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Correcting Maxillary Sinus Deficiencies

By Leon Chen, MD

General dentists, oral surgeons, and periodontics often encounter resistance from patients when protracted or invasive reconstructive therapies are prescribed to correct maxillary sinus deficiencies in preparation for dental implants. Cases are often hampered by a lack of clinical precedent, and the patient is often being passed from one practitioner to another, causing patient frustration and a lack of coordinated care. Clinicians may even shelve a difficult case indefinitely for these reasons.

While conservatism has its place in dental practice, patients may continue to suffer as a result of indecision or a lack in awareness regarding possible treatments. We have evaluated the benefits of a new, minimally-invasive sinus elevation method as it compares with two established sinus elevation methods. These include the long-practiced buccal (lateral) window procedure and the osteotome (internal) approach. Woo assesses the buccal window approach as the most widely practiced, and the osteotome method as the most conservative. With proper administration of a technique called Hydraulic Sinus Condensing®

(HSC), a case can be made for liberalizing some of the beliefs that serve to limit the pool of sinus elevation and dental implant candidates. Dentists often will see patients who have been traditionally turned down for implant surgery, and utilizing HSC allows the practitioner to provide equal treatment for all patients. It should be noted that an eight-year retrospective study on HSC has been published in the peer-reviewed *Journal of Periodontology* in 2005. In addition, the procedure has also been presented at numerous medical symposiums, including the AAP and ICOI, and has significant patient data to establish the procedure as both repeatable and generally successful in patient cases.

Successful resolution of issues associated with cumbersome treatment protocols, trauma, and pain management are benefits of the HSC method compared to traditional techniques such as the Lateral Window technique, which is shied

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away from by most dental practitioners due to difficulty, success rate, and contraindications.⁶ Utilizing Hydraulic Sinus Condensing, the healing time until a full restoration can be completed is often 4-8 months, with an average healing time closer to six months. Patients routinely have little to no swelling present, and are able to return to work or school the following day. A small group of patients also report not requiring narcotics for post-treatment pain management and, instead, use over the counter medications such as Advil or Tylenol. All of these findings are based on the reports of patients, and more study should be completed to determine more accurate findings.

This article discusses the most non-traumatic method of Sinus Augmentation in conjunction with implant placement which is most ideally suited to those who are most apprehensive to treatment or turned away for medical reasons. This method is commonly referred to as a transgingival implant utilizing HSC. For the case type detailed below, we will discuss our reasons for implementing Hydraulic Sinus Condensing and its associated benefits. It is important that the surgery procedure is tailored to each patient in order to accommodate for any special circumstances and to increase success of the implant.

Table 1 ^{1-a}	
Clinical Sinus Classification	
Class 1	> 10 mm cortical bone
Class 2	6 mm to 10 mm cortical bone
Class 3	< 5 mm cortical bone
Class 4	No cortical bone present. Soft tissue only.
Classes 1SL, 2SL, 3SL, or 4SL	Patients with a sloped (SL) sinus floor
Classes 1SP, 2SP, 3SP, or 4SP	Patients with one or more sinus septa (SP)

We categorize patients according to thickness of available cortical bone, and whether certain anatomical features, to be discussed in an upcoming article, are present. For a given implant site, cortical bone thickness is evaluated by measuring from the highest point of the alveolar crest to the lowest point of the sinus floor. In common practice, most clinicians avoid sinus elevations followed by immediate implantation for patients with < 5 mm of cortical bone. These patient types are designated as Class 3 or Class 4 patients in *Table 1*, and our patients who receive HSC and immediate implantation generally fall into these two categories. Class 2 describes another category of patient whom a fair number of clinicians would judge as suitable for

sinus lift therapy with immediate implants. Significantly fewer clinicians would recommend sinus augmentations for Class 1 patients.

We performed a patient survey to aide in determining HSC's effectiveness in treating sinusitis. Out of 1,000 patients, 314 were pre-diagnosed with sinusitis; this group of 314 became our polling group. The survey itself was conducted one month after performing Hydraulic Sinus Condensing. Each patient was asked to rate the change in their sinusitis on a 1-10 scale, with one being no change, five being improved, and 10 being completely improved. Out of the 314, we had 309 patients respond to our survey request. The average improvement from responded patients was 8.2, with all ratings falling over five,

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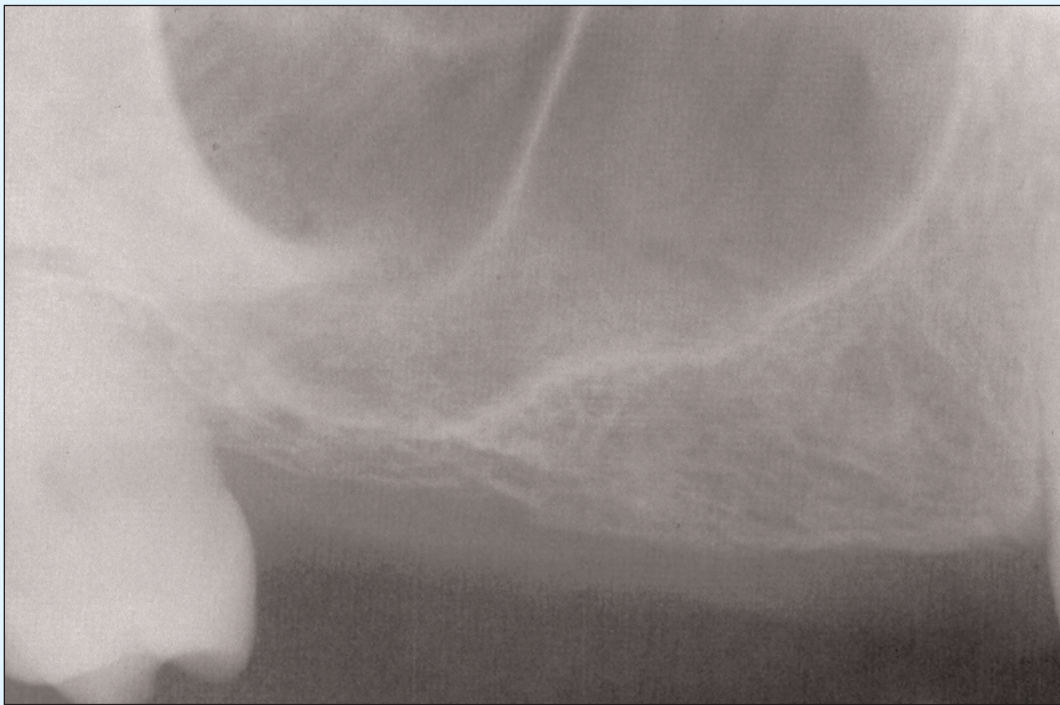


Figure 1: Four Implant sites to be approached transgingivally

indicating that a notably large improvement was made. Obviously, many factors contribute to the findings, and further, more detailed study is required to provide substantial, quantifiable backing to any sinusitis claims; however, preliminary findings are promising.

HSC may not replace all indications for sinus augmentation procedures, but it could serve as a replacement for common cases that lack maxillary post ridge height. HSC allows clinicians to treat patients that too often have been turned away due to ridge height. This not only allows for more complete treatment, but also allows dental implants to be considered as a more universal treatment rather than one that is only available in the most ideal of situations.

Contraindications, such as heavy smoking, sinusitis, or diabetes, need not be viewed as unconditionally prohibitive to the sinus elevation solution presented here. Another

article in this series will discuss how infection and certain features of sinus anatomy, typically viewed as obstructive to the maxillary sinus lift procedure, can, in fact, be turned to the surgeon's advantage.

A 56-year-old male with a Class 3 sinus floor and a two-pack-per-day smoking habit, fitted with a partial denture, is presented as a candidate for implants at tooth numbers 2, 3, 4, and 5 (*Figure 1*). The patient was highly sensitive to epinephrine and was taking Coumadin® on a daily basis. The patient's referring physician would not permit interruption of the anticoagulant therapy for any reason. Therefore, in order to fulfill the subject's desire for implants, it was necessary to perform the sinus elevation quickly under conditions of homeostasis in order to effectively manage blood flow.

One advantage working in this particular subject's favor included a wide alveolar ridge, which is characterized by a low sinus position

and serves to eliminate the possibility of undercutting on the buccal side.

The patient also benefited from the presence of 5 mm of keratinized tissue. Both of these items significantly improved this patient's chance of success.

We elected to approach the sinus cavity transgingivally. Blood flow management was achieved with the use of a carbon dioxide laser. The utility of such lasers in cases calling for extra delicacy is well documented in literature.⁸⁻¹² A biopsy punch was used to landmark the four implant sites.

One carpule (54 mg) of Carbocaine® 3% (mepivacaine hydrochloride) with Ø epinephrine was infiltrated on both the buccal and palatal sides of the treatment area. Following the previously discussed HSC drilling procedure, a single pin-hole was tapped through the ridge with a sinus bur at tooth



Figure 2a: Utilizing the #2 sinus bur to break the cortical floor. The water pressure from the hand piece will simultaneously loosen the sinus membrane



Figure 2b: Condensing the graft materials utilizing the Chen sinus condenser



Figure 3a: Transgingival fixtures placed at the same surgery as the sinus lift

number 4. We then condensed DBX®a through the pinhole to loosen the sinus membrane until the correct depth was achieved (*Figure 2a*). Due to the fact that there was approximately 2 mm of soft tissue over a 3-mm sinus floor, the 5-mm depth marking on the sinus condenser served as an important reference.

Once the membrane was loosened, 5-mm osteotomes were drilled at the implant sites we previously marked with the biopsy punch. The aforementioned permanent graft mixture was then condensed at each location (*Figure 2b*), and implants were placed at the condensed implant sites. By using

the carbon dioxide laser and approaching the sinus transgingivally, we were able to gain excellent control of the patient's blood flow, and performed the HSC procedure with no visible postoperative swelling (*Figure 3a*). *Figure 3b* shows the graft six months postoperative. *Figure 3c* shows a CAT scan, taken nine years after, performed on the patient.

This type of indication is common among our patients. Soft tissue healing often may be compromised by smoking habits, inflexible medication regimens, or systemic conditions. In these cases, it is useful to amend the HSC procedure by employing a cauterizing laser to

aid in blood flow management. This approach is especially true if the patient suffers from a hereditary blood disorder of any kind. A minimally invasive transgingival approach can be utilized for patients with medically compromised conditions such as diabetes, as well as patients who are heavy smokers or utilize chewing tobacco. This surgical approach allows these types of patients to be able to have implant surgery, including sinus elevations, despite the contraindications present.

Summary

The use of hydraulic force to condense bone particulate into the



Figure 3b: Final restoration 6-months postoperative

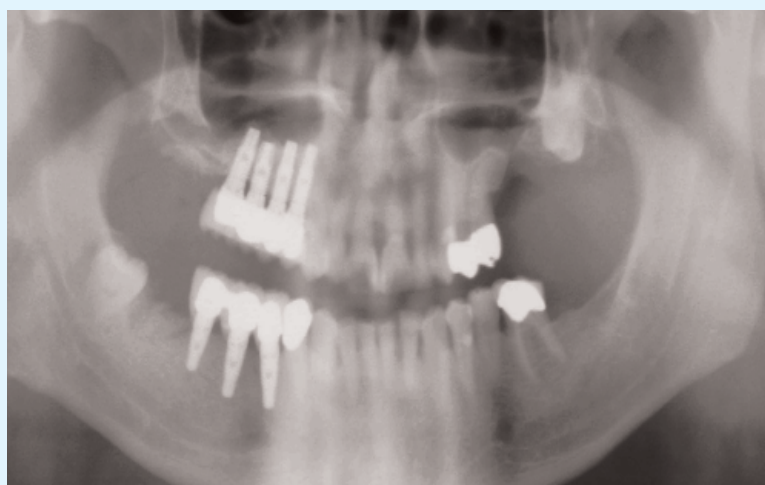


Figure 3c: Panoramic x-ray taken over nine years after the surgery was performed on the patient.

maxillary sinus is a predictable and less invasive method of site preparation for many, but not all, dental implant candidates. It is our approach in the primary indication for HSC — patients with advanced periodontitis in whom insufficient cortical bone at the alveolar ridge of the posterior maxilla stands as a detriment to effective implantation. A second indication for HSC is for those patients who suffer

blood disorders or sensitivity to certain medications, such as vasoconstrictors, and in whom it is crucial to manage bleeding during surgery.

In these cases, changes in the armamentarium used for the procedure can effectively accommodate special needs. Indication three refers to the patient in whom robust bone is absent in some localized area of the sinus floor, possibly

as a result of a failed implant or poor post-extraction healing. Hydraulic force in this scenario is abandoned altogether in favor of a special split-thickness soft dissection and graft that has shown predictable regenerative effect.

Utilizing the techniques presented in this article, real-time chair side relief is a possibility for a much wider variety of patients. All clinical

cases presented were followed for 10 years to show the continued success of the Hydraulic Sinus Condensing technique, and multiple follow-ups with the patients were performed.

The sinus condensing instruments referenced in this article can be purchased separately from the Dental Implant Institute. The instrument set is specifically designed to aid in performing HSC with the least risk to the patient. Suitable replacement instruments may also be found with other traditional instrument manufacturers, though it may prove difficult to use when compared to the specifically designed Hydraulic Sinus Condensing instruments.

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Clinically Significant ABSTRACTS

Rocchietta I, et al. **Clinical outcomes of vertical bone augmentation to enable dental implant placement: a systematic review.** *J Clin Periodontol.* 2008;35:203-215.

Background: This review addressed the focused question of what is the predictability of vertical ridge augmentation techniques for patients who were diagnosed with insufficient alveolar bone volume for the placement of dental implants. **Material and Methods:** A systematic online review of three main databases was performed between 1966 and November 1, 2007. Four groups of vertical bone augmentation techniques have been identified and evaluated: 1) guided bone regeneration; 2) distraction osteo-

genesis; 3) onlay bone grafting; and 4) an array of different techniques. Data extraction was based on the following outcomes: a) success and failure rate of the procedure (vertical bone gain/loss); b) complication rate of the procedure; and c) implant survival, success, and failure rate.

Results: The initial search identified 189 papers from the electronic database. The review produced seven papers for GBR, 13 reporting distraction osteogenesis, five for onlay bone grafting, and three describing different techniques.

Conclusions: For the concept of vertical ridge augmentation to enable dental implant placement, there are clinical and histological data supporting its potential use. Given the confined number of investigators using these techniques and the low number of patient treatments reported in the literature; the generalizability of this approach is limited at this time.

Tonetti MS, et al. **Advances in bone augmentation to enable dental implant placement: Consensus Report of the Sixth European Workshop on Periodontology.** *J Clin Periodontol.* 2008;35:168-172.

Background: Bone augmentation procedures to enable dental implant placement are frequently performed in practice.

Methods: In this session, the European Workshop on Periodontology discussed the evidence in support of the procedures, and examined both adverse events and implant performance in the augmented bone. While the available evidence improved both in quantity and quality since previous workshops, the conclusions that could be drawn were limited by elements of design and/or reporting that are amenable to improvement.

Results: With regard to lateral bone augmentation, a sizable body of evidence supports its use to