OUTCOME MEASURES: Physiologic measure: Gait deviation index (GDI) score, Gait profile score (GPS).
METHODS: Consecutive patients with high-grade spondylolisthesis underwent pre- and post-operative 3D gait analysis studies.
RESULTS: All four patients had Meyerding grade 4 spondylolisthesis pre-operatively. Mean age was 14.5 years and all were female. Pre- and post-operatively mean GDI score, right/left GPS were 76.35 and 91.72, 10.33/9.16 and 7.75/6.85, respectively. Surgery achieved reduction to Meyerding grade 1 in all patients. Common pre-operative features in coronal plane included pelvic obliquity and increased hip abduction. In sagittal plane, posterior pelvic tilt, reduced flexion of hip at initial contact, increased flexion of knee at initial contact, decreased extension of knee in stance, decreased second rocker in foot was noted. In transverse plane, increased external rotation of hips and foot progression angle. Post-operatively all sagittal parameters normalised. Hip abduction, hip external rotation, and external foot progression angle improved but did not return to normal.
CONCLUSIONS: In high-grade spondylolisthesis pre-operative gait abnormalities concern patients. Posterior decompression, posterolateral instrumented fusion and reduction normalised all sagittal gait parameters and increased walking velocity, step and stride length.
CONFLICTS OF INTEREST: No conflicts of interest.
FUNDING SOURCES: No funding obtained.

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Sacral osteotomies for correction of high pelvic incidence

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BACKGROUND CONTEXT: The limits of osteotomy are generally reached when the degree of lumbar lordosis exceeds the capabilities of the technique in cases of very high pelvic incidence (PI>90°). In these cases, the best place for an osteotomy is between the sacral plateau and femoral heads, in order to decrease the PI.
PURPOSE: Our aim was to analyse the outcome and alteration in radiological parameters, including the change in PI, in patients undergoing a sacral osteotomy.
STUDY DESIGN/SETTING: Retrospective review.
PATIENT SAMPLE: Three patients' case series with PI greater than 90°.
OUTCOME MEASURES: Radiological parameters, visual analogue scale (VAS), Oswestry Disability Index (ODI).
METHODS: Review of radiological and clinical parameters of cases after a sacral osteotomy performed by a single surgeon.
RESULTS: Three patients underwent sacral osteotomies to reduce a very high PI. All patients were female with an average age of 36 years (24–48) and a mean follow-up of 20 months (10–36). The aetiology was high grade spondylolisthesis with two patients having undergone previous fusion surgery. Two patients underwent an S1 osteotomy and 1 had an S2 osteotomy (all 3 column). The fixation was from L2/L3/L4-pelvis in all patients with no complications. The radiological parameters (mean) changed from pre-operatively to final follow-up as follows: PI (103.5°–75°), LL (44.5°–52°), SVA (17 cm–6.5 cm). Clinical markers (average) also improved: VAS low back pain (LBP) 8 to 3; VAS LP 7 to 2; ODI 70 to 33.5.
CONCLUSIONS: In this small series of patients with very distal lumbar/sacral kyphosis, a posterior sacral subtraction osteotomy below the sacral plateau decreased the PI, achieving a better (but not perfect) sagittal profile.
CONFLICTS OF INTEREST: Departmental research/fellowship support DepuySynthes, Medtronic.
FUNDING SOURCES: Nil.

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Efficacy of SpineSage tool for assessing the expected complication rates in adult spine deformity surgery—preliminary results

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BACKGROUND CONTEXT: The 'SpineSage' is an informatics platform offering an objective and universal tool allowing individualised estimation the perioperative complication rate (CR) from spine surgery. It has never been validated in predicting CR in cases of surgical correction of spinal deformities.
PURPOSE: To assess the efficacy of SpineSage in predicting probability of complications in adult spine deformity surgery.
STUDY DESIGN/SETTING: Retrospective data analysis.
PATIENT SAMPLE: Pilot group of 28 surgical cases of the adult spine deformity.
OUTCOME MEASURES: Nil.
METHODS: The necessary data (medical background, details of the operation, perioperative complications) were extracted from the patients' medical records. Using the online algorithm (http://spinesage.com) the predicted complication rate (pCR) was estimated for each case. The pCR was compared with the observed complication rate (oCR) by mean of Fisher exact test.
RESULTS: Three subgroups of patients were distinguished: Group 1: pCR 0%–30%—8 cases; Group 2: pCR 31%–70%—12 cases and Group 3 pCR≥71%—8 cases. The oCR in particular groups were as follows: Group 1—2 cases (25%); Group 2—6 cases (50%) and Group 3—6 cases (75%). There were no significant differences between pCR and oCR ratios (Fisher p=1.00 in all groups).
CONCLUSIONS: The initial results indicate the SpineSage algorithm adjusted for the analysis of adult spinal deformities may predict the real prevalence of complications. Our study will be continued in a prospective setting in order to verify that thesis basing on a wider group of patients.
CONFLICTS OF INTEREST: Early results of the study were presented at 3rd Annual Mount Sinai Spine Research Day and Fellows Reunion on May 7, 2015.
FUNDING SOURCES: None.

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Computational models for characterisation and design of patient-specific spinal implant

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BACKGROUND CONTEXT: Spinal fusion is designed to reduce movements between vertebrae and therefore pain. The most used devices for this procedure are mainly made of titanium or polyether ether ketone (PEEK). However, the mismatch between devices, with standard shapes and materials, and the surrounding bones can lead to suboptimal outcomes. Computational models, namely, Finite Element Analyses (FEA), can be employed to optimise existing device and design more effective solutions.
PURPOSE: The goal of this study was to compare the performance of different materials and material densities for spinal cages, and to design a novel geometry which can ideally match the anatomical characteristics of a patient.
STUDY DESIGN/SETTING: Computational.
PATIENT SAMPLE: Nil.
OUTCOME MEASURES: Nil.
METHODS: FEA were set up to simulate compression (400 N) and bending (7.5 Nm) on a generic cage design. Three materials were modelled: titanium, PEEK and polycarbonate. Polycarbonate was included as widely available within additive manufacturing techniques. For each of the cages, four designs were modelled with varying material filling density. Furthermore, a new cage was modelled to match the pre-operative computed tomography (CT) of a patient exactly. The patient-specific cage was also tested by means of FEA.

RESULTS: Stress distribution was compared between all the three materials tested. Consistently, stresses increased with reducing material density. Stress peak values were lower than the respective risk of failure in all the simulated cases, confirming the feasibility of polycarbonate implants. The patient-specific design showed even stress distribution consistently within anatomical constraints.
CONCLUSIONS: Computational analyses suggested the feasibility of a lighter, cheaper and patient-specific cage for spinal fusion.
CONFLICTS OF INTEREST: No conflicts of interest.
FUNDING SOURCES: EPSRC Centre for Innovative Manufacturing in Medical Devices (MeDe).

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Povidone-iodine irrigation (PVI) has a profound effect on in vitro osteoblast proliferation and metabolic function and inhibits their ability to mineralise and form bone

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BACKGROUND CONTEXT: Povidone-iodine irrigation (PVI) has been proposed as a safe and effective practice to reduce infection in spinal surgery. However, recent evidence in multiple cell types suggests that PVI has a deleterious effect on cellular viability and function.
PURPOSE: To model spinal wound irrigation with dilute PVI in vitro, in order to investigate the effect on osteoblast proliferation, metabolism and bone mineralisation.
STUDY DESIGN/SETTING: An in vitro study on human osteoblast cells exposed to 0.35% PVI for 3 minutes, and analysed for proliferation rate, oxidative capacity and mineralisation.
PATIENT SAMPLE: Primary osteoblasts cultured from a femoral head undergoing total hip replacement. Primary cell lines cultured from Human Osteoblast Cell Line hFOB 1.19 (ATCC England, UK).
OUTCOME MEASURES: (1) Cell proliferation assay: MTS (Promega). (2) Metabolic function: oxygen consumption rate, extracellular acidification rate and proton production rate (Seahorse, Bioscience, USA). (3) Mitochondrial function: Western Blot Immunoprobe (GE Healthcare, UK). (4) Bone nodule formation: Alazarin Red (Sigma-Aldrich, UK).
CONFLICTS OF INTEREST: None.
FUNDING SOURCES: Grant from British Scoliosis Research Foundation.

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Comparison of primary and conversion surgery with magnetically controlled growing rods in children with early onset scoliosis (EOS)

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BACKGROUND CONTEXT: It is not known how effective the magnetically controlled growing rods (MCGR) technique is in previously operated children.
PURPOSE: To compare outcomes of primary versus conversion surgery using MCGR in children with early onset scoliosis (EOS).
STUDY DESIGN/SETTING: Retrospective multicentre study.
PATIENT SAMPLE: Primary and conversion patients with EOS.
OUTCOME MEASURES: Clinical and radiological.
METHODS: Data obtained for 27 primary (P) patients (mean age 7.0 (2.4–10.7) years) and 23 conversion (C) patients (mean age 7.7 (3.6–11.0) years) with 1-year follow-up.
RESULTS: The mean major curve was 64° (P) and 47° (C) at baseline (p=.0009) and 39.5° and 39.6°, respectively, at 1-year follow-up (p=.99). Spinal growth (T1-S1) from initial post-operative to 1-year follow-up showed no statistical difference (1.8% (P) vs −2.2% (C)) p=.09). Mean distraction of the rods achieved was 9.3 mm in P group (standard deviation [SD] 5.6) and 7.6 mm in C group (SD 5.8) (p=.37). Subgroup analysis of patients with minimum three distractions showed correction of the major curve was better in P versus C group (40% vs 22%, p=.03). The mean percentage change from baseline was larger in P versus C group for thoracic spine (19% vs 9.5%, p=.14) and T1–S1 spine (17% vs 8.1%, p=.08). Mean change in spinal growth in the thoracic spine (2.2% P vs 1.3% C, p=.69) and T1–S1 spine (1.7% P vs 1.1% C, p=.77) were similar.
CONCLUSIONS: Spinal deformity can be equally controlled after conversion from standard growing rods into MCGR, but spinal growth from baseline is less in C patients as compared with the P group.
CONFLICTS OF INTEREST: None to declare.
FUNDING SOURCES: Ellipse Technology.

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Estimated X-ray exposure and additional cancer risk during surgical treatment of scoliosis in the growing spine

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BACKGROUND CONTEXT: Clinicians must weigh the benefits of radiological imaging against the risks of X-ray exposure in the diagnosis and treatment of scoliosis.
PURPOSE: Estimate absorbed X-ray dose and additional cancer risk in scoliosis patients treated in our unit.
STUDY DESIGN/SETTING: Retrospective review of estimated absorbed dose on the Computerised Radiology Information System (CRIS).
PATIENT SAMPLE: Patients undergoing surgical correction of scoliosis (age≤25) from August 2010 to August 2015.
OUTCOME MEASURES: Physiologic (estimated absorbed dose—milligrays (mGy)) and functional measures (additional cancer risk and calculated equivalent dose—millisieverts (mSv)).
METHODS: Estimated absorbed dose recorded on CRIS. Pedicle screws inserted using image intensification. Equivalent dose and additional cancer risk calculated from the National Research Council document in 2006, 'Health risks from exposure to low levels of ionising radiation'.
RESULTS: 271 patients identified. Mean age 15 (range 2–25). Mean total absorbed dose was 2,136 mGy (SD 1,700). During treatment the mean number of spinal imaging episodes was 8 (SD 3) with total 1,884 mGy exposure (SD 1,609 mGy). Additional dose was provided by computed tomography (CT) (mean 0.17 episodes), plain chest and abdominal radiographs (mean 0.25 and 0.0625 events) and image intensification. Mean number of image intensification episodes was 1.1 with mean estimated exposure 180 mGy (SD 238). Image intensification accounted for 8% of the estimated absorbed dose during treatment. Estimated mean effective dose delivered was 20.952 mSv equating to an additional cancer risk of 0.27%–0.45%.
CONCLUSIONS: Use of image intensification for pedicle screw insertion is a minor contribution (8%) to the total patient dose. Additional cancer risk from cumulative imaging is small and equivalent to approximately 8 years of natural background radiation.
CONFLICTS OF INTEREST: No conflicts of interest.
FUNDING SOURCES: No funding obtained.

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