraductally using sialoendoscopy; *3*) marking the position of the calculus in the oral floor mucosa according to the light transmitted from the tip of the endoscope; *4*) making an incision at the marked position; *5*) isolating the duct from the surrounding tissues and distinguishing the lingual nerve from Wharton's duct; *6*) incising the hilum according to the guidelines of the endoscope; *7*) separating the stone from the ductal wall and releasing it; *8*) irrigating the hilum; *9*) performing sialoendoscopic surgery for remnant stones, mucous plugs, and other possible pathologic features; and *10*) suturing the hilum and the oral mucosa and inserting an endoluminal stent for duct plasty.

FOLLOW-UP

The endoluminal stent was removed 2 weeks after surgery. The patients were encouraged to massage the affected glands and to stay well hydrated. At the follow-up visits, the clinical outcomes were evaluated according to the patients' symptoms and physical examination and radiographic imaging findings. The median follow-up period was 18 months (range, 1 to 38).

Results

Of the 78 consecutive patients with sialolithiasis, 18 were treated with sialoendoscopically assisted open sialolithectomy immediately after failure of intraductal extraction of large submandibular hilar calculi. For 17 patients, large hilar sialoliths were successfully removed using this surgical technique. The median operative time was 89 minutes (range 60 to 176). The median diameter of the removed stones was 1.5 cm (range 0.8 to 2.5). The surgery failed in 1 patient with submandibular multiple sialoliths and was converted to open sialoadenectomy. The success rate of sialoendoscopically assisted open sialolithectomy was 94.4%.

No major complications occurred intra- or postoperatively. Minor complications were recorded in 4 patients. One patient had a postoperative infection, and 3 developed temporary numbness of the tongue for 1 week postoperatively and recovered completely without additional intervention. The overall complication rate was 23.5%.

During follow-up, all 17 patients were symptom free, and no recurrence was documented. However, the clinical examination showed that clear saliva could be observed from the orifice in 11 patients, with little or no saliva identified from the orifice in 6 patients. No long-term complications were recorded.

CASE REPORT

A 40-year-old woman presented with repeated episodes of left submandibular gland swelling of 8 years' duration to our department (Fig 2A). The panoramic radiograph (Fig 2B) and computed tomography scan (Fig 2C) showed radiopacity in the hilar area. The preoperative uptake and excretion functions of the salivary glands were quantitatively assessed using scintigraphic examination with ^{99m}Tc-pertechnetate (Fig 2D). The time-activity curve of the left submandibular gland showed a decline in excretion function (Fig 2E). She was diagnosed with sialolithiasis of the left submandibular hilum.

Sialoendoscopic surgery was performed with the patient under local anesthesia. After insertion of the endoscope (Fig 2F), the large calculus was identified at the hilum. It was attached to the ductal wall (Fig 2G). We marked the position of the calculus in the oral floor mucosa using the guideline of the endoscopic light (Fig 2H). The mucosa was incised, and the duct was isolated, distinguishing it from the lingual nerve (Fig 2I). Next, the hilum was cut, and the stone was removed (Fig 2J). The reniform calculus was 2 cm in diameter (Fig 2K).

At the 1-year follow-up visit, clear saliva could be observed from the orifice of Wharton's duct of the left submandibular gland. Scintigraphic assessment (Fig 2L) revealed that the excretion function of the left submandibular gland had been restored to normal, and the bilateral glands had equivalent function (Fig 2M). The treatment was considered a clinical cure, and the patient was followed up for 30 months with no evidence of recurrence.

Discussion

Obstructive salivary gland disease continues to be the leading indication for sialoadenectomy. Previous studies have revealed that 62% to 80% of submandibular gland excisions result from sialolithiasis.[8,9] Sialoadenectomy can eradicate the obstructive symptoms; however, at the same time, it entails possible postoperative complications, such as facial nerve injury, in addition to the obvious functional and cosmetic impairments. Berini-Aytes and Gay-Escoda[8] showed that long-term complications developed in 25.3% of patients after excision of the submandibular gland. The high rate of sialoadenectomy resulted from the common concept that irreversible gland dysfunction would occur in the presence of obstructive diseases with a long course. However, a recent study has shown that a significant increase occurs in the functional fraction and the excretion rate of the gland after intraoral open removal of salivary calculi.[10] Moreover, a histopathologic study of submandibular glands removed for sialolithiasis demonstrated that a significant percentage of the glands exhibited normal histologic findings.[11] On the basis of these considerations, sialoadenectomy might be overtreatment of ductal disorders, and a conservative attitude toward salivary ductal obstruction appears justified.

The clinical application of sialoendoscopy is a large step forward in the management of salivary ductal obstruction. Sialoendoscopy, a minimally invasive surgical technique, enriches the treatment of obstructive salivary gland disease and obviates the need for sialoadenectomy. The miniaturization of the instrumentation has made it possible to eliminate pathologic features located in the deep ductal system with a high cure rate and a low morbidity rate of postoperative complications. In most patients, successful extraction of the obstructions will result in satisfactory long-term outcomes.[1-5] Our recent study using the saliva flow rate test and scintigraphic examination also demonstrated that glandular function recovery after sialoendoscopic management of obstructive salivary gland disease is possible and satisfactory.[12]

However, large hilar sialoliths are still one of the most technically challenging issues in sialoendoscopic surgery. Stones larger than 1 cm and located in the hilum are always attached to the ductal wall. The intraductal approaches, including wire basket and forceps, are incapable of releasing such large stones.[7] Even if these stones can be captured, it is nearly impossible for them to pass through the relatively narrow duct channel. Therefore, we used the surgical technique of sialoendoscopically assisted open sialolithectomy to remove large submandibular hilar sialoliths in the present study. Of the 18 patients with a large submandibular hilar sialolith, 94.4% were successfully treated using this approach, with gland preservation and no symptoms during the follow-up period. The technique is similar to that reported by Nahlieli et al,[7,13] McGurk et al,[14] and Marchal.[15] Compared with traditional transoral open sialolithectomy,[16,17] this endoscopically assisted technique has some advantages. The endoscope plays an indispensable role in this approach, including duct exploration,

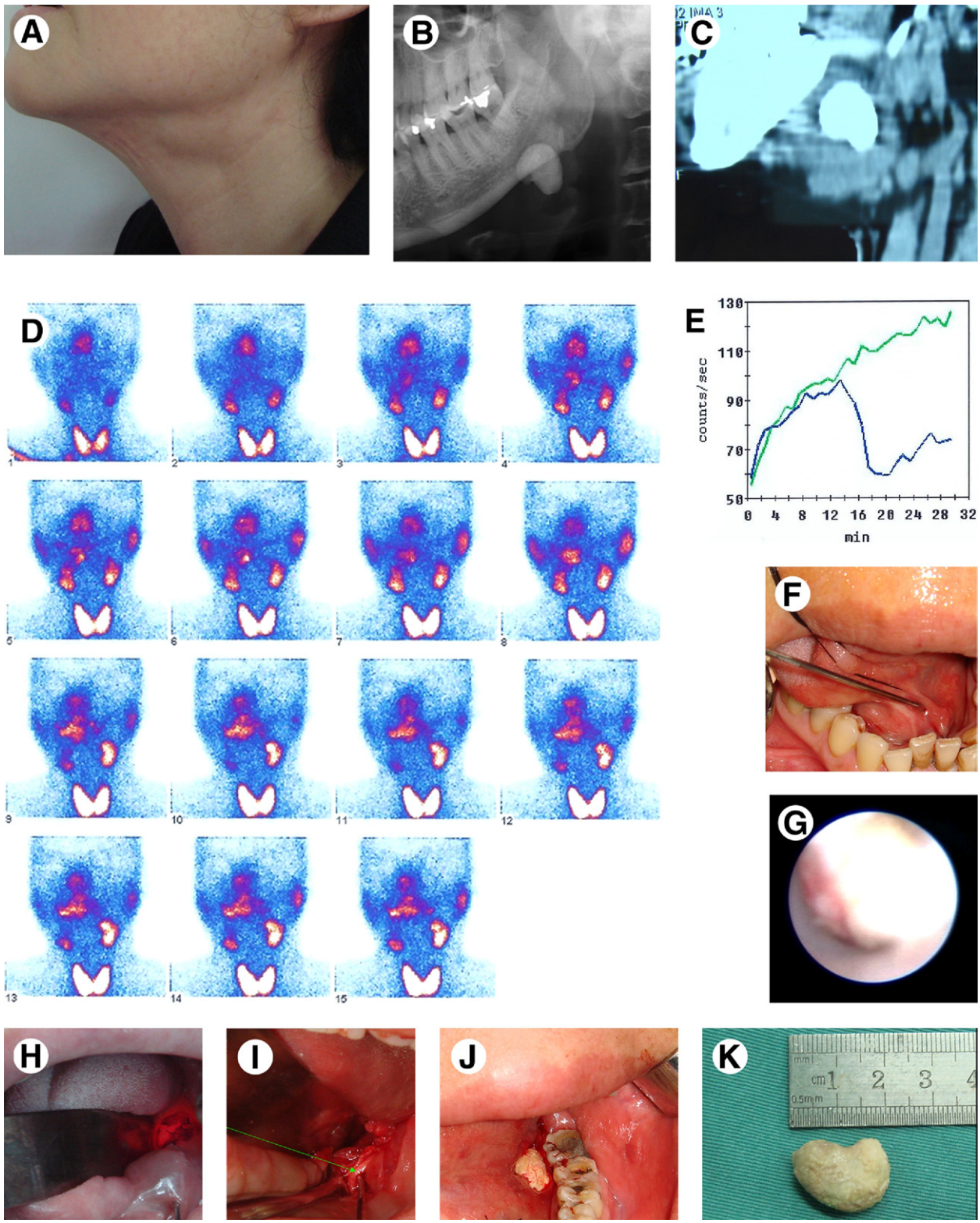

FIGURE 2. *A,* A 40-year-old woman presented with repeated episodes of left submandibular gland swelling of 8 years' duration. *B,* Pantomographic view of sialolith. *C,* Computed tomography scan showing large stone located in left submandibular hilum. *D,* Reframed dynamic images (2 min/frame) of preoperative salivary scintigraphy. *E,* Time-activity curve showing left side *(green line)* with reduced excretion function preoperatively. *F,* Endoscope introduced into Wharton's duct. *G,* Stone attached to hilar wall identified under endoscopic view. *H,* Light transmitted from tip of sialoendoscope showing position of hilar calculus. *I,* Incision into marked position, distinguishing lingual nerve *(arrow)* from Wharton's duct and isolating duct. *J,* Cutting hilum and removing stone. *K,* Reniform stone 2 cm in diameter. **(Figure 2 continued on next page.)**

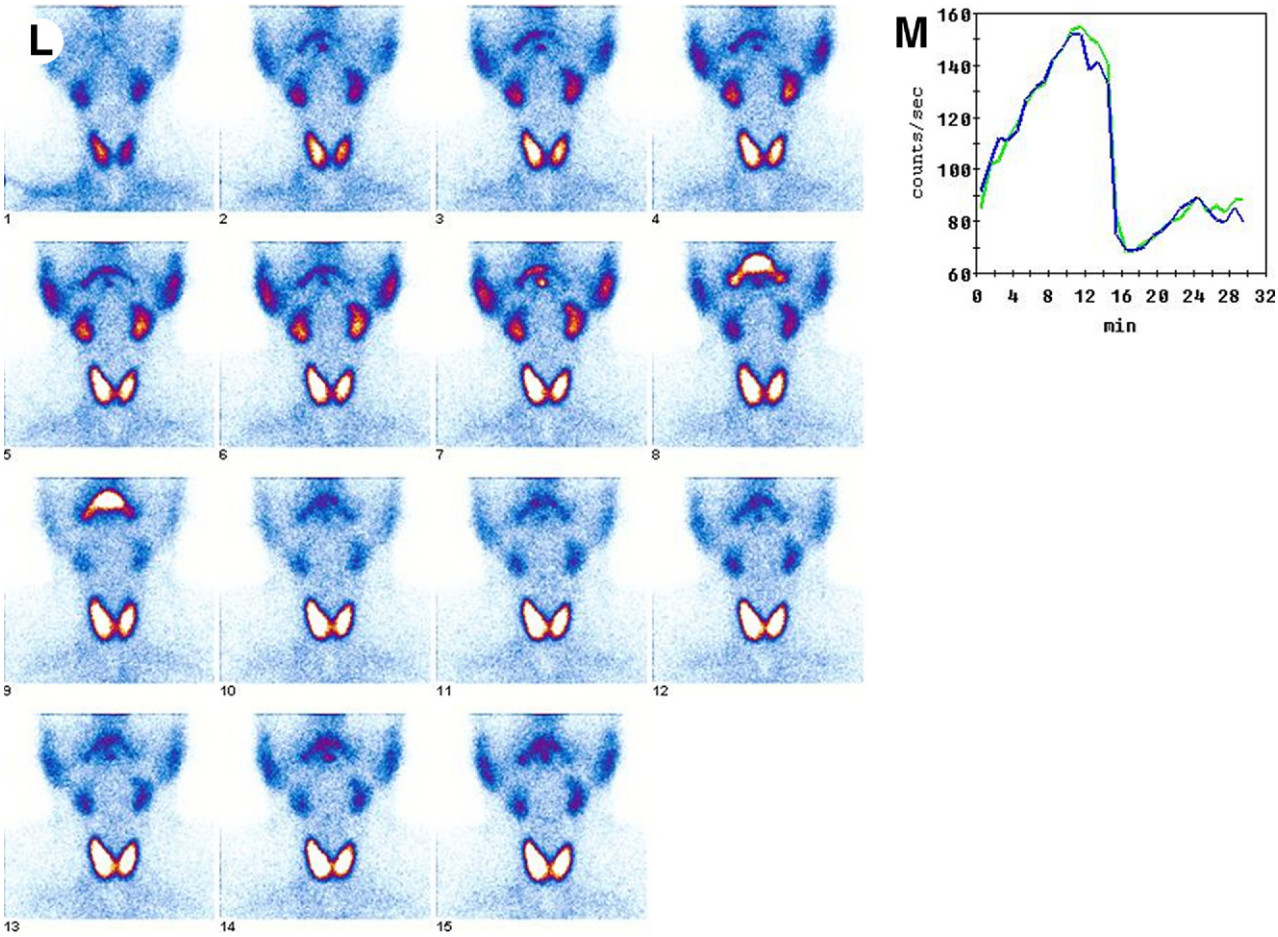

FIGURE 2 (cont'd). *L,* Reframed dynamic images (2 min/frame) of salivary scintigraphy 1 year postoperatively. *M,* Time-activity curve showing bilateral glands have equivalent function postoperatively.

Su et al. Sialoendoscopically Assisted Open Sialolithectomy. J Oral Maxillofac Surg 2010.

exact orientation of the sialoliths, differentiation of the main duct and the lingual nerve, and management of other pathologic features, such as remnant calculi and mucous plugs. One of the most important issues with this procedure is identifying and protecting the lingual nerve. Anteriorly to the hilum, the lingual nerve crosses the duct laterally and then passes medially to the tongue. With the endoscopic light transmitted inside the duct, it is not only easier to locate the sialoliths, but also more reliable for the operator to distinguish the duct from the lingual nerve. Our experience has revealed that the endoscope facilitates the retrieval of large hilar calculi, making the surgery more precise and reducing the possibility of remaining stones. The technique can serve as an attractive alternative to existing techniques, such as extracorporeal shock wave lithotripsy,[18,19] for the extraction of large hilar sialoliths.

The present study had some limitations. First, the size of our patient population was limited. Second, the glandular functional recovery of each patient after surgery needs to be evaluated. Although the functional recovery of the salivary gland in our case report is inspiring, the lack of enough data for statistical analysis was the weakness of the present study. For 17 patients who underwent this surgery successfully, all were symptom free during the follow-up period, but little or no saliva was found from the duct orifice in 6 patients. The different functional status of these glands is an interesting issue that needs to be assessed further. Finally, the long-term outcomes are still to be investigated before reaching some final conclusions.

We can conclude, therefore, that sialoendoscopically assisted open sialolithectomy is an effective and safe surgical technique for the removal of large submandibular hilar calculi. The initial clinical outcomes were satisfactory, but the long-term results and the functional recovery of glands are yet to be investigated.

References

1. Nahlieli O, Baruchin AM: Endoscopic technique for the diagnosis and treatment of obstructive salivary gland diseases. J Oral Maxillofac Surg 57:1394, 1999
2. Marchal F, Dulguerov P, Becker M, et al: Specificity of parotid sialendoscopy. Laryngoscope 111:264, 2001

3. Nahlieli O, Baruchin AM: Sialoendoscopy: Three years' experience as a diagnostic and treatment modality. J Oral Maxillofac Surg 55:912, 1997
4. Nahlieli O, Nakar LH, Nazarian Y, et al: Sialoendoscopy: A new approach to salivary gland obstructive pathology. J Am Dent Assoc 137:1394, 2006
5. Marchal F, Dulguerov P, Becker M, et al: Submandibular diagnostic and interventional sialendoscopy: New procedure for ductal disorders. Ann Otol Rhinol Laryngol 111:27, 2002
6. Papadaki ME, McCain JP, Kim K, et al: Interventional sialoendoscopy: Early clinical results. J Oral Maxillofac Surg 66:954, 2008
7. Nahlieli O, Shacham R, Zagury A, et al: The ductal stretching technique: An endoscopic-assisted technique for removal of submandibular stones. Laryngoscope 117:1031, 2007
8. Berini-Aytes L, Gay-Escoda C: Morbidity associated with removal of the submandibular gland. J Craniomaxillofac Surg 20:216, 1992
9. Preuss SF, Klussmann JP, Wittekindt C, et al: Submandibular gland excision: 15 Years of experience. J Oral Maxillofac Surg 65:953, 2007
10. Makdissi J, Escudier MP, Brown JE, et al: Glandular function after intraoral removal of salivary calculi from the hilus of the submandibular gland. Br J Oral Maxillofac Surg 42:538, 2004
11. Marchal F, Kurt AM, Dulguerov P, et al: Histopathology of submandibular glands removed for sialolithiasis. Ann Otol Rhinol Laryngol 110:464, 2001
12. Su YX, Xu JH, Liao GQ, et al: Salivary gland functional recovery after sialendoscopy. Laryngoscope 119:646, 2009
13. Nahlieli O, London D, Zagury A, et al: Combined approach to impacted parotid stones. J Oral Maxillofac Surg 60:1418, 2002
14. McGurk M, MacBean AD, Fan KF, et al: Endoscopically assisted operative retrieval of parotid stones. Br J Oral Maxillofac Surg 44:157, 2006
15. Marchal F: A combined endoscopic and external approach for extraction of large stones with preservation of parotid and submandibular glands. Laryngoscope 117:373, 2007
16. Roh JL, Park CI: Transoral removal of submandibular hilar stone and sialodochoplasty. Otolaryngol Head Neck Surg 139:235, 2008
17. McGurk M: Surgical release of a stone from the hilum of the submandibular gland: A technique note. Int J Oral Maxillofac Surg 34:208, 2005
18. McGurk M, Escudier MP, Brown JE: Modern management of salivary calculi. Br J Surg 92:107, 2005
19. Escudier MP, Brown JE, Drage NA, et al: Extracorporeal shock wave lithotripsy in the management of salivary calculi. Br J Surg 90:482, 2003