3.1
THE USE OF MINDFULNESS-BASED INTERVENTION FOR IMPROVING BRACING COMPLIANCE FOR ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS: PROTOCOL FOR A RANDOMIZED CONTROLLED TRIAL

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Introduction: For AIS patients, new evidence implicates that bracing compliance significantly decreased the progression of high-risk curves to surgery threshold. Intervention that may improve bracing compliance is of great interest. This study will investigate mindfulness-based intervention (MBI) effect on bracing compliance and quality of life among AIS patients.

Methodology: This is a two-arm single-blind randomised controlled trial. 120 AIS patients (10-15 years) with non-satisfactory bracing compliance will be recruited. Study will take place at Department of orthopedic and traumatology of Prince of Wales Hospital. Patients in MBI group will join weekly sessions, an adapted shorter version of MBSR, for 8 weeks. Control group will consist of an 8-week physiotherapy exercise (PE) that is recommended by SOSORT 2011 guideline. The primary outcome is the 6-month post-intervention score of bracing compliance. Secondary measures include quality of life related psychosocial measurements.

Results and Analysis: ANCOVA will be conducted to compare the effect of MBI versus PE on outcome measures. To investigate significant change over time, Linear Mixed Models (LMM) will be conducted. We have since 15 February 2017 recruited 107 patients (81 females and 26 males). 14 subjects (batch 1) completed intervention and were included in analysis. A positive change of compliance in MBI group (p<0.05) has been noticed. Compared with control group, MBI didn't induce a significant difference in participants' compliance and other measurements.

Discussion and Conclusion: This is the first psychosocial intervention study aiming to improve AIS patients’ bracing compliance. Results from this study will potentially carry significant impact on future AIS treatment by emphasizing on psychosocial care.

3.2
REDEFINING GUIDELINES FOR BRACE WEANING IN ADOLESCENT IDIOPATHIC SCOLIOSIS BASED ON STANDARDIZED SKELETAL MATURITY PARAMETERS

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REDUCTION OF SCOLIOSIS CURVATURE AFTER AN INTENSIVE PHYSIOTHERAPY
SCOLIOSIS SPECIFIC EXERCISE PROGRAM – IMPACT ON DEFORMITY CORRECTION
AND HOME EXERCISE COMPLIANCE

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Introduction: Physiotherapy Scoliosis specific exercises (PSSE) have demonstrated promising results in the conservative management of scoliosis with successful reduction in curve size in some adolescent idiopathic scoliosis (AIS) patients. However, compliance is often poor. Our aim of study is to investigate the effectiveness and compliance of a 5-day intensive PSSE program.

Methodology: Four programs on PSSE were arranged during school-holiday. Each consisted of 5 inpatient days of PSSE with the Schroth approach. Each program enlisted 8 subjects. Patients were aged between 10 and 18. This was compared with a control group who underwent the same PSSE on a weekly basis and continued daily at home. The spinous process angle (SA) was measured using a 3D ultrasound immediately before, at the end, one week and one month after the program.

Results and Analysis: There were 32 and 33 subjects recruited in the study and control group respectively. Mean Cobb angle before PSSE was 24.4±8.6 (study group) and 23.2±8.1 (control group). The SA had interaction effect within groups and treatment (p<0.001). Post hoc comparison showed the study group SA reduced significantly at 1 week (p<0.001) and was similar at 1 month (p=0.58). Percentage of improvement in SA had interaction effect between groups and treatment (p<0.001). Post hoc comparison showed superior improvement in the 1 week study group vs control group (38% vs 10%; p<0.001) and for the 1 month study group vs control group (37% vs 10% improvement; p<0.001). In the study group, 70% had good compliance (>20min a day; >3 times a week) but only 56.7% in the control group.

Discussion and Conclusion: This study showed a 5-day intensive PSSE program had a greater reduction in curve magnitude and improved the overall compliance to treatment.

EFFECTS OF PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISE FOR AIS
SUBJECTS WITH DIFFERENT CURVE PATTERNS: A PRELIMINARY STUDY

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Introduction: Spinal flexibility is one of the most important factors influencing the degree of scoliosis correction with bracing or surgery. Thoracic curves are inherently more rigid as compared to the lumbar curve due to the ribcage. Whether these differences can be translated to physiotherapeutic scoliosis specific exercises (PSSE) is unknown. This study aims to investigate the influence of curve type on the outcomes of PSSE for adolescent idiopathic scoliosis (AIS).

Methodology: 78 AIS patients aged 10-16 were reviewed. Adopted Schroth scoliosis classification, 3C and N3N4 curves were considered as thoracic-primary (group A). Whereas SL and 4C curves were considered as lumbar-primary (group B). Both groups underwent a standardized PSSE protocol of >30min/time and >2 times/week. Exercises taught were 50 semi-hangings, and self-correction exercise in sitting/standing (50 repetitions) and lying (50 repetitions). Each subject underwent 3D ultrasound examinations. The spinous process angle (SA) measured on ultrasound was obtained before commencing of treatment, and at 2 and 6 months after.

Results and Analysis: There were 32 and 33 subjects recruited in the study and control group respectively. Mean Cobb angle before PSSE was 24.4±8.6 (study group) and 23.2±8.1 (control group). The SA had interaction effect within groups and treatment (p<0.001). Post hoc comparison showed the study group SA reduced significantly at 1 week (p<0.001) and was similar at 1 month (p=0.58). Percentage of improvement in SA had interaction effect between groups and treatment (p<0.001). Post hoc comparison showed superior improvement in the 1 week study group vs control group (38% vs 10%; p<0.001) and for the 1 month study group vs control group (37% vs 10% improvement; p<0.001). In the study group, 70% had good compliance (>20min a day; >3 times a week) but only 56.7% in the control group.

Discussion and Conclusion: This study showed a 5-day intensive PSSE program had a greater reduction in curve magnitude and improved the overall compliance to treatment.
3.6

THE EPIDEMIOLOGY AND RISK FACTORS OF BACK PAIN IN ADOLESCENT IDIOPATHIC SCOLIOSIS – A LARGE-SCALE STUDY

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Introduction: Adolescent idiopathic scoliosis (AIS) presents with a three-dimensional deformity which may affect spinal biomechanics. Thoracic and back pain occur in AIS patients but little is known for their prevalence at various time period and risk factors.

Methodology: A total of 987 conservatively treated AIS patients were recruited and filled in structured questionnaire regarding current thoracic pain (TP), low back pain (LBP) and chronic back pain (TP/LBP), pain histories at previous 7-days, 30-days, 12-months and lifetime. Insomnia Severity Index, Epworth Sleepiness Scale, and Depression Anxiety Stress Scales were assessed. These features and scoliotic curvature phenotypes were compared between patients with/without back pain.

Results and Analysis: Various period prevalence for TP and LBP ranged from 5.6% to 14.1%, and 5.5% to 29.3% respectively. Patients with back pain (current/last 12 months) had significantly poorer function, more insomnia and daytime sleepiness (p<0.05) than those without pain. Chronic back pain patients had same problems plus moderate depression (p<0.05). Older age (OR=1.2-1.4), Cobb angle>40° (OR=2.4-3.7), daytime sleepiness (OR=2.4), insomnia (OR=1.8-2.3) were significant risk factors for episodic and/or chronic back pain. Moderate depression (OR=3.3) and brace-wearing (OR=3.0) were independent risk factors for chronic back pain.

Discussion and Conclusion: This is the first large-scale study reporting the epidemiology and risk factors of AIS back pain, giving an insight of the impact of biopsychosocial factors. Our results highlight the importance of back pain screening and management for AIS with specific imaging and psychosocial profile.
3.7

UNIQUE CORRELATION BETWEEN BONE STRUCTURE AND HANDGRIP MUSCLE STRENGTH IN GIRLS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction: Previous studies reported the association between adolescent idiopathic scoliosis (AIS) and low bone mass and poor bone health. Cross-talk between bone and muscle was recently described receiving wide attention and can potentially shed lights on the nature of poor bone health. This study aimed to investigate the correlation between handgrip strength and bone qualities in girls with AIS versus age-matched normal girls.

Methodology: 142 AIS girls aged 12-14 years and 247 matched girls were recruited. Maximum handgrip strength was measured with a standard dynamometer and bone qualities of non-dominant distal radius were measured by high-resolution peripheral quantitative computed tomography (HR-pQCT). Bone mechanical properties were assessed using Finite Element Analysis (FEA). Partial correlation was used to control confounding from age, arm span and weight.

Results and Analysis: In non-AIS girls and after adjustment for confounders, handgrip strength was positively correlated with bone area (R = 0.17 in cortical area and R = 0.24 in trabecular area) and bone mechanical properties (R = 0.25 in stiffness and R = 0.24 in failure load), but not correlated with volumetric bone mineral density and trabecular bone micro-architecture. In contrast for AIS girls, handgrip strength was positively correlated with cortical area (R = 0.22), cortical thickness (R = 0.19), and bone mechanical properties (stiffness, failure load and apparent modulus, R = 0.22 – 0.33).

Discussion and Conclusion: This study indicated unique correlation patterns between bone qualities and handgrip strength in AIS as distinct from controls. This finding suggests that AIS has characteristic bone-muscle cross talk. This study is supported by RGC of HKSAR (468809, 468411 & 14135016).

3.8

A CASE OF MALIGNANT SCOLIOSIS AND ITS RELATIONSHIP WITH PULMONARY FUNCTION IMPAIRMENT

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Introduction: The purpose of this study is to report the relationship between CT and Special post-operative MRI scan of the thorax scan, the clinical pulmonary test and clinical improvements of a patient with severe adolescent idiopathic scoliosis treated with corrective scoliosis surgery using posterior spinal instrumented fusion.

Methodology: A detailed study of an eleven-year-old girl with severe scoliosis (Major Cobb>100) was done. She had demonstrated rapid progression with a BMI of 10. Patient was already complaining of shortness of breath and chest pains with exertion before operation. Pulmonary function tests were performed before surgery and eight months post-surgery. The Pre-operative CT, Pulmonary function tests, Bruce treadmill course protocol, and echocardiogram done for this patient with severe scoliosis are studied and correlated.

Results and Analysis: The pre-operative FVC (630ml), FEV1 (570ml) and FEF 99L/min of this patient was 21%, 20% and 28% of her predicted normal respectively. The CT scan demonstrated the reduction of the thorax cavity was 872ml. Corrective scoliosis surgery using posterior spinal instrumented fusion was done due to progression of the curve and patient’s failing pulmonary status. Post-operative Cobb’s angle improved with the thoracic curve at 36 degrees and lumbar curve at 10 degrees. Follow up MRI lung volume confirmed the improvements in lung.

Discussion and Conclusion: This study reconfirms the influence of spinal deformities on pulmonary impairment in patients with severe scoliosis. The mechanism of pulmonary function impairment had not been reported in literature. This highlights the objective measures taken to demonstrate the improvements with lung volumes that corrective scoliosis surgery can provide.
3.9

SELECTION OF LOWEST INSTRUMENTED VERTEBRA USING FULCRUM BENDING RADIOGRAPHS ACHIEVED SHORTER FUSION SAFELY COMPARED WITH THE LAST “SUBSTANTIALLY” TOUCHING VERTEBRA IN LENKE TYPE 1A AND 2A CURVES

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3.10

OUTCOME AND SAFETY ANALYSIS OF 3D-PRINTED PATIENT-SPECIFIC PEDICLE SCREW JIGS FOR COMPLEX SPINAL DEFORMITIES: A COMPARATIVE STUDY

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Introduction: Spinal deformities are very challenging to treat and have a great risk of neurologic complications because of hardware placement during corrective surgery. Various techniques have been introduced to ensure safe and accurate placement of pedicle screws. Patient-specific screw guides with predrawn and prevalidated trajectory seem to be an attractive option.

Methodology: A total of 20 patients were enrolled during the study: 10 were operated on with the help of 3D printing (Group 1) and 10 were operated on with freehand technique (Group 2). Group 1 included six patients with congenital scoliosis, three patients with adolescent idiopathic scoliosis (AIS), and one patient with post-tubercular kyphosis, and Group 2 included five patients with congenital scoliosis, four patients with AIS, and one patient with post-tubercular kyphosis. Primary outcomes were measured in terms of screw violation, and secondary outcomes were measured in terms of surgical time, blood loss, radiation exposure (number of shoots required), and complications.

Results and Analysis: We found a significant difference (p=0.03) between the two groups regarding perfect screw placement in favor of 3D printing. Surgical time was significantly less (p=0.03) in the 3D printing group compared with the freehand group. Mean blood loss was higher in the freehand group but was not statistically significant (p=0.3) in the 3D printing group. Fluoroscopic shots required were less in number in the 3D printing group compared with the freehand group.

Discussion and Conclusion: In our study, focusing on spinal deformities with statistically significant higher rates of accurate screw positioning and higher numbers of inserted screws with 3D printing was possible because of enhanced safety, particularly at apical levels. Developing these patient-specific drill templates will enable an average spine surgeon to treat these patients with much ease and safety.
3.11

IMPLANT DENSITY AND CURVE CORRECTION RATE IN SCOLIOSIS SURGERY USING A 3D BASED CORRECTION STRATEGY

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Introduction: Adolescent idiopathic scoliosis (AIS) is a three-dimensional deformity. The pedicle screw (PS) instrumentation and 3D correction strategy is currently the method to arrest progression and restore normal 3D alignment of the spine to provide a long lasting functional spine. Implant density and location has been a controversial issue in relation to curve correction. This paper aims to analyse the relationship between implant density and curve correction rate.

Methodology: We review AIS patients who had undergone Posterior Spinal Fusion from 2014 to 2017. Pre-operative standing, side bend (SB), fulcrum bend (FB) and post operative Cobb angles were analysed to determine the relationship between implant density, curve flexibility and correction rates. The sagittal alignment was also analysed in these patients.

Results and Analysis: There are 33 patients with 25 female and 8 male. Pre-operative Cobb angle was 73° +/- 19 (49-102°), Side bend correction was 27+/− 14%, fulcrum bend correction was 46+/−17%, and operative correction was 66+/−12%. Fulcrum Bend Correction index (FBCI) was 157+/− 47% (86-259). The implant density was 76+/−14% (55-100). The Fulcrum Bend flexibility is lower in high magnitude curves. The operative correction rate is correlated to FBCI. There is a weak correlation between implant density and operative correction rate. The FBCI was inversely related to the implant density. Implant density below 70% there is a weak correlation between implant density and correction rate and there is no correlation when density was above 70%. A sub-group analysis of 7 rigid cases FB correction less than 30%, the higher density index has a better curve correction but the number of cases were small.

Discussion and Conclusion: In this small study with detailed analysis of intrinsic flexibility of the scoliosis, it showed that in flexible curves there is no advantage in having high density implant (>70%) as the correction plateau out. There may be some evidence that in rigid cases, higher implant gave a better correction rate. Further study is required to study the high angle and rigid cases and also to study other factors such as BMI, age and bone quality by Dexascan.

3.12

A COMPARISON ON THE SAGITTAL ALIGNMENT IN CHINESE AIS GIRLS BY EOS RADIOGRAPHY UNDERGOING A POSTERIOR SPINAL FUSION SURGERY: A PRE- AND POST-SURGICAL COMPARISON

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Introduction: Adolescent idiopathic scoliosis (AIS) is the most common pediatric spinal deformity, affecting 3% of adolescents. Patients with progressive curve often needs surgical correction. The purpose of surgery is to reduce scoliotic curvature, however, it often neglects the importance on sagittal alignment. An undesirable sagittal alignment may lead to long term complications such as pain and aggravated spinal degeneration. In this study, we aimed to evaluate the sagittal spinopelvic alignment in AIS subjects before and after surgery.

Methodology: Total 17 pre-op AIS girls with a primary right thoracic curve (Risser sign ≥4) and 17 healthy girls were recruited. All subjects underwent EOS biplanar radiographs at baseline with radiological parameters comparisons. Thus, AIS subjects underwent two additional follow-up radiological comparisons at: 1) 1-month post-op; 2) ≥3months follow-up.

Results and Analysis: There was significant difference on radiological parameters between pre-op AIS and controls. Cobb angle was significantly reduced after surgery, while lumbar lordosis, pelvic incidence and sacral slope significantly improved at post-op stage. But these parameters were reverted to their initial status at follow-up stage. In addition, cervical lordosis, thoracic kyphosis and pelvic obliquity remained significantly different from controls even after surgery.

Discussion and Conclusion: Our results reaffirmed the presence of significant reversed cervical lordosis, thoracic hypokyphosis, lumbar hyperlordosis in AIS patients. Despite an excellent improvement in coronal profile, most of sagittal spinopelvic parameters remained significantly different from controls. Although most of the sagittal parameters did show initial improvement after surgery, some of them would eventually revert to profile similar at pre-op stage and should be aware in surgical correction.
USING RADIATION-FREE ULTRASOUND FOR SCREENING SCOLIOSIS AMONG SCHOOL CHILDREN IN HONG KONG - A PILOT STUDY

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Introduction: Scoliosis screening of Student Health Service, Department of Health in HK received international recognition for reliable case identification. Nevertheless, there were screened subjects with x-ray showing Cobb angle < specialist referral threshold of 20°. This study evaluated accuracy of ultrasound in identifying subjects with Cobb angle > referral threshold of 20° with the aim of further reducing x-ray exposure.

Methodology: 36 thoracic and 37 lumbar curves (mean Cobb angle 24.8±9.7°) were studied. X-ray radiography generating the x-ray-based Referral Status, i.e. “for specialist referral” or “not for specialist referral”, was used as the gold standard. The measurement by ultrasound was used to determine the ultrasound-based Referral Status. Raters were blinded to either one of the investigation measurements.

Results and Analysis: For lumbar curves, the sensitivity and specificity of the ultrasound-based evaluation were 92% and 91% respectively. For thoracic curves, the corresponding sensitivity and specificity were 84% and 91% respectively. Ultrasound skin-to-skin scanning procedure typically took less than 1 minute to complete.

Discussion and Conclusion: Results indicate ultrasound can potentially be useful to screen scoliosis and identify affected subjects for orthopaedic referral. Given that this study was confined to those with confirmed diagnosis of scoliosis, a large-scale definitive study inviting subjects directly from the pre-diagnosis phase of the screening program is warranted for defining the role of ultrasound for screening scoliosis and determining the referral status for orthopaedic management.

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VALIDATION STUDY OF 3D ULTRASOUND IN EVALUATING PATIENTS WITH MILD TO MODERATE SCOLIOSIS

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Introduction: Radiation-free 3D ultrasound imaging has shown good correlation with radiographs in assessing spinal deformity. The objective of the study is to investigate the correlation of the ultrasound imaging with radiographs of the spine for children with mild to moderate scoliosis. This helps to explore the role of ultrasound as a screening tool for scoliosis in school children.

Methodology: The children (age 10-16) who attended the scoliosis clinic with ATR >= 3 degrees and with Cobb's angle < 50 degrees were recruited. The back asymmetry were assessed by both 3D ultrasound and radiographs. The Scolioscan angles (SSA), spinal curvature denoted by the two most tilted vertebrae on the coronal image, were compared with the Cobb's angle of the corresponding segment in the radiographs. The measurements were done by two independent raters. The intra and inter-rater reliabilities were evaluated and the correlation between the SSA and Cobb's angle were carried out.

Results and Analysis: 111 children were enrolled in the study with the average age of 13 (F:M = 2.4:1). Both the intra and inter-raters had high consistency. The average Cobb's angle was 21.5 (5-48) degrees and the average SSA was 17.6 (1.4-39). There was a moderate to strong correlation between 3D ultrasound and radiographic assessments (R2 = 0.85).

Discussion and Conclusion: There was good internal consistency and correlation between ultrasound and radiographic assessment for children with mild to moderate scoliosis. However, the present study was limited by small sample size.