

## ARAŞTIRMA / RESEARCH ARTICLE

# Diagnostic and interventional sialendoscopy in recurrent salivary gland swellings

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### Tekrarlayan tükürük bezi şişliklerinde tanısal ve girişimsel sialendoskopi

**Amaç:** Sialendoskopi, majör tükürük bezlerinin kanallarını incelemeye yarayan bir endoskopi tekniğidir. Minimal invaziftir ve kanal patolojilerinin tanısı ile tedavisinde kullanılabilir. Tanısal sialendoskopinin temel endikasyonu, nedeni belirlenemeyen tüm intermittan tükürük bezi şişmeleridir. 1990 yılından bu yana geliştirilmiş ve dünya genelinde bazı merkezlerde kullanımı yaygınlaşmıştır. Bu makalede, 2004 yılından beri kullanmakta olduğumuz sialendoskopi tekniğini tanımlamayı ve tanıtmayı amaçladık.

**Yöntem:** Nisan 2004 ve Mayıs 2006 tarihleri arasında başvuran, submandibuler veya parotis bezi kanalında fonksiyon bozukluğu olduğunu düşündüğümüz dokuz olgu değerlendirildi. İzlenen patolojiler mukus tıkaçları, tükürük bezi taşları, sialodokitis ve kanal polipi olarak sınıflandırıldı. Kanal sisteminin tamamı hastaliksiz olarak değerlendirildiğinde "sialendoskopik başarı" olarak yorumlandı. Sialendoskopinin başarısız veya olanaksız olduğu durumlarda veya bez rezeksiyonu uygulandığında "sialendoskopik başarısızlık" olarak yorumlandı.

**Bulgular:** Tanısal sialendoskopi tüm tükürük bezlerinde %100 başarı oranı ile uygulanabildi. Girişimsel sialendoskopi beş tükürük bezinde (2 parotis ve 3 submandibuler) %80 başarı oranı ile uygulanabildi. Daha önce tükürük bezi rezeksiyonu önerilmiş olan hastaların yalnızca bir tanesinde açık cerrahi gerekli oldu.

**Sonuç:** Sialendoskopinin avantajı, majör tükürük bezi kanallarındaki tıkaçıcı patolojinin esas sebebinin tanımlayabilmesi ve eş zamanlı olarak bertaraf edebilmesidir. Girişimsel sialendoskopi sayesinde tükürük bezi cerrahisinin endikasyonları azalabilecektir.

**Anahtar Sözcükler:** Sialendoskopi, sialoskopi, tükürük bezi, tükürük taşı, polip, darlık, Wharton kanalı, Stensen kanalı.

### Abstract

**Objectives:** Sialendoscopy is an endoscopic technique to examine the ducts of the major salivary glands. It is minimally invasive and can be used for diagnosis and management of ductal pathologies. The main indication for diagnostic sialendoscopy is intermittent salivary gland swelling of unclear origin. Since 1990 this technique has been developed and progressively used in certain centers in the world. We aimed to describe and introduce the sialendoscopy techniques, which we are using since 2004.

**Methods:** Between April 2004 and April 2006, nine consecutive patients with the suspected submandibular or parotid duct dysfunction were evaluated. The observed disorders of the ducts were classified as mucus plugs, sialolithiasis, sialodochitis and ductal polyps. "Sialendoscopic success" was considered when the entire ductal system was rendered free of disease. Sialendoscopic failures" were considered when sialendoscopy was impossible or unsuccessful, or when an open gland resection was performed.

**Results:** Diagnostic sialendoscopy could have been carried out in all glands with 100% success rate. Interventional sialendoscopies were carried out in five glands (2 parotid and 3 submandibular) with 80% success rate. Only one open approach was required in the patients, who all had been considered previously as the candidates of gland resection.

**Conclusion:** Sialendoscopy has the advantage to identify and eliminate the real cause of obstructive pathology of the major salivary glands at the same time. Interventional sialendoscopy may reduce the number of indications for traditional salivary gland excisions.

**Key Words:** Sialendoscopy, sialoscopy, salivary gland, sialolithiasis, polyp, stenosis, Wharton's duct, Stensen's duct.

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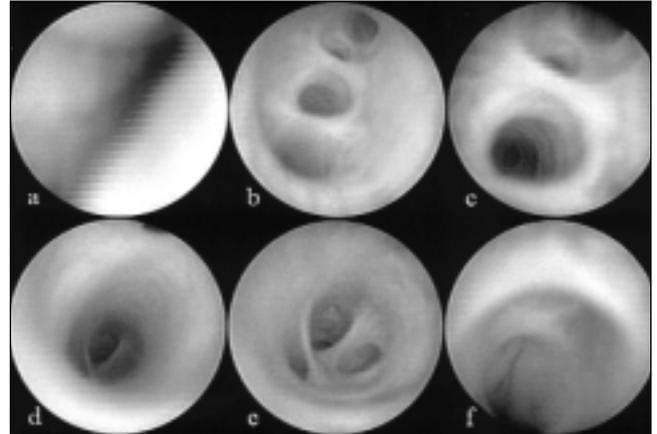
## Introduction

Non-neoplastic diseases of salivary glands can be divided into parenchymal ones, which require traditional treatments, and ductal ones, which can be handled endoscopically in the majority of cases.<sup>1</sup> Any obstructive lesions in the salivary ducts may result in a mechanical obstruction, which causes recurrent swelling during meals, and sometimes it can be complicated by bacterial infections.<sup>2</sup>

Besides the manual palpation, the standard x-Ray films, computed tomographic scan, ultrasonography, conventional or digital subtraction sialography and MR sialography are the diagnostic methods for salivary gland disorders. In some patients with swelling of major salivary glands, diagnosis cannot be made by conventional radiological means or even with high-resolution ultrasound.<sup>3</sup> Stenoses may not be readily distinguished from sialolithiasis. Sialoliths with smooth consistency can often not be differentiated from fibrinous plugs, fibrotic changes, such as stenosis, chronic sialadenitis, calcifications in the gland or lymph nodes, and plugs in blood vessels. Moreover, obstructive diseases can be caused by other conditions, such as organic foreign bodies, intraductal tumors or anatomic variations.<sup>4</sup>

In a suspicious ductal obstruction like sialolithiasis, when intensive conservative measures such as duct bougienage, gland massage, and sialogogues have failed to eliminate the stone, then if the stone is close to papillae, a marsupialization (sialodochoplasty) has been performed for many years.<sup>5</sup> Recurrent episodes of sialadenitis were accepted as an indication for open gland resection. However, in a sialolithiasis case, a parotidectomy was less frequent than submandibular gland resection.

To solve these difficulties in diagnosis and management of ductal pathologies, the sialendoscopy techniques were defined in 1990, and have been progressively used and developed worldwide. Sialendoscopy is an endoscopic technique to examine the ducts of the major salivary glands (Figure 1). With the small diametered sialendoscopes, some ductal problems like sali-



**Figure 1.** Normal sialendoscopy of a submandibular patients Wharton's duct. **a.** primary duct, **b.** secondary duct openings, **c.** approximation of sialendoscope to a secondary duct, **d.** tertiary duct openings, **e.** approximation to tertiary ducts, **f.** ending of a tertiary duct.

vary stones, mucus plugs, polyps and stenoses can be directly detected. It is minimally invasive and can be used for management of ductal pathologies too. Diagnostic sialendoscopy is an evaluation procedure, while interventional sialendoscopy must be considered as an operation.<sup>1</sup>

In this article we aimed to introduce the sialendoscopy techniques and share our initial experiences.

### Indications for sialendoscopy

The technical advances and improvements in endoscopes led to a widened spectrum of indication for diagnostic and interventional sialendoscopy. The main indication is: All intermittent salivary gland swellings of unclear origin.<sup>6</sup> Koch et al.<sup>4</sup> added new indications regarding their experiences: 1. detection of occult sialoliths; 2. detection of early formation sialoliths (mucous or fibrinous plugs) and prophylaxis of stone formation; 3. treatment of postinflammatory stenoses and other obstructive conditions; 4. detection and therapy of anatomic variations or malformations; 5. diagnosis and new insights into causes of autoimmune disorders that may involve salivary glands leading eventually to therapeutic consequences; and 6. follow-up and control of therapy success rates.

## Materials and Methods

### Patients

Between April 2004 and April 2006, nine consecutive patients with the suspected submandibular or parotid duct dysfunction were evaluated. The mean age was 43.3, with a range of 26 to 58 years. Six of the patients had submandibular and three parotid symptoms; one of the parotid patients had bilateral symptoms. Eight of the patients had been the candidates of gland resection in other clinics. The minimum period between last sialadenitis attack and the sialendoscopy procedure was 3 weeks. All of the patients had an otolaryngologic examination, complete blood analysis and ultrasonographic evaluation before the procedure. One submandibular patient with a prior unsuccessful marsupialization attempt was excluded because of the obstacles to finding the papilla in the scar tissue.

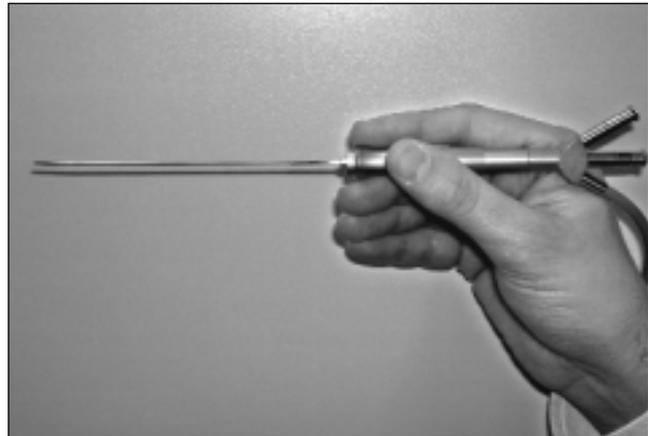
The observed disorders of the ducts were classified as sialolithiasis, sialodochitis and ductal polyps. Each pathological finding in each ductal system was noted. The stones were measured after removal.

The numbers of diagnostic and interventional procedures per gland, the type of anesthesia were recorded. "Sialendoscopic success" was considered when the entire ductal system was rendered free of disease. "Sialendoscopic failures" were considered when sialendoscopy was impossible or unsuccessful, or when an open gland resection was performed.<sup>1</sup>

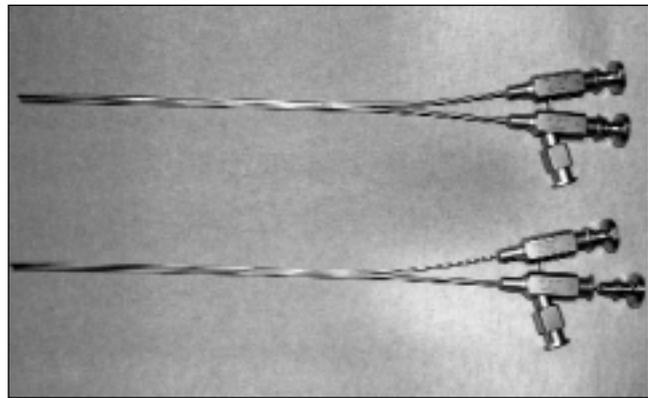
### Endoscopes used in sialendoscopy

1. For diagnostic sialendoscopy, a 1.3 mm-outside diametered semirigid Marchall sialendoscope (Karl Storz AG, Germany) with 0.25 and 0.65 mm working channels (Figure 2); or a 1 mm diametered semi-rigid miniature telescope with 1.3 mm-outside diametered, single-lumen examination sheath were used.

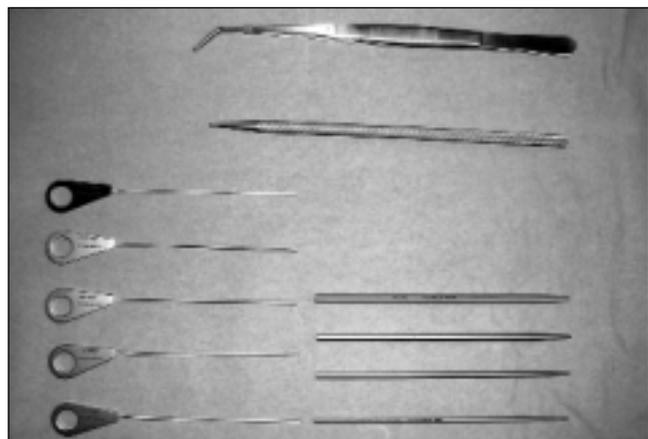
2. For interventional sialendoscopy, a 1mm diametered semi-rigid miniature telescope with a 0.8 mm/1.3 mm double-lumen operation sheath with working channel 0.65 mm and telescope channel 1.15 mm and/or with a 1.3 mm/1.3 mm double-lumen operation sheath with working channel 1.15 mm and telescope channel 1.15 mm were used (Figure 3).



**Figure 2.** Marchall sialendoscope with 0.25 and 0.65mm working channels.



**Figure 3.** Double-lumen operation sheaths with working and telescope channels.



**Figure 4.** Salivary duct probes with increasing diameters (left), a salivary duct dilatator (up), bougies with increasing diameters (right).

### Other materials

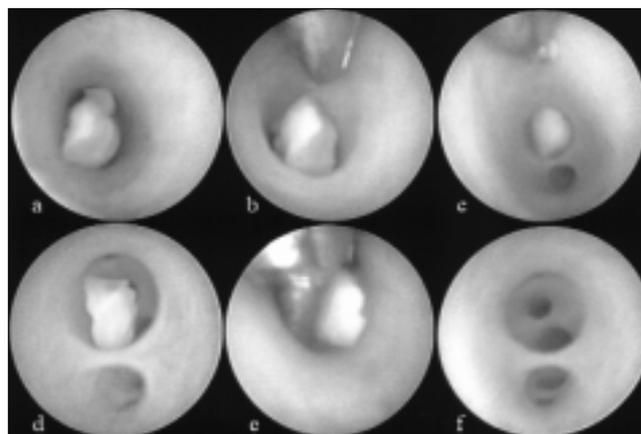
Other materials include salivary duct probes with increasing diameters, a salivary duct dilatator, bougies with increasing diameters (Figure 4), stone extractor with 6 wires and a grasping forceps. Fragmentation of larger stones was tried with a 400 µm holmium laser probe (Coherent, Versapulse Select, Santa Clara, California).

### Technique

Sialendoscopies were performed with local or general anesthesia. The papilla of the affected gland was injected with local anesthetic agent (xylocaine 1% with epinephrine 1:200000).

The ducts were probed and the papillae were carefully dilated using duct probes or bougies with increasing diameters until the size is large enough to take the sialendoscope. Then the sialendoscope introduced into the salivary duct and advanced, while continuously rinsing with isotonic saline solution. The rinsing system provides for dilatation of the duct, defogging, and irrigation of debris. Special care should be taken to avoid trauma of the ductal walls and perforation. Normally, the ducts can be observed from main duct to tertiary branches until the sialendoscope can not go forward.

When we observed an obstructive pathology, we used several techniques to handle it. To remove the sialoliths in width smaller than 4 mm for submandibular glands and smaller than 3 mm for parotid glands, we approximated the top of the sialendoscope to the sialolith, and then a 1 mm diametered flexible grasping forceps or a stone extractor (wire basket forceps) was inserted into the working channel. The stones were grasped under sialendoscopic observation after several attempts and the sialendoscope was pulled back with the grasping forceps (Figure 5). In cases with bigger stones, we inserted the holmium laser probe into the working channel and we targeted to the stone to fragment it. The stone fragments can be removed with the same technique. In cases of mucus plugs, sticky secretion plugs were mobilized and cleared by rinsing and suctioning. Stenoses can be treated with metallic dilators when located in the main duct or with balloon



**Figure 5.** Interventional sialendoscopy. **a.** multiple salivary stones in Warthon's duct, **b.** grasping forceps is approaching to the first salivary stone, **c.** the second salivary stone is impacted in a secondary duct, **d.** the third salivary stone, **e.** the third salivary stone is grasped with the forceps, **f.** the second and tertiary duct openings after complete stone removal.

catheters under endoscopic control for localized or more peripheral strictures.<sup>7</sup>

Postoperatively, the patients were followed closely because of theoretical respiratory distress due to iatrogenic gland swelling or soft tissue edema. The follow up period was 2-17 months.

### Results

All of the patients were complaining of recurrent swellings in submandibular or parotid region during some meal times. One parotid patient had only one infectious attack 2 months ago. Three of submandibular patients and one of parotid patients had a few infectious attacks in the past. Ultrasonography revealed sialolithiasis in four of the submandibular cases and in two of the parotid cases.

Diagnostic sialendoscopy could have been carried out in all glands with 100% success rate. It verified sialolithiasis in Wharton's ducts of three submandibular patients and in Stensen's duct of one parotid patient. There were found three 1.5-2x2 mm diametered flat and irregular salivary stones in the first submandibular case; a 1.3 cm diametered spherical and distally located immobile stone in the second; and a 2x2x1 mm and

a 9x2x2 mm two cylindrical stones in the main duct of the third case. In the parotid patient during dilatation and irrigation, a mixture of microcalculi and mucus plug (like a mud) flew out the papilla. Then in his sialendoscopy we found dense mucus plug and a 2x2x1 mm diametered salivary stone.

One each submandibular and parotid cases had no sialoliths in their glands, which is contradictory with their pre-sialendoscopy ultrasound (n=2). Sialodochitis was observed in Stensen's duct of this parotid patient; and in the submandibular patient, sialendoscopy was totally normal. The sialendoscopy of the remaining submandibular patient was normal too.

In the third parotid patient, bilaterally mucus plugs and in the right side a ductal polyp were detected in Stensen's ducts; she was later diagnosed with Sjogren's syndrome.

Interventional sialendoscopies were carried out in five glands (2 parotid and 3 submandibular) with 80% success rate. In the parotid patient with Sjögren's syndrome the thick mucus plug was removed with forceps and the duct was irrigated. In the other parotid patient, all of the mucus plugs and calculi under 1mm diameter were removed with irrigation and parotid massage and the stone was removed with wire-basket. In two submandibular patients with multiple stones, the stones were removed one by one using a grasping forceps or wire-basket. In the other submandibular patient with distally located immobile stone, we attempted to break it into small pieces with Ho:Yag laser. But it was unfortunately impossible due to hindering of the folding lumen and concrete like composition of the stone. This patient underwent to resection of the submandibular gland.

Only one open approach was required in eight patients (13%), who all had been considered previously as the candidates of gland resection. All the other patients except the submandibular patient with Sjögren's syndrome had no symptoms in their follow up.

## Discussion

Progressive miniaturization of rigid and flexible endoscopes enables the otolaryngologist to visually

inspect regions that could never have been inspected directly before. The development of "sialendoscopy of the salivary glands", is the first procedure to identify the real cause of obstructive disorders of the major salivary glands.<sup>8</sup> Direct visual inspection allows the examiner to differentiate between stenoses, secretion plugs and calculi. The success rate of diagnostic sialendoscopy varies between 92 and 100 percent.<sup>9,10</sup> We could perform the procedure successfully in all of our patients except the one who previously had had an unsuccessful marsupialization attempt.

The first report of a distal submandibular stone extraction was published in 1990; the procedure was performed blindly with a wire basket, during sialography.<sup>11</sup> Sialendoscopy was first described in 1990.<sup>12</sup> Initially used for diagnosis, it is now scheduled as interventional sialendoscopy for the treatment of stones and stenosis of salivary ducts and glands.<sup>13</sup>

The main indications for submandibular gland resection are sialolithiasis and sialadenitis, which represents up to 89% of all indications.<sup>14</sup> There is a common misbelieving that a gland with obstructive sialolithiasis is no longer functional. In a histopathological study on submandibular glands removed because of sialolithiasis showed that, there was no correlation between the degree of gland alteration and the number of infectious episodes; there was no correlation between the degree of gland alteration and the duration of evolution; and despite appropriate indications for submandibular gland removal, close to 50% of the removed glands were histopathologically normal or close to normal.<sup>15</sup> A conservative approach even in long-standing sialolithiasis appears therefore to be justified. Although submandibular gland resection is a frequent operation, several reports demonstrate a rather high rate of complications.<sup>14,16</sup> Even simple marsupialization of the ductal papilla may be result in complete stenosis and disappearance of the papilla. The non- or minimally invasive therapeutic methods used for submandibular sialolithiasis include radiologically controlled<sup>17</sup> removal, shock wave lithotripsy,<sup>18,19</sup> and interventional sialendoscopy,<sup>13,20</sup> which allows us to manage the ductal pathologies under direct visualization.

Interventional sialendoscopy has been used mainly for sialolith removal and is proposed immediately after

the diagnostic procedure for stones smaller than 4mm. For sialoliths larger than 4mm, the shape of the stone is important, and an irregular shape or a very posteriorly located stone would render interventional endoscopy difficult, risking basket blockage or the necessity of using fragmentation procedures. In those cases, the procedure should be performed under general anesthesia.<sup>1</sup> When the diameter of the sialolith is too large to pass through the papilla, then there are two options: incision of the papilla or lithotripsy (endoscopic laser<sup>3</sup> or shock wave lithotripsy<sup>18,19</sup>) and removing of the fragments. Laser-induced shock wave lithotripsy (LIL) can be performed by transferring short laser pulses via an inserted fibre onto the surface of the stone to disintegrate it.<sup>8</sup> For parotid stones smaller than 3mm, 97% could be retrieved with the wire basket without fragmentation; for stones larger than 3 mm, the success rate for large stones of this technique was 35%. With the adjunct of fragmentation, the success rate for large stones increases to 72%.<sup>10</sup> The success rate of interventional sialendoscopy varies between 82 and 98.6 percent.<sup>1,21</sup> Our success rate in interventional sialendoscopy is 80%.

Directing the endoscope at distal end of the canal system is difficult, because of the movement restriction in very narrow lumen. Extremely tortuous canal could hamper endoscope progression too. In this situation, viewing of the pathology may be possible, however any effort causes to folding of the lumen, which hinders to continue of the technique. Progression should be done only in the center of the lumen, under clear vision.<sup>1</sup> Another problem with this conservative technique is that after each salivary duct probe change, the surgeon goes out of the papilla and thus loses the papilla hole, which can be hard to find again. Indeed, at each step, the probe diameter increases, which makes it harder to go through the papilla. This problem can be overcome with guide wire technique described by Chossegros et al.<sup>22</sup> After the titanium guide wire is inserted, the bougies with center drilled channel or the scope follows the way of the guide wire and enters in the duct. Then the guide wire can be removed and the sialendoscopy can begin. Operating the sialendoscope requires experience. It is delicate, as any small movements of the sialendoscope against the canal wall result

in a blurred image. It may be hazardous because of theoretical risks of perforation and vascular or neural damage.<sup>7</sup> Marchal et al.<sup>1</sup> experienced 11 ductal wall perforation and 2 wire basket blockages in 110 submandibular gland interventional sialendoscopy. Nine of the perforations were due to canal wall stripping, and 2 perforations occurred with the holmium laser. The complication rates varies between 0.9 and 12 percent.<sup>4,10</sup> We didn't observe any complication in our patients.

Interventional sialendoscopy may reduce the number of indications for salivary gland surgery. Koch et al.<sup>4</sup> evaluated 103 cases with recurrent swelling of the major salivary glands of uncertain origin. Altogether, gland preserving treatment was performed in 55.3% of all cases (in 27 parotid gland and in 30 submandibular gland cases). Gland extirpation was necessary in only 1.9% of all cases (2 of 103). In the study of Ziegler et al.<sup>9</sup> this rate is 8% (6 of 72). Eight of our patients had been the candidates of gland resection in other clinics. Only in one patient we had to use the open procedure to resect the submandibular gland (13%). Recurrence of obstructive symptoms occurs rarely following the initial procedure. The procedure can be safely repeated.<sup>10</sup>

## Conclusion

We will not recommend marsupialization of the ductal papilla, which may be result in complete stenosis and disappearance of the papilla. Sialendoscopy techniques can be used in the diagnosis and management of major salivary gland ductal disorders, and may reduce the number of indications for salivary gland surgery.

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**Conflict of interest statement:**

No conflicts declared.

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