Two Different Clinical Indications Using Hydraulic Sinus Condensing\textsuperscript® (HSC) Technique: Ten Years Follow-Up

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A minimally invasive surgical technique called Hydraulic Sinus Condensing\textsuperscript® (HSC), using sinus bur with water pressure to drill through the crestal bone and loosen the sinus membrane with water pressure at the same time, was introduced at the annual meeting of American Academy of Periodontology in 1998. Since then, this technique has evolved to many modified techniques with the same concept (drill through the bone), such as trephine, peiz, and Reamer. The procedure is versatile and can be performed in conjunction with immediate extraction and implant placement, or transgingival, often known as flapless implant placement. For these indications, many patients have reported that HSC has been shown to provide quick relief of respiratory deficiencies or sinus-related pressure. This technique provided a minimal postoperative discomfort for medically compromised patients and avoided multiple surgeries. A 10-year follow-up CAT scan is included for long-term success of the procedure.

Dentists often encounter resistance from patients when protracted or invasive reconstructive therapies are prescribed to correct maxillary sinus deficiencies in preparation for dental implants. Cases hampered by a lack of clinical precedent can result in a sequence of referrals, with the patient being passed from one practitioner to another. Clinicians may even shelf a difficult case indefinitely.

While conservatism has its place in dental practice, patients may continue to suffer as a result of indecision. We have evaluated the benefits of a new, minimally invasive sinus elevation method as it compares with two established sinus elevation techniques: These include the long-practiced buccal (lateral) window procedure and the osteotome (crestal) approach. Dr. Woo assesses the buccal window approach as the most necessary.

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Summary of Mechanisms Involved with CS and Bone Repair

CS has been shown to stimulate bone growth in controlled defect studies. Its unique biologic properties are probably based on its in vivo dissolution. There are at least four proposed mechanisms by which CS could stimulate bone regeneration:

1) Space filling/prevention of fibrous tissue ingrowth. At its most basic level, CS fills space in a bone defect, preventing the ingrowth of soft tissue and retaining the space for bone regeneration. In vivo, in a bone defect filled with solid CS, the CS dissolves at about 1 mm per week from the outside inward. This dissolution can significantly outpace the formation of new bone but, nonetheless, acts to reserve space for new bone.

2) Calcium Phosphate Precipitate. After using CS as a bone-repair material for over 115 years, we are beginning to understand that CS has properties that were not appreciated or understood until the last 15 years. Calcium ion release by the CS causes high-local calcium ion concentrations in surrounding bone tissues. High calcium ion concentrations cause significant cellular changes, including increased alkaline phosphatase activity and gene expression favorable to bone formation.

3) Carbonate apatite precipitation. One of the observed effects of CS dissolution is the local precipitation of carbonate-substituted apatite. This precipitate forms at the surface of the CS material as it dissolves, is left behind in the tissue as the CS dissolves beneath it, and acts as a trellis for osteoconductive ingrowth of new bone.

4) pH Change and Calcium Ion Release. There are other important aspects to be considered as CS dissolves in the body. In vitro, as the CS dissolves, the local pH decreases. This result is probably caused by a combination of sulfur ion release and the precipitation of carbonate apatite. It may also explain why the observed precipitate forms in intermittent bands in vivo instead of forming a more consistent mass. In vivo, the local pH drop would be expected to interrupt apatite precipitation until local body fluids are buffered to a pH that again allows precipitation to again proceed, probably resulting in cyclic pH changes. This local drop in pH may lead to a chain of events that may also contribute towards development of bone in the defect.

References


