BIOMECHANICAL EFFECTS OF THE LUMBAR SPINE AFTER DIFFERENT FORAMINOPLASTY SCHEME OF PTED: A FINITE ELEMENT ANALYSIS.

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Study Design: Finite element analysis. Objective: To investigate the biomechanical effect of the lumbar spine after different foraminoplasty method of percutaneous transforaminal endoscopic discectomy (PTED). Summary of Background Data: With the widely utilized of percutaneous transforaminal endoscopic discectomy (PTED), foraminoplasty is commonly used in patients with lumbar disc herniation. However, there is no standard for the foraminoplasty method. The biomechanical effects of different foraminoplasty methods on the lumbar spine are remains unclear.

Methods: A nonlinear intact three-dimensional L4-5 finite element model (Mod) was developed and validated from computed tomography images. Design three kinds of trephine with diameters of 7.5mm, 8.5mm and 9.5mm (7.5, 8.5, 9.5). All three trephines are foraminoplasty at an angle of 10°, 30° and 50° (Lower, Medium, Upper) with the coronal plane. The range of motion (ROM) and maximum von Misses stresses of the intervertebral disc for the nine models (7.5L, 7.5M, 7.5U, 8.5L, 8.5M, 8.5U, 9.5L, 9.5M, 9.5U) were compared with Mod in flexion, extension, left and right lateral bending and left and right axial rotation. Results: 7.5M, 7.5U, 8.5U, 9.5U showed the greatest increase in ROM with extension, L-bending, and L-rotation, and the extension state is the most obvious. 7.5U, 8.5U, 9.5L, 9.5M, 9.5U showed the increase significantly in von Misses stresses of intervertebral disc with extension, L-bending, and L-rotation. Interestingly, the von Misses stresses of intervertebral disc as increasing as the diameter of the trephine and the coronal angles. For 7.5L, 7.5M, 8.5L, 8.5M, Furthermore, the von Misses stress was magnified in the L5 superior articular process with L-bending and it’s no significant changed for 7.5U, 8.5U, 9.5L, 9.5M, 9.5U. Conclusion: For L4-5 foraminoplasty, using the trephine with a diameter of 7.5mm or 8.5mm can be done without sacrificing lumbar stability. Using 9.5mm diameter trephine increases ROM and reduces the biomechanical stability of the lumbar spine. Compared to upper coronal angle, the lower coronal angle can maintain the biomechanical stability of the lumbar spine better, but it will increase the risk of tip fracture of the superior articular process.
Disclosures:
author 1: none
EFFECT OF INDIRECT DECOMPRESSION THROUGH LATERAL LUMBAR INTERBODY FUSION TO LIGAMENTUM FLAVUM FOR DEGENERATIVE LUMBAR DISEASE

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Purpose
Lateral lumbar interbody fusion (LLIF) including extreme lateral lumbar interbody fusion (XLIF) and oblique lateral lumbar interbody fusion (OLIF) have been reported successfully treated spinal stenosis by improving central canal area via indirect decompression. However, indirect decompression effect on posterior spinal elements especially ligamentum flavum has not been studied. This study evaluated changes of ligamentum flavum area, thickness, flavum-central canal improvement ratio and compared with degree of facet joint degeneration after LLIF.

Methods
Thirty-five patients presenting with degenerative spinal disease and nerve compression underwent XLIF (18 patients) or OLIF (17 patients) with percutaneous pedicle screw fixation at 57 levels (XLIF; 26 levels, OLIF; 31 levels) without posterior direct decompression were included. Magnetic resonance images with clear visualized ligamentum flavum pre- and post-operative at 3 to 6 months after surgery were evaluated. Changes in ligamentum flavum area (LFA), ligamentum flavum thickness (LFT), cross-sectional area (CSA) of thecal sac, posterior disc height, foraminal height and cage alignment were measured and compared with facet degeneration (mild; grade I,II vs moderate to severe; grade III,IV). Cage position (determined by anterior or posterior to mid-vertebral body) and its effect to each parameter and flavum-central canal area improvement ratio were evaluated.

Results
There was radiographic improvement in all cases. No statistical differences between XLIF and OLIF except cage alignment (0.54° in XLIF, 6.13° in OLIF; p < 0.05). By comparing pre- and post-operative radiographs, mean LFA decreased from 78.92 mm² to 66.89 mm² (-12.03 mm²; p < 0.05). Mean right LFT decreased from 2.89 mm to 2.32 mm (-0.57 mm; p < 0.05). Mean left LFT decreased from 3.33 mm to 2.63 mm (-0.7 mm; p < 0.05). Mean CSA increased from 93.13 mm² to 127.31 mm² (34.18 mm²; p < 0.05). Flavum-central canal area improvement ratio was 35%. Degree of facet joint degeneration showed no effect on radiographic outcomes.

Conclusions
Study confirmed that indirect decompression through LLIF can decrease both area and thickness of ligamentum flavum regardless of severity of facet joint degeneration or cage position. Thinning of ligamentum flavum contributed around one third of central canal area increments after surgery.

Disclosures:
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COMBINED ONE STEP LATERAL INTERBODY FUSION AND POSTERIOR MIS TRANSPEDICULAR SCREWING USING 3D IMAGING AND NAVIGATION

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STUDY DESIGN: Prospectively collected data of the first 30 consecutive patients treated with single-position one level lateral (LLIF) with bilateral percutaneous pedicle screw and rod fixation using O-Arm 3d imaging and navigation.

OBJECTIVE:
To evaluate the clinical feasibility, accuracy, and efficiency of a single-position technique for LLIF with bilateral pedicle screw and rod fixation.

SUMMARY OF BACKGROUND DATA:
Minimally-invasive lateral interbody approaches are performed in the lateral decubitus position. Subsequent repositioning prone for bilateral pedicle screw and rod fixation requires significant time and resources and does not facilitate increased lumbar lordosis.

METHODS:
The first 32 consecutive patients (128 screws) treated with single-position LLIF and bilateral pedicle screws by a single surgeon between December 2016 and August 2018 were included in the study. O-Arm 3d imaging combined to navigation was employed in this setting. Fusion were graded using computed tomography and several timing parameters were recorded including retractor, irradiation, and screw placement time. Complications including reoperation, infection, and postoperative radicular pain and weakness were recorded.

RESULTS:
Average screw placement time was 1.2 min/screw. Average total operative time (interbody cage and pedicle screw placement) was 107.3 minutes. Average total irradiation was 19 mGy. No pedicle screw breach was recorded. Fusion rate at 6-months postoperative was 93.5%.

CONCLUSION:
The single-position, all-lateral technique was found to be feasible with high accuracy, low irradiation, and complication rates comparable with the published literature available in TLIF. This technique eliminates the time and may lead to significant improvements in operative efficiency and cost savings.

Disclosures:
author 1: none; author 2: none; author 3: none
ACCURACY OF SCREW PLACEMENT IN MINIMALLY INVASIVE, ROBOT-ASSISTED ILIOSACRAL SCREW INSERTION IN CHILDREN WITH NEUROMUSCULAR SCOLIOSIS
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The combination of fusionless surgery with growing rods is increasingly indicated in early-onset scoliosis in general and neuromuscular scoliosis in particular. This technique is based on the bilateral attachment of rods fixed to the upper spine with 6 hooks or sublaminar bands and fixed to the pelvis with two iliosacral screws. The latter have excellent biomechanical characteristics but are particularly difficult to position; even with a dedicated instrument set, it is difficult to control the positioning, and an incorrect trajectory can result in failure of the fixation or damage to the nerve root.

Objective: To evaluate the accuracy of iliosacral implant positioning with robotic assistance.

Method: A retrospective study of all patients operated on since October 2017 in our department of paediatric orthopaedics. The trajectory planned with the robot’s software was compared with the iliosacral screws’ actual real position. The pre- and post-surgery flat-panel CT images were merged. The distance (the 3D vector error between the planning and the middle of the implanted screw) was measured at two points on the trajectory (the iliac entry point, and the screw tip’s target point in the sacrum).

Results: Ten patients (20 implants) were included in the study. The mean (range) age was 10.9 years (7.2-18.2), and all the patients had severe neuromuscular scoliosis. The mean ± standard deviation (range) error for 20 iliosacral screws was 1.93 ± 0.7 mm (1.3-3.12) at the entry point and 1.49 ± 0.41 mm (1-2.4 at the target point. All the screws were located within the sacrum (i.e. in the absence of cortical breaches), thus enabling the connector to be positioned between the wing of the ilium and the sacrum. No neurologic or vascular complications were associated with the positioning of iliosacral implants.

Conclusion: Robotic assistance enables the highly accurate implantation of iliosacral screws, which guarantees biomechanical efficiency and limits morbidity related to the implant’s position. Trajectory planning results in optimal positioning with regard to the spinal deformation - even in children. Robot-assisted implantation was associated with a high level of agreement between the planned and achieved screw positions.

Disclosures:
SURGICAL WOUND INFILTRATION OF MULTIMODAL COCKTAIL ANALGESIA COMPARED WITH LOCAL ANESTHETIC FOR REDUCE POST-OPERATIVE PAIN IN MIS-TLIF: A RANDOMIZED CONTROLLED TRIAL.

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Study design: Triple blind randomized controlled trial.

Background: Local injection of multimodal cocktail analgesia has been shown benefits in many orthopedic operations but still rarely used in spinal surgery. The purpose of this study was to evaluate efficacy and outcome between the usage of surgical wound infiltration with multimodal cocktail consists of Ketorolac, Morphine and Bupivacaine compared with standard local anesthetic (Bupivacaine only) in minimal invasive transforaminal lumbar injection interbody fusion (MIS TLIF).

Method: 80 adult patients who underwent MIS TLIF were included in the study. Patients were randomized into two group. Control group (n=40) received 0.5% bupivacaine 100 mg (20ml.) & adrenaline 0.5mg (0.5ml) local injection and Multimodal group (n=40) received 0.5% bupivacaine 92.5 mg (18.5ml.) Ketorolac 30mg (1ml.) Morphine 5mg (0.5ml.) & adrenaline 0.5mg (0.5ml) local injection. The operations were performed by one surgeon with same protocol and post-operative medication. Patient, surgeon and researcher were all blinded. Pain was recorded in visual analog scale (VAS) before operation, at 3 hours, 6 hours, 12 hours and 24 hours after operation. Post-operative morphine consumption and side effects from opioid were assessed.

Result: Multimodal group shown significant lower in VAS compared to control group at 3 hours (mean3.18 vs 4.53, p < 0.001), 6 hours (mean2.13 vs 3.23, p = 0.002) and 12 hours (mean1.80 vs 2.55, p = 0.011) after surgery. There was no significant difference in VAS at 24 hours (mean 1.40 vs 2.17, p = 0.075) after surgery. Morphine consumption was higher in control group (mean 2.8 mg vs 0.33 mg, p <0.001). The incidence of side effect of opioid including nausea, vomiting and itching was lower in multimodal group.

Conclusions: Surgical wound infiltration of multimodal cocktail analgesia (bupivacaine, ketorolac and morphine) provides better effectiveness and lower side effect in post-operative pain control after MIS-TLIF.

Disclosures:
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CLINICAL AND RADIOLOGICAL RESULTS OF TREATMENT OF LUMBAR SPONDYLOSIS USING CORTICAL BONE TRAJECTORY SCREWS (CBT)

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Background and purpose: Cortical bone trajectory screws (CBT) is an alternative method of transpedicular spinal fusion for degenerative disease. The new entry point location and screwdriving direction enables the reduction of approach-related morbidity. We present our experience with the CBT technique on a series of 40 patients with lumbar degenerative disease and with an average follow-up of 35 months (range: 22-52 months).

Material and methods: Indication for surgery was a critical stenosis of the intervertebral foramen requiring the sacrifice of the entire intervertebral joint on at least one side during the decompression. Thirty-seven (93%) patients had low back pain, 38 (95%) had radicular pain, 25 (63%) had neurogenic claudication, 19 (48%) had paresis, and 25 (63%) had sensory disturbances. The patients were fused at L4-L5 (N=23), L5-S1 (N=6), L3-L4-L5 (N=6), and L4-L5-S1 levels (N=5). The pain syndrome was assessed according to the Numerical Rating Scale (NRS) for low back and for radicular leg pain. Patient functional status was assessed using the Oswestry Disability Index (ODI) questionnaire. Treatment efficacy was measured according to the minimal clinically important difference (MCID). Improvement for MCID was defined if postoperative improvement for NRS was \( \geq 3 \) and ODI was \( \geq 12 \). Long-term radiological control was obtained 12 months after surgery. Follow up CT and dynamic X-ray of the lumbar spine were performed in 39 (98%) patients, 1 year after surgery.

Results: The mean preoperative NRS for low back and leg pain and ODI were 6.8 (range: 0-10), 7.3 (range: 1-10), 52 (range: 22-82), respectively. At the most recent follow-up, NRS for low back and leg pain and ODI were 1.7 (range: 0-5), 1.5 (range: 0-4), 19.4 (range: 0-48), respectively. The mean improvements in NRS for low back and leg pain and ODI were 5.1 (range: 0-10), 5.8 (range: 1-9) and 32.6 (range: -10-70), respectively. The MCID in the most recent follow-up for the back and leg pain NRS and ODI was achieved in 92%, 95% and 95% of patients, respectively. The 1 year follow-up dynamic X-rays and CT showed no instability at the fused levels. Solid bone union in situ was obtained on 47 (92%) levels, collapsed union on 2 (4%) levels, non-union was found in 1 (2%), and 1 (2%) patient was lost to follow-up. Complications included: incorrect screw placement 1/182 (0.6%), screw loosening 5/182 (2.8%), interbody device dislocation 1/78 (1.3%). Three (7.5%) patients required revision surgery, including repositioning of one screw with removal of the interbody device in 1 patient, repositioning of one screw in 1 patient and removal of one screw in 1 patient.

Conclusions: In our study, the high effectiveness and safety of CBT lumbar fusion in degenerative spine disease was confirmed at a mean of 2.9 years of follow-up.

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EVALUATION OF BONE ONGROWTH ON THE SURFACES OF A NEWLY-DEVELOPED 3D-PRINTED POROUS TITANIUM ALLOY CAGE: IN VIVO ANALYSIS USING CT COLOR MAPPING

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Introduction: A 3D-printed porous titanium alloy (PTA) cage has been developed to achieve osseointegration on the surfaces of the cage frames. The aim of this study was to evaluate the difference of bone ongrowth in the PTA cages between the surfaces of the cage frames and those of the open windows filled with autologous local bone grafts using in vivo computed tomography (CT) color mapping.

Methods: 22 consecutive patients (11 males, 11 females; median age, 68.5 years [interquartile range (IQR), 63-75 years]) who underwent single- or two-level posterior lumbar interbody fusion (PLIF) were included in this prospective study. Two PTA cages filled with morselized local bone grafts in their open windows were inserted into all PLIF segments. Bone ongrowth in each cage was evaluated on the upper and lower surfaces of the cage frames (4 surfaces per one cage) and open window (2 surfaces per one cage) by postoperative CT scans (within 1 week and 6 months postoperatively). The rectangular region of interest (ROI)s were placed on the surfaces of each cage with 1-mm height on the sagittal plane, and the Hounsfield Unit (HU) values of each ROI were calculated. The obtained HU values were mapped to a spectral color scale that displayed from dark purple (0 HU) to red (1600 HU) and postoperative color changes were also evaluated. If the color tone on the surfaces of the cage frames or open windows changed toward red on the sagittal plane, we judged postoperative bone ongrowth existed (Grade 0, without bone ongrowth; Grade 1, 1-33% of the surface with bone ongrowth; Grade 2, 34-66%; Grade 3, 67-100%). Bone ongrowth index (BI) in each cage was defined as the average of bone ongrowth grades of either the surfaces of the cage frames or those of the open windows. The postoperative changes of HU values and BI were compared between the surfaces of the cage frames and those of the open windows.

Results: 18 patients underwent single-level PLIF and 4 patients underwent two-level PLIF. A total of 52 cages were evaluated in this study. The median postoperative changes of HU values on the surfaces of the cage frames were 101.1 HU (IQR, 5.6-183.6 HU) and those of the open windows were 34.0 HU (IQR, 43.6-109.5 HU). The median BI on the surfaces of the cage frames were 1.5 (IQR, 1-2) and those of the open windows were 0.5 (IQR, 0-2). Both of the postoperative increase in HU values and BI were significantly larger on the surfaces of the cage frames than those of the open windows (Wilcoxon signed-rank test, p < 0.001).

Conclusions: The postoperative increase in HU values and large BI suggest new bone formation on the cage surfaces. Thus, this study shows that osseointegration or bone bonding between the adjacent vertebral endplates and PTA cages can progress earlier on the surfaces of the 3D-porous titanium alloy frames than on those of the open windows filled with local bone grafts.

Figure. An example of the CT color mapping based on the Hounsfield Unit values.

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REDUCED RADIATION PROTOCOL FOR O-ARM NAVIGATION IN PAEDIATRIC DEFORMITY PATIENTS: A FEASIBILITY STUDY
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BACKGROUND:
O-arm assisted pedicle screw placement has been proven to be more accurate than free hand technique. Radiation exposure remains the primary drawback. We determined the feasibility and safety of a reduced radiation protocol in paediatric patients undergoing scoliosis correction.

METHODS:
A reduced radiation protocol for a Medtronic O-arm navigational system was devised. 3D CT reconstructions of an anthropomorphic pelvic phantom indicated adequate image quality after reduction to 20% of current manufacturer recommended factors devised by the Mayo Clinic. A feasibility study to test the image quality was undertaken on 3 patients, 1 with syndromic and 2 with idiopathic scoliosis each receiving reductions in radiation exposure to 60%, 50% and 40% of what would have been delivered using the Mayo clinic protocol by reducing the x-ray tube current to 10mA while keeping the tube potential consistent with the Mayo clinic recommendations.

RESULTS:
A low dose O-arm protocol was able to generate adequate image quality while delivering as little as 40% of the recommended protocol radiation dose. The total radiation dose delivered with this protocol was approximately 0.77 milliSieverts (mSv), which includes a pre and post instrumentation spin. This effective dose represents <1/3 of average UK and <1/6 average US annual radiation exposure. There were no neurological or implant related complications.

CONCLUSIONS:
Our low dose O-arm radiation protocol significantly reduces the radiation exposure compared to the Mayo clinic protocol providing operational image quality to allow more accurate screw placement in deformed spines.

Disclosures:
author 1: none; author 2: none; author 3: none; author 4: none

PARTIAL HEMI-VERTEBRA RESECTION (SRS-SCHWAB GRADE 4 OSTEOSIS) FOR CONGENITAL SCOLIOSIS: A COMPARISON WITH RADICAL HEMI-VERTEBRA RESECTION
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Introduction. SRS-Schwab grade 4 osteotomy (partial HV resection) recently has been reported to be well utilized in the correction of congenital kyphosis caused by HV deformity. Since SRS-Schwab grade 4 osteotomy was characterized with less invasion, post-operative bone to bone connection and well protection of nerve roots, we thereby hold that the partial HV resection should be preferred in certain CS patients with single HV. The purposes of this retrospective study was to investigate the radiological and clinical outcomes of partial HV resection in CS caused by non-incarcerated HV.

Methods. CS patients with single HV undergoing partial HV resection in our center from February 2011 to May 2016 were matched with those undergoing radical HV resection on age, gender, curve magnitude and apex location at a match ratio of 1:1. Comparisons were performed in terms of correction outcomes, clinical results and complications at pre-, post-operation and last follow up between partial HV resection group (P group) and radical HV resection group (R group).

Results. Both P group and R group included 25 CS patients and there was no significant difference in pre-operative radiologic parameters between two groups. Significantly improvements in Cobb
angle were observed post-operatively and at final follow up in both R and P groups. Compared with the R group, the P group had a similar correction of Cobb angle at post-operation (38.6±6.7° vs 35.2±5.6°, P=0.057) and at last follow up (38.4±7.0° vs 34.7±6.7°, P=0.062), and less estimated blood loss (P=0.023). Improvements at different levels were achieved in each domain of Scoliosis Research Society-22 (SRS-22) questionnaire at last follow up in both groups. During follow-up, no significant correction loss and major complications was observed in P group while 1 patient in R group was found to have rod breakage with pseudarthrosis at 24 months follow-up.

Conclusions. SRS-Schwab grade 4 osteotomy is a safe, effective and less invasive procedure while achieving comparable amount of deformity correction with radical HV resection in the treatment of CS due to single non-incarcerated HV.

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QF55

ACCURACY OF SCREW PLACEMENT OF ANTERIOR PEDICLE SCREW IN CERVICAL SPINE -RADIOLUMENT GUIDE-WIRE SYSTEM CAN IMPROVE THE ACCURACY OF SCREW PLACEMENT?

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Introduction
We have used anterior pedicle screw (APS) procedure W/WO plate fixation using the fluoroscope-assisted pedicle axis view imaging technique since 2006. We used the radiolucent guide-wire system to increase the accuracy of screw placement since 2012. In this study we reported those clinical outcomes and screw placement.

Materials and Methods
Seventy-four patients who underwent multi-level anterior decompression and APS fixation were enrolled. They were 43 men and 31 women and their mean age was 57 years old. Forty-eight cases had local kyphotic deformity. All underwent anterior decompression, strut bone graft and (APS) fixation (APS alone; 35 cases, APS & plate 23 and APS & posterior fixation in 16). Screw placement was evaluated as Grade 0-II (Grade0: intact, Grade I [screw exposure]; less than half diameter of screw out of pedicle, Grade II [pedicle perforation]; more than half screw out of pedicle)

Results
JOA score was improved from 11.4 to 14.7 and recovery rate was 58.3%. One hundred fifty-one APSs were inserted in 74 cases. Eight of 151 screws were considered as Grade I and 0 screws as Grade II. Screw malposition was decreased from 7.6% (7/92) to 1.6% (1/61) after radiolucent guide-wire system. No graft dislodgement was seen. Local alignment was 8.0 degrees kyphosis preoperatively, 3.0 lordosis postoperatively and 0.7 lordosis finally. Six cases of 35 APS alone cases needed posterior supplementary fixation due to graft sinking and/or kyphotic deformity. C5 palsy was developed in 9 of 48 cases with local kyphotic deformity and completely recovered in 8 cases.

Conclusion
APS procedure provided good clinical outcomes and few screw-related complications, and could be the surgical option which offers the strongest fixation in multi-segmental anterior cervical reconstruction. Radiolucent guide-wire system promoted the accuracy of screw placement.

Disclosures:
Introduction: A new concept of augmented reality surgical navigation (ARSN) system with intraoperative 3D cone beam CT (CBCT) and non-invasive patient tracking was developed for spine surgery. We introduce the first study that compares the accuracy of pedicle screw placement with ARSN vs free-hand (FH) technique and its impact on implant density.

Methods: Twenty consecutive patients, including 13 scoliosis cases, were enrolled in this prospective study. The ARSN system is composed of a ceiling-mounted robotic C-arm with integrated optical video cameras in a hybrid OR. An intraoperative 3D CBCT was acquired. The images were used for automatic pedicle identification and screw path planning. The trajectory of the screw paths were augmented to the video display of the surgical field for navigation.

Retrospective data from a matched group of 20 patients, operated by free-hand technique, for similar indications as the ARSN group was collected. Screws within the pedicle or encroaching the cortex (Gertzbein grade 0 or 1) were defined as accurately placed, while screws breaching 2 mm or more (Gertzbein grade 2 or 3) were defined as inaccurate. Implant density including number of screws and hooks were compared in both groups as well as secondary clinical outcomes such as deformity correction, length of hospital stay, and procedure time.

Results: A total of 262 and 288 screws were placed in the ARSN and FH groups respectively. The accuracy of the ARSN group was higher (93.9% vs 89.6%, p<0.05) with twice the amount of screws entirely within the pedicle, i.e. Gertzbein grade 0 (63.4% vs 30.6%, p<0.001). None of the groups had a screw with more than 4 mm breach, i.e. Gertzbein grade 3. No statistical difference was observed for combined implant density between the ARSN (1.76 per spinal level) and the FH group (1.69 per spinal level). However, there was a significant lower hook density (0.05 vs 0.18 per spinal level, p<0.01) due to a significant higher screw density (1.71 vs 1.51 per spinal level, p<0.05) in the ARSN group. There was no difference in deformity correction, length of hospital stay or procedure time.

Conclusion: A significantly higher pedicle screw accuracy was achieved with ARSN compared to free-hand technique. While the total implant density is comparable in both groups, the ARSN allowed pedicle screw placement in small pedicles instead of hooks, yielding potentially better...
biomechanical stability.

Disclosures:
FIRST EXPERIENCE WITH PLATELET RICH FIBRIN AUGMENTATION OF DEEP SURGICAL SITE INFECTIONS AFTER INSTRUMENTED SPINAL SURGERY

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Background:
Late-onset deep surgical site infections after instrumented spinal surgery is a rare but harmful complication currently lacking universally accepted management strategies. Radical surgical debridement of devitalized tissue and targeted antibiotic treatment is frequently insufficient. Multiple revision-surgeries and even removal of the instrumentation may ensue. Primary wound-closure is frequently impaired by extended tissue destruction. Platelet rich fibrin (PRF) is an autologous low cost biomaterial - easy-to-prepare - in the operating theater by a single centrifugation process of the patients own blood, without any additional chemical handling. It is enriched with leukocytes and autologous growth factors. PRF has been recognized as a powerful cicatrization matrix for the promotion of wound healing in various applications of regenerative medicine.

Purpose of the study:
In the present study we assess the potential of PRF to augment deep surgical site infections and obtain wound closure after instrumented spinal fusion. In this study we explored an adjuvant approach, where after initial surgical debridement and initiation of the pathogen-specific antibiotic regimen, the surgical site is secondary augmented with injectable and solid platelet rich fibrin, in order to eliminate residual post-infectious tissue deficits and thus promote a successful primary wound-closure with retention of the instrumentation.

Materials and Methods
4 patients who underwent instrumented spinal surgery presented with late onset deep surgical site infections. Extended resection of the devitalized and necrotic tissue and sampling of the involved pathogens was initially performed followed by intravenous administration of pathogen-sensitivity-adapted antibiotics. Primary wound closure was attempted in each patient. Due to persistent wound-dehiscence in all cases, a second surgical debridement was performed, and the remaining post-infectious tissue deficits were filled with solid PRF obtained from the centrifugation of 50 ml of patients own blood. The surrounding tissues were injected with 20 ml of injectable PRF (iPRF). Primary wound closure was performed. Wound inspections and laboratory follow ups have been performed every two weeks for 3 months.

Results
Primary wound healing was found in all patients with no recurrence of infection during the follow up periods. No removal of Instrumentation was required. In all 4 cases Staphylococcus aureus was the identified pathogen. All 4 patients showed positive blood culture results for the same pathogen. Infections resolved in all patients.

Conclusions
Autologous PRF is a simple-to-use low cost biomaterial which may facilitate wound healing in patients with deep surgical site infections after instrumented spinal fusion.

Disclosures:
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 DOES OBESITY AFFECT LONG-TERM OUTCOMES OF LATERAL LUMBAR INTERBODY FUSION (LLIF)?

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Introduction: Obese patients are known to pose significant challenges to spine surgeons in performing traditional open lumbar fusion procedures. The increased risk of complications in these patients has led surgeons to be wary in pursuing traditional operative interventions. Since the advent of minimally-invasive approaches to lumbar fusion, surgeons are turning to these procedures in an attempt to minimize operative time, blood loss and complications. With the increased proportion of obese patients, it is imperative to understand the long-term outcomes in minimally-invasive approaches. One such approach is lateral lumbar interbody fusion (LLIF).

Purpose: The purpose of this study was to evaluate the long-term outcomes of LLIF in obese patients by assessing clinical outcome scores, reoperation rate, and pelvic parameters.

Methods: A retrospective review was performed to identify patients who underwent LLIF with posterior stabilization since 2007 with a minimum of 5 years follow-up. Demographics including BMI were recorded and patients were subdivided into 2 cohorts: (A) nonobese (BMI <30 kg/m2) and (B) obese (BMI >30 kg/m2). Functional outcomes were assessed by comparing pre- and post-operative VAS and ODI scores. Reoperation rates were compared between cohorts. Pelvic incidence (PI) and lumbar lordosis (LL) mismatch was calculated from both pre- and post-operative radiographs.

Results: 115 consecutive patients were included (53 nonobese & 62 obese) with a mean follow up of 95.3 months. Mean BMI was 25.3 in cohort A and 35.3 in cohort B (p<0.001). There were more females in cohort A. VAS scores decreased by a mean of 5.7 in cohort A, and 5.4 in cohort B (p=0.213). ODI improvement was also similar between the cohorts. 5.6% of nonobese patients required reoperation compared to 9.6% of obese patients (p=0.503). Both cohorts achieved a similar proportion of PI-LL mismatch correction, 85% in obese vs 78% in nonobese patients (p=0.526).

Conclusion: Contrary to traditional open fusion procedures, obese patients who undergo minimally invasive LLIF have similar surgical outcomes compared to nonobese patients with respect to functional outcome scores, reoperation rates, and correction of PI-LL mismatch after long-term follow-up. With similar outcome and reoperation profiles, LLIF, a minimally invasive approach to the lumbar spine, is a safe and effective option for fusion in obese patients.

Disclosures:
FUSION PERFORMANCE OF ATTRAX® PUTTY VS. AUTOGRRAFT IN INSTRUMENTED POSTEROLATERAL SPINAL FUSION; A RANDOMIZED INTRA-PATIENT CONTROLLED NON-INFERIORITY TRIAL

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Introduction
Spinal fusion is a frequently performed surgical procedure for many spinal conditions. Autologous bone grafting is the gold standard to establish a bony fusion, but this procedure has some drawbacks including harvesting morbidity and limited amounts. This has led to development of various alternatives over the past decades. Current microporous synthetic ceramics consisting of tricalciumphosphate are promising due to their high bioactivity as shown by ectopic bone induction in animal models. We investigated the non-inferiority of such a ceramic (AttraX® Putty) in comparison to autograft in instrumented posterolateral spinal fusion.

Methods
After ethical approval and informed consent, 100 non-traumatic adult patients indicated for a primary posterolateral fusion between T10 and S1 were included in this multicenter randomized intra-patient controlled non-inferiority trial. After instrumentation and preparation for bone grafting, the allocation side of AttraX® Putty was disclosed. The contralateral side of the fusion trajectory was grafted with autologous bone graft, so each patient served as its own control. For the primary outcome, the fusion rate of both grafts was assessed at 1 year follow-up on CT-scans. Each segment and side was scored by two blinded observers independently. Subsequently, a single fusion score per side was calculated to correct for multilevel fusions. Non-inferiority of AttraX® Putty was tested with McNemar’s test. The non-inferiority margin was set at 15%, with 80% power and alpha of 0.05. Secondary outcomes included the rate of (serious) adverse events compared to control populations from literature, Oswestry Disability Index (ODI), EQ-5D-5L and Visual Analogue Scale (VAS) for back pain.

Results
A total of 87 patients were included in the primary analysis. There were 42 males and 45 females, mean age 55 (range 33-79) years. A mean of 1.7 (range 1-8) spinal segments were instrumented for fusion. The overall posterolateral fusion rate was 71%. At the AttraX® Putty side 55% of the segments were unilaterally scored as fused, compared to 52% at the autograft side. After correction for multilevel fusions, McNemar’s test showed no difference between the treatment conditions (p=0.868, 90% CI -9.1% to +13.7%). None of the reported adverse events could be directly related to the use of AttraX® Putty.

Conclusion
This randomized intra-patient controlled study including 87 patients demonstrated non-inferiority of AttraX® Putty in comparison to autograft in terms of posterolateral fusion performance in instrumented thoracolumbar spinal fusions.

Disclosures:
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THORACOSCOPIRIC VERTEBRAL BODY TETHERING FOR ADOLESCENT IDIOPATHIC SCOLIOSIS: MID-TERM RESULTS OF 24 PATIENTS

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Introduction
Growth friendly surgical options by modulating the spinal growth and preventing the possible complications of fusion are new trends for the management of adolescent idiopathic scoliosis (AIS) in skeletally immature patients. Vertebral body tethering (VBT) as a fusionless minimally invasive treatment option has been shown to be effective to induce and also correct the scoliotic deformity by many animal studies. However, only a few studies exist in the literature with regard to the clinical and functional early results of VBT. The aim of this study is to present the 2-years results of VBT applied to 24 skeletally immature patients with AIS.

Patients and Methods
24 patients with a diagnosis of AIS were included in the study prospectively after evaluation of their clinical and radiographic data. All patients were skeletally immature and followed up within a brace for at least 6 weeks. A decision to proceed with surgery was established after the detection of curve progression within the brace (>40°) with a minimum curve flexibility of 30%.

Results
18 females and 6 males had a mean age of 11.4, mean follow-up period of 2 years. Patients had a mean pre-operative major curve magnitude of 48 degrees and a mean curve flexibility of 48.2%. An average of 8 levels of tethering was performed through thoracoscopic approach. Thoracic screws were placed thoracoscopically, while mini-lumbotomy was added in thoracolumbar levels. Tethering cord was advanced transdiaphragmatically and tensioned appropriately. 21 patients underwent unilateral instrumentation, while 3 patients with double curves underwent bilateral tethering from the convex side of both double curves. Post-operatively, a mean first erect major curve magnitude of 16 degrees was acquired, while the mean major curve magnitude at the last follow-up was detected as 10 degrees. One patient was diagnosed chylothorax immediately post-operatively and treated conservatively, while no other major complications were acquired. A TLSO brace was used for six weeks post-operatively to achieve union at the screw bone interface.

Discussion and Conclusion
Anterior VBT as a growth modulating treatment option by allowing the correction of the scoliotic deformity and restoring the coronal balance without the disruption of sagittal balance is a safe and effective option for the surgical treatment of AIS in skeletally immature patients. VBT also allows the preservation of motion of spinal segments yielding to return sports at the same pre-operative level. It has been shown that anterior VBT was able to yield excellent clinical and radiographic results without causing any major complications.

Disclosures: