BIOMECHANICAL COMPARISON OF TRADITIONAL ILIAC SCREW (TIS) FIXATION versus DISTAL ILIAC SCREW (DIS) FIXATION: A CADAVERIC STUDY

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P25 - BIOMECHANICAL COMPARISON OF TRADITIONAL ILIAC SCREW (TIS) …

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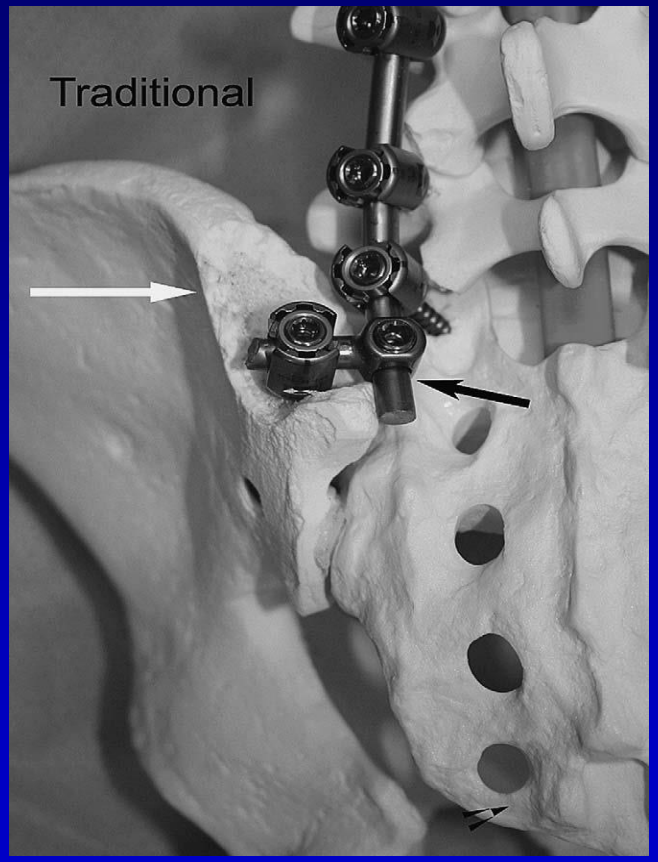
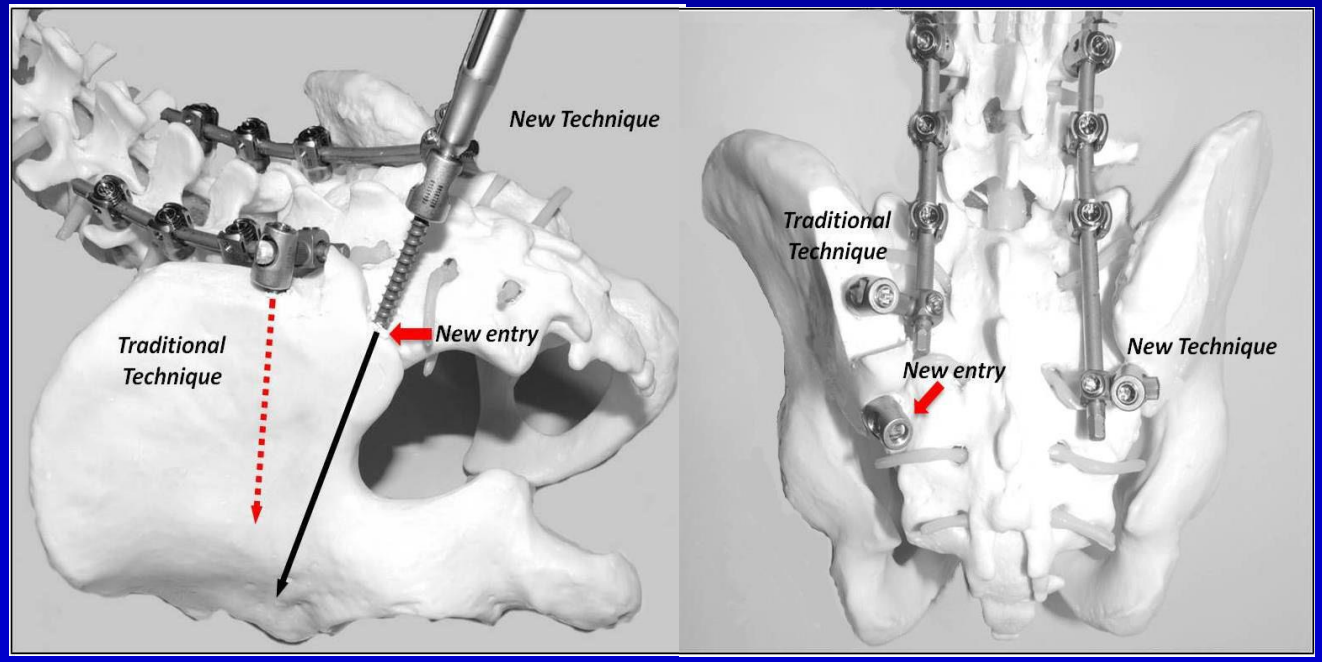
INTRODUCTION

- ✓ **Disadvantages of traditional iliac screws;**
  - ✓ **Resection of the posterior superior iliac spine**
  - ✓ **Loss of the cortical bone**
  - ✓ **Decrease in the insertional torques of the iliac screw**



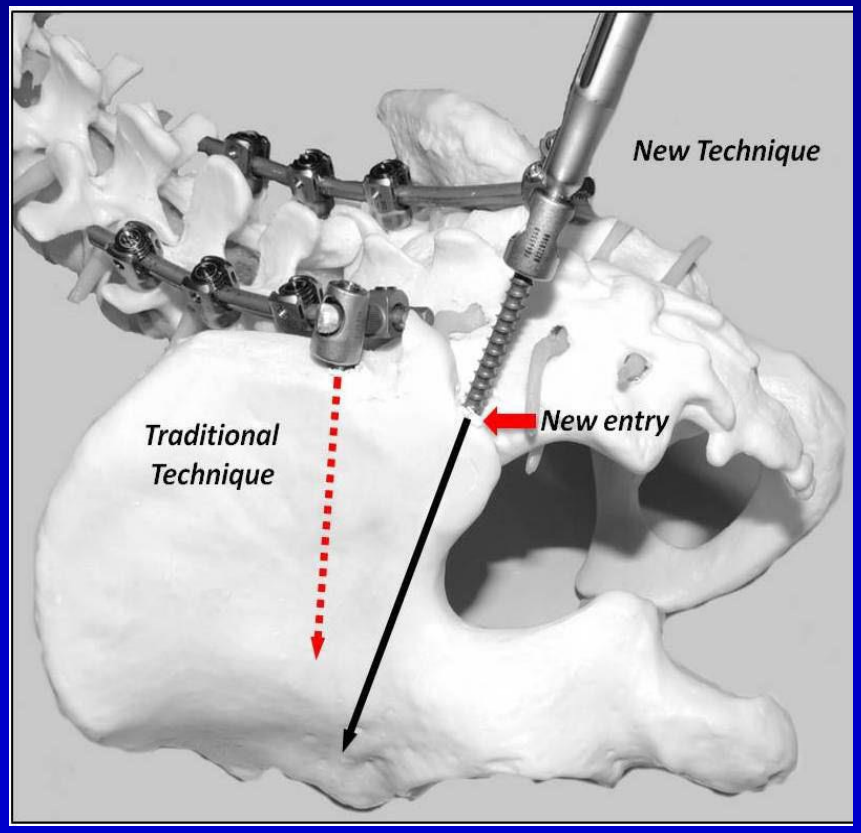
INTRODUCTION

- ✓ **To overcome these problems => Distal Iliac Screw (DIS)**
  - ✓ **Starting point located more distally at the posterior inferior iliac spine**
  - ✓ **Does not require any decortication or osteotomy for entry point**
  - ✓ **Trajectory courses very close to the rigid subcortical bone over the sciatic notch**



PURPOSE

The aim of this study is to biomechanically evaluate and compare TIS fixation vs DIS fixation technique with a cadaveric study.



MATERIAL & METHODS

- ✓ **Eight fresh human (4F,4M) lumbopelvic spines were tested and each specimen was assigned a TIS fixation on one side and DIS fixation on the contralateral side.**
  - ➢ **The insertional torque forces**
  - ➢ **Maximum axial pull-out forces**
  - ➢ **Stiffness**
  - ➢ **Toggle forces**
- ✓ **The insertional torque forces were recorded with a digital torque wrench through placement and the axial pull-out and toggle tests were conducted using a MTS test system.**
- ✓ **All specimens were radiographed, and 3D images were taken using O-Arm system prior to and after testing.**

RESULTS

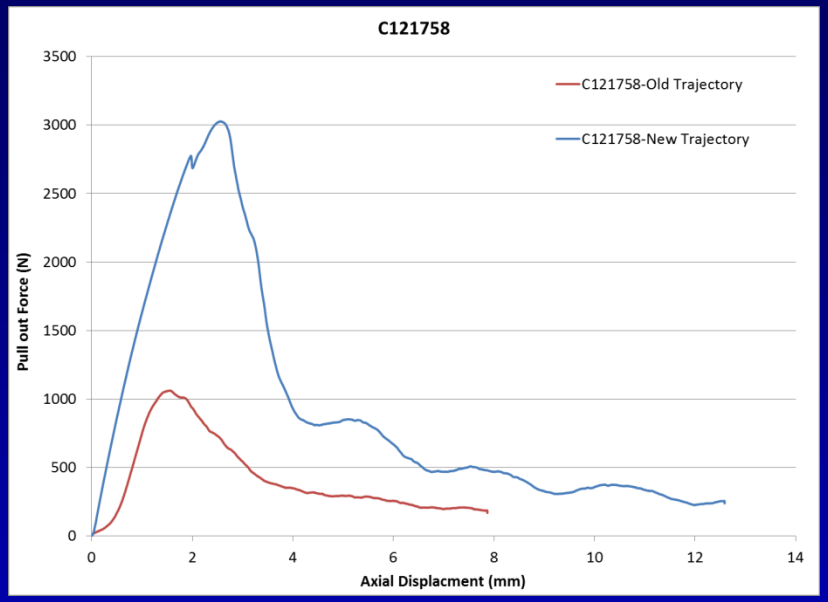
Table 2: Information for the screw location, screw sizing, and peak insertional torque.

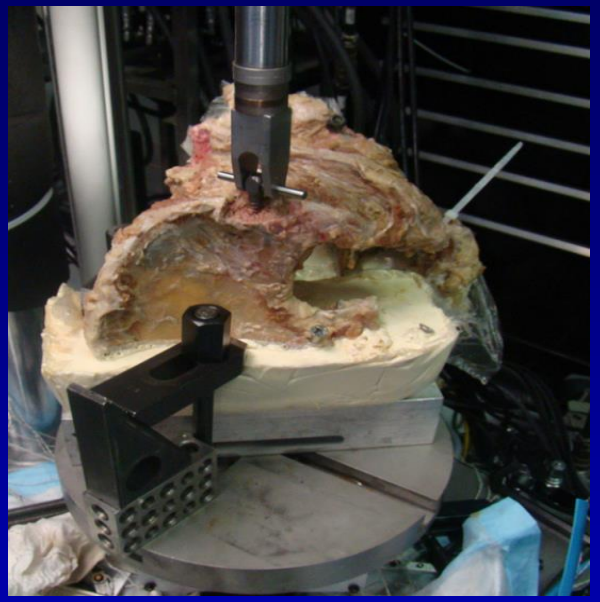
Test Group	Specimen #	Peak Insertion Torque (Nm)		Location (Screw diameter x length mm)	
		Traditional Trajectory	New Trajectory	Traditional Trajectory	New Trajectory
Pullout	L140686	1.31	2.36	Right, 7.5 x 70	Left, 7.5 x 100
	C121650	0.96	1.72	Left, 7.5 x 80	Right, 7.5 x 100
	C121758	1.43	4.80	Right, 7.5 x 80	Left, 7.5 x 100
	C121963	5.93	8.88	Left, 7.5 x 80	Right, 7.5 x 100
Toggle	332	2.21	3.62	Right, 7.5 x 80	Left, 7.5 x 100
	C130025	2.66	4.59	Left, 7.5 x 80	Right, 7.5 x 100
	483	4.54	7.51	Right, 7.5 x 80	Left, 7.5 x 100
	C121398	0.84	1.29	Right, 7.5 x 80	Left, 7.5 x 100

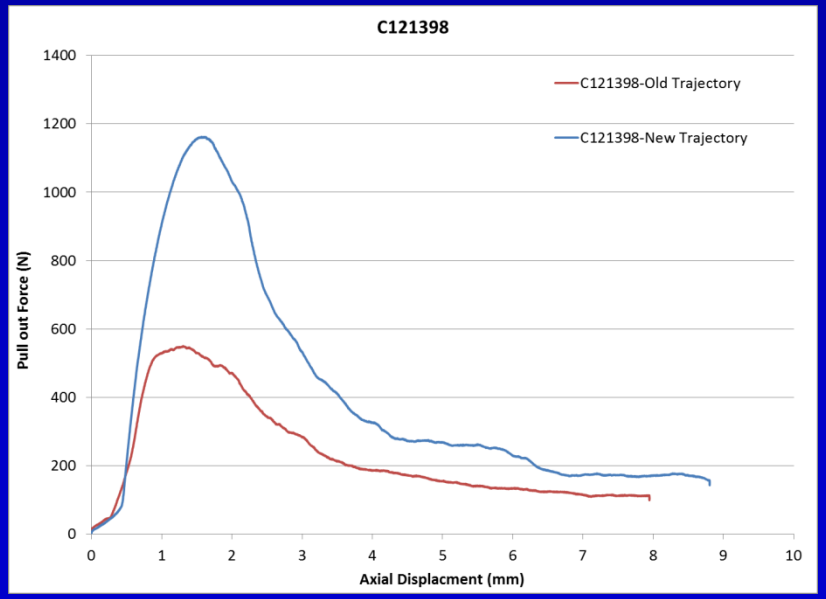
- ✓ **Mean peak insertion torque was**

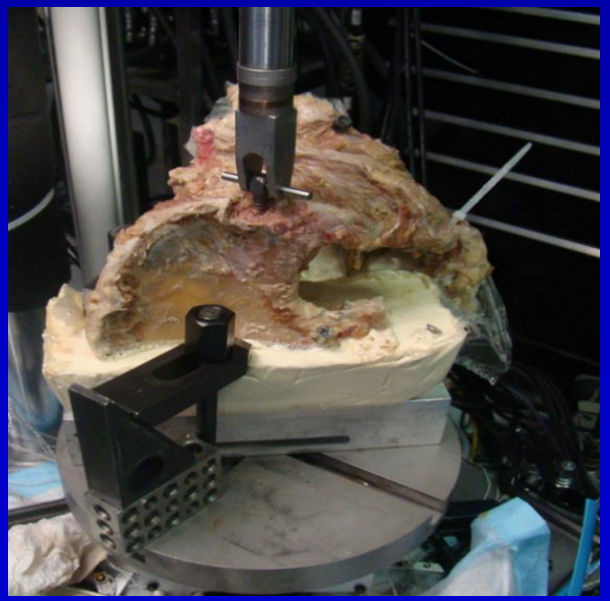
  2.48±1.84Nm for traditional and 3.98±2.40Nm for new trajectory ($p<0.008$).

RESULTS


C121758
C121758-Old Trajectory
C121758-New Trajectory
Pull out Force (N)
Axial Displacment (mm)
0
500
1000
1500
2000
2500
3000
3500
0
2
4
6
8
10
12
14




C121398
C121398-Old Trajectory
C121398-New Trajectory
Pull out Force (N)
Axial Displacment (mm)
0
200
400
600
800
1000
1200
1400
0
1
2
3
4
5
6
7
8
9
10



RESULTS

Table 3: Axial pull-out test results: maximum pull-out force and stiffness.

Specimen ID	Maximum Pullout Force (N)		Stiffness (N/mm)	
	Traditional Iliac Fixation Screw	New Iliac Fixation Screw	Traditional Iliac Fixation Screw	New Iliac Fixation Screw
L140686	601.7	1841.5	342.2	2270.7
C121650	1031.6	1656.9	1723.2	1778.8
C121758	1061.5	3027.3	1095.6	1887.8
C121963	4486.6	6956.1	2770	4319.1
Average	1546.3	2928.8	1411.4	2323.1
St Dev	1660.6	2353.2	903.8	1162.1

✓**DIS fixation achieved higher maximum axial pull-out force and higher stiffness than TIS fixation**

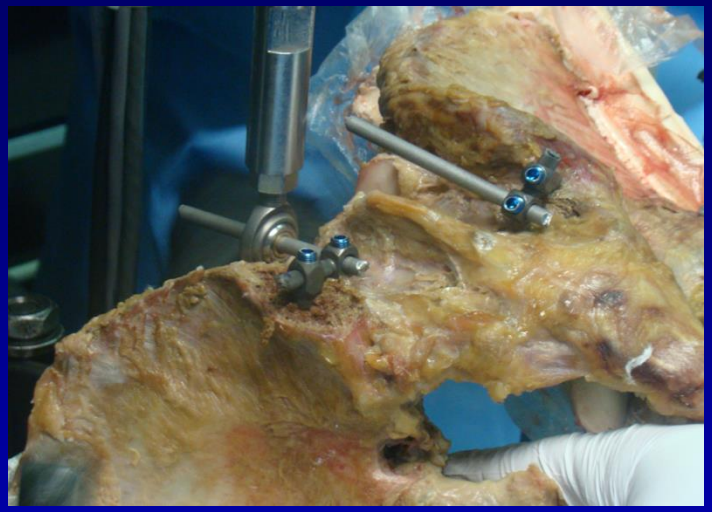
RESULTS

Table 4: Toggle test results: Toggle force realized at the pedicle rod at a maximum of 5mm axial displacement of the actuator. Force was calculated at a distance of 30mm from the center of the screw.

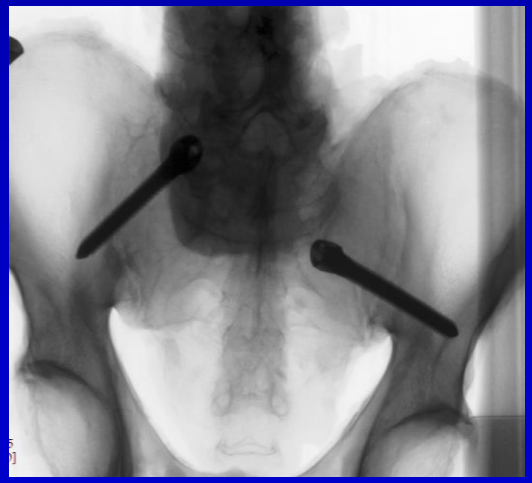
Specimen ID	Traditional Iliac Fixation Screw		New Iliac Fixation Screw	
	1st Cycle	100th Cycle	1st Cycle	100th Cycle
332	432.64	374.46	426.67	391.19
C130025	423.68	380.99	423.65	384.07
483	396.86	349.13	322.17	305.01
L130137	278.37	245.32	538.76	497.31
Average	382.9	337.5	427.8	394.4
St Dev	71.3	63.0	88.5	78.9

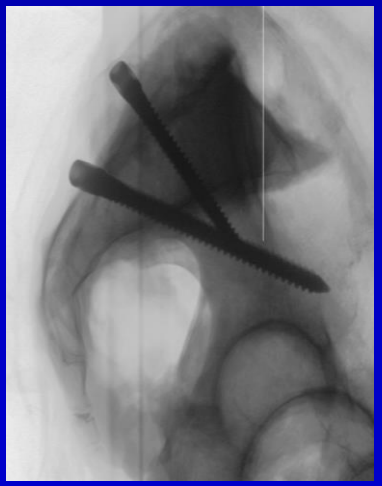
RESULTS

- ✓ At the 1st and 100th load cycle with toggle displacement of 5mm, DIS achieved higher toggle forces than the TIS fixation



- ✓ All screws placed in the new trajectory were longer in length compared to the screws placed in the traditional trajectory without any cortical breech.





CONCLUSION

DIS fixation technique provided higher insertional torques, stiffness, axial pull-out & toggle forces and longer screw length than TIS fixation. The results of this study encourages the clinical application of DIS fixation technique in primary or revision adult deformity surgery.