of such implants have prompted us to screen various implant metals for their potential influence upon the metabolism of articular tissues. Here we report the effect of $CoCl_2$ on the in vitro production of three neutral proteinases and Prostaglandin E_2 (PGE_2) by lapine and human synoviocytes, with preliminary data on titanium as well. We also present preliminary data describing the effect of cobalt on bone resorption.

Cells were cultured in Ham's F-12 medium supplemented with fetal bovine serum and antibiotics. At confluence, the cells were washed with Gey's balanced salt solution and incubated for a further three days in serumless 'Neuman-Tytel' medium in the absence (control) or presence of 10^{-4} to 10^{-3}M $CoCl_2$ or $TiCl_4$. Conditioned media were then assayed for collagenase, gelatinase, and caseinase activity by standard radioactive techniques; PGE_2 concentrations were determined by radioimmunoassay.

Co^{+2} reversibly stimulated the cellular production of all three neutral proteinases from lapine cells by 10-20 fold, with peak stimulation occurring at 10^{-6} to 10^{-5}M $CoCl_2$. The highest concentrations of cobalt inhibit PGE_2 production, while the lower ones stimulate it in these cells. Human cells respond in a qualitatively similar manger, with the maximum effect occurring at 10^{-4} to 10^{-3}M $CoCl_2$. Overall, production of PGE_2 was slightly depressed by cobalt using human cells.

Identical experiments using lapine synoviocytes with $TiCl_4$ demonstrated that peak protease production occurred at 10^{-3}M $TiCl_4$. This usually represented a 3 to 5 fold increase. All other concentrations did not prompt an increase in caseinase, gelatinase, or collagenase production. Unlike cobalt-impregnated cells, titanium innoculation slightly depressed PGE_2 production by lapine synoviocytes at all concentrations from 10^{-7} to 10^{-3}M. The results of work with titanium and human cells in this lab are pending.

Ca^{45} dissolution from radioactive calcium-labelled fetal mouse calvaria and long bones in response to cobalt was measured with standard radioactine techniques. Preliminary studies indicate that Co^{+2} causes a 50% increase in bone resorption in the presence of lapine synoviocytes compared to control cultures or cultures containing synoviocytes without metal after a nine day incubation period. No data is available on titanium to date.

These data support the suggestion that Co^{+2} leached from orthopaedic prostheses stimulate the osteoclastic activities of adjacent tissues, thereby contributing to aseptic loosening, which is now the major cause of implant failure. Ti^{+2} may be more innocuous. In total hip replacements, for example, were it possible to perform a randomized study in identical patient populations with structurally identical prostheses comparing loosening rates in titanium-containing prostheses versus cobalt-containing prostheses, one might speculate as to how loosening rates might vary based on these data. Also, given the many factors which may cause early or late radiolucent lines at the bone-cement interface on total hip radiographs, these data suggest that degradative enzyme production, stimulated by metal salts, may play a significant role in the propagation of these lines, and indeed in which ones go on to symptomatic loosening. Interestingly, the presence of synoviocytes was a necessary condition for the induction of bone resorption by cobalt. Perhaps communication between the space at the bone-cement interface and the joint cavity is a necessary (though perhaps not sufficient) condition for the propagation of lucent lines in this hypothetical biological loosening model. Clearly the role of prosthetic metals needs to be studied further in this regard.

GORE-TEX AUGMENTED PATELLAR TENDON REPAIRS IN A CANINE MODEL J.T. Behr, M.S. Pinzur (Loyola University Medical Center, Maywood, IL), G. Knight (Nines Veteran's Administration Medical Center), M. Castelli (Loyola) and A. Patwardhan (Hines)

Synthetic augmentation of autogenous tissue is an intuitively appealing solution to the difficult problem of ligament repair and reconstruction. Based on this premise, Gore-tex augmented patellar tendon repairs were investigated biomechanically and histologically in 20 adult mongrel dogs.

In each dog the left hindleg patellar tendon was isolated, divided and repaired. Experimental tendon repairs were augmented with Gore-tex. Unaugmented tendon repairs served as shams and unoperated contralateral tendons served as controls. The dogs were sacrificed at 4, 10 and 20 weeks. A Gore-tex augmented tendon from each group was submitted for histology. The remaining specimens were biomechanically studied using specially designed grips and an Instron Model 1122 Electromechanical Test System.

Both at 4 and 10 weeks, Gore-tex augmented repairs were statistically stronger than unaugmented sham repairs. ($P < .05$ and $P < .001$, respectively.) At 20 weeks the Gore-tex augmented repair was 13 percent stronger than its unoperated contralateral control. On histologic examination, fibroblasts were observed growing through the entire Gore-tex graft as early as 4 weeks. Also of note was the total absence of any inflammatory or foreign body response in all specimens studied.

The combination of synthetic and autogenous tissue may provide an ideal construct for ligament repair and reconstruction.

DOWEL ARTHRODESIS FOR DEGENERATIVE ARTHRITIS OF THE TARSOMETATARSAL (LISFRANC) JOINTS. Jeffrey E. Johnson, M.D., Kenneth A. Johnson, M.D. (Mayo Clinic, Rochester, MN). A late complication of fracture with dislocation involving the tarsometatarsal joints of the foot (Lisfranc fracture) is progressive degenerative arthritis and pain. A dowel-graft arthrodesis technique is described that uses percutaneous bone graft from the iliac crest supplemented by crossed-wire fixation. Fifteen cases between 1979 and 1982 were reviewed retrospectively. These patients suffered from painful posttraumatic degenerative arthritis after tarsometatarsal joint fracture-dislocation. Follow-up evaluation (mean, 37 months) of 13 of the 15 patients demonstrated satisfactory pain relief in 11 patients, whereas 2 were dissatisfied. Complications included three instances of nonunion and one postsurgical reflex sympathetic dystrophy syndrome.

FOREFOOT RECONSTRUCTION IN RHEUMATOID ARTHRITIS. Mark F. McDonnell, M.D., and Thomas 0. Clanton, M.D. At the University of Texas Medical School at Houston Foot Clinic, we have performed forefoot reconstruction in patients with severe forefoot deformities due to rheumatoid arthritis. This has included first metatarsophalangeal joint arthrodesis and resection arthroplasties of the second through fifth metatarsophalangeal joints. Prior reports of techniques used to treat severe forefoot deformities due to rheumatoid arthritis have not described the use of these particular two procedures in combination. The indications for surgery were patients with intractable pain that did not respond to nonoperative modalities such as shoe modification and anti-inflammatory agents. Eleven reconstructive procedures were performed on seven patients. The technique of first metatarsophalangeal joint arthrodesis was that described by Mann and Oates(1). Resection arthroplasties of metatarsophalangeal joints two through five have been described by various authors(2,3). The patients were allowed to bear weight in a postoperative wooden soled shoe on the second postoperative day. The parallel threaded Steinmann pins used for fixation of the arthrodesis were removed when there was roentgenographic evidence of healing at the arthrodesis site. Average followup of these patients was nineteen months. Ten patients had their result as excellent and one as good. They all had

increased their activity level as a direct result of the surgery unless other joint problems had intervened. No cases of recurrent hallux valgus or dorsal dislocation of the toes were seen. Average time to bony union was seven weeks. One painless fibrous union developed in a patient who experienced a hardware failure. One pin tract infection occurred, but resolved with hardware removal and oral antibiotics. We feel that severe forefoot deformities in rheumatoid arthritis can be safely and effectively treated with simultaneous first metatarsophalangeal joint arthrodes+s and resection arthroplasties of the lesser metatarsophalangeal joints.

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THE EFFECT ON FUNCTIONAL REHABILITATION OF THE CAT-CAM ABOVE-KNEE PROSTHESIS. F.C. Flandry, M.D., J.L. Beskin, M.D. (Tulane School of Medicine, Dept. of Orthopaedic Surgery, 1430 Tulane Avenue, New Orleans, LA 70112) R.C. Chambers, M.D., J. Perry, M.D., R.L. Waters, M.D., R. Chavez, C.P. (Pathokinesiology Service, Rancho Los Amigos Medical Center, 7601 Imperial Hyw., Downey, CA). In order to determine its effect on the ambulatory function of above-knee amputees, the CAT CAM above-knee prosthesis was studied in a pilot project. Five above-knee amputees, who were accomplished quadrilateral socket conventional above-knee prosthetic wearers, were converted to the CAT CAM prosthesis. Patients were evaluated prior to conversion in their quadrilateral above-knee prosthesis. Parameters studied included stump condition, weight bearing femoral inclination, observational gait analysis, metabolic cost of ambulation, ambulatory functional level, hip torque forces, and subjective evaluation by wearers of comfort, balance, and stability. Significant improvement occurred in many parameters after conversion to the CAT CAM prosthesis. Utilization of the CAT CAM above-knee prosthesis may allow prosthetic rehabilitation of a greater percentage of above-knee amputees than has previously been reported.

COMPUTERIZED TOMOGRAPHY FOR DISORDERS OF THE FOOT AND ANKLE. JE Herzenberg, MD, PW Gilmer, MD, S Martinez, MD, JL Goldner, MD (Duke University Medical Center, Durham, NC 27710).

Computerized tomography (CT) has established itself as an important diagnostic imaging modality in orthopaedic surgery, particularly for problems of the spine, hips, Pelvis, and in musculoskeletal tumors. Only recently has CT been applied to the foot and ankle. This paper reviews our experience with CT diagnosis of selected foot and ankle disorders in 150 extremities in 130 Patients. Anatomic cadaver studies clarified the coronal anatomy. For traumatic lesions, CT was most helpful in the preoperative evaluation of intra-articular calcaneus fractures, sagittal split fractures of the talus, and distal tibial pilon fractures. For congenital problems, CT was the single most accurate test for the characterization of talo-calcaneal tarsal coalitions. For staging of bony and soft tissue tumors, CT aided in the localization and preoperative approach to lesions of the ankle and hindfoot. In selected cases of post-traumatic and acquired degenerative disease of the hindfoot, CT provided useful clinical information. All studies were classified as clinically helpful if they helped to either make the diagnosis, rule out a diagnosis being considered, or plan an operative approach. Ninety-one percent of the studies could be classified as helpful. The complex bony architecture of the hindfoot, particularly the sub-talar joint often makes traditional imaging techniques unsatisfactory, CT is a valuable adjunct in the diagnosis and management for certain disorders of the foot and ankle.

RAY RESECTION IN THE TREATMENT OF MACRODACTYLY OF THE FOOT IN CHILDREN. Dr. D.K. Dedrick and Dr. T.F. Kling, Jr. (University of Michigan, Ann Arbor, Michigan 48109) Macrodactyly is an uncommon deformity which causes an increase in width, length and height of the forefoot, creating a problem in shoe fit, ambulation and cosmesis. Due to the progressive nature of the disease, multiple surgical procedures have been advocated. To assess the outcome of such treatment, we reviewed 13 patients followed to maturity. Eleven had unilateral involvement, and all had hypertrophy of at least the 2nd ray. All cases had both soft tissue and bony enlargement, and in each case there was metatarsal enlargement. None had distortion of the bony architecture other than hypertrophy, and no case involved the hindfoot. All patients reported forefoot width caused the greatest problem in fitting shoes. Treatment - Initial soft tissue resection in 9 children were successful in the short term and in combination with bony resection did decrease the size of the foot. In each case there was further foot enlargement and all subsequently had a mean of 4 additional procedures to reduce the size of the foot. Epiphyseodesis controlled the length but not the circumference of the tarsal bones. Partial 2nd ray resection in 2 cases led to painful hallux valgus with degeneration of the 1st metatarsophalangeal joint. Complete ray resection, including ample soft tissue, particularly of the 2nd ray, was the most useful procedure in reduc- the width and size of the foot.

The goal of surgery is to provide a plantigrade foot which is equal in size to its mate, fits into a normal shoe and is pain free with the least number of surgical procedures. While appearance is important, all patients felt it could be sacrificed to achieve these goals. Any procedure to control foot size can be considered, but early aggressive bone and soft tissue resection best accomplish these goals in this series. This review recommends complete 2nd ray resection at an early age when the foot is two standard deviations wider than a normal foot for its age.

BIOMECHANICAL CHARACTERISTICS OF HUMAN ANKLE LIGAMENTS D. Attarian, H. McCrackin, D. DeVito, J. McElhaney, and W. Garrett, Duke University Medical Center, Durham, N.C. The purpose of this study was to define the biomechanical characteristics of the individual bone-ligament-bone complexes of the human ankle. Twenty human ankles were dissected of all soft tissues to leave only the tibia, fibula, talus, and calcaneus with their intact anterior talofibular, calcaneofibular, posterior talofibular, and tibiotalar ligaments. Specimens were mounted and tested on a Minneapolis Testing System. Protocol consisted of cyclic loading of each ligament, followed by several constant velocity load-deflection tests at varying rates, followed by a final, extremely rapid load to failure test. All ligaments exhibited strain rate dependence; that is, the more rapid the deflection, the greater the load withstood, and the more energy absorbed at a given deflection by each specimen. This inherent property makes ligaments uniquely suitable to provide joint stability in a variety of physiologic and traumatic situations. The load to failure tests established the ultimate strength of the ligaments in trauma. The anterior talofibular ligament had the lowest load to failure