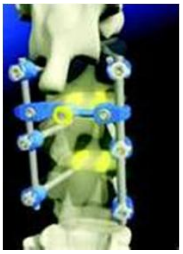
Positioner assembly tool for back and spinal surgery

Par3 Technology

Doctors perform tens of thousands of back and spinal surgeries every year. These types of surgeries the most complicated, because every one of them is different. Surgeons sometimes have to place support systems into the spine to support a person's back and/or repair injuries. Specially designed systems are inserted into the patient's spine to repair back problems. These systems often include the following:

1. Screws to be inserted into the spine as seen above in picture "C" below right.
2. Self positioning movable swivels connected to the top of the screw for the rod to be placed in as seen in picture "B" below center.
3. Individual short rods are placed in-between each swivel and screw. This allows the back to move freely and flex/bend at each connection point as seen in picture "A" below left.
4. Cap to lock and hold each rod into place as seen be in picture "B" below center.

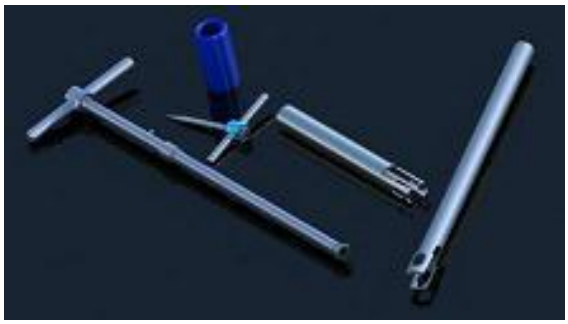


Par3 Technology [1] has helped develop medical tools, implants, and devices for several years. Vice President Earl Dunlap was watching a back surgery one day to observe a monitoring apparatus his company had developed. During the surgery, Dunlap noticed that the doctor was struggling with a tool that is used to insert the screws and position the rods and pins. After the surgery, Dunlap got the opportunity to ask the doctor why he was having such difficulty. After hearing about the multiple problems, Dunlap asked if he could watch a few more surgeries to see if Par3 could offer some suggestions to develop a better design. After watching a few more surgeries that used the same tools, it was clear that the same problems were arising for the doctors. The main problems with the current design were the necessity of multiple tools to complete the surgery, tool slipping in the doctors' hands causing positioning and function problems, and tools being dropped,

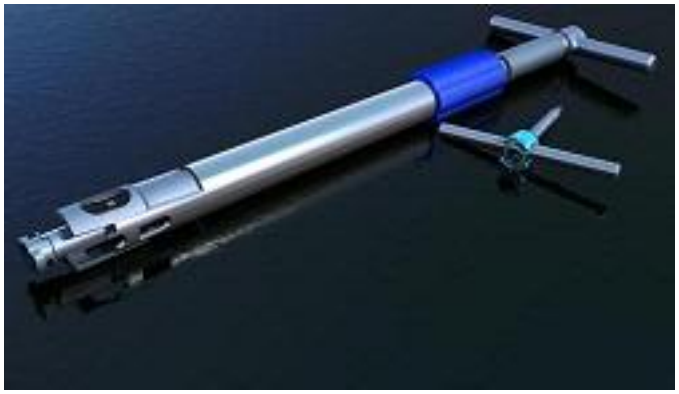
breaking the sterile field and stopping or delaying the surgery. Below is a chart comparing current design problems versus new design enhancements.

Old Design Flaws	New Design Enhancements
Current method uses 3 different tools for screwing in screws, positioning rods, connection rods in to sequence and locking rods into place.	New design is one tool assembly that performs all the steps/procedures required to complete the surgery. The assembly comes apart for easy cleaning and sterilizing.
Multiples tools cause user to handle multiple tools at once slowing down surgery to let go of one tool and pick up another tool and then realign two different tools, screw and rods at once often times causing problems.	The single tool design allows the user to perform all these functions without ever letting go of tool or having to realign the implants or tools to include: screwing the screw in place, hold the rods in place, connecting the rods in sequence and locking the rods down
Handling multiple causing more fluids and blood to get on the three different tools making them slippery making them slippery to handle for the user with screwing in the screw and locking the caps and rods into place.	The single tool design allows one of the users hands to stay dry and the other one to not transfer fluids and blood to the tools helping with better gripping for positioning the screws, rods and connections in place.
Multiple tools increase the chances of dropping one of them breaking the sterile field stopping the operation while tool have to be re-sterilized.	Single tool that you never have to let go of almost eliminates the chances for dropping the tool and breaking the sterile field.
Current tool to screw in the screws is short and makes the use have to turn it with shear force and unnatural leverage to get the screw and swivel into place.	New design has a "T" handle and longer shaft naturally give good leverage for the user to screw the screw and swivel into place easier
Current design uses a separate tool a lever to move/leverage the rods into place and connecting them to the next swivel and rod sequence	New design has a longer shaft with sterilizable handle that grips and the shape to offer the user easier leverage for positioning rods and connecting rods into sequence

The new design used to complete the surgery is named the Positioner Assembly Tool. The single tool design assembly includes details within the assembly which work with individual tools to complete all the necessary functions. During the product development process, Par3's Analysis Driven Design Process was used to create features and functions to enhance and optimize the product. This process uses computer aided analysis software to optimize the design of a product and reduce the need for costly sample building and speed up the development cycle.



Finite Element Analysis (FEA) was used to dial in the scissoring/clamping function of the tool assembly to hold onto swivel, so that the doctor would not have to reposition it while using another part of the tool. Computation Fluid Dynamics (CFD analysis) was used to simulate blood and body fluids on the surfaces of tools to drive the design features and material choices for gripping and leverage functions. Both FEA and CFD Analysis helped optimize the overall product development.



This Positioner Assembly Tool is lightweight, easy-to-use, and comes apart to ensure proper sterilization before the next surgery.

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[1] http://www.par3technology.com/