Self-measuring Orthopedic Drill System – Executive Summary

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When using drills for internal screws to fasten and repair fractured bones the overlying soft tissue often is entangled in the drill bit. To overcome this issue, soft tissue protectors were invented to allow the drill bit to be delivered to the bone without directly contacting the soft tissue. After the drill bit passes through the bone, however, it has the potential to plunge into the soft tissue on the far side of the bone and endanger the neurovascular structures. A third issue in bone drilling is the necessity to measure the depth of the hole that was drilled to allow for accurate screw length adding to surgical times.

Our novel drill sleeve is designed to address all three of these issues in a single integrated device. It is designed to serve as a standard soft tissue protector with an auto-stop device which utilizes a hydraulic damping system to prevent plunging through the bone and allows the calibrated sleeve to give accurate measurement of hole depth. The reduction of plunge in surgery will significantly decrease the damage caused during surgery, the healing time of the patient, and surgical time saving the patient and hospital both time and money.

As the drill-bit progresses through the bone, the chuck of the drill pushes a slider into the base of the device, which is planted firmly on the exposed bone. When incipient plunging occurs, the increased acceleration of the slider is negated by force produced by a viscous fluid in the base and reduces the advancement of the drill. This anti-plunging mechanism makes the product favorable as there is no such device currently in use. It also includes a calibrated ruler so hole depth can be measured simultaneously during drilling.

To test the effectiveness of the hydraulic plunger, trials with various fluids were performed. We drilled through bovine bone and found the device decreased the plunging distance by threefold when using a fluid with the viscosity of corn syrup.

There is currently a drill bit made by Surgionix that is able to accurately measure the hole depth without using the depth gauge. However, this drill bit does not prevent plunging into the soft tissue and is more expensive than the usual drill bits used and since the drill bits often must be replaced, this solution is not ideal. For this reason, our novel device is superlative since it prevents plunging, measures the depth of the hole, and does not require the need for special drill bits.

The cost to manufacture the device will be around $500 per device when manufactured on a large scale. The device would then be sold for $2500 per device. The primary consumer would be teaching hospitals where less experienced physicians would use the device to learn how to prevent plunging. With each institution purchasing multiple devices, the selling of the device would gross over $3,000,000 in sales.