

## Leading Clinical Paper Salivary Glands

# Intraoral removal of proximal submandibular stones – an alternative to sialadenectomy?

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**Abstract.** Submandibular salivary stones account for most symptomatic sialoliths and most are treated by adenectomy. Transoral removal of proximal or hilar stones is an alternative approach that preserves the functioning gland. Between 1999 and 2006, 186 consecutive patients had transoral removal of 186 stones in the proximal third or hilum of the submandibular gland. Both patient and treatment details were recorded prospectively and outcome assessed by a structured questionnaire. Stone removal was achieved in 99% (185/186) of cases treated. Morbidity was low and there were no intra-operative complications. At median follow up of 28 months (range 4–62 months) 4% (7/186) had subsequently undergone sialadenectomy for persisting symptoms. 105/186 responded to a questionnaire, 76% (80/105) were symptom-free and in a further 17% (18/105) symptoms were mild. No patient had lingual nerve anaesthesia but 6% (6/105) reported a mild tingling. 93% (97/105) were pleased to have had the operation. Submandibular stones can be reliably retrieved from the proximal portion of the duct or hilum with minimal morbidity. Evolving review data suggests that the incidence of recurrent disease is low at 2 years, suggesting that this technique may be a viable alternative to adenectomy.

**Keywords:** salivary stone; submandibular; sialadenectomy.

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Approximately 50% of salivary gland disease is the result of stones and the annual incidence of symptomatic salivary calculi in the UK is judged to be 5.9/100,000<sup>6</sup>. Post-mortem studies, which include asymptomatic disease, suggest a prevalence of 1%<sup>13</sup>. Demographic data indicate that 80–90% of stones are in the submandibular system<sup>2,5,11,14</sup> with approximately 40% of these located in the distal duct near to the punctum. Stones become symptomatic when they are large enough to obstruct the duct and induce a painful swelling at mealtimes. The gland can

become chronically inflamed and occasionally acutely infected<sup>14</sup>.

It is accepted policy to remove distal stones by simple intraoral surgery, while gland removal has been reserved for symptomatic stones in the proximal duct or gland. Submandibular sialadenectomy successfully relieves symptoms<sup>1,17</sup>, but results in scarring and transient or permanent facial nerve weakness in up to 30% and 7% of cases, respectively<sup>1,8–10</sup>. Unilateral submandibular gland excision halves the rate of resting salivary flow<sup>3,8,17</sup>. In keeping with the overall trend

in surgery towards minimally invasive procedures, new techniques have been developed to preserve the gland whilst removing the obstruction. The rationale for such an approach is scintigraphic evidence of significant increases in the functional fraction and the excretion rate after calculus removal<sup>12</sup> and the return to asymptomatic glandular function in most patients<sup>16,18,21</sup>.

Extracorporeal shockwave lithotripsy has been used to treat small (<8 mm diameter) submandibular calculi, but only cures about one-third of patients<sup>7,19</sup>. Radi-

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ologically guided basket retrieval is possible if the stone is mobile and  $>5$  mm in diameter<sup>4</sup>. Larger, more proximal stones remain a clinical problem. SELDIN et al.<sup>14</sup> noted that most submandibular calculi could be approached intraorally and challenged the premise that the gland had to be removed. They suggested a technique whereby palpable proximal or intra-glandular stones are approached by an incision over the stone that is deepened until the stone is reached. In 141 cases only one patient had recurrent symptoms that required the gland to be removed. In 1968, SEWARD<sup>15</sup> noted the inherent risk to the lingual nerve in this blind procedure and described a technique whereby an incision is made in the floor of the mouth to expose the whole course of the submandibular duct and to separate this from the lingual nerve via tape retractors. The duct is incised over the calculus, which is then removed and the mucosa closed. Recently, ZENK et al.<sup>20</sup> reported excellent success and low morbidity, using a similar technique in which the duct is opened from the ostium to the obstruction. Once the stone(s) are retrieved the duct is marsupialised into the floor of the mouth. The presented method differs in that the duct is fully exposed in the floor of mouth and the stone located before a limited ductotomy is performed, the stone or stones extirpated and the duct closed to re-establish integrity.

### Patients and Methods

186 patients at Guy's Hospital Salivary Gland Unit with submandibular stones underwent intraoral stone removal from January 1999 to May 2006. The presence of stones was confirmed by a combination of plain radiography, sialography, ultrasonography and endoscopic visualisation. In some cases the functional status of the gland was quantified using scintigraphy. Cases with small stones amenable to lithotripsy or radiologically guided basket retrieval (those  $>5$  mm in diameter or fixed) were excluded from the study; the remainder (N = 186) were listed for intraoral removal.

### Technique

Under local or general anaesthesia, the mouth is held open using an ipsilaterally placed Ferguson gag while the tongue is retracted using the non-dominant index finger and a gauze swab, thus exposing and tensing the floor of mouth. Following infiltration with 2 ml 2% lignocaine with 1:80,000 adrenaline, to help with haemostasis, the sublingual gland is identified and an incision made along its medial border



Fig. 1. Incision in the floor of mouth just medial to the sublingual gland; note ipsilateral gag and position of index finger.

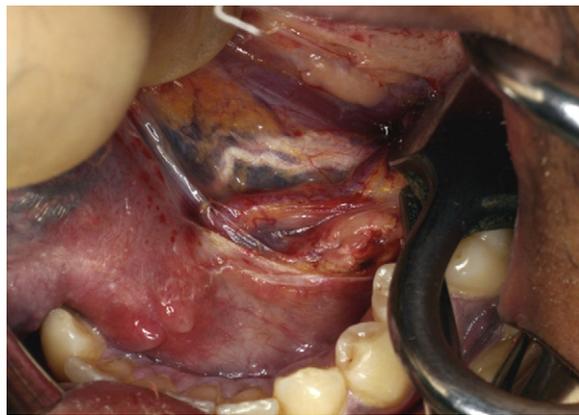


Fig. 2. Initial identification of structures in the floor of the mouth.

(Fig. 1). The incision is deepened using blunt dissection whilst taking care to identify and preserve the submandibular duct and lingual nerve (Fig. 2). As the deeper tissues are released, the sublingual gland is retracted laterally and can be held with a silk suture anchored between the lower premolars. Meticulous haemostasis is imperative throughout.

The submandibular duct is traced proximally until the stone is located, an assistant raising the floor of mouth with finger pressure in the submandibular triangle. It is crucial to expose the course of the lingual nerve (Fig. 3). A limited longitudinal ductotomy is performed with a scalpel directly over the stone, which is shelled out (Fig. 4). This process often

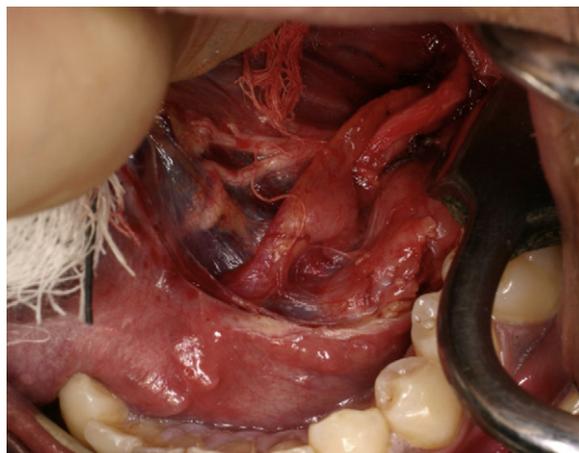


Fig. 3. Full exposure of the submandibular duct and lingual nerve.

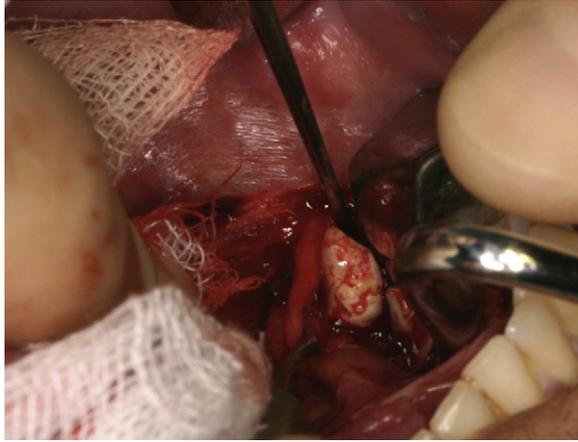


Fig. 4. Release of the sialolith after limited ductotomy.

requires a Mitchell's trimmer or dental pattern excavator and is invariably complicated by haemorrhage that occurs when the duct is incised.

The duct is then thoroughly irrigated with saline and closed using 6/0 polyglactin (Vicryl™) sutures. The floor of mouth is loosely closed with 4/0 polyglactin and a lingual nerve block is then performed using 5 ml 0.5% bupivacaine with 1:200,000 adrenaline. The surgery is covered with intravenous antibiotic prophylaxis given at induction, followed by a week-long course of oral antibiotics and chlorhexidine mouthwash, because experience has shown that acute sialadenitis occurs in approximately 5% of patients after instrumentation of the duct. Patients are encouraged to take oral fluid on the evening of the operation, and to resume a normal diet as soon as possible, whilst starting to chew gum on the second postoperative day.

## Results

From 1999 to 2006, 186 patients underwent intraoral surgical removal of proximal submandibular duct or hilar stones; all calculi except one were successfully retrieved. In one case the stone proved impossible to remove, otherwise there were no peri- or early postoperative complications. In order to obtain standardised data on long-term outcome a structured review (telephone and proforma) was undertaken. Of 186 patients, 105 responded to the review. The average age of this group was 41.7 years (range 11–76 years) with mean follow up of 28 months (range 4–62 months). Two of the 105 had required submandibular sialadenectomy for persisting symptoms. It is known from routine follow up that 7 of the total group of 186 (4%) have required gland removal all for symptoms related to persistent sialadenitis. Two patients out of 105 developed

ranulas as a consequence of surgery, both of which had subsequently been successfully treated by local excision without sublingual gland removal. At the date of review, 76% of patients (80/105) were free from troublesome symptoms, while 17% (18/105) reported feeling 'better, but still slightly or occasionally troubled by symptoms'; these were not sufficient to lead the individual to seek further treatment. Although the actual nature of the symptoms was not elucidated from the questionnaire, clinical review patients tend to complain of vague discomfort rather than classical obstructive symptoms.

92% (97/105) of patients were pleased that they had undergone the procedure and 87% (91/105) said that they would have the procedure contralaterally, should the need arise. 6/105 (6%) were left with a persistent 'tingling' sensation of the lateral border of the tongue; this condition was modest in all cases and no patient complained the symptom was debilitating. A supplemental course of antibiotics was required from the family doctor in 10 (10%) patients following the completion of the standard one-week postoperative course of antibiotics; the exact reasons were not obtained in the questionnaire.

## Discussion

Intraoral removal of proximal submandibular stones using the technique described is a simple, successful procedure. It is generally well tolerated and acceptable to patients, eliminating the most debilitating side effects related to sialadenectomy. It can be performed as a day-case procedure, is less time consuming than sialadenectomy, and gland function is retained even after long-term obstruction. Either local or general anaesthesia can be used, with stones that are easily palpable in the floor of mouth

being potentially amenable to removal under local anaesthetic. If it is necessary to raise the floor of the mouth by extraoral pressure to locate the stone the patient will find this uncomfortable and potentially intolerable. As many stones retrieved are in the proximal duct or gland hilum and require such pressure, general anaesthesia is advisable in most cases and especially until the operator has refined the technique.

Both the presented technique and that described by ZENK et al.<sup>20</sup> are similarly successful but vary slightly. The latter involves incision of the submandibular duct, together with the oral mucosa, from the ostium until the stone becomes visible, identifying the lingual nerve in the process. In the procedure described, the duct is exposed intact, along with the lingual nerve, before a limited incision of the duct is performed immediately over the stone. Suturing the duct to the floor of the mouth in ZENK's technique creates a neo-ostium proximally, while the limited ductotomy allows the duct anatomy to be reconstructed. Opening the whole duct and then not reconstructing it allows traction to be applied to the duct to facilitate access to proximal stones, which may explain why it is possible to perform ZENK's technique almost ubiquitously under local anaesthesia, although this may also reflect local patient expectation. Postoperative discomfort is much reduced by the intraoperative use of bupivacaine to block the lingual nerve and usually resolves 48–72 h after the operation.

Case selection does not involve additional investigation over and above those traditionally used for salivary gland obstruction. In Guy's Hospital Salivary Gland Unit approximately two-thirds of all symptomatic submandibular stones are addressed by radiologically or endoscopically guided basket retrieval, with the other one-third listed for intraoral surgical removal. Inevitably some stones cannot be retrieved by basket and default to surgical removal, the success rate for the latter procedure being 97%. In the patient cohort, stones that are palpable on bimanual examination tend to be easier to retrieve. This is because the non-palpable stone resides in the gland and surrounding tissue masks its position.

Gland removal is an uncommon sequel, with 2 of 105 glands removed in the group that could be contacted at 28 months review, and 7 of 186 overall (4%). Complications of concern are the occurrence of ranulas after surgery and the presence of persistent altered sensation of the lateral border of the tongue. The ranulas occurred when the sublingual gland was transgressed through an incision that was inadvertently placed too laterally in the floor of

mouth. This observation led to an alteration in practice whereby the incision is placed medially and the sublingual gland is carefully mobilised laterally, so allowing dissection to proceed below its deep surface. In all six cases of persistent altered sensation the patients reported a tingling sensation rather than numbness; none was overly concerned by this outcome. The lingual nerve is clearly visualised at surgery and no nerve was injured by sharp dissection. Rather, damage occurs due to traction that is required to access deep proximal stones.

In conclusion, the intraoral removal of proximal submandibular stones as described is not a new procedure; it was first described over 50 years ago<sup>14</sup>. It requires meticulous haemostasis and patience in displaying the structures in the floor of the mouth. The stone or stones can be removed either by a limited ductotomy, which is then closed as described in this paper, or by opening the duct along its length to the hilum; the marsupialised duct is then sutured to the floor of the mouth<sup>20</sup>. Stones are reliably retrieved by this technique, morbidity is low and patients appear to be generally satisfied. The technique is a legitimate alternative to sialadenectomy for proximal submandibular stones.

#### Competing interests

None declared

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None

#### Ethical approval

Not required

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