

Hatch Reamer[®] / MISE Set

A. Introduction

Sinus lifting procedure utilizing Hatch Reamer System is quite different in its approach and method from other sinus lifting procedures utilizing osteotomes or lateral window approach. When used according to the instruction, Hatch Reamer System's CLE (Cut/Lift/Elevate) Technique minimizes possibility of damage to sinus membrane, forms appropriate size osteotomy site for implant placement, and allows placement of appropriate amounts of bone grafting materials into elevated sinus cavity.

B. Components

A Hatch Reamer's tip end, called Reamer Head (RH), has 4 distinct components/functions built into it.

1. Tapered Cutting Edge (CE) for initial osteotomy and outer limits of the cylindrical osteotomy site.
2. Cutting Angle (CA) is formed as Cutting Edge (CE) and acute reverse line angle of the tip at the bur meet. Cutting Angle (CA) performs osteotomy in circumferential manner, resulting in *hatch* opening action.
3. Reaming Edge (RE) achieves internal osteotomy as Cutting Edge (CE) and Cutting Angles (CA) achieve initial osteotomy and form outer limits of the circular osteotomy site. Reaming Edge (RE) thins out cortical bone prior to Cutting Angle (CA) forming the *hatch*.
4. Groove collects and extrudes bone particles as Reamer Head (RH) continues osteotomy process. This collection and extrusion of bone chips is critical to effective osteotomy function of the Hatch Reamer System. The best analogy is where timely removal of saw dust from saw teeth is required for efficient and effective cutting action of the saw in use.

C. Description

Hatch Reamer System burs (Hatch Reamers) are made out of titanium alloy (Ti6AL4U), and are coated with golden hue titanium nitrate (Ti-N) for extra hardening/strengthening and use longevity. Size varies from 3.0 mm diameter to 5mm diameter in 0.5mm intervals, resulting in a total of 5 reamers in a kit. For easy differentiation, each Reamer has its size laser etched and has unique color stripe assigned – red (3.0mm), orange (3.5mm), yellow (4.0mm), green (4.5mm) and blue (5.0mm). Each Hatch Reamer's Reamer Head (RH) is 1.5mm narrower in diameter than its body – i.e., 3.0mm diameter Hatch Reamer has 1.5 diameter Reamer Head (RH) and 3.5mm diameter Hatch Reamer would have 2.0mm diameter Reamer Head (RH). Length of Cutting Edge (CE) is 4mm in total – first 2mm with steeper cutting angle and the later 2mm with more gradual cutting angle. Total length of a Hatch Reamer is 15mm. First length marking is a line at 5mm from the Cutting Angle (CA). 7-9mm and 11-13mm stripes are also laser etched in. Hatch Reamer System is not designed for osteotomy at high speed. It is designed rather for reaming at

50 RPM, requiring 40Ncm of torque for easy reaming of maxillary cortical bone; and saline or sterile water irrigation is not recommended.

D. Working Principle

1. Cutting Edge (CE) & Cutting Angle (CA)

Reamer Head is tapered towards its line angles at the tip, forming the Cutting Edge (CE). This taper toward the Cutting Edge (CE) at its initial point, starting at the groove, forms more acute and sharper angle than at its end, which comes 270° later. This acute angle of the Cutting Edge (CE) facilitates relatively minimal resistance as it forms the initial osteotomy site. This increase in initial osteotomy cutting efficiency allows the operator to have better control in both directional force and rate of speed for the osteotomy.

2. Reaming Edge

After marking of planned osteotomy site with a round bur, initial cutting by the Cutting Edge (CE), and forming of circular osteotomy site with Cutting Angle (CA), Reamer Edge (RE) forms the internal aspects of the osteotomy site as the Reamer Head (RH) is carefully guided into the osteotomy site. Due to the fact that Reaming Edge's (RE) osteotomy direction is not in vertical direction as in typical osteotomy burs, but rather is offset to be side-cutting, Hatch Reamer System's bone cutting rate/speed is considerably slower than other osteotomy burs. But such feature of the Reaming Edge (RE) significantly reduces the risk of damage to the maxillary sinus membrane when they come in contact with each other. The best analogy is that of electric shaver where the blades of the shaver move parallel to the skin surface, resulting in cutting of the hair without damage to the skin. As a result, risk of damage to sinus membrane is minimal even if Reaming Edge (RE) comes in contact with the sinus membrane when the CLE (Cut/Lift/Elevate) process occurs as cortical bone of the sinus cavity is reamed and the *hatch* is formed on the sinus floor.

E. CLE (Cut/Lift/Elevate) Process

CLE refers to the process where a *hatch* is formed on the floor of the sinus cavity. This occurs as a Reamer Head comes in contact with the maxillary sinus cortical bone at its inferior border and as the simultaneous and balanced osteotomy action of Cutting Edge (CE), Cutting Angle (CA), and Reaming Edge (RE) is no longer in balance. As the Reaming Edge (RE) comes in contact with cortical bone of the maxillary sinus floor, operator may notice what feels like a loss of traction in wheel spinning as various heights of the cortical bone begins to be thinner. The *hatch* is formed as the operator exerted directional force onto the Hatch Reamer overcomes the resistance of the cortical bone layer in maxillary sinus floor while the force subjected area forms a bone plate and is fractured. This *hatch* allows the lifting of the sinus membrane. As this *hatch* is formed between the Reamer Head and the maxillary sinus membrane, it is this *hatch* that inherently prevents the Reamer Head (RH) and the maxillary sinus membrane coming in contact with each other. As CLE process occurs, small bone chip particles are pushed superiorly into the sinus cavity from the reaming action of the Reamer Head (RH), resulting in lifting up of the sinus membrane as well. Thus, this pushing in of the bone chips initiates natural bone grafting process inherent to the CLE process.

F. Placing Screw Type Implant Using the Hatch Reamer System: A Step by Step

Clinical Example: 5mm of maxillary bone height remaining below maxillary sinus floor.
Plan to place 5mm×11mm screw type implant.

1. Using round bur and appropriately fabricated surgical guide, make initial marking of the desired bone site. This marking of the desired site is especially more important with Hatch Reamer System than with typical twist drill sequence as, unlike twist drills where the center of the drill is the cutting point, Reamer's bone cutting actions from the Cutting Angle (CA) and Reamer Edge (RE) occur off-centered. This off-centered bone cutting action can initially make it difficult for a novice operator to make stable and accurate initial osteotomy drilling at the desired location.

Use a twist drill to perform initial osteotomy to 1mm short of the estimated sinus floor. Although experienced operators may find use of the twist drill as the first drilling sequence to be a redundant process, in order to counter the off-centered feel of the Hatch Reamer's cutting action, many operators find this step of using the twist drill as a prelude to the Hatch Reamer to be quite useful. Once the operator is experienced with this Hatch Reamer System, skipping of the twist drill sequence and starting with 3.0mm Hatch Reamer for the initial osteotomy would probably be the preferred sequence.

2. Use 3.0mm and 3.5mm Hatch Reamers in sequence to 1mm short of the maxillary sinus floor; or, once the operator is experienced enough, up to the cortical bone of the maxillary sinus floor which will have an inherently harder feel than the cancellous bone within the maxillary alveolar bone. Due to the difference in hardness of the cortical bone and cancellous bone in maxilla, operator can easily feel the difference in resistance and hardness when he/she reaches the cortical bone layer of the maxillary sinus floor. Also, due to the off-centered location of the cutting action in Hatch Reamers, there will be a slight wobbling of the Hatch Reamer as it comes in contact with the cortical bone. This wobbling of the Hatch Reamer and reduction in cutting efficiency/speed are indicative of the reaming action onto the cortical bone and increase in severity of this wobbling indicates the start of CLE process.

Although the following step may seem a bit mundane and time consuming, it is imperative that the operator proceed with much caution. Just as saw dust stuck in saw teeth can markedly reduce cutting efficiency of the saw, periodic removal of the bone particles collecting in the groove and the Reamer Head will improve the cutting efficiency of the Reamer. The collected bone particles from the Hatch Reamer groove can be either used alone or mixed with any of the grafting material of choice and be re-inserted into the osteotomy site for lifting of the sinus floor.

Some of the bone particles in the Reamer Head, although they reduce the cutting efficiency of the Hatch Reamer in its action, can also play a significant role in facilitating the sinus lifting process as they are naturally pushed against the sinus membrane during the CLE process. Therefore, instead of frequent removal of bone particles from the Reamer Head, it is recommended that the operator take advantage of this wobbling action for increase in osteotomy efficiency by facilitating to ensure maximum contact between the Cutting Angle of the Hatch Reamer and cortical bone during this whole process. This will facilitate the CLE process and resulting sinus lifting process as well.

It is recommended that 3.5mm (1mm narrower than the final Reamer size) Hatch Reamer be used to 1mm short of the cortical bone. Then, after removing/collecting the bone particles collected

within the groove, the same Hatch Reamer is used to go 1-2mm deeper towards sinus floor for the CLE process. This means, in typical cases, the Hatch Reamer that is 1mm narrower than the final Reamer (which is typically 0.5mm narrower than the planned implant diameter) is used for the actual sinus lifting process. In cases where there is additional need for primary stability of the placed implant due to poor bone quality, final Hatch Reamer size can be 1mm narrower than the planned implant diameter, rather than the usual 0.5mm difference.

3. After accomplishing the initial CLE process, the osteotomy site is filled in with either the collected bone particles and/or a bone particle mixture with operator's graft material of choice. Use the 3.0mm diameter condenser instrument to lightly condense the graft material within the osteotomy site. Size of the condenser tip is recommended to be 0.5mm narrower than the last used Hatch Reamer size. Since the cortical layer of the maxillary sinus is already CLE'ed, aggressive condensing of the graft material with the condenser is relatively well tolerated at this point.

However, for patient comfort and increased accuracy in sinus lifting amount/volume, it is recommended that the operator follow the principles presented in this manual. Deviation or variation of this presented technique is recommended only after gaining considerable experience with this Hatch Reamer System.

For example, in cases where bone quality is poorer than usual, the operator can start the reaming process with either 4.0mm or 4.5mm Hatch Reamers for larger diameter implants. And, in cases where there is minimal remaining bone inferior to sinus cavity (i.e., >2mm), the operator can start the reaming process with the 3.0mm Hatch Reamer immediately after the round bur marking, achieve the CLE process, sinus lifting/bone condensing process in smaller increments.

After condensing of the bone graft material with condenser, use the next size up (0.5mm wider) in diameter Hatch Reamer and proceed 2mm further than the with the previous Hatch Reamer (now up to 9mm). In short, use 3.5mm Reamer to 5mm depth and initiate CLE process. After filling in with bone graft material, use 4.0mm Reamer to 7mm depth, which will allow further placement of bone graft material and sinus lifting. This process can be repeated to 9mm depth (or 1 to 2mm short of the implant length).

In other words, for insertion of a 5mm diameter implant, reaming must be performed to 4.5mm (final Reamer size). CLE process is performed with a Hatch Reamer that is 1.0mm narrower than the final Reamer. Placement of bone graft material and condensing /sinus lifting steps can be repeated as needed but, in order to assure primary stability of the implant being placed, the reaming process/sinus lifting process using the final Reamer must only be used once.

This means all the necessary bone graft material condensing and sinus lifting to the desired dimension should be done and can be repeated with the Hatch Reamer 0.5mm narrower than the final Hatch Reamer size.

4. For the final and 3rd sinus lifting/bone grafting, use the 4.5mm Hatch Reamer (final Hatch Reamer for this case) and ream to 11mm marker. Limiting the use of final Hatch Reamer to only once assures initial stability of the implant being inserted at the time.

5. Insert the planned 5mm×11mm implant by following implant manufacturer instruction at this point. In cases where bone is too dense and prevents full insertion or counter-sinking of the implant at this point, respective implant system's final drill should be used without irrigation at 50 RPM and 40 Ncm to further prepare the native bone only, and/or appropriate use

of the hand wrench/extension for implant insertion should be considered. Do not insert any non Hatch Reamer drill into the sinus lifted area as that can significantly disturb the grafted bone in the area.

G. Depth Gauge

Depth gauge has 2mm diameter semi-circular tip and lines are 1mm apart with the exception of stripes at 5-6mm, 10-11mm, and 15-16mm markings. This semi-circular tip is attached to 0.5mm diameter body which flairs out to 2.5mm diameter. The undercut portion of the semi-circular tip is designed to be stopped at inner aspect of the sinus cortical plate after lifting of the membrane. This feature allows accurate measurement of the operating site's bone height by subtracting 1.0mm from the marked line measurement numbers as that 1.0mm represents the dimension of the semi-circular tip which is technically beyond the floor of the sinus at this point. When measuring the actual depth of the sinus lift, of course, subtraction of the 1.0mm is not indicated. Such ability to measure the lifted sinus height is obviously invaluable through out the sinus lifting and implant surgery process.

H. Summary

For the case where there is 5mm of remaining bone height inferior to sinus floor/cortical layer and plan is to place 5×11mm implant, marking desired site initially with a round bur and proceed with twist drilling to depth of 4mm. Use of twist drill can eventually be skipped after adequate experience with the Hatch Reamer System. Start with 3.0mm Hatch Reamer to 4mm depth, followed by 3.5mm Hatch Reamer to same depth. Perform CLE process with 3.5 mm (1.0mm narrower than the final Hatch Reamer size) by pushing the 3.5mm Hatch Reamer 1-2mm deeper. As the operator feels the wobbling feel of the Hatch Reamer at the time of CLE process, place bone graft material into the osteotomy site and use the 3.0 mm condenser to gently condense. The following reaming with 4.0mm Hatch Reamer (1.0mm narrower than the planned implant diameter) is carried to 7mm and 9mm depths with appropriate bone grafting/sinus lifting at each step. Following additional bone grafting and sinus lift/condensing, final Hatch Reamer (4.5mm diameter: 0.5mm narrower than the planned implant diameter) is used to 11mm depth. After confirmation of now available dimension, planned implant can be inserted.