Paul Tornetta, III
Andy Whitten
Priyesh Patel
Susan Tseng
William Ricci

Boston University Medical Center
UC Davis Medical Center
Washington University Medical Center

smith&nephew

TRIGEN® SURESHOT®

Distal Targeting System

The magic wand for distal locking

Orthopaedics
Smith & Nephew, Inc.
1450 Brooks Road
Memphis, TN 38116
USA

www.smith-nephew.com

Telephone: 1-901-396-2121
Information: 1-800-821-5700
Orders and Inquiries: 1-800-238-7538

7118-1583 REV0.2 03/10

Introduction

Intramedullary nailing is most commonly performed using a statically locked construct. Although mechanical devices have been described for distal locking, the vast majority of surgeons use a “freehand” fluoroscopic method. This method requires assistance to hold the extremity in a specific position, and some expertise from the radiology technician. For those that do not perform many nail surgeries, and those with less experience, distal locking can be difficult, time consuming, and exposes the patient and surgeon to radiation. A new technology, using an electromagnetic field generator, a wand that goes down the nail, and computer based calibrated software has been created to allow distant locking without fluoroscopy. This technique is radiation free, position independent, and provides computer guided 3D real time feedback of location and orientation of drill relative to interlocking hole.

Purpose

The purpose of this study is to compare the efficacy of distant locking using a standard fluoroscopic freehand technique with the electromagnetically guided “wand” technique in the distal tibia and proximal femur.

Methods

Twelve cadaveric limbs with torso attached were used for the study. Residents with some experience locking using the freehand technique performed the locking procedures to allow generalizability. Prior to their participation, an experienced trauma surgeon demonstrated the freehand technique in the distal tibia and proximal femur to establish time and fluoroscopic baseline data. For each limb, the tibia and femur were nailed. Distant locking was performed with the freehand and the wand technique for each nail in alternating order by locking with one technique and then backing the nail up, rotating it slightly, and locking using the other technique. The first technique used was alternated. All procedures were timed using a stopwatch, and fluoro time and mA/mAs readings documented. Times taken included moving the machine in, getting a perfect circle, drilling across the nail. For the wand technique, the time to place the wand in the nail, and the time to lock were documented. All tibial nails were locked with 2ML and 1AP screw (times for both 2 and 3 screw constructs were recorded), and all femurs with 2AP screws. One resident did all tibias and one, all femurs.

Results

Using the freehand technique in the tibia, the drill was placed through the nail successfully in 31/33 attempts. The other two times, the drill went anterior to the nail because the leg moved during drilling. For the wand technique, the drill was successfully placed in 33/33 attempts. In one case, the drill slid upon the initiation of drilling, and this was seen on the monitor and corrected before an incorrect hole was made. For the femur, the drill was placed correctly in 23/24 attempts for both techniques. In five of the freehand attempts, the fluoro machine or drill had to be repositioned after drilling commenced. The single errant screw using the wand was not perfectly lined up, and the surgeon attempted to squeeze the screw through. This hole was eventually used successfully. The time to place the locking screws, the fluoro time, and the radiation exposure is noted in the table below. For both the tibial and femoral screws, the experienced surgeon’s times and fluoro data fell within the range of those performed by the residents, indicating that the freehand technique was well represented. Including setup time, the use of an electromagnetic wand technique was faster, taking 58% ($p<0.0001$), 52% ($p<0.0001$), and 67% ($p = 0.009$) as long as the standard fluoroscopic method for the 2ML tibial, 3 tibial, and 2 femoral screws.

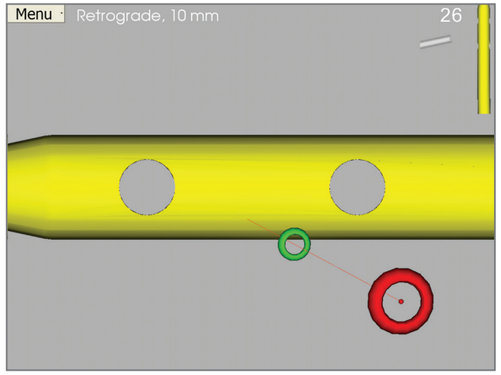

Figure 1

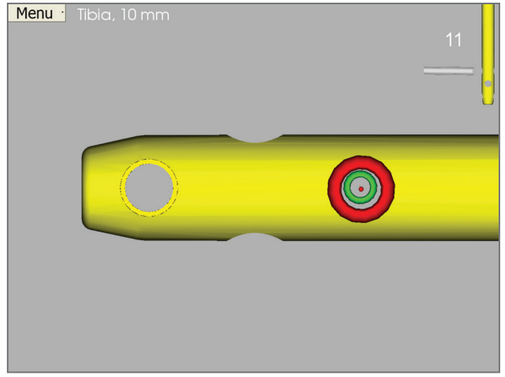

Figure 2

Conclusion

Both methods were effective in locking, but fewer misses were encountered using the wand method. Any shift in the nail position or misdirection of the drill was seen in real time and easily corrected using the guided system. The average radiation exposure to the patient saved was 785 mRad for the tibia and 2362 mRad in the femur. In conclusion, the electromagnetic wand technique is at least as accurate as the standard freehand fluoro technique, takes less time, and utilizes no radiation exposure. Additionally, the limb did not need to be moved to place the screws, possibly reducing malalignment that can occur in fractures near the distant end of the nail and there is continuous visual feedback regarding the drill orientation allowing for continuous correction as needed (figure). We consider that this method has been adequately validated and recommend that clinical evaulations begin using this technology.

	Tibia								Femur 2AP screws			
	2ML screws				All 3 screws							
	Fluoro Technique			Wand	Fluoro Technique			Wand	Fluoro Technique			Wand
	Time (s)	Fluoro (s)	mRad	Time (s)	Time (s)	Fluoro (s)	mRad	Time (s)	Time (s)	Fluoro (s)	mRad	Time (s)
Avg	334	22	473	196	551	36	785	289	280	49	2362	190
SD	72	10	219	53	87	13	285	55	56	25	1232	63

Table 1