

DISTRACTIONS

The Newsletter of
The Limb Lengthening and Reconstruction Society: ASAMI North America

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Big Bash in Beantown

LLRS members and guests gathered in Boston for the Thirteenth Annual Scientific Meeting at the stately Fairmont Copley Plaza Hotel on July 25–27, 2003. LLRS' second freestanding meeting was two and one half days of quality podium presentations, posters, and workshops. Three guest speakers from around the world shared their expertise with the membership: David Lowenberg, MD from San Francisco spoke about his research on limb transplantation in rats and the obstacles and implications of this procedure for humans; Professor Michael Weber, MD from Aachen, Germany showed many innovative reconstructive techniques for limb deformities; and Professor Alexander Gritsano, MD, Sci.D. from St. Petersburg, Russia spoke on the terrible human toll inflicted by land mines. The forty-six podium presentations stimulated plenty of discussion. In addition to the presentations, there were ten posters for viewing during breaks. The Society thanks EBI, L.P., Orthofix, and Smith & Nephew, Inc., for the afternoon educational workshops.

John Birch and Will Mackenzie are planning a superb program for the Fourteenth Scientific Meeting of LLRS: ASAMI–North America to be held in Toronto, Ontario, Canada, July 23–25, 2004. The venue is the Delta Chelsea Hotel. More information will be provided on the website at www.asaminorthamerica.org, and in future newsletters and mailings. Please plan to attend!

Don't Toss That Fixator!

Don't let those used external fixators go to waste. J. Mike Holloway, MD, a retired LLRS member, is teaching physicians in Africa and requests that we contribute spare or reusable external fixators components. He took 120 pounds of equipment to Africa, but with the large numbers of untreated deformities and nonunions in Kampak, he needs more. Please give generously as your efforts will help the less fortunate. If you have external fixators and components you're willing to donate, please contact Mike at jordanholloway@msn.com.

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Abstracts in A Minute

The purpose of Abstracts in A Minute is to facilitate members' self-study. Because of the brevity, these abstracts are not intended to be an authoritative or critical review.

Trauma

Akmaz I, Pehlivan O, Kiral A, Solakoglu C, Arpacioğlu O. **Short-term results of external fixation of unstable distal radial fractures.** *Acta Orthop Traumatol Turc* 2003; 37:126–132. Clinical study of 25 patients with unstable distal radius fractures treated with external fixation. K-wires or volar plates were also used in 17 patients. Mean age 39 (20–71) years. The fixator was used for a mean of 6.6 weeks. AO fracture classification was B1 (1 fracture), B2 (2), C1 (8), C2 (10) and C3 (4). Radiographic and functional results showed poorer functional than radiographic results. The high success rates in anatomic results do not closely reflect satisfactory functional results. The protocol implemented after external fixator application has to be determined according to the type of fracture.

Ali AM, Burton M, Hashmi M, Saleh M. **Treatment of displaced bicondylar tibial plateau fractures** (OTA-41C2&3) in patients older than 60 years of age. *J Orthop Trauma* 2003; 17:346–352. Eleven patients >60 years old (mean 72, range 60–90) with bicondylar tibial plateau fractures were reviewed. Indications for surgery were displacement, open fractures, and fractures with severe soft tissue injury. Treatment was limited articular reconstruction and percutaneous intrafracture screw fixation followed by neutralization with a stable beam-loaded ring external fixator and early mobilization. Mean follow-up was 38 months (range 18–51). All achieved union. Seven of 11 began full weight-bearing 2–6 weeks postop. 82% scored satisfactory on Rasmussen's system. Three had limited flexion. Five had superficial pin infections but no deep or joint infections.

Devgan A, Sangwan SS. **External fixator in the management of trochanteric fractures in high risk geriatric patients – a friend to the elderly.** *Indian J Med Sci* 2002; 56:385–390.

Study evaluated 110 elderly patients (mean age 65) with trochanteric fractures, treated with external fixation under local anesthesia. Fractures united in an average of 16.4 weeks. Overall satisfaction rate was 80% at follow-up. At follow-up 83% were ambulatory with support; 74% were ambulatory with a stick or better.

Hedin H, Hjorth K, Rehnberg L. **External fixation of displaced femoral shaft fractures in children: a consecutive study of 98 fractures.** *J Orthop Trauma* 2003; 17:250–256. Unilateral external fixators were applied to consecutive series of 96 children between ages of 3 and 15. Hospital stay averaged 8.7 days. Pin tract infections occurred in 37%. Heterotopic ossification (1), need for two re-reductions, minor angulation (9), leg length discrepancy >2 cm (1), refractures (2), and bent regenerates (2) also occurred. Authors believe advantages outweigh the complications, many of which can be avoided.

Trauma continued

Hedin H, Hjorth K, Larsson S. **Radiological outcome after external fixation of 97 femoral shaft fractures in children.** *Injury* 2003; 34:287–292. Prospective consecutive series of 97 closed femoral shaft fractures in 95 children, treated with unilateral external fixator. Leg length discrepancy averaged 0.1 cm at one year. Mean overgrowth was 0.3 cm at one year, 0.5 cm at two years. Overgrowth and remodeling did not correlate with healing in a shortened or lengthened position, pin site infection, or re-reduction. Authors recommend fixing the fracture without shortening regardless of age of the child, type of fracture, fracture level, or injury.

Hosny G, Fadel M. **Ilizarov external fixator for open fractures of the tibial shaft.** *Int Orthop* 2003; 17:17. Report of 30 patients with open tibial shaft fractures with a mean follow-up of 40.5 (24–80) months. There were 2 Grade I, 16 grade II, 6 grade IIIA, 5 grade IIIB, and one grade IIIC. There were 28 excellent and good, one fair, and one poor results.

Kalesinskas RJ, Varnas N, Mickevicius G. **The treatment and complications of intraarticular fractures of the distal radius.** *Medicina (Kaunas)* 2003; 39:384–389. Intraarticular fractures and their complications were evaluated, based on joint movement and wrist pain, radioulnar slope. There were more secondary displacements and shortening of the radius seen in the group treated with casts. Good distraction of the fracture was seen in those treated with external fixation, but the soft tissue strain caused contractures of the fingers and instability of the wrist. The incongruence of the joint surfaces causes early arthritis and pain.

Ponsen KJ, Hoek van Dijke GA, Joosse P. **External fixators for pelvic fractures: comparison of the stiffness of current systems.** *Acta Orthop Scand* 2003; 74:165–171. The stiffness of several external fixation systems was investigated by applying frames to replicas of the human pelvis made from aluminum and perspex. A type C pelvic ring fracture was created. In the weight-bearing situation, all fixators failed. Single bar systems performed better than frame configurations. Stability by any external fixator system is low, and, in the case of type C pelvic ring injury, it is insufficient for patient mobilization and weight-bearing.

Schmidt AH, Finkemeier CG, Tornetta P, 3rd. **Treatment of closed tibial fractures.** *Instr Course Lect* 2003; 52:607–622. Review of indications for treatment methods. External fixators are well-suited for skeletally immature patients with unstable fracture patterns or for patients with unacceptably small intramedullary canals. Intramedullary interlocking nails are the treatment of choice for most unstable tibia-fibula shaft fractures.

Trauma continued

Werber KD, Raeder F, Brauer RB, et al. **External fixation of distal radial fractures: four compared with five pins: a randomized prospective study.** *J Bone Joint Surg Am* 2003; 85-A:660–666. Fifty patients underwent treatment for unstable distal radius fractures. Half were treated with a four-pin external fixator; half were treated with a four-pin external fixator with a fifth pin stabilizing the distal articular fragment. Patients were randomized. Fixators were removed at nine weeks. Radiographs, range of motion, strength, and functional ratings were done at six months. The five-pin group had better radiographic and functional results.

Upper Extremity

Kaleli T, Ozturk C, Ersozlu S. **External fixation for surgical treatment of a mallet finger.** *J Hand Surg (Br)* 2003; 28:228–230. Nineteen patients treated for mallet finger with a mini-external fixator across the DIP joint and resection of a portion of the extensor mechanism. At mean follow-up of 36 (24–48) months, the mean extensor lag was 2 (–7 – 13) degrees, and the mean flexion range was 70 (20–90) degrees.

Nonunions

Banaszkiewicz PA, Sabboubeh A, McLeod I, Maffulli N. **Femoral exchange nailing for aseptic non-union: not the end to all problems.** *Injury* 2003; 34:349–356. Eighteen patients with 19 aseptic nonunions of the femur underwent exchange nailing. Eleven (58%) achieved union in 9 (3–24) months. Five did not heal, two developed an infection, and one required dynamization. Eighteen (95%) eventually healed. Eleven (58%) had complications requiring further surgery, including four repeat exchange nailings, two Ilizarov frame applications, and five nail removals.

Hankemeier S, Bosch U, Gosling T, Krettek C. **Femoral hemicallotaxis with a half-segment for the reconstruction of a long partial bone defect.** *Unfallchirurg* 2003; 106:248–251. Case report of a 6 cm partial femoral cortical defect treated with hemicallotaxis. Advantages, potential problems, alternative methods, and indications are discussed.

Ozturkmen Y, Dogrul C, Karli M. **Results of the Ilizarov method in the treatment of pseudoarthrosis of the lower extremities.** *Acta Orthop Traumatol Turc* 2003; 37:9–18. Forty-six patients with a mean age 38.6 (28–69) years underwent treatment for a femoral (8) or tibial (38) pseudoarthrosis. The pseudoarthrosis was hypertrophic in seven and atrophic in 39. Mean bone loss was 7.4 (3–12) cm. Application was monofocal in 30 and bifocal in 16. Union occurred in 42. The fixator was worn for a mean of 208 (98–296) days for monofocal and 286 (140–496) days for bifocal applications. Complications included pin tract infections (28), reflex sympathetic dystrophy (3), refracture after frame removal (3), and equinus contracture (4). Cancellous bone grafting was utilized in four at the docking site.

Nonunions continued

Ring D, Gulotta L, Jupiter JB. **Unstable nonunions of the distal part of the humerus.** *J Bone Joint Surg Am* 2003; 85-A:1040–1046. Fifteen patients with mean age of sixty with unstable nonunions of the distal humerus were treated with excision of the interposed soft tissue, opening of the sclerotic fracture surfaces, internal fixation with multiple plates and screws, and autogenous bone grafting. Average time from fracture to index treatment was eleven months. Vascularized fibular grafts and supplemental external fixation were necessary in two patients with large bone defects after debridement. Three failed to heal and were treated with total elbow arthroplasty. Twelve healed, but six required further surgery. Average ROM was 22–117 degrees. Authors advocate capsular release to reduce stress on implants and to improve ROM.

Wang ZG, Liu J, Hu YY, et al. **Treatment of tibial defect and bone nonunion with limb shortening with external fixator and reconstituted bone xenograft.** *Chin J Traumatol* 2003; 6:81–98. Twenty patients with tibial nonunion with bone defect or with congenital pseudoarthrosis were treated by shortening 2–9 (average 4.8) cm with external fixation. Reconstituted bone xenograft (RBX) was used in 12 patients; autogenous ilium was used in 3; and autogenous fibular graft in the medullary canal was used in one. No graft was used in 4. All patients healed. Authors concluded RBX has good biocompatibility and does not cause immunological rejections.

Lengthening

Guichet JM, Deromedis B, Donnan LT, et al. **Gradual femoral lengthening with the Albizzia intramedullary nail.** *J Bone Joint Surg Am* 2003; 85-A:838–848. Review of 41 femora in 31 patients which underwent lengthening with the Albizzia totally implantable lengthening device between 1993 and 1997. Diagnoses were congenital short femur (13), post-traumatic LLD (11), and developmental disorders (7). Ten patients underwent bilateral femoral lengthening for short stature. The nail was inserted antegrade after an intramedullary osteotomy. Fifteen alternating internal and external rotation maneuvers elongated the nail by 1mm. Mean gain in length was 3.4 (2–5.5) cm in the unilateral and 6.3 (4.6–8.4) cm in the bilateral cases. Additional procedures were necessary, averaging 3 per patient, including ratcheting under general anesthesia (13) and treatment of complications (11). This number of procedures did not include insertion and removal.

Lengthening continued

Hosalkar HS, Jones S, Chowdhury M, et al. **Quadricepsplasty for knee stiffness after femoral lengthening in congenital short femur.** *J Bone Joint Surg Br* 2003; 85:261–264. Five children who developed knee stiffness after an Ilizarov lengthening for treatment of a congenital short femur underwent quadricepsplasty. Mean percentage lengthening was 24%. These five patients all had knee stiffness despite intensive physical therapy for one year. The quadriceps was adherent to the regenerate bone. Through a lateral approach, a V–Y quadriceps lengthening and lysis of adhesions was performed, followed by use of a CPM machine and physical therapy. At follow-up (mean 27 months), mean active flexion was 102 (80–130) degrees. Gain in movement ranged from 50 to 100 degrees.

Mackool RJ, Hopper RA, Grayson BH, Holliday R, McCarthy JG. **Volumetric change of the medial pterygoid following distraction osteogenesis of the mandible: an example of the associated soft-tissue changes.** *Plast Reconstr Surg* 2003; 111:1804–1807. Six pediatric patients underwent distraction osteogenesis of the mandible. Computed tomography showed greater percentage increase in the volume of the medial pterygoid muscle than percentage lengthening of the mandible, indicating that the volume of attached musculature is increased as well as the length of the deficient bone.

Mader K, Gausepohl T, Pennig D. **Shortening and deformity of radius and ulna in children: correction of axis and length by callus distraction.** *J Pediatr Orthop B* 2003; 12:183–191. Review of seven patients (10 forearms) which underwent lengthening of the radius or ulna with a monolateral fixator. Mean age was 9.5 (range 2–16) years. Diagnoses were: physeal injury sequelae, multiple hereditary exostoses, and fibrocartilaginous dysplasia of the forearm. Target length was achieved in all cases. There was significant improvement in the range of motion. There were no complications. All patients were satisfied with the final appearance. Authors favor monolateral fixators due to reduced soft tissue transfixion and improved patient compliance.

Manzotti A, Rovetta L, Pullen C, Catagni MA. **Treatment of the late sequelae of septic arthritis of the hip.** *Clin Orthop* 2003; 410:203–212. Fifteen patients with late sequelae of septic arthritis of the hip were treated between 1982 and 1997. Average patient age was 21.1 years. Average leg length discrepancy was 6.5 cm. Average time in the fixator was 225.5 days. Seven patients' fixator extended across the knee to the tibia. Ten patients had a good or excellent result, three had a fair result, and two had a poor result, based on pain relief, ROM, Trendelenburg sign, and leg length discrepancy. Complications included one common peroneal nerve palsy, two patients with loss of angulation of the proximal femur, and three patients with knee subluxation. At follow-up, thirteen patients were satisfied, all had returned to their previous occupation, and no patient had a total hip arthroplasty.

Lengthening continued

Marti RK, De Vries JS, Kloen P. **Limb salvage after subtotal supramalleolar amputation by initial shortening followed by tibial lengthening.** *Arch Orthop Trauma Surg* 2003; 30:30. Case report of a subtotal traumatic supramalleolar amputation, initially treated with a vascular reconstruction with deliberate bone and soft tissue shortening followed by a supramalleolar osteotomy, followed by a Wagner distraction and finally correction of equinus.

Oznu A, Alpaslan AM. **Lengthening of short great toe and correction of all lesser toe deformities by distraction-lengthening.** *Foot Ankle Int* 2003; 24:345–348. Case report of a 27-year-old woman with a short first ray, attributed to previous osteomyelitis, who had pain under her second metatarsal head. Gradual distraction was performed with a proximal metatarsal osteotomy and use of a 4-pin custom-made external fixator. The original dorsal fixator was replaced with a medial fixator. The regenerate was augmented with a tricortical iliac crest bone graft. Four cm of lengthening was achieved.

Sawaizumi T, Ito H. **Lengthening of the amputation stumps of the distal phalanges using the modified Ilizarov method.** *J Hand Surg (Am)* 2003; 28:316–322. Six patients underwent lengthening of the distal phalanges less than 10mm long by using the Ilizarov minifixator (Ito Medical Instruments Tokyo). All phalanges had sustained traumatic amputation. Mean preoperative length was 6.0 mm; mean deficiency was 9.5 mm compared to the contralateral digit. Mean length gained was 6.8 mm; mean final length was 12.8 mm. Four patients underwent onychoplasty and advancement flap coverage; one underwent DIP arthrodesis. All patients were satisfied with their appearance.

Segev E, Hayek S. **Adjustable bracing technique for the prevention of knee flexion contracture during tibial lengthening.** *J Pediatr Orthop* 2003; 23:385–386. Authors present a thigh-bone brace that is connected to a tibial Ilizarov frame to prevent knee flexion contractures during tibial lengthenings. The knee can be mobilized for physiotherapy and locked in extension during rest.

Sen C, Kocaoglu M, Eralp L, Cinar M. **Bone lengthening of congenitally short metacarpus and metatarsus by the callus distraction technique.** *Acta Orthop Traumatol Turc* 2003; 37:154–161. Seven metacarpal and four metatarsal lengthenings are reviewed. Mean age was 15. Ilizarov semi-circular or mini-Orthofix external fixators were used. Distraction rate was 0.25 mm twice daily. Mean metacarpal lengthening was 20 (15–25) mm; mean metatarsal lengthening was 25 (20–30) mm. Mean healing index was 1.4 months/cm for metacarpals; 1.8 months/cm for metatarsals. One patient required autologous fibular grafting for nonunion. Overall complication rate was 36%.

Lengthening continued

Wu CC, Chen WJ, Carmack DB. **Tibial lengthening: technique for speedy lengthening by external fixation and secondary internal fixation.** *J Trauma* 2003; 54:1159–1165. Report of twelve adult patients undergoing tibial lengthening 3–12 cm (mean 4.6 cm). The Ilizarov fixators were removed; internal fixation and either autogenous or a mixture of autogenous and allogeneous bone graft was inserted. Mean external fixation time was 1.9 (1.2–4.5) months. Mean time to healing was 4.8 (4–6) months. Two patients required TAL for equinus contractures. There were no infections. Authors conclude this technique shortens external fixation time and reduces patient suffering.

Upper Extremity

Bagatur AE, Dogan A, Zorer G. **Correction of deformities and length discrepancies of the forearm in children by distraction osteogenesis.** *Acta Orthop Traumatol Turc* 2002; 36:111–116. Ten forearms with shortening and/or deformity in nine patients were reviewed. Mean age at surgery was 10.2 (5–16) years. Multiple diagnoses were listed. Ilizarov fixators were used in seven cases; Orthofix fixators were used in three. Mean length gain was 36.7 mm (range 25–60). Mean length increase as 31.5% (14–66%). A satisfactory functional and cosmetic result was achieved in all. Callus deformity after fixator removal was the most common complication.

Boireau P, Laville JM. **Rotational osteotomy technique for congenital radio-ulnar synostosis with central medullary nailing and external fixation.** *Rev Chir Orthop Reparatrice Appar Mot* 2002; 88:812–815. The Hernigou–Goutallier procedure was used to treat six cases of congenital radioulnar synostosis. Two pins are placed in the ulna at the desired angle of correction. An osteotomy is performed between the pins and rotated around a previously inserted intramedullary nail. The ulna is rotated to make the pins parallel. The pins are attached to a fixator, parallel to each other. Bony union occurred within two months. Any over-correction leading to vessel or nerve injury can be reversed without losing the axis, allowing progressive correction if necessary.

Koch PP, Exner GU. **Supracondylar medial open wedge osteotomy with external fixation for cubitus varus deformity.** *J Pediatr Orthop B* 2003; 12:116–122. This study describes an incomplete distal humeral opening wedge osteotomy via a medial approach, fixed with four Schanz screws attached to a fixator.

Please make note of Karen Syzdek's e-mail address change.
The new address is
ksyzdek@assocconvspec.com.

Upper Extremity continued

Matsumoto K, Nakanishi H, Koizumi Y, et al. **Correction of a deformed thumb by distraction of the phalanx.** *Scand J Plast Reconstr Surg Hand Surg* 2002; 36:368–372. Six deformed thumbs in four patients were treated with distraction osteogenesis. Two had Apert syndrome; two had polydactyly. The mean healing index in Apert syndrome was 37.2 (24.2–41.5) days per centimeter and 64.3 (62.5–66.0) days per centimeter in polydactyly.

Deformity Correction

Alekberov C, Shevtsov VI, Karatosum V, et al. **Treatment of tibia vara by the Ilizarov method.** *Clin Orthop* 2003; 409:199–208. Sixty-nine lower extremities in 45 patients with tibia vara were treated with the Ilizarov method. Mean age was 10 + 8. Twenty-four had bilateral involvement; six had simultaneous procedures; eighteen had staged procedures. Eleven patients with femoral deformity greater than 10° underwent simultaneous procedures. There were no complications. Weight bearing began on the second postop day. Results were measured based on range of motion, internal tibial torsion, and radiographic tibiofemoral angles. Internal tibial torsion improved from 20.7° (range 0–48) before surgery to 3.5° (range 0–9) external torsion postop. Residual deformity was seen in six patients, corrected later with the same technique. The Ilizarov method allows early weight bearing and allows correction of all components of the deformity.

Donnan LT, Saleh M, Rigby AS. **Acute correction of lower limb deformity and simultaneous lengthening with a monolateral fixator.** *J Bone Joint Surg Br* 2003; 85:254–260. Forty-one children had 57 limb deformities treated with acute correction and lengthening with a monolateral fixator. Mean age was 11.3 (3.2–18.7) years. Mean maximum correction in one plane was 23 (7–45) degrees. Mean length gained was 6.4 (1.0–17.0) cm. Bone healing index (BHI) (days/cm) was better in longer lengthenings. Age and actual bone lengthening had little effect. BHI was greater with greater angular correction. This technique is suitable for femoral deformity and shortening, but should be used with care in the tibia, since the risk of compartment syndrome or neuropraxia is much greater.

Feldman DS, Madan SS, Koval KJ, et al. **Correction of tibia vara with six-axis deformity analysis and the Taylor spatial frame.** *J Pediatr Orthop* 2003; 23:387–391. Nineteen patients (22 tibias), 6 with infantile and 13 with adolescent tibia vara underwent correction with the Taylor spatial frame. Results were evaluated by Schoencker's criteria and radiographic parameters (MAD, LDFA, MPTA, PPTA, varus, and procurvatum). Twenty-one out of 22 achieved mechanical axis deviation within 3 degrees of normal. Complications included three pin site infections and one delayed union.

Deformity Correction continued

Jones S, Hosalkar HS, Hill RA, Hartley J. **Relapsed infantile Blount's disease treated by hemiplateau elevation using the Ilizarov frame.** *J Bone Joint Surg Br* 2003; 85:565-571. Three boys and four girls underwent hemiplateau elevation for relapsed infantile Blount disease using the Ilizarov frame. Mean age was 10.5 years. Mean follow-up was 29 months. Three-dimensional CT reconstruction was useful for preop planning. In addition to hemiplateau elevation, this technique can be used to address rotational deformities and limb-length discrepancy. Authors describe an angle to quantify medial plateau depression. Mean preop angle was 41 (30-50) degrees; mean postop angle was 7.5 (6-20) degrees.

Kiely PD, McMahon C, Smith OP, Moore DP. **The treatment of flexion contracture of the knee using the Ilizarov technique in a child with haemophilia B.** *Haemophilia* 2003; 9:336-339. Case report of a 13-year-old boy with severe factor IX deformity, treated with an external fixator for three months. His fixed flexion deformity was reduced from 50 to 5 degrees. Four months after surgery he was walking freely without pain. There was no peri- or postoperative bleeding or joint swelling; his factor IX level was maintained at 1 UL/mL.

Parvizi J, Frankle MA, Tiegs RD, Sim FH. **Corrective osteotomy for deformity in Paget disease.** *J Bone Joint Surg Am* 2003; 85-A:697-702. Twenty-five osteotomies were performed in 22 patients between 1975 and 1995. Mean age was 67 (range 36-85) years. Bones treated were tibias (16), femurs (8), and radius (1). Indications for surgery were intractable pain, underlying degenerative joint disease, recurrent painful stress fractures, and reduced ROM. Osteotomy was performed at various levels. Fixation was achieved with plates (7), external fixation (6), staples (5), intramedullary nail (4), long femoral component (2), and spica cast (1). All but 2 patients had substantial pain relief, improved appearance, and improved function. Two patients had delayed union; both had a mid-diaphyseal osteotomy fixed with an intramedullary nail. Disease activity, measured by serum alkaline phosphatase level, and treatment with calcitonin and/or bisphosphonates did not affect time to union. Osteotomy sites were selected by the severity of the deformity and the bone quality; correction was planned with two-dimensional paper tracings.

Sangkaew C. **Correction of shortening and/or angular deformities by distraction osteogenesis using AO-tubular fixator.** *J Med Assoc Thai* 2003; 86:24-36. Eighteen patients (twenty bony segments) were treated with the AO tubular external fixator for angular (mean 18.9,

Sangwan SS, Marya KM, Siwach RC, Singh Z, Devgan A. **Cubitus varus - correction by distraction osteogenesis.** *Indian J Med Sci* 2002; 56:165-171. Cubitus varus was corrected and stabilized by external fixation in 30 children, age 6-14 years. Varus deformity measured 17-43 degrees. Excellent results were achieved in 28 cases. There was no neurological complication or permanent stiffness. Superficial pin tract problems occurred, especially in the summer and in fat children. This method is technically simple and minimizes the lazy S deformity.

Sato W, Ohnishi I, Nishimura N, Nakase T, Tsuchiya H, Hirose M, Matsushita T, Hirasawa Y, Nakamura K. **Correction of tibial deformity in adults.** *J Orthop Sci* 2003; 8:306-312. Forty-nine adult patients with 59 tibial deformities at five Japanese hospitals were reviewed. Trauma was the most common etiology. Varus angulation was the most common deformity. Twenty-two patients had a leg length discrepancy. Aim of correction was to normalize the mechanical axis and the inclination of knee and ankle joints. Complications occurred in 22, including pin tract infections, 28% refractures, delayed consolidation, or fixator failure. Average fixator time was 9 months. There were no circulatory or neurologic complications. 71% were completely corrected; 47% had no residual length discrepancy.

Sen C, Kocaoglu M, Eralp L. **The advantages of circular external fixation used in high tibial osteotomy (average 6 years follow-up).** *Knee Surg Sports Traumatol Arthrosc* 2003; 11:139-144. Twenty-six patients underwent HTO + internal fixation; twenty-seven underwent HTO + Ilizarov fixator. The patients with the external fixation had better HSS score, alignment of the lower extremity, and prevention of progression of osteoarthritis and avoids patella infera and bone loss, which occurs in classic HTO with internal fixation.

Shimizu T, Fujioka F, Gomyo H, Isobe K, Takaoka K. **Three-dimensional starch model for simulation of corrective osteotomy for a complex bone deformity: a case report.** *Foot Ankle Int* 2003; 24:364-367. Authors used computed tomography data to build a model of patient's ankle for a simulated osteotomy. The real osteotomy was performed immediately. Authors recommend this method for preoperative planning and end result accuracy.

Shimode K, Miyagi N, Aoki Y, Yasuda K, Yamazaki S, Minami A. **Juvenile Blount's disease: bilateral case with asynchronous onset.** *J Orthop Sci* 2003; 8:222-226. Case report of a 9-year-old girl who had bilateral juvenile Blount disease, with corrective surgery performed 18 months apart due to asynchronous onset.

Research

Aida T, Yoshioka I, Tominaga K, et al. **Effects of latency period in a rabbit mandibular distraction osteogenesis.** *Int J Oral Maxillofac Surg* 2003; 32:54–62. Rabbit study to determine the ideal latency period for mandibular distraction osteogenesis. The rabbit mandible underwent bilateral corticotomy and external fixator application. Latency periods of 0, 2, 5, and 10 days were investigated, distraction was done 0.25 mm every 12 hours. The 0 day specimens showed fibrous tissue in the gap. In the 10 day specimen, the gap was almost filled with woven bone. In the 2 and 5 day specimens, there was mineralization at the periphery of the fibrous interzones. Additionally, new bone formation occurred around the periosteum.

Arslan H, Ketani A, Gezici A, et al. **The effects of osteoporosis on distraction osteogenesis: an experimental study in an ovariectomized rabbit model.** *Acta Orthop Belg* 2003; 69:67–73. Twenty-four ovariectomized female rabbits underwent tibial metaphysis distraction twice daily for 3 weeks and were compared to a control group. Histopathological exam showed a significant difference in callus remodeling, with remodeling occurring later in the osteoporotic group. The new bone was more osteoporotic in the ovariectomized rabbits.

Cancedda R, Mastrogiacomo M, Bianchi G, et al. **Bone marrow stromal cells and their use in regenerating bone.** *Novartis Found Symp* 2003; 249:133–143. Cultured bone marrow stromal cells (BMSCs) can be regarded as mesenchymal progenitor/precursor cells derived from adult stem cells. BMSCs combined with a mineralized scaffold form highly vascular bone tissue when implanted in immunodeficient mice. Authors have used BMSC/bioceramic composites to treat full-thickness gaps in sheep tibial shafts. Similar implants have been inserted in three patients. The sequence of events is: (1) bone formation on the outer surface of the implant, (2) bone formation on the inner cylinder canal, (3) formation of fissures and cracks in the implant body, (4) bone formation in the bioceramic pores.

Cheung KM, Kaluarachi K, Andrew G, et al. **An externally fixed femoral fracture model for mice.** *J Orthop Res* 2003; 21:685–690. A four-pin external fixator was applied to femoral fractures in mice. Radiological and mechanical testing showed steady progression of healing. This model may be used to investigate fracture healing.

Haidukewych GJ, Kumar S, Prpa B. **Placement of half-pins for supra-acetabular external fixation: an anatomic study.** *Clin Orthop* 2003; 411:269–273. This study evaluated placement of half pins in cadaver pelvis by inserting the pin under fluoroscopic control and then exposing the insertion site in the pelvis. Proximity to nerves, vessels, and hip capsule was checked. Half pins can be accurately and safely placed in the supra-acetabular region using percutaneous techniques, appropriate soft tissue sleeves, and fluoroscopic guidance. Insertion of pins at least 2 cm above the hip is recommended to avoid potential hip capsule penetration.

Moore DC, Leblanc CW, Muller R, Crisco JJ, 3rd, Ehrlich MG. **Physiologic weight-bearing increases new vessel formation during distraction osteogenesis: a micro-tomographic in aging study.** *J Orthop Res* 2003; 21:489–496. Eighteen rats underwent femoral lengthening. Half were allowed to bear weight; half were maintained non-weight bearing. After a 7-day latency period, femurs were lengthened 7mm over a 21-day period. Vessels were infused with BaSO₄ after sacrifice. Vessel volume was measured with a fan-beam micro-tomography machine. Vessel volume and vessel density was significantly greater in the weight bearing group. Vessel diameter did not vary significantly between the weight bearing and non-weight bearing groups.

Schultz W, Weber T, Blumentritt S, et al. **Gait-analytical studies in patients treated by valgus tibial head osteotomy.** *Orthopade* 2003; 32:331–339. Authors performed gait analysis to investigate force distribution patterns at knee joint, since radiographic measurements do not give any information about the load on joints under dynamic conditions. Even after correction of the varus knee, 30% of cases showed increased varus moments. For these reasons, authors recommend over-correction to about 5 degrees beyond the physiologic angle to prevent revarization and/or to eliminate varus moment at knee joint.

Shevtsov VI, Gordievskikh NI, Bunov VS, et al. **Changes in blood flow during tibial thickening by the Ilizarov method.** *Bull Exp Biol Med* 2002; 134:525–527. Blood flow in the dog hindlimb was measured after tibial thickening with the Ilizarov method. The increase in blood flow was determined by the increase in volume of the bone.

Tuz HH, Kisnisci RS, Gunhan O. **Histomorphometric evaluation of short-term changes in masseter muscle after lengthening the rabbit mandible by distraction osteogenesis.** *J Oral Maxillofac Surg* 2003; 61:615–620. Masticatory muscles were studied after lengthening of rabbit mandibles, harvested at the end of the consolidation period. Muscles showed combinations of atrophy, hypertrophy, regeneration, and mild interstitial edema and fibrosis.

Watson MA, Mathias KJ, Maffulli N, et al. **The effect of clamping a tensioned wire: implications for the Ilizarov external fixation system.** *Proc Inst Mech Eng (H)* 2003; 217:91–98. This study demonstrates that clamping tensioned wire can cause reduction in wire tension. Clamping the wire could be considered to squeeze the wire outwards, like toothpaste from a tube, reducing the tension. The tension of a 1.8mm wire on a 180mm diameter steel ring was reduced by 8–29%.

Research continued

Yazawa M, Kishi K, Nakajima H, et al. **Expression of bone morphogenetic proteins during mandibular distraction osteogenesis in rabbits.** *J Oral Maxillofac Surg* 2003; 61:587–592. Twenty-three rabbits underwent mandibular lengthening. Expression of BMPs 2 through 8 was evaluated immunohistochemically. Fresh-frozen sections were evaluated. Expression of BMPs 2, 4, 5, and 6 was observed continuously from beginning of distraction. BMP-7 was expressed weakly, BMP-3 was not observed during distraction but at 1- and 2-week consolidation. Both intramembranous and endochondral ossification was observed. Authors concluded that expression pattern of BMPs during membranous bone distraction was similar to that during long bone distraction; unlike long bone distraction, the expression of BMPs was maintained for 2 weeks after the completion of distraction.

Other

DiCaprio MR, Friedlaender GE. **Malignant bone tumors: limb sparing versus amputation.** *J Am Acad Orthop Surg* 2003; 11:25–37. Limb-lengthening technique is one of several limb-sparing procedures in the treatment of malignant bone tumors. Limb lengthening and bone transport has limited utility after resection of bone malignancies when used as the primary reconstruction technique. Large osseous defects are difficult to replace, and the required extended periods of treatment are associated with significant complications. Limb-lengthening procedures are better suited as adjuncts to other methods of reconstruction or for smaller defects.

Kuo KN, Qureshi A, Bush-Joseph CA, et al. **Ilizarov distraction histogenesis to reconstruct massive post-traumatic osteoarticular defects: a case report.** *J Bone Joint Surg Am* 2003; 85-A:1125–1128. Case report of a 3-year-old boy who sustained a lawn mower injury with loss of medial tibial plateau. The medial tibial plateau was reconstructed by performing an osteotomy in the sagittal plane medial to the tibial spine, and transporting the osteotomized segment beneath the medial femoral condyle with two olive wires. Further reconstructive procedures included a contralateral epiphyseodesis, ipsilateral fibular epiphyseodesis, and ipsilateral tibial lengthening. Joint surface biopsies showed fibrocartilage and hyaline cartilage.

Other continued

Ruch DS, Smith AM. **Articulating external fixation to overcome nerve gaps in lower extremity trauma.** *J Orthop Trauma* 2003; 17:290–294. Review of four patients with segmental nerve defects treated with application of an articulated external fixator in a position to allow end-to-end tension-free nerve repair. After three weeks of immobilization, joint extension was performed gradually. Motor and sensory functions partially returned. This series demonstrates that joint positioning through external fixation may be used safely and effectively to facilitate primary neuroorrhaphy.

Educational Opportunities

September 15–16, 2003
Limb Reconstruction Symposium
Verona, Italy
reneeyttredahl@orthofix.com

September 26–27, 2003
IM Nailing of Long Bone Fractures
Napa Valley, CA
kay.collins@smithnephew.com

October 8–9, 2003
International Ring Fixation Course
Sheffield, England
reneeyttredahl@orthofix.com

October 9–11, 2003
Orthopaedic Trauma Association (OTA) Annual Meeting
Salt Lake City, UT
www.ota.org

October 13–14, 2003
Complex Trauma Symposium
Verona, Italy
reneeyttredahl@orthofix.com

October 22–25, 2003
Essentials of Ex-Fix: Ilizarov and Taylor Spatial Frame
Tucson, AZ
monica.dolbi@smithnephew.com

October 27–28, 2003
Pediatric Orthopedic Symposium
Verona, Italy
reneeyttredahl@orthofix.com

October 31–November 2, 2003
Foot & Ankle Applications of The Ilizarov Method
Memphis, TN
mmm@acfas.org

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More Educational Opportunities

November 24–25, 2003
Trauma & Orthopedics Course
Verona, Italy
reneyttredahl@orthofix.com

December 3–7, 2003
2003 International Pediatric Orthopaedic Symposium
San Diego, CA
www.pedsref.org

December 4–6, 2003
Current Solutions in Orthopaedic Trauma
Tampa, FL
kay.collins@smithnephew.com

December 11–12, 2003
Foot & Ankle Symposium
Verona, Italy
reneyttredahl@orthofix.com

February 20–21, 2004
Orthopaedic Trauma Symposium
Lake Tahoe, CA
kay.collins@smithnephew.com

February 20–22, 2004
Taylor Spatial Frame
Snowmass, CO
bonnie.muse@smithnephew.com

February 23–27, 2004
25th Annual Orthopaedic Symposium
Snowmass, CO
bonnie.muse@smithnephew.com

February 28–March 5, 2004
International Trauma Course
Flims, Switzerland
monica.dolbi@smithnephew.com

March 11–15, 2004
AAOS Annual Meeting
San Francisco, CA
www.aaos.org

March 13, 2004
LLRS Specialty Day
www.asaminorthamerica.org
ksyzdek@assocconvspec.com

March 26–27, 2004
Trauma & Upper Extremity
Cologne, Germany
reneyttredahl@orthofix.com

April 29–May 1, 2004
Fracture Forum
Dana Point, CA
kay.collins@smithnephew.com

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The Limb Lengthening and Reconstruction
Society: ASAMI-NA
P. O. Box 91868
Austin, TX 78709-1868 USA

More Educational Opportunities

May 27-29, 2004
Third International ASAMI Meeting
Istanbul, Turkey
www.asami2004.org

July 23-25, 2004
14th Annual Scientific Meeting of
LLRS: ASAMI-NA
Toronto, Ontario, Canada
www.asaminorthamerica.org
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