

# Procedure

## Sinu-Clear Laser Microsurgery of the Paranasal Sinuses - Clinical Procedures Review

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Functional Endoscopic Sinus Surgery (FESS) has revolutionized the surgical approach to sinus disease. However, FESS is not without its limitations or complications. The most important goal of the surgery is to regain ventilation of the obstructed sinuses and to reestablish physiologic mucociliary flow. The increased bleeding that has been associated with the removal of sinonasal polyps is frequently the limiting factor in the ability to completely remove diseased tissue. Inadequate polyp removal leads to a higher recurrence rate, while a more complete removal allows for better reepithelialization.

Although techniques have evolved to reduce bleeding, it is still problematic in many cases, including extensive polyposis patients, AAP patients (aspirin sensitivity, asthma and polyps), revision surgeries, etc. Recent advances in instrumentation, such as through-cutting instruments and powered tissue debriders, remove tissue in a less avulsive manner than previously, but still do not prevent bleeding and, in the case of the debrider, provide utility primarily in the nasal passage and not in the deep sinus recesses.

The Sinu-Clear (TM) technique was developed to optimize visualization and control of bleeding in sinonasal surgery, with atraumatic removal of diseased tissue and sparing of non-diseased tissue, thus enabling a safe and complete procedure with enhanced rather than compromised visualization. The procedure utilizes a combination of warmed water and a unique controlled laser energy delivery system to enhance the surgeon's operating environment. The warmed water provides vasoconstriction, eliminating the need for pharmaceutical vasoconstricting agents. The water also lavages the sinonasal areas and magnifies the optical field, enhancing visualization. The laser, specifically the SLT Contact Nd:YAG Laser with the DF 2 diffuser flat probe, gently and controllably coagulates tissue. Hemostatic tissue removal is more gently accomplished as the diseased tissue is weakened by the coagulation process. This system enables the surgeon to prevent bleeding rather than attempting to address it if and when it occurs.

### Technique

Light general anesthesia is employed throughout the procedure to allow for gentle emergence from anesthesia. This avoids any bucking, coughing or vomiting which can cause bleeding from the nose and sinuses. A cuffed endotracheal tube is used to prevent aspiration of liquids during the procedure. The patient is placed in a semi-Fowler's (25-30°) position, draped and protected from the laser as usual. A small disposable, flexible dental suction is placed into the nasopharynx to serve as outflow for the irrigating solution. No sprays, injections, or vasoconstrictor-soaked pledgets are used prior to, during, or after the procedure.

Pre-operative CT scans are utilized and referred to throughout the procedure. Sinuscopy is then performed using a Wolf Hydrascope with a 25° Panoview telescope and a video monitor. The Hydrascope handle provides suction via a trumpet-valve button and irrigation via a finger-controlled stopcock valve. The irrigation is warmed to approximately 41° C by a SIMS Level 1 fluid warmer system. All suction and irrigation tubing, as well as laser accessories, are provided in the SLT Sinu-Clear kit which is pre-labeled for easy set-up.

Liberal warm irrigation during initial sinuscopy lavages the sinonasal spaces, displacing secretions that may be stagnant in the nose or sinuses, and provides mucosal vasoconstriction. Landmarks can be identified while viewing the path and turbulence of the irrigating stream, which simulates the inspired air column. Hydrogen peroxide-soaked pledgets will blanch areas of mucosal damage caused by irritation to assist in surgical planning to restore adequate ventilation.

The laser utilized is an SLT CL MD Contact Nd:YAG laser, although other Nd:YAG or diode lasers with SMA 905 interfaces can be used with the SLT fiber and probe system. The laser energy is delivered through a reusable SLT

LAH/LAW 0 handpiece with a Frazier-type proximal bend. In cases where there is a need to improve the posterior ventilation, an SLT GRP 6 scalpel tip is used at a power setting of typically 12-18 watts to partially excise posterior mulberry tips or impacted and hypertrophied turbinates. More anterior hypertrophy can be treated with intramural photocoagulation by placing the GRP 6 tip submucosally and applying laser energy of typically 12-16 watts for approximately 7 to 10 seconds at a time. Then the SLT DF 2 diffuser flat probe is placed between the polyps and energy applied at typically 8-14 watts with simultaneous warm irrigation. The polyps are coagulated at their base as observed by mucosal blanching. Whenever utilizing laser energy, it is recommended to begin at a lower power setting, then increase the power setting if required to achieve the desired tissue effect.

The DF 2 probe incorporates a proprietary surface treatment that absorbs a portion of the Nd:YAG wavelength, heating the probe surface on the front and sides. The laser energy provides a combined thermal heating effect of diffused Nd:YAG absorption in tissue and thermal conduction from the heated DF 2 tip, tempered by the heat sink effect of the irrigation. Due to the diffuse and slow thermal effect of this laser delivery system, coagulation can be observed and ceased when desired, providing optimal control of depth and area of thermal tissue effect, thus ensuring enhanced safety. This is notable in its contrast to the deep thermal effect of native free-beam Nd:YAG laser energy. It is also preferable to other laser wavelengths which will precede a very rapid tissue effect, possibly unintended, with the inherent risk of complication.

A vertical lateral partial hemiturbinectomy may need to be performed to improve access and/or ventilation to the middle meatus, or to remove the lateral half of a concha bullosa. In less severe cases it may be possible to leave the middle turbinate undisturbed. An osteomucosal flap of middle turbinate is constructed for later use or as a landmark. Attention and care must be paid posteriorly in the area of the sphenopalatine artery during the partial turbinectomy. The posterior edge of the lacrimal/maxillary bone is identified, serving as a constant landmark even in cases of severe polyposis, scarred mucosa, or previous surgery. The DF 2 probe is used to blanch the mucosa over the uncinata process, ethmoid bulla, and the area of the natural maxillary sinus ostium and fontanelles. A maxillary antrostomy is made through the fontanelle and the retrograde dissector (a backbiter is used to dissect and elevate mucosa and not used as a biter) is utilized to dissect the mucosa off the bony lateral nasal wall. The uncinata process is rotated and removed in a posterior direction and then is followed toward its superior attachment and carefully excised. The maxillary sinus mucosa/polyps are removed with warm irrigation and gentle suction curettage. The ethmoid bullae are entered using the DF 2 probe and irrigation continued. Polyps are coagulated. The sphenoid sinus ostium is irrigated and enlarged if needed. Sphenoid polyps are coagulated with the DF 2 probe if required. The lamina papyracea is identified anteriorly and superiorly in the area of the upper attachment of the uncinata and followed into the frontal recess. The base of the skull is similarly identified, taking care not to injure the ethmoidal neurovascular canals. Polyps here are also dissected with warm irrigation and carefully removed with gentle suction curettage.

The frontal sinus ostium is identified and copiously irrigated. If present, diseased tissue is removed. A "frontal duct" canalplasty may need to be performed if indicated to maintain potency. Care is to be taken medially where the middle turbinate attaches to the skull base in the area of the lateral wall of the olfactory fossa. This may be the area encountered during the procedure that is most thin. The sphenoid sinus ostium is irrigated and enlarged if needed. Sphenoid polyps are coagulated with the DF 2 probe if required. A small elliptical stent may be placed into the frontal ostium if it was widened. Gelfilm® and hydrophilic antiseptic nasal gelpaste are applied in the sinus, as well as a septal wafer to prevent synechia formation. An eye pad is used as a "moustache" dressing. Patients are able to resume many day-to-day activities with minimal limitations within a few days.

## **Results**

The Sinu-Clear(TM) procedure has evolved and been refined to its current state over the last 5 years with over 500 patients. I have had no major complications using this technique and no ill effects to intracranial or orbital structures, even though dissection of the lamina papyracea and anterior skull base is performed routinely if needed. With respect to symptom improvement and polyp recurrence rates, the results have been gratifying and are attributed to the completeness of surgery achieved with this procedure, as well as patient adherence to the post-operative nasal hygiene protocol.

The Sinu-Clear procedure supplies numerous advantages. The laser coagulation denatures protein, weakening diseased tissue and its adherence to underlying structures, allowing gentle, safe and hemostatic tissue removal. Thermal effects with the DF 2 probe and irrigation are minimal and do not penetrate deeply for the durations applied. Because the atraumatically shaped DF 2 probe works on contact, the surgeon has tactile feedback and is able to feel whether the tissue being contacted is soft or hard. The Sinu-Clear procedure provides exquisite visualization and

control of bleeding, a necessity for safe and complete microsurgery of the paranasal sinuses, nasal passages and the anterior base of skull.