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KINCISE™ Surgical Automated System: Surgical Tips And Pearls For Total Hip Arthroplasty

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Surgeons must determine which technology will amplify their ability in the operating room to deliver optimum patient outcomes in an effective and efficient manner. The KINCISE™ Surgical Automated System was designed to deliver a consistent application of energy, automate bone preparation, and facilitate implant assembly and final placement during Total Hip Arthroplasty (THA), while making the surgical procedure simpler and easier for the surgeon to perform these tasks.

This paper touches on the design rationale while focusing on surgical tips and pearls based on one surgeon's clinical experience in over 1000 THA cases with the KINCISE Surgical Automated System for preparation and implantation of DePuy Synthes total hip products.

KINCISE SURGICAL AUTOMATED SYSTEM DESIGN RATIONALE:

1. Co-Linear Impaction

The KINCISE Surgical Automated System provides a controlled, co-linear impaction each time the trigger is depressed. The energy is delivered in the same location, direction, and vector. As a comparison, standard femoral preparation with a mallet requires multiple strikes on a broach handle. Each strike varies according to the direction of the mallet, the location on the strike plate the hit is made, and the force applied to the handle by the surgeon. These off-axis blows produce energy out-of-plane with the overall direction of movement. The KINCISE System allows that energy to be delivered in a co-linear direction.

2. Controlled Energy Delivery

The KINCISE Surgical Automated System provides consistent and controlled energy delivery. This allows for a constant delivery of power to automate positioning, bone preparation and facilitate implant assembly. As a comparison, the energy from a typical mallet strike can vary during the various steps of a THA procedure. When there is less energy delivered with each impact, the concern of boney fracture may be alleviated within diverse types of bone quality.

3. Controlled Excursion

Typically in a THA procedure, using a mallet may have significant variations of excursion of the instrumentation and final implant based on a surgeon's impact distance from the strike plate and the velocity imparted to the mallet. The patient's bone quality and the sharpness of the cutting teeth are just a few other variables that lead to inconsistency of excursions. In some cases, mallet blows cause small excursions of the broach, stem or shell, while others cause large excursions. The KINCISE System has a controlled known total excursion distance with each impact to the instrumentation or implant, and the system cannot exceed the maximum by design.

4. Uni-directional

The KINCISE Surgical Automated System provides a controlled, co-linear impaction in the forward or reverse direction each time the trigger is depressed. This differs from The Woodpecker® from Integrated Medical Technologies whose motion sends the implement first forward, then backward repetitively in a reciprocating type motion. While the KINCISE System only hits uni-directional, mimicking the normal motions a surgeon makes in the operating room.

5. Delivers "free energy"

The KINCISE Surgical Automated System provides energy for bone preparation and implant placement. Based on the author's discussion with other surgeon users, one of the most common complaints from orthopedic surgeons is the physical exhaustion that results from swinging the mallet hundreds of times per day. The KINCISE System delivers "free energy" to the surgeon via battery power. Much like the powered reamer that has become standard of care over the last thirty years, this now allows power to be applied to preparation and implantation, steps that require significant surgeon energy.

ACETABULAR COMPONENT PLACEMENT:

Accurate biomechanical reconstruction of the joint is essential for proper function making the acetabular positioning a key factor for stability and wear. To facilitate accurate acetabular shell position, the KINCISE Surgical Automated System can be utilized in any surgical technique such as anterior or posterior approach and in the primary or revision setting. If the shell anteversion or inclination needs to be adjusted during implantation of the final component, the KINCISE System allows for repositioning of the acetabular shell by simply depressing the trigger and adjusting the shell orientation. When impacting the shell, it is easiest to place the shell in 50 to 75 degrees of anteversion on initial impaction to clear the anterior wall and then decrease the anteversion as the shell continues to be impacted in to its final seating position. A slight, slow, rocking motion often assists further impaction as the shell seats inside the acetabulum. The technique of repositioning the shell after complete seating by depressing the trigger while adjusting the shell may improve initial component fixation via the acetabular shell coating "broaching" into the bone. Utilizing either a line-to-line or 1 millimeter under ream technique are viable options with the KINCISE Surgical Automated System and PINNACLE® Acetabular Shell with either GRIPTION® or POROCOAT® Porous Coating. Auditory feedback with a higher pitch change will often be received when the shell is fully seated. In addition, by utilizing the ANTERIOR ADVANTAGE™ MATTA METHOD™ Approach the final component seating depth can be verified with fluoroscopy. After the shell is seated, the KINCISE System can also be used to seat and lock the final acetabular liner into the shell.

While adjustments in the use of KINCISE Surgical Automated System are not required for patients with higher BMI, it may be helpful to insert the shell into the acetabulum while connected to the KINCISE System Acetabular Shell Adapter only. Once the shell is inserted into the surgical site, the KINCISE Automated Surgical Impactor can then be attached to the Shell Adapter for shell impaction.

FEMORAL BONE PREPARATION:

The KINCISE Surgical Automated System comes with two approach-specific femoral broach adapters that are compatible with the DePuy Synthes ACTIS®, CORAIL®, SUMMIT®, and TRI-LOCK® Bone Preservation Stem Total Hip Systems. When preparing the femoral canal for the stem, the surgeon should select the broach adapter that best suits their approach and prepare the femoral cavity sequentially using appropriately sized broaches for the patient's anatomy. When the ultimate broach is fully seated, the broach progression slows significantly and will stop advancing despite continuing to hold the trigger. The KINCISE System will no longer advance the broach. As compared to auditory or tactile feedback that accompanies the use of a mallet, the feedback from the KINCISE System is visual. The automated process of

broaching with the KINCISE System prevents toggle that may occur due to surgeon variability when impacting and extracting the broach from the canal.

Due to the reduction in toggle as well as the continuous automated impaction, the femoral bone may be able to receive a larger ultimate broach size than was originally planned, even though less energy is being imparted to the bone and broach with each strike. This contrasts with the use of a traditional broach handle and mallet which effectively stops the progression of the broach between each mallet strike and requires more energy to cause the broach to progress in the bone. Lastly, since the progression of the broach is consistent with each impact of the KINCISE Surgical Automated System, the relative risk of boney fracture may potentially be reduced as the movement of the broach is the same every time with the KINCISE System.

The KINCISE Surgical Automated System can also be used to check the rotational stability of the ultimate broach in the same means as a traditional broach handle. Using this method introduces an additional rotational stability check as the KINCISE System has a longer lever arm as compared to the traditional broach handle. However, when the broach no longer advances it is rare to not have rotational stability.

For those patients with DORR classification A femoral anatomy, the femoral bone can get tight distally when broaching. Holding the trigger of the KINCISE System while moving the broach in forward and reverse, or impaction and extraction, can assist with preventing broach incarceration.

FEMORAL COMPONENT PLACEMENT:

For stem insertion, place the final femoral stem by hand in the bone applying manual pressure until the stem stops progressing. With typical bone the stem, such as ACTIS Total Hip System, usually sits approximately 15mm proud of the final broaching level. The KINCISE Surgical Automated System Bullet Tip Stem Inserter can then be used to impact the implant into its final position. As stated above, variability in the force and direction of the mallet strikes is removed by using a continuous automated process for broaching, which further assists with reducing the variability in stem seating height. The KINCISE System creates a consistent envelope during broaching to allow the final stem to consistently seat.

CONCLUSION

The KINCISE Surgical Automated System allows controlled delivery of energy during preparation and final implantation during total hip arthroplasty. Based on the author's discussion with other surgeon users that have utilized the KINCISE System, this technology is found to be intuitive and easy to use and allows these surgeons to quickly realize how much "free energy" they enjoy after discontinuing the use of a mallet.

The surgical tips and pearls presented in this paper are based on a surgeon's clinical experience in over 1000 THA cases with the KINCISE Surgical Automated System.

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