Preliminary Experience With The TangoRSRS: Polyaxial, Percutaneous, Cement Augmenting Pedicle Screw System

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Citation

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Abstract

Multiple pedicle screw systems have evolved over the last three decades. All have certain attractions and all have drawbacks. The tendency to move more to percutaneous placement and minimal access surgery has led to a new generation of systems. A series of cases, compromising the initial experience with the TangoRSRS system [Ulrich, Ulm, Germany] is presented and the advantages over the existing systems are discussed.

INTRODUCTION

There are innumerable pedicle screw systems available to the spine surgeon, choices usually being made on historical and loyalty grounds. The mere fact that there are so many demonstrates that no one system contains all the benefits and none of the drawbacks. Every spinal surgeon will have a view on the “best” system, but may not have had experience of all the available options. The TangoRS system has been designed by surgeons and engineers together to combine all the necessary features of a pedicle screw system, with ergonomic instrumentation and a user-friendly system for the theatre nursing staff.

MATERIALS AND METHODS

The TangoRS system is a polyaxial screw-rod system {Figure 1}, made from titanium alloy, with cannulated screws in three diameters (5.5, 6.5, 7.5mm), the rod diameter is 6 mm and a cross connector is available.

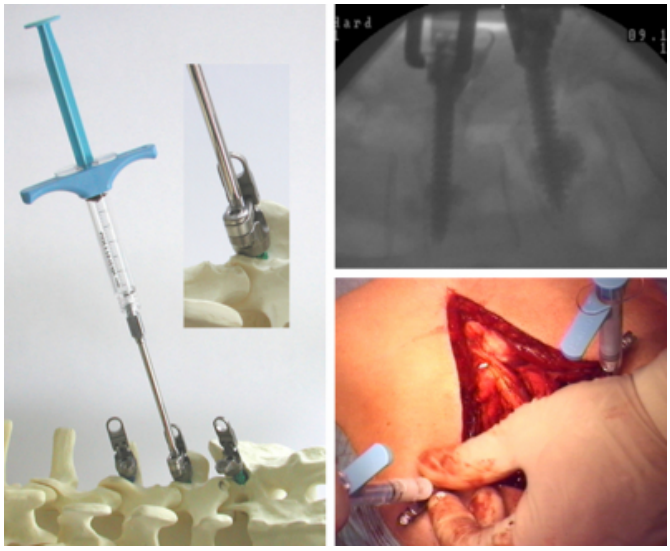
Figure 1

Figure 1: TangoRS screws left side (yellow – 5.5 mm, green – 6.5 mm, blue – 7.5 mm) and polyaxial screw-rod fixation right side

The screws are perforated in the anterior third of the thread to allow screw augmentation with bone cement after inserting the screw. Due to a special augmentation adapter, which is temporarily fixed to the screw, there is no risk of cement leakage blocking the polyaxial mechanism after augmentation {Figure 2}. A special reduction instrument allows easy reduction of a spondylolisthesis of up to 50%.

Figure 2

Figure 2: Cement augmentation through the implanted pedicle screws with fenestrations in the anterior third of the screws, left side sawbone model in the overview and detail, right side intraoperative



The three spine surgeons operated upon a consecutive series of 34 patients requiring pedicle screw fixation, over a three-month period. Patients ranged in age from 23 to 83 years, 17

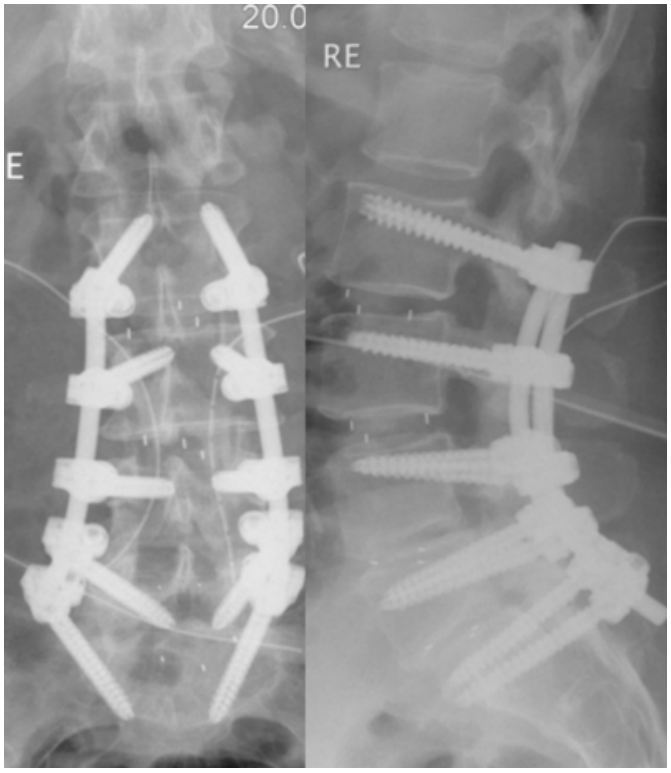
were male. The indications for fusion were:

Figure 3

Diagnosis	Number of patients
degenerative instability and stenosis	15
degenerative scoliosis	3
degenerative disc disease	3
spondylolisthesis	5
failed back surgery syndrome	4
pathological # (metastasis)	2
spondylodiscitis	2

Figure 4

Figure 3: X-rays of a four level procedure augmented with TLIF PEEK-cages



The TangoRS instrumentation was utilised, including guide-wire percutaneous placement, when indicated. Cement augmentation, utilising the multiple fenestrations near the tip of the screws, was utilised in 8 patients, to reinforce osteoporotic vertebral bodies. 24 patients underwent single level fusion, 5 two level, 3 three level and in two a 4 level procedure {Figure 3} was performed. The postero-lateral fusion was augmented by a TLIF procedure in 23, PLIF in 2, ALIF in 2 and vertebral body replacement in 2.

RESULTS

At follow up, thee were no signs of screw loosening. Fusion was augmented with rh-BMP-2 [Medtronic, Minneapolis, USA] in 4 cases. There were no neurological complications, no CSF leaks and no instrument failures. To date there have been no cases of infection or wound breakdown. Mean operating time was 150 minutes (40 – 240); mean blood loss was 220 ml (50 – 400).

DISCUSSION

As with most developments in spinal surgery, there has been a huge proliferation of designs of instrumentation, for pedicle screw fixation of the lumbar spine. Initial designs from the 1970's {$_5$} were simple systems allowing solid fixation between adjacent vertebrae. To facilitate reduction of spondylolisthesis and fracture, modifications were made {$_6$}, leading to a widening of the indications, but also an increase in the complexity of the systems and trays. To facilitate fixation with less need for rod bending, polyaxial screw systems were developed {$_3$} in the early 1990's, allowing easier rod placement, but bringing with them a new tier of concerns for the operating surgeon: would the fixation take the forces involved and would the stability be maintained over time? {$_1$} In the $_2$000's, minimally invasive spinal surgery began to receive mainstream attention and the ability to place pedicle screws safely, through smaller and smaller incisions became the goal {$_2$}. A wide variety of systems and applications followed. During this time, the design of the screw itself went through a renaissance. Screws which once resembles woodscrews now had self-tapping threads, self-drilling threads, cylindrical threads on conical shafts and tapered threads, widening at the base of the screw to conform better to the anatomy of the pedicle and to afford a more secure fit.

Cement vertebral augmentation has been used for many years, in cases of osteoporotic bone, by inserting cement into the drilled or tapped pedicle and then quickly inserting the screw to allow the cement to harden around it, rather like a rawlplug. This is known to have the effect of increasing the pullout strength of the screw {$_4$}.

The TangoRS system has been designed jointly by engineers and surgeons, to allow this single system all the advantages a spinal surgeon would expect from a pedicle screw system and yet to keep it simple. The system is ergonomic, with padded contoured handles and has an appropriate range of the necessary screws, rods and connectors. The screws have

a cylindrical thread on a conical shaft to give highest stability in within the pedicle, have thickened threads in the intra-pedicular region to increase the surface area in contact with the bone. The screws are cannulated to allow passage over a guide wire, a vital teaching aid and a useful adjunct for percutaneous placement, as well as allowing injection of cement into the vertebral body after screw placement. This allows maximal screw-to-bone contact and yet gives the surgeon the confidence that a potentially weak osteoporotic bone has been adequately reinforced, reducing the risk of collapse or screw loosening.

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