Free Paper Session VII — Paediatric Orthopaedics

7.1

Bone Mineral Density Predicts Curve Progression in Newly Diagnosed Adolescent Idiopathic Scoliosis Girls — A Longitudinal Cohort Study of 632 Patients

B Yip,[1,2] FWP Yu,[1,3] V Hung,[1,3] TP Lam,[1,3] L Qin,[1] BKW Ng,[1] JCY Cheng[1,3]
[1]Department of Orthopaedics and Traumatology, Faculty of Medicine, Prince of Wales Hospital, The Chinese University of Hong Kong, Hong Kong
[2]School of Public Health and Primary Care, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong
[3]Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Hong Kong and Nanjing, China

Introduction: This study aimed to investigate the incremental prognostic value of osteopenia on curve progression in adolescent idiopathic scoliosis (AIS) as defined by Scoliosis Research Society (SRS) criteria.

Methods: Bilateral hips were measured by dual-energy X-ray absorptiometry at first clinic visit of AIS patients without prior treatment, followed by regular follow-up with detailed clinical and radiological assessments. Following SRS criteria, curve progression was defined as ≥6-degree increase in Cobb's angle at maturity (years since menarche ≥2 and age ≥16 years). Area under the curve (AUC) and integrated discrimination improvement (IDI) were used to evaluate incremental prognostic value of z-score bone mineral density (zBMD). Likelihood ratio test (LRT) was used for model comparison.

Results: Among 632 subjects, 78 were assigned for surgery, 291 for bracing, and 263 for observation. The mean (± standard deviation) zBMD for 3 groups were -0.66 ± 0.99, -0.57 ± 0.95 and -0.18 ± 0.96, respectively. Progressed patients had significantly lower zBMD at baseline than non-progressed patients (-0.62 vs. -0.21). Regression model with zBMD had better overall performance than model without (AUC, 0.78 vs. 0.76; IDI, 0.22 vs. 0.20) and improved the data fitness significantly (LRT, $p=0.002$). The AIS patients with 1 unit lower in zBMD had significantly 49% higher risk (odds ratio=1.47, $p<0.0001$) of progression after adjustment for Cobb's angle, menarche status, assigned treatment, and age at first clinic visit.

Conclusion: Results suggest early evaluation of BMD could be important prognostic parameter in predicting the risk of curve progression at the initial presentation stage that could have important potential clinical implications.

7.2

12-Year Follow-up of a Case of Proximal Femoral Unicameral Bone Cyst Treated by Steroid Injection — Followed up to Skeletal Maturity with Longitudinal Radiological and Dual-energy X-ray Absorptiometry Scan Data

BKW Ng, V Hung, WW Chau, TP Lam, JCY Cheng
Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

Introduction: Treatment of unicameral bone cyst has many different methods each with its comparable success rate and complications. We report a case of a large proximal femoral bone cyst in a young patient treated by steroid injection followed up for 12 years with dual-energy X-ray absorptiometry (DEXA) scan to study the evolution of such lesion with this treatment.

Materials and Methods: Clinical record, X-rays, and DEXA scan record of the patient were retrieved for study. Number and dosage of steroid injections and relationship between intralesional steroid treatment and DEXA scan were chronologically recorded. Complications during treatment were also recorded.

Results: A total of 9 injections were given to this patient aged 3 to 10 years. Dosage range of methylprednisolone (depomedrone) given averaged 90 mg. Mean interval between injections were 13 months. At age 13.8 years, i.e. 44 months after last injection, the X-rays of proximal femur had remodelled back to normal appearance with shortening of the femoral neck from growth inhibition. The DEXA scan of the patient showed despite normal radiological appearance, DEXA scan of the affect femur remained lower in bone density. Functionally the patient was clinically normal.

Discussion and Conclusion: Steroid injection in the treatment of difficult bone cyst can be successful with careful monitoring and follow-up of the disease activities with DEXA scan. The significance of lower bone density in the affected bone is interesting that this may be a lifetime permanent change and longer follow-up in this respect is required to confirm this observation.

7.3

Use of Tranexamic Acid on Reducing Blood Loss during Scoliosis Surgery in Chinese Adolescents

BKW Ng,[1] WW Chau,[1] LH Hung,[1] ACN Hui,[2] TP Lam,[1] JCY Cheng[1]
[1]Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong
[2]Department of Surgery, Prince of Wales Hospital, Hong Kong

Introduction: There have been many reports on the application of antifibrinolytic medications on spinal corrective surgery and the surgical outcome evaluations of its efficacy on reducing blood loss. This study aimed to assess the efficacy of tranexamic acid (TXA) in reducing operative blood loss during posterior spinal fusion for the treatment of severe adolescent idiopathic scoliosis (AIS).

Materials and Methods: A retrospective cohort study was carried out in 90 (55 TXA and 35 controls) AIS girls undergoing posterior spinal surgery. Patients in TXA group used TXA as an antifibrinolytic agent to reduce blood loss, while control group did not. Blood loss, haemoglobin change, and amount of blood transfused was estimated from intra-operative measurement by anaesthesiologists.

Results: The TXA group showed significantly less intra-operative blood loss, less cell saver blood transfused back to patients, shorter total time taken for surgery, and total blood loss per surgical segment level. The use of TXA decreased total blood loss by 794.3 mL after adjusting for maximum Cobb's angle, age, number of segments fused, bone graft, clotting capability, and infusion of coagulation factors.

Discussion and Conclusion: Patients undergoing posterior spinal corrective surgery with the use of TXA showed much reduced total blood loss, reduced use of transfused blood, and much less cell saver blood transfused back to the patient. The total blood loss was decreased using TXA after controlling for maximum Cobb's angle, age, surgical parameters, clotting capability, and infusion of coagulation factors.

7.4

Accelerated Mobilisation Rehabilitation Protocol of Operative Tibial Tubercle Fracture in Adolescence: An Early Experience

LH Hung,[1] RMY Wong,[1] KW Ho,[1] WW Chau,[2] BKW Ng,[1] JCY Cheng[1]
[1]Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong
[2]Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

Introduction: Traditional rehabilitation protocol of displaced tibial tubercle avulsion fracture with operative fixation has been conservative with prolonged cast protection for 6 weeks and gradual weight-bearing walking exercise. This results in prolonged quadriceps wasting, slow recovery of knee range of motion, and delay in returning to sports activity.

Materials and Methods: Since 2012, we started to have accelerated rehabilitation programme that allowed early knee mobilisation and immediate full weight-bearing exercise. All displaced fractures were fixed openly with screw and no protection wire was applied. From 2012 to 2014, the 5 prospectively operated cases (accelerated group) were compared with other 4 retrospectively operated cases (original group) in the period of 2006 to 2012. Timing for radiological union of fracture, progress of knee range of motion, and return to sports were studied and results were compared between the 2 groups.

Results: All patients in both groups maintained fixation alignment at week 2, week 4, and radiological union at week 6. Knee range of motions in accelerated group were 30 degrees at week 2, 90 degrees at week 4, 120 degrees at week 6, and all of them achieved full squatting at week 10 and return to sports at week 12. The original group had delayed for more than 6 weeks in achieving the same progress of range of motions and return to sports activities.

Discussion and Conclusion: Our preliminary results showed that the new accelerated rehabilitation programme is effective and safe for selective case of tibial tubercle fracture that require operative fixation.

7.5

20 Years' Experience in Acute Paediatric Monteggia Treatment

SWH Liu,[1] LH Hung,[1] RMY Wong,[1] RP Lee,[2] BKW Ng,[1] JCY Cheng[1]
[1]Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong
[2]Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong

Objective: To review treatment results of Monteggia fracture in children using a ulnar fracture pattern–based approach.

Methods: The charts and radiographs of patients with Monteggia fracture and <16 years were retrospectively reviewed.

Results: A total of 58 patients with acute Monteggia fracture were reviewed from 1995 to 2014. They included 37 boys and 21 girls with a mean age of 6.6 years (range, 1.5-16 years). There were 31 cases of type I, 2 type II, 18 type III, and 7 combined types I and III cases based on Bado's classification. Among them, 4 patients had Gustilo type I open fracture. Also, 11 cases were associated with preoperative posterior interosseous nerve palsy, 1 with median nerve palsy, and 1 associated with distal radius fracture. The ulnar fracture was reduced by the close method in 45 cases, and by open reduction in 13 cases. A total of 13 patients with greenstick ulnar fracture were managed successfully with closed reduction plus casting alone, 43 patients with transverse and short oblique pattern with intramedullary K-wire, and 2 patients with comminuted pattern fixed with plating. The mean follow-up duration was 1.5 years. Bruce Scoring System showed 57 patients having good to excellent results and 1 (2%) had fair result. There was full recovery for all neurological injury after observation for 3 to 6 months' period.

Conclusions: Intramedullary K-wiring for the ulnar fracture is safe and effective. An excellent result is expected when Monteggia fracture in children is treated promptly and appropriately.

7.6

Outcome of Developmental Dysplasia of the Hip Treated by Medial Open Reduction

W Chow,[1] E Kuong,[1] P Koljonen,[2] M To[1]
[1]Department of Orthopaedics and Traumatology, The Duchess of Kent Children's Hospital at Sandy Bay, Hong Kong
[2]Department of Orthopaedics and Traumatology, Queen Mary Hospital, Hong Kong

Introduction: Medial open reduction for developmental dysplasia of the hip (DDH) has been a popular approach for many surgeons because minimal dissection is required, and the obstructions to reduction are encountered directly.

Materials and Methods: A total of 22 hips in 19 patients treated by medial open reduction were reviewed. The mean age at surgery and follow-up duration was 8.5 (range, 3-22) months and 67 (range, 28-96) months, respectively. The perioperative parameters, maintenance of reduction, and postoperative changes in the acetabular index, and centre-edge angle were recorded.

Results: The acetabular index decreased from a preoperative mean of 37 degrees to 20 degrees compared with 18 degrees on the normal side at the latest follow-up. A secondary bony procedure was performed in 10 hips at a mean age of 3.6 years. Avascular necrosis was noted in 5 cases. Four belonged to Bucholz-Ogden type I and 1 belonged to type III. There are 4 hips with caput valgus without shortening of lateral femoral neck. The latest centre-edge angle was 21.3 degrees. Among the 16 hips in 13 patients over 6 years at the latest follow-up, 15 belonged to Severin groups I or II and 1 belonged to group III. No redislocation occurred.

Conclusion: Medial open reduction is a minimally surgical procedure that allows effective release of the structures obstructing femoral head reduction. It should be a useful treatment modality for selected cases with DDH.

7.7

Predictability of Peak Growth Spurt and Growth Cessation Using the Distal Radius and Ulna Classification

JPY Cheung, PWH Cheung, D Samartzis, KMC Cheung, KDK Luk
Department of Orthopaedics and Traumatology, The University of Hong Kong, Hong Kong

7.8

Morphological and Orientation Symmetry in Vestibular Systems — Any Difference between Progressive and Non-progressive Adolescent Idiopathic Scoliosis and Normal Controls?

FWP Yu,[1] SCN Hui,[2] L Shi,[2] D Wang,[2] JCY Cheng,[1] WCW Chu[2]
[1]Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong
[2]Department of Imaging and Interventional Radiology, The Chinese University of Hong Kong, Hong Kong

Introduction: Previous studies suggested that abnormalities in vestibular systems (VS) could be the cause of postural imbalance in adolescent idiopathic scoliosis (AIS). This study aimed to investigate the morphological difference of semicircular canals between AIS and normal controls (NC).

Methods: A total of 42 progressive (P-AIS) and 26 non-progressive (NP-AIS) right-thoracic (RT) AIS patients and 28 NC were recruited. T2-weighted images of VS were obtained. The anatomical variances of semicircular canals were described using approximated best-fit circle. Lengths and angles of the lines joining centres of the best-fit circles, radius of the circles, and the rotational angles around the 3 major orthogonal axes were used for shape description. The measurements were compared between AIS and NC using one-way analysis of variance.

Results: The shape analysis of the left-side VS between AIS and NC was statistically different. The distance between the centres of the lateral and superior canals was P-AIS < NP-AIS < NC ($p=0.0188$). The angle between the centre-joining lines at the posterior canal was P-AIS < NP-AIS < NC ($p=0.0112$). In the right-side VS, no significant difference was detected. There was greatest orientation asymmetry along the z-axis for P-AIS ($p=0.0193$).

Conclusion: Evidence of abnormal morphoanatomical changes in VS in AIS affects only left VS in AIS girls with predominantly RT curve. Such differences are even more prominent in P-AIS than NP-AIS. This asymmetry in VS probably results in an unbalanced vestibulospinal control and may contribute to the development and progression in AIS.

7.9

Can We Predict Skeletal Maturity and Curve Progression in Idiopathic Scoliosis by a New Simplified Thumb Ossification Composite Index?

LH Hung, WW Chau, FWP Yu, B Yip, BKW Ng, JCY Cheng
Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong

Introduction: Accurate skeletal maturity assessment is important for clinical management of idiopathic scoliosis (IS). Commonly used methods are still inadequate or too complex for rapid clinical use. This study aimed to evaluate whether a new Thumb Ossification Composite Index (TOCI) staging could correlate well with skeletal maturity parameters and predict curve progression in IS.

Methods: This study involved a prospective series of immature IS girls and they were followed up at 6-monthly intervals longitudinally till skeletal maturity. Anthropometric data, peak height velocity (PHV), Cobb's angle (CA), and computed angle velocity (AV) were recorded. A new TOCI skeletal maturity staging was registered and compared with digital skeletal age (DSA) score. Inter-observer reliability was tested. Logistic regression analysis was used to evaluate the risk of curve progression at each TOCI stage versus CA.

Results: Of the 127 IS girls (mean age, 11.3 years) with initial mean CA of 24.1 degrees, 66% (n=84) with curve progression of >5 degrees had mean AV at onset of curve acceleration phase (CAP) of 13.5 degrees/year. The PHV occurred at TOCI stage 5 and highly correlated with DSA score ($r=0.91$, $p<0.01$) and CAP ($r=0.90$, $p<0.01$). Logistic regression analysis showed that patients with >30-degree CA and TOCI stage ≤5 had 90% risk of progression to surgical magnitude (>50 degrees) at maturity. The TOCI also showed excellent inter-rater reliability between 3 orthopaedic surgeons (intraclass correlation coefficient [ICC]=0.97 [0.96, 0.98]) and 3 non-medical raters (ICC=0.93 [0.89, 0.96]).

Conclusion: The TOCI staging system correlated well with skeletal maturity parameters and could predict curve progression in IS at early stages. Its simplicity and high reliability have good potential for application in busy clinical settings.

7.10

Reliability of the Shenton's Line in Interpreting Pelvic Radiographs in Paediatric Hip Dysplasia

S Mahapatra, E Kuong, P Koljonen, W Chow
Department of Orthopaedics and Traumatology, The Duchess of Kent Children's Hospital at Sandy Bay, Hong Kong

Introduction: Interpreting pelvic radiographs for skeletally immature patients with hip dysplasia is challenging, and undetected paediatric hip dysplasia and subluxation can have serious consequences. The Shenton's line has long been a standard radiographic feature used for assessing hip dysplasia and has been reported to have good reliability in skeletally mature patients. This study aimed to validate the reliability of this radiographic feature for skeletally immature patients, and usefulness for assessing paediatric hip dysplasia.

Methods: A total of 263 supine anteroposterior pelvic radiographs were taken for 28 skeletally immature patients with unilateral hip dysplasia and 18 patients with bilaterally normal hips. A total of 526 Shenton's lines were independently rated by 5 separate observers of different levels of orthopaedic and paediatric subspecialty training and inter-observer reliability was studied.

Results: The Fleiss' kappa value for multiple observers obtained was 0.219 (95% confidence interval: 0.192-0.246). In assessing dysplastic hips the kappa value marginally improved to 0.256 (95% confidence interval: 0.210-0.301) and removing observers not trained in the paediatric orthopaedics subspecialty did not improve the agreement. Respective mean sensitivity and specificity for recognising hip dysplasia was 75.8% and 52.9%.

Conclusion: In skeletally immature pelvic radiograph and for a dichotomous rating, this result suggests poor agreement. The Shenton's line has poor inter-observer reliability and in children with dysplastic hips it has fair sensitivity and poor specificity for diagnosis.

7.11

Can We Further Simplify Current Hand Bone Age Models in Adolescent Idiopathic Scoliosis by just Focusing on Thumb? Conclusions Drawn from a Radiological Analysis of 9546 Hand Bone Epiphyses

LH Hung, WW Chau, V Hung, TP Lam, BKW Ng, JCY Cheng
Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong

Introduction: Traditionally, evaluation on a total of 21 epiphyses from hand and wrist radiographs following the Greulich & Pyle Atlas or Tanner-Whitehouse III (TWIII) method were required to decide the bone maturity stage. We proposed a novel method based on thumb region only by studying the ossification and fusion timing relationship between thumb and remaining 4 digits.

Materials and Methods: Retrospective review of longitudinal hand and wrist radiographs taken at 6-month intervals from females with adolescent idiopathic scoliosis was carried out. The TWIII method was used to score all epiphysis in all 5 digits.

Results: A total of 9546 epiphyses from 600 hand and wrist radiographs were reviewed and scored. Stage F of thumb proximal phalange (PP) epiphysis representing 80% of epiphyses in ulnar 4 digits were covered (stage F), representing the pre-puberty period. Advanced capping (stage G) of thumb PP epiphysis referred to preponderance of epiphyseal capping (81.5% stage G) in all digits, indicating period of peak growth velocity. Fusion at thumb distal phalange (DP) physis (stage I) was found in 70% of DP epiphysis of 4 ulnar digits. Besides, 96.5% of epiphysis in remaining digits fused at the same time with thumb PP physis (stage I), corresponding to descending pubertal growth period.

Discussion and Conclusion: The timing of ossification and fusion in epiphysis of thumb correlated closely with the epiphyses of ulnar 4 digits. There was 80% chance that TWIII stages in thumb epiphysis were the same stage as in the remaining digits. Using thumb region to evaluate maturity is potentially quick and feasible.

7.12

Paediatric and Adolescent Limb Fractures in Hong Kong

M To,[1] W Chow,[1] CM Fong,[2] LH Hung,[3] E Kuong,[1] A Ma[4]
[1]Department of Orthopaedics and Traumatology, The Duchess of Kent Children's Hospital at Sandy Bay, Hong Kong
[2]Department of Orthopaedics and Traumatology, United Christian Hospital, Hong Kong
[3]Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong
[4]Department of Orthopaedics and Traumatology, Tuen Mun Hospital, Hong Kong

Introduction: Paediatric and adolescent fractures are common. In this retrospective study, the epidemiology of the limb fractures was reviewed.

Materials and Methods: The Clinical Data Analysis and Reporting System of the Hospital Authority was used to retrieve the limb fracture information during the period from 2000 to 2014. The limb fractures were classified according to the region. The fracture types, season of presentation, and age of the patients were evaluated.

Results: There were more than 54,000 fractures during the period with upper-to-lower limb fracture ratio of about 4:1. The male-to-female ratio was about 2.88:1. The age-adjusted incidence was used to evaluate the fractures. The fracture incidence fluctuated over the past 15 years with a decreasing trend between 2000 and 2009 but with a rising trend between 2009 and 2014. Majority of the upper limb fractures happened in spring and autumn.

Discussion and Conclusion: The birth rate in Hong Kong remained low in the past decade. Although there was a decreasing paediatric and adolescent population in Hong Kong, the fracture incidence seemed to be in an increasing trend after 2009. The change in the fracture incidence should be further evaluated by the government and the health care providers. The causes might be related to change in the children activities, public safety awareness, diet or even the general health of the children.

7.13

Humeral Lengthening in Achondroplasia: Tips and Tricks for Safe and Successful Surgery

LH Hung,[1] CS Chui,[1] KL Lee,[2] KKW Li,[1] BKW Ng,[1] JCY Cheng[1]
[1]Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong
[2]Department of Diagnostic Radiology and Organ Imaging, Prince of Wales Hospital, Hong Kong

Bilateral humeral lengthening in achondroplasia (ACH) with previous lower limb lengthening is a rewarding procedure to improve the body proportion, personal hygiene care, and activities of daily living. Monolateral external fixators are popular options owing to its comfort and simple construct. The operation is technically challenging especially for 1 stage of simultaneous deformity correction and lengthening. Important complications regarding radial nerve injury and incomplete correction with residual deformity, union problem has been reported.

A standard surgical protocol has been developed over 15 years' surgical experience involving 10 ACH patients with 20 limbs lengthening, which included preoperative magnetic resonance image mapping of nerve and pin planning, safe pin insertion and osteotomy technique, C-arm–based 2- or 3-dimensional navigation-assisted distal pin insertion, and postoperative tailor-made physiotherapy programme and bone mineral density monitoring for optimal distraction rate decision. This study aimed to establish the safety corridor of pin insertion to humerus in ACH and to evaluate our treatment protocol regarding the effectiveness and its safety to achieve successful outcome.

Multiplanar corrective lengthening of humerus using monolateral external fixator is safe and feasible in ACH with good preoperative planning and meticulous surgical technique. Computer-aided surgical technique has great potential to decrease the learning curve of surgery.

7.14

Gender Difference in Trabecular Microarchitecture in Children and Adolescent — A Study with Advanced Individual Trabecular Image Segmentation

KY Cheuk,[1] V Hung,[1] WYW Lee,[1] TP Lam,[1] EX Guo,[2] JCY Cheng[1]
[1]Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong
[2]Bone Bioengineering Laboratory, Department of Biomedical Engineering, Columbia University, United States

Introduction: In the development of bone, significant differences in trabecular bone and mechanical property between genders have been reported. This study aimed to investigate the gender differences in trabecular rod and plate relative proportion and detail microstructure with the use of advanced image segmentation — individual trabeculae segmentation (ITS).

Materials and Methods: A total of 90 boys and 124 girls (aged 7-16 years) were recruited. Non-dominant distal radius was scanned by high-resolution peripheral quantitative computed tomography (HR-pQCT). Maturity was self-reported by Tanner staging. Dietary calcium (Ca) intake and physical activity level were collected by questionnaires. Trabecular bone structure was extracted by HR-pQCT for ITS analysis. One-way analysis of variance was done with adjustment of maturity, Ca intake, and physical activity in data analysis.

Results: After adjusted for Tanner staging, Ca intake and physical activity, boys had higher bone volume fraction (BV/TV), plate BV/TV, axial BV/TV, plate trabecular number, and plate trabecular thickness (all $p<0.05$). In addition, boys had shorter trabecular rod and higher trabecular connectivity (all $p<0.01$).

Discussion and Conclusion: Regardless of maturity and nutrition status, boys showed better trabecular bone strength as reflected by more abundant, thicker, larger, and better load of aligned trabecular plates than rods.

7.15

Improving Low Bone Mass in Girls with Adolescent Idiopathic Scoliosis Using Calcium and Vitamin D Supplementation — A Randomised Double-blinded Placebo-controlled Trial

TP Lam,[1] B Yip,[1] EKL Tsang,[1] FWP Yu,[1] BKW Ng,[2] JCY Cheng[1]
[1]Department of Orthopaedics and Traumatology, The Chinese University of Hong Kong, Hong Kong
[2]Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Hong Kong

Introduction: Adolescent idiopathic scoliosis (AIS) is a prevalent 3-dimensional spinal deformity associated with osteopenia. This study aimed at evaluating the therapeutic effect of oral calcium + vitamin D (Vit-D) supplementation for low bone mass in skeletally immature AIS girls.

Materials and Methods: This was a randomised double-blinded placebo-controlled trial recruiting 330 AIS girls (aged 11-14 years) with femoral neck areal bone mineral density (aBMD) Z-scores of <0 and Cobb's angle of >15 degrees. They were randomly allocated to group 1 (placebo), group 2 (600 mg calcium + 400 IU Vit-D3/day), and group 3 (600 mg calcium + 800 IU Vit-D3/day). The treatment period was 2 years. At baseline (T0) and 24 months (T1), dual-energy X-ray absorptiometry (DXA) and high-resolution peripheral quantitative computed tomography (HR-pQCT) were performed to evaluate bone status. Analysis of variance and generalised estimating equations were used for analyses.

Results: A total of 270 (81.8%) subjects completed the study. Differences in changes across the treatment period in femoral neck aBMD, bone mineral content, and mean volumetric BMD (vBMD), trabecular vBMD, trabecular bone volume fraction, trabecular number, and trabecular separation of the non-dominant distal radius between groups indicated therapeutic anabolic bone effect with calcium + Vit-D supplementation.

Discussion and Conclusion: The results indicated that treatment with 600 mg calcium + 400/800 IU Vit-D3 was effective for treating low bone mass in AIS subjects. Given the suboptimal 25(OH)Vit-D levels and the association between AIS and low bone mass, Vit-D status and bone density and quality should be assessed and be followed as needed with calcium + Vit-D supplementation for all AIS subjects.