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1.**Hematoma and Distraction Arthroplasty for Thumb Basal Joint Osteoarthritis: Minimum 6.5-Year Follow-Up Evaluation. JOS** January 2007, Pages 23-29 . **Meals MD**[a]

The goal of the present study was to evaluate the results of this procedure in patients at least 6.5 years after surgery. 22 cases were studiet

Treatment consisted of piecemeal excision of the entire trapezium and 5 weeks of K-wire immobilization of the thumb metacarpal in opposition and slight distraction. No ligament reconstruction or tendon interposition was used.

Motion, strength, standardized dexterity tests, stress radiographs, and outcome questionnaires

Results

6 M 17 of 22 patients reported complete pain relief

ROM showed 21 of 22 thumbs adducted fully

Strength: average of 21% increase in grip strength and tip pinch strength, and an 11% increase in key pinch strength over preoperative values.

Although the radiographically determined scaphoid–thumb metacarpal distance decreased with time from surgery, no correlation with strength or functional outcome measurements was found.

Conclusions

After trapezial excision, K-wire immobilization in a slightly overcorrected position without formal interposition or ligament reconstruction allows for restoration and maintenance of a stable, pain-free thumb that has comparable strength and motion with published reports of more complicated interventions over comparable time periods.

1. A simple trapeziectomy: provides excellent pain relief, but subsidence into the trapezial void was blamed for findings of postoperative instability and weakness.

2. Arthrodesis of the CMC joint: shown to provide excellent stability and pain relief.[3] With arthrodesis, however, comes the inherent loss of motion and risk of nonunion.

3. Interpositional arthroplasties have been proposed to maintain motion while filling the void created by trapezial excision. Silicone implant arthroplasty has waned in popularity because dislocation, breakage, and synovitis have complicated its use.

4. The reconstruction of a disrupted anterior oblique ligament, implicated in the development of basal joint arthritis : techniques of tendon tunneling and suturing for ligament reconstruction, with or without tendon interposition. Questions have been raised whether these more complicated procedures are necessary.

In 1997, Gerwin : Similar satisfaction, strength, and range of motion at the 23-month (LRTI) and those who had ligament reconstruction

Kriegs-Au et al[16] also found that adding tendon interposition did not affect the outcome of ligament reconstruction at 48 months, and found no difference in the proximal metacarpal migration between the 2 groups.

Davis et al[18] compared trapeziectomy, trapeziectomy with tendon interposition, and trapeziectomy with ligament reconstruction and tendon interposition at 1 year and found that there was no benefit of tendon interposition or ligament reconstruction.

A meta-analysis of 5 surgical procedures for CMC osteoarthritis (trapeziectomy, trapeziectomy with interpositional arthroplasty, trapeziectomy with ligament reconstruction, LRTI, and joint replacement) showed that no single procedure produced greater pain relief or strength than the other procedures, although those patients who had trapeziectomy alone had fewer complications.

Temporary fixation to distract and stabilize the thumb metacarpal, however, may provide sufficient modification to this straightforward procedure to confer excellent results.

In 2003 Kuhns et al[21] reported that at the 2-year follow-up evaluation patients who had a trapeziectomy modified with temporary K-wire fixation (termed *hematoma and distraction arthroplasty* [HDA]) had superior strength and motion

The 4 patients unavailable for the most recent follow-up evaluation were an average of 13 years older than those 22 patients seen at the most recent follow-up evaluation.

Seventeen patients were women and 5 were men, with an average age of 65 years (range, 52–82 y) at the time of the HDA procedure.

14 patients had stage III disease, and 5 patients had stage IV disease.

Results

At 24 months after surgery, 20 of 22 patients (91%) were entirely pain free and the remaining 2 had subjective weakness and 1 patient reported stiffness.

21 of 22 thumbs adducted fully into the plane of the palm, and 20 of 22 opposed to the small finger metacarpal head. Two patients' opposition was limited to the proximal interphalangeal joint of the small finger.

The 2-year follow-up evaluation showed a 40% increase in grip strength ($p < .001$), a 22% increase in key pinch strength ($p < .01$), and a 17% increase in tip pinch strength

	Before Surgery	After Surgery (24 mo)	% Change Compared to Before Surgery	After Surgery (88 mo)	% Change Compared to Before Surgery
Grip strength	19	26	+40*	23	22*
Key pinch	5	6	+22*	5	13
Tip pinch	4	6	+17*	5	22*

The scaphoid–thumb metacarpal distance at rest, as measured on a reverse Robert-view radiograph, averaged 10 mm before surgery, 5 mm at 6 months (50% decrease), 5 mm at 24 months (53% decrease), and 2 mm at 88 months (77% decrease)

There was no correlation between the degree of metacarpal subsidence on either static or stress x-rays with grip or pinch strength or with functional outcome measurements. No dorsal subluxation or divergence of the thumb and index metacarpals was noted on pinch radiographs or noted clinically during forceful pinch.

AIMS2 Variables	Before Surgery	6 mo	2 year	7 year
Hand and finger function	5	2.3*	1.3*	1.6*
Arm function	1.5	0.6*	0.2*	0.3*
Self-care	0.3	0.1	0.2	0.3
Mobility	1.1	0.4	0.6	1.2
Household tasks	0.7	0.7	0.9	0.9
Arthritis pain	6.1	4.2*	4.1*	4.7*
Satisfaction with hand and finger function	8.3	3.3*	2.4*	1.7*

All 22 patients at the 88-month follow-up evaluation answered “very satisfied.”

Dexterity testing on the nonsurgical hand showed an increase in the Jebsen subtest II mean time from 6.6 seconds at baseline to 7.7 seconds at 88 months ($p < .05$).

Discussion

The results of this study suggest that HDA creates a durable, stable, and pain-free thumb.

Pain Relief and Satisfaction

Our results compare favorably with published reports of pain relief and satisfaction with more complicated procedures. In a 9-year follow-up evaluation of LRTI, Tomaino et al[23] reported that 20 of 22 patients (91%) had complete pain relief, and 21 of 22 patients (95%)

Motion

The results of this study suggest that motion at the basal joint after HDA is similar to that found after LRTI or palmaris longus tendon interposition.

Strength

Patient grip and pinch strengths after HDA were greater than the preoperative strengths at all time points. The strength of the contralateral hands also decreased over the same period, although not significantly, suggesting that advancing age, and not history of surgery, may be associated with

weakness of grip and pinch.

Our findings are similar to those of Tomaino et al,[23] with a 9-year follow-up period in the study of LRTI. At 7 years, patients who had HDA had some diminution in strength over the 2-year measurements, yet these strengths compared favorably with the 6-year follow-up figures of Tomaino et al

Subsidence

Although the scaphoid–thumb metacarpal distance continued to decrease with time from surgery, the progressive subsidence was not symptomatic.

2.**A Comparative Study of Ulnar-Shortening Osteotomy by the Freehand Technique Versus the Rayhack Technique. JHS**, February 2006

Purpose

To compare the results of ulnar shortening by the traditional freehand method with those achieved by the Rayhack technique.

Methods

97 :: 45 ulnas) were treated by the freehand technique and 52 patients (52 ulnas) by the Rayhack technique.

Both groups were well matched in terms of age, gender, prior history of trauma, and associated injuries. The following variables were compared: duration of surgery, relief of pain, return to work, postoperative complications, time elapsed between surgery and return to work, union of the osteotomy, collinear alignment of the ulnar shaft, and alignment of the plate against the bone.

Results

Statistical analysis of the compared parameters: duration of surgery, relief of pain, return to work, postoperative complications, time elapsed between surgery and return to work, and union of the osteotomy, showed that none was significant. There were no cases of malalignment of the ulnar shaft or malalignment of the plate against bone in either group. Our calculations show that one would need a cohort of at least 300 patients in each group to show meaningful differences between the groups provided the same proportions held true.

Conclusions

There was a trend toward a higher incidence of nonunion in patients who had the freehand technique although we were unable to show a statistical difference.

11Wks Vs 21

Oblique osteotomy, Zig and IFS

3. **Predictors of Functional Outcomes After Surgical Treatment of Distal Radius Fractures JOHS 32**,[1] 2007, Pages 76-83

Purpose

The predictors of functional outcomes after distal radius fracture (DRF) treatment have not been well defined in the past.

Methods

This was a prospective cohort study designed to identify predictors of hand outcomes after DRF treatment.

ORIF with volar plating. Outcome data were collected 3, 6, and 12 months after surgery.

Michigan Hand Outcomes Questionnaire (MHQ).

We hypothesized that the following factors are important predictors of functional outcomes: (1) age, (2) socioeconomic status, (3) severity of fracture pattern, and (4) postsurgical radiographic measurements

Results

66 data available at 3 months and 49 patients had data available at 1 year.

At 3 months after surgery, radiographic incongruity (step + gap) was a significant predictor after controlling for age, fracture type, dorsal–volar tilt angulation, and income.

Patients with increased incongruity reported lower MHQ scores (worse functional outcomes). At 1 year after surgery, Increased age and decreased income were associated with lower MHQ scores.

Conclusions

After successful surgery and hand therapy, only age and income were significantly associated with long-term outcomes 1 year after surgery. Precise anatomic reduction enhances short-term functional outcomes in DRF treatment.

4. **Closed Flexor Pulley Injuries in Nonclimbing Activities JHS** May 2006

Closed flexor pulley injuries have been reported in rock climbers. We report 6 digital flexor pulley injuries in 6 patients aged 5 to 73 years that were not associated with a climbing injury. Excellent outcomes were achieved through conservative therapy in 5 patients and surgical therapy in 1 patient.

Pulley ruptures have been identified clinically in rock climbers.

Pulley ruptures may cause bowstringing of the flexor tendons, which would result in a functional deficit.[7] The diagnosis can be made clinically if tendon bowstringing is detectable[7]; otherwise diagnostic accuracy is improved with ultrasound and/or magnetic resonance imaging (MRI).[10] and [11] Staging of pulley injuries has been described based on ultrasound examination of a series of 122 pulley injuries in rock climbers by Schöffl et al.[7] Single pulley injuries in rock climbers are treated conservatively with good to excellent outcomes[12]; however, multiple pulley ruptures require surgical repair.[7] and [13] We report 6 pulley injuries in 6 nonclimbers and discuss their clinical and diagnostic assessment, treatment considerations, and outcomes.

Therapeutic Guidelines for Closed Pulley Ruptures

	Grade I	**Grade II**	**Grade III**	**Grade IV**
Injury	Pulley strain	Complete rupture of A4 or partly rupture of A2 or A3	Complete rupture of A2 or A3	Multiple ruptures (eg, A2/A3, A2/A3/A4) or single rupture (A2, A3) combined with lumbrical muscle or ligamentous trauma
Therapy	Conservative	Conservative	Conservative	Surgical repair
Immobilization, d	0	10	10–14	14 (after surgery)
Functional therapy, wk	2–4	2–4	4	4
Pulley protecti	Tape	Tape	Thermoplastic or soft	Thermoplastic or soft cast ring

	Grade I	Grade II	Grade III	Grade IV
on			cast ring	

Figure 2. Ultrasound image of patient 5 (5-year-old girl with an A2-pulley rupture) (TB distance, 3.5 mm).

Figure 3. Clinical photograph of patient 5 (5-year-old girl with an acute A2-pulley rupture, middle finger, left hand) with the hand (A) open and (B) closed. Note the swelling and the active flexion deficit in the proximal interphalangeal joint 1 week after the trauma.

5. Pyrolytic Carbon Proximal Interphalangeal Joint JHS Jan 2007

Purpose

To retrospectively review the surgical technique, postoperative therapy/splinting protocols, and clinical and radiographic outcomes of patients who had pyrolytic carbon proximal interphalangeal (PIP) joint arthroplasty.

Methods

A total of 50 PIP joint replacements in 35 patients were performed with a minimum follow-up period of 27 months. Indications for surgery included pain, decreased range of motion, instability, and/or deformity. The preoperative diagnosis was osteoarthritis in 14, rheumatoid arthritis in 11, and posttraumatic arthritis in 10. There were 20 women and 15 men affected. The average age at the time of surgery was 53 years. The fingers replaced included the index (15), middle (18), ring (10), and small (7). The preoperative arc of motion averaged 40° (0°–60°), and the pinch and grip measurements averaged 3 and 19 kg, respectively. The preoperative pain scores averaged 6 (scale, of 0–10) on a visual analog space scale.

Results

The arc of motion was 47° after surgery, and the average pinch and grip measurements were 4 and 25 kg, respectively. Pain scores improved to 1. At the final follow-up evaluation the overall patient satisfaction was nearly 80%. The results of index finger PIP replacements are compatible with other digits. Fourteen joints (in 14 patients) to date have required additional procedures to improve or maintain joint motion/function or pain; 5 for minor reasons and 9 for major complications. The revision arthroplasty rate was 8%. No infections were noted. Although not medically necessary, 2 patients requested and had an amputation. Radiographic subsidence and subsequent settling (in accordance with Wolff's law) without apparent loosening occurred in 20 joints.

Conclusions

Our 2-year minimum follow-up evaluation of pyrolytic carbon implant arthroplasty showed improved pain relief and good overall patient satisfaction. Twenty-eight percent of patients required a second procedure and 8% required a revision arthroplasty. Radiographs showed gross changes in implant and eventual settling to a stable position in 40% of the joints. A longer follow-up period will help to better determine the efficacy of this implant.

6.**Volar Fixed-Angle Plating of Distal Radius Extension Fractures: Influence of Plate Position on Secondary Loss of Reduction.** JHS April 2006 Jupiter[e]

Purpose

Treatment of extension fractures of the distal radius with volar fixed-angle plates has become increasingly popular in the past 2 years. It has been observed clinically that placement of the distal screws as close as possible to the subchondral zone is crucial to maintain radial length after surgery. The purposes of this study were (1) to evaluate radial shortening after plating with regard to plate position and (2) to evaluate whether plate position has an influence on the strength and rigidity of the plate–screw construct.

Methods

An extra-articular fracture (AO classification, A3) was created in 7 pairs of fresh-frozen human cadaver radiuses. The radiuses then were plated with a volar distal radius locking compression plate. Seven plates were applied subchondrally; 7 plates were applied 4.5 mm to 7.5 mm proximal to the subchondral zone. The specimens were loaded with 800-N loads for 2,000 cycles to evaluate radial shortening in the 2 groups. Each specimen then was loaded to failure.

Results

Radial shortening was significantly greater when the distal screws were placed proximal to the subchondral zone. The amount of shortening after cyclic loading correlated significantly with the distance the distal screws were placed from the subchondral zone. Rigidity of the plate systems was significantly higher in radiuses in which the distal screws were placed close to the subchondral zone.

Conclusions

To maintain radial length after volar fixed-angle plating, placement of the distal screws as subchondral as possible is essential. The subchondral plate–screw–bone constructs showed significantly greater rigidity, indicating higher resistance to postoperative loads and displacement forces.

7.**Relationship Between the Duration and Severity of Symptoms and the Outcome of Carpal Tunnel Surgery JHSNov 2006**

Purpose

There is no consensus regarding the prognostic value of preoperative symptom severity and duration for determining the anticipated results of carpal tunnel release. Some studies show a detrimental influence of symptom duration and severity on outcomes; others have found no effect. To study these contradictions, a database was created at 2 separate hand centers to explore the extent to which the duration and severity of symptoms before surgery are predictive of surgical outcome.

Methods

At 2 hand centers 523 hands from the United States and United Kingdom completed surgery and follow-up evaluation. Symptoms, time of onset, duration, prior treatment, and medical history were recorded. Each patient had a physical examination and completed the Levine-Katz questionnaire.

Results

Symptom duration, corrected for gender, was not associated with Levine-Katz symptom severity, Levine-Katz functional status, or changes in these scores from the pretreatment to 6-month follow-up evaluations.

Conclusions

Preoperative symptom duration does not affect the surgery outcome as determined by the Levine-Katz symptom severity or functional status scores. The more severe the symptoms as determined by patient self-assessment, the greater the amount of change in the Levine-Katz symptom severity and functional status scores, although at 6 months after surgery the scores were still higher than those of patients with milder cases.

8.**Carpal Kinematics After Proximal Row Carpectomy JHS Jan 2007-08-13**

Purpose

Proximal row carpectomy (PRC) is a clinically useful motion-sparing procedure for the treatment of certain degenerative conditions of the wrist. Clinical outcome studies after PRC have shown that wrist flexion–extension averages approximately 60% of that of the contralateral wrist. The purpose of this study was to determine how the kinematics of the wrist are altered after PRC.

Methods

Eight fresh-frozen cadaver forearms were scanned with computed tomography before and after PRC. Forearms were scanned in 5 different wrist positions (neutral, extension, flexion, radial deviations, and ulnar deviation). Wrists were positioned dynamically and then held statically in a custom fixture through forces applied to the 4 wrist flexor/extensor tendon groups. Three-dimensional computer models of the radius, lunate, and capitate were generated from the computed tomographic images, and the kinematics of the capitate and lunate were calculated relative to the neutral position. For the intact wrist, the motion of the capitate was calculated relative to both the lunate (midcarpal motion) and the radius (overall wrist motion) and the motion of the lunate was calculated relative to the radius (radiocarpal motion). After PRC, only the movement of the capitate relative to the radius was calculated, which represents radiocapitate and overall wrist motion. All motions were plotted in 3 dimensions for purposes of qualitative visualization.

Results

After PRC, the capitate articulated with the lunate fossa of the radius for all positions in all samples. Overall wrist motion decreased 28%, 30%, 40%, and 12% in flexion, extension, radial deviation, and ulnar deviation, respectively. Motion at the radiocarpal joint after PRC, however, was greater compared with motion at the radiocarpal and midcarpal joints of the intact wrist during flexion and extension. This was not the case in radial deviation because of impingement of the trapezoid on the radial styloid. In radial and ulnar deviation, motion of the capitate head changed from predominantly rotational in the intact wrist (midcarpal joint) to a combination of rotation and translation after PRC (radiocarpal joint).

Conclusions

Removal of the proximal carpal row decreased normal wrist flexion and extension. Although ulnar deviation was preserved, radial deviation was limited by impingement of the trapezoid on the radial styloid. Radiocapitate range of motion after PRC was greater than capitolunate range of motion in the intact wrists. Compared with previously published requirements, wrist range of motion observed after PRC was sufficient for activities of daily living.

9. Elbow Capsulectomy for Posttraumatic Elbow Stiffness **JOHS** October 2006

Ring &. Jupiter

Purpose

To determine factors associated with diminished elbow function and upper-extremity–specific health status after elbow capsulectomy for posttraumatic stiffness.

Methods

Forty-six adult patients with posttraumatic elbow stiffness were evaluated an average of 48 months after open capsular excision. A second capsular excision was performed in 9 patients (29%). Stepwise multiple linear regression analysis was used to identify predictors of the American Shoulder and Elbow Surgeons Elbow Score, the Mayo Elbow Performance Index, and the Disabilities of the Arm, Shoulder, and Hand scores after all procedures.

Results

The average improvement in ulnohumeral motion after the index surgery for capsular release was 53°. (The average flexion was 98°.) The 9 patients who had subsequent repeat elbow contracture release gained an additional 24°, leading to a final average flexion arc for the entire cohort of 103°. Multiple linear regression identified the American Shoulder and Elbow Surgeons pain score, persistent ulnar nerve dysfunction, and duration of follow-up evaluation after the initial capsular release as independent predictors of a higher Disabilities of the Arm, Shoulder, and Hand questionnaire score; flexion arc and pain score as independent predictors of the Mayo Elbow Performance Index; and flexion arc, forearm arc, pain score, and persistent ulnar neuropathy as independent predictors of the American Shoulder and Elbow Surgeons score.

Conclusions

Open elbow capsulectomy for posttraumatic elbow stiffness restores a near-100° flexion arc on average. Second elbow releases provide limited additional motion in most patients. Final motion influences physician-based rating scales but not patient-specific health status (Disabilities of the Arm, Shoulder, and Hand questionnaire), which is dominated by pain and persistent ulnar neuropathy.

10. Ankle Instability and Impingement Volume 12, Issue 1 , March 2007, Pages 177-195

Ankle instability and ankle impingement are two of the more common complications of ankle injury. Ankle instability must be differentiated between mechanical instability, peroneal dysfunction, and reflex inhibition. Mechanical instability is the only form that may potentially benefit from surgery. Ankle impingement typically requires surgery. Success rates of surgery are high with accurate mechanical and anatomic diagnosis.

Ankle sprains are extremely common injuries and chronic disability is rare. Two common causes of chronic disability after ankle sprain are instability and impingement. Each may take several forms, and the typical contributing factors include failure to seek treatment, under treatment, recurrent injuries, and youth. Treatment of instability often responds to rehabilitation but may require surgery. Symptomatic, disabling impingement usually requires surgery.

Ankle instability

Anatomy and pathomechanics of ankle injury

Ankle stability depends on static/dynamic *stability*

Comparison of the major stabilizing ligaments of the ankle

Ligament	**Origin**	**Insertion**	**Tightest in**	**Stabilizes**
Anterior talofibular	Anterior margin of distal fibula	Lateral aspect of talar neck	Plantarflexion	Inversion in plantarflexion
Calcaneofibular	Medial aspect of tip of fibula	Lateral wall of calcaneus, posterior to longitudinal axis of fibula	Dorsiflexion	Inversion in dorsiflexion
Anterior inferior tibiofibular	Anterior margin of fibula at syndesmosis	Anterior distal tibia at syndesmosis	Dorsiflexion	External rotation of talus in dorsiflexion
Deltoid	Medial malleolus	Talus, calcaneus,	Different bands tighten in various positions of	Eversion in any position of

Ligament	Origin	Insertion	Tightest in	Stabilizes
		spring ligament, navicular	dorsiflexion/plantarflexion	dorsiflexion/plantarflexion

The ATFL courses obliquely from posterolateral to anteromedial with respect to the tibiotalar joint. It thus resists internal rotation of the talus and not just anterior translation.
The CFL courses posteriorly from its origin on the tip of the fibula to insert on the calcaneus posterior to the fibula. As a result, it is coplanar with the fibula in 10° to 20° of dorsiflexion—an important consideration when performing physical examination or reconstructing the CFL.
The medial and lateral talocalcaneal interosseous ligaments are capsular thickenings that contribute to eversion and inversion stability, respectively, of the subtalar joint. The role of the cervical ligament is less well defined but is largely believed to be a secondary inversion stabilizer of the subtalar joint . Its strain increases when the calcaneofibular ligament is insufficient.

The musculotendinous units that cross the ankle joint provide dynamic stability to the ankle and hindfoot. The most important of these are the peroneal tendons and the posterior tibialis tendon, which stabilize against inversion and eversion, respectively. Chronic lateral or medial instability can cause overuse injury, such as tendonitis or rupture, to the peroneal tendons or posterior tibialis tendon, respectively.

Pathophysiology

Chronic ankle instability and ankle impingement result from inadequate and inappropriate healing after ligamentous injury. Chronic ankle instability results when the injured ligaments do not regain the mechanical integrity necessary to stabilize the ankle against physiologic stress. Varus tibial plafond alignment, varus hindfoot alignment, or a posterior fibular position can predispose to chronic ankle instability and. Peroneal or posterior tibialis tendonitis can develop from overuse of the dynamic stabilizers that attempt to stabilize the unstable ankle. Another cause of ankle pain with instability is increased stress on the intact ligaments. This finding is especially common with medial instability

Anterior soft tissue ankle impingement can be attributable to hypertrophic fibrosis of the injured ligament impingement typically affects the ATFL, AITFL, or the anterior tibiotalar or tibionavicular bands of the deltoid ligament. Posterior soft tissue impingement can be caused by hypertrophic fibrosis of a previously injured posterior tibiotalar band of the deltoid ligament, transverse tibiofibular ligament

The osteophytes are likely attributable to progressive degenerative changes rather than capsular traction. Posterior bony impingement can be attributable to an unstable os trigonum, fracture, or nonunion of the trigonal (posterolateral) process of the talus, or repetitive compression of either the os trigonum or trigonal process of the talus

History

"My ankle gives out on me" is a common complaint of many people who have any number of ankle abnormalities after one or more sprains.

It is imperative to determine whether or not they have mechanical instability, reflex inhibition because of pain from any cause, or dynamic instability.

Mechanical and dynamic instability are better evaluated with physical examination, whereas reflex inhibition can be diagnosed largely by history.

Pain with giving-way typically occurs after the episode when there is mechanical instability, whereas pain before a giving-way episode implies reflex inhibition.

Giving-way attributable to mechanical instability is more frequent on uneven ground or in running sports when the involved leg is the outside leg while turning or running in a curved pattern.

Deceleration maneuvers in sports are also frequent causes. Descending stairs or a slope can cause giving-way because these activities require weight bearing on the forefoot with the ankle in plantarflexion.

Physical examination

1.Vascular and sensory examination

2.The standing alignment of the ankle and hindfoot.

3. ROM.

4. Limited active eversion suggests inadequate rehabilitation of the peroneal musculotendinous units.

5.Pain at extreme passive dorsiflexion/plantarflexion implies impingement.

Because the CFL does not contribute to stability in plantarflexion, anteromedial rotatory drawer should be done with the ankle plantarflexed to isolate the ATFL.

The CFL stabilizes the ankle and subtalar joint against inversion in the dorsiflexed ankle; therefore, stress examination of the CFL consists of inverting the hindfoot with the ankle dorsiflexed.

Subtalar instability may be appreciated by applying adduction force to the forefoot while maintaining inversion and internal rotation stress to the heel while the ankle is in 10° of dorsiflexion. Medial shift of the calcaneus and opening of the talocalcaneal joint compose a positive test.

Pain over the AITFL with external rotation of the dorsiflexed foot and ankle implies distal tibiofibular syndesmosis instability.

The squeeze test, wherein the fibula and tibia are squeezed together in the midleg, also reproduces pain at the distal tibiofibular syndesmosis when unstable. Unlike tests of the ATFL and CFL, no appreciable motion occurs with stability testing of the distal tibiofibular syndesmosis, and therefore pain indicates a positive test

Deltoid ligament instability can be difficult to assess because of its multiple bands and broad origin and insertions. It is unlikely that the ankle will open medially with eversion stress; instead, pain localized to the band of the deltoid being tested implies instability. The posterior bands of the deltoid (superficial posterior tibiotalar and deep posterior tibiotalar) are stressed by everting the dorsiflexed ankle, the middle band (tibiocalcaneal) by everting the neutral ankle, and the anterior bands (tibiospring, tibionavicular, and deep anterior tibiotalar) by anterolateral rotatory drawer of the plantarflexed ankle.

Ankle strength, especially the peroneals and the posterior tibialis, should be critically evaluated. Lateral ankle instability may be associated with peroneal tendonitis, rupture, or subluxation.

Diagnostic testing

X ray: AP, lateral, and oblique views. [a weight-bearing position is preferred]

MRI

Clinical findings are often sufficient for the diagnosis and treatment of anterior soft tissue impingement.

Fig. 7. MRI arthrogram of the ankle depicting anterior soft tissue impingement. The arrow points to an anterior soft tissue impingement lesion occupying the anterior recess of the ankle, which, when normal, should fill the way the posterior ankle has filled in this MRI.

Treatment

Ankle ligament reconstruction

The two basic forms of ankle ligament reconstruction are anatomic and nonanatomic procedures. The most common anatomic technique is the modified Brostrom procedure, which consists of reefing of the ATFL and CFL and then reinforcing the repair by proximally advancing the inferior extensor retinaculum. This procedure minimizes the loss of range of motion.

The most commonly reported nonanatomic techniques are the Chrisman-Snook reconstruction and the Evans reconstruction. Both techniques use the peroneus brevis tendon to reconstruct the lateral ankle ligaments. The advantage of these procedures is the use of healthy tissue, but range of motion and eversion strength are compromised. The results of nonanatomic reconstruction are not as good as anatomic reconstruction with regard to persistent and recurrent instability, limitation of motion, and altered gait kinematics.

Modified Brostrom procedure

A curvilinear incision is made along the anterior border of the distal fibula and extends distally and posteriorly along the tip of the fibula. Full-thickness tissue flaps are elevated anteriorly to expose the ATFL and inferiorly to expose the peroneal tendons and the calcaneal tuberosity. It is important to expose the calcaneus posterior to the fibula because the CFL attachment is relatively posterior on the calcaneus. The peroneal tendons must be retracted from their sheath to expose the underlying CFL.

The ATFL and CFL are inspected and if adequate tissue extends from the fibula, a capsulotomy is made along the same line as the skin incision so that the residual ATFL and CFL are transected. Occasionally, the most attenuated portion of either ligament is at the fibular attachment. When this is the case, the attenuated tissue is excised and periosteum is elevated from the underlying fibula to create flaps for later repair to the residual ATFL and CFL.

Redundant and unhealthy tissue is débrided. Nonabsorbable, braided 2-0 sutures are placed so that the transected ligaments and capsule are advanced and shortened, but are not tied until all have been placed. The ankle is dorsiflexed and everted while applying a posterior drawer and the sutures placed in the ATFL tightened and tied. The ankle is then gently plantarflexed and everted and the sutures placed in the CFL are tightened and tied. The remaining capsular sutures are then tightened and tied.

The inferior extensor retinaculum is then mobilized by blunt dissection, advanced proximally to the area of reconstruction, and repaired to the reconstruction with absorbable, braided 3-0 suture. The wound is closed in layers, and the ankle is immobilized in a posterior splint with the foot and ankle in eversion and resting flexion.

A removable walker boot is applied 2 weeks after surgery and used for 6 weeks for a total of 8 weeks of immobilization. The patient must be non–weight bearing for 4 weeks. Active, nonresistive ankle and hindfoot exercises are initiated by the patient 2 weeks after surgery and physical therapy is begun 6 to 8 weeks after surgery. The earliest athletic activity may resume is 3 months after surgery and depends on the patient's ability to maintain single-limb balance with the eyes closed for at least 30 seconds, perform 30 side-to-side hops on the involved leg, and hop up a single step on the involved leg.

Chrisman-Snook procedure

The skin incision begins 3 cm proximal to the tip of the fibula, continues parallel to the peroneal tendons, and extends to the base of the fifth metatarsal. The sheaths enclosing the peroneus brevis are all divided.
Fig. 8. Chrisman-Snook procedure wherein one half of the peroneus brevis is anchored to the lateral aspect of the talar neck, then passed through a tunnel in the distal fibula where it is anchored at the entrance and exit of the tunnel, and then passed to the lateral calcaneus where it is anchored approximately 1 cm posterior to the posterior aspect of the fibula.

Ankle impingement

Arthroscopic treatment of anterior ankle soft tissue impingement is highly successful and the results are reliably reproducible. Bony impingement can also be successfully treated arthroscopically because the osteophytes are intra-articular and not capsular . Excellent to good results are less frequent than after arthroscopic treatment of anterior soft tissue impingement, and the results are worse with higher grades of osteoarthritis and. Open treatment may be necessary depending on the size of the osteophytes and the surgeon's experience with arthroscopic technique.

Fig. 9. Arthroscopic view of an anterior soft tissue impingement lesion. The view is looking anterolateral from a medial portal. The talus occupies the left half of the picture, and the soft tissue lesion arising from the inferior margin of the AITFL occupies the right half of the picture.

Significant bony impingement is more amenable to open decompression. An anteromedial incision and arthrotomy is usually sufficient but an anterolateral incision may also be necessary. The tibial osteophytes are typically located laterally and the talar osteophytes are typically located medially.

Posterior ankle impingement

There is significant radiographic variability in patients who have posterior ankle impingement symptoms; therefore, the MRI findings are important to preoperative planning. Most posterior impingement pathology can be approached surgically from posterolateral.

The os trigonum is removed by subperiosteal dissection, whereas the lateral tubercle of the posterior process of the talus should be removed with a curved osteotome or rongeur so that the posterior surface of the talus is flush with the posterior surface of the tibia. Excision does not result in lateral subluxation of the FHL tendon because the tendon is contained within a sheath and the line of action of the FHL would cause it to sublux medially if insufficiently constrained.

11.**Combined Subtalar and Ankle Arthritis. Foot and Ankle Clinics of North America** 12: 57-73

Combined subtalar and ankle arthritis is a difficult entity to treat.
The goals of treatment are to eliminate pain and correct deformity while creating a limb that can be used to ambulate
There are many different ways to attain these goals

Cause

1.Talus fractures
2. A posttraumatic arthritis can follow severe pilon
3. Isolated arthritis of the ankle or subtalar joint treated with fusion can lead to degenerative changes of the contiguous joint
4. Failed total ankle arthroplasty with previous subtalar fusion is another permutation that can result in combined arthritis.
5. Neuropathy has long been a known cause of pantalar arthritis.
6. Rheumatoid arthritis, crystalline arthropathies, polio, and congenital deformities, such as talipes equinovarus
7.Posterior tibial tendon insufficiency
8. Chronic instability following ankle sprain

Biomechanics

The ankle and subtalar joints have vital roles in locomotion. The ankle joint should have 20° of dorsiflexion (DF) and 40° of plantar flexion (PF). Subtalar motion has been difficult to define, with a range of 20° to 60° reported and a 2:1 ratio of inversion to eversion
Mann [17] and Isman and Inman [15] found that subtalar eversion and tibial-talar internal rotation help dissipate the ground reaction force from an axial to a rotational vector at heel strike. In this way, each joint absorbs less stress.

Nonoperative treatment

1.Activity modification
2. Nonsteroidal anti-inflammatories (NSAIDs)
3.Patients who have rheumatoid arthritis or gout may be receiving systemic corticosteroids.
4. Corticosteroid injections are also an option for symptomatic relief. The duration of pain relief, however, is unpredictable and is unsubstantiated in the literature.
5.Orthotic intervention can help cushion and support the arthritic subtalar and ankle joint.
Early arthritis may get some relief with elastic inserts, sole posting, and rocker bottoms
More advanced flexible deformities may benefit from nonarticulated ankle-foot orthotics, Arizona braces, or Ritchie braces.
Fixed deformities need custom, well-padded orthoses that help prevent breakdown from bony prominences.

In addition, some patients find relief from patellar bearing orthoses.

Operative treatment

Who were refractory to nonoperative intervention.

The goal of treatment is threefold:

(1) correct deformity,

(2) correct instability,

(3) provide pain relief.

Options: tibiotalocalcaneal (TTC) arthrodesis,
total ankle arthroplasty (TAA) and subtalar fusion,
Syme amputation,
Below knee amputation (BKA).

Tibiotalocalcaneal arthrodesis

The key concepts for managing arthritis with fusion:

(1) consider patient's age, height, and desired activity level

(2) fuse the painful joints,

(3) fuse as few joints as possible,

(4) correct deformity and maintain normal biomechanical axis in three planes,

(5) provide rigid fixation for arthrodesis,

(6) use bone grafts and cast immobilization if indicated, and

(7) provide frequent postoperative follow-up, including rehabilitation, shoe wear selection, and restoration of the patient to the highest possible level of function.

Arthrodesis techniques

Current techniques to achieve fusion of the TTC are screws, external fixator, blade plate, or intramedullary nail.

Single or combined incisions have been described, including medial, anterior, transmalleolar, and transverse approaches

Papa and Myerson [3] described entering the heel going from posterior distal to anterior proximal passing through the subtalar joint and into the distal tibia. A second screw was placed parallel to the first with the hope that one of the two screws would capture the anterior cortex of the tibia (Fig. 3 and Fig. 4). Felix and Kitaoka [30]used a similar technique with screws placed in the opposite direction. A fibular onlay graft was often used with this technique [32]. In patients who had adequate soft tissue and bone stock, this technique worked well. Patients who had rheumatoid arthritis and diabetes, however, seemed to have problems with the fixation used in this technique. For this reason, many surgeons turned to external fixators for additional stability.

Acousta and colleagues [32] used a combination of external fixator and osseous staples to stabilize their arthrodeses (Fig. 5). They used a Calandruccio external fixation system. Russotti [5] arthrodesed 21 patients using external fixation along with a Steinman pin by way of a posterolateral approach. The joints were exposed posteriorly by splitting the Achilles tendon, the cartilage surfaces were denuded,

and a trough was cut from the tibia to the calcaneus. The alignment was held by way of a retrograde Steinmann pin though the calcaneus. The Calandruccio external fixator was applied and then the trough was filled with bone graft. The external fixator was removed 9 weeks postoperatively but the Steinmann pin was retained. Russotti [5] believed the Calandruccio external fixator system to be the most effective because its biplanar stability allowed compression to be applied while the height of the hind part of the foot could be maintained simultaneously.

Hanson and Cracchiolo [33], looking for greater stability than the conventional screw techniques, turned to blade plate fixation. Using a posterior approach, he osteotomized the distal insertion of the Achilles tendon, denuded the talocrural and subtalar joints, and excised the lateral malleolus to use as bone graft with posterior iliac crest bone graft. A 95° blade plate was seated into the posterior calcaneus and secured to the distal tibia in a compression mode (Fig. 6 and Fig. 7). He believed that the posterior approach avoided incisions from previous surgery. The blade plate was especially advantageous for larger patients in whom the standard screw fixation was not adequate. Although the blade plate technique offered more stability, the approach was maximally invasive. Researchers looked for another transfixion mode that could offer stability with a less extensive approach.

Russotti [5] started to use a larger intramedullary rod for fixation, precluded the use of an external fixator. Using a posteromedial approach instead of the trans-tendon approach, because it had fewer wound complications, the subtalar and ankle joints were exposed and denuded. An incision was made on the plantar surface of the heel and a guide wire was advanced in a retrograde fashion to the tibia. The bone was then reamed to 11.5 mm and a 12-mm intramedullary rod was inserted. The distal and plantar holes were locked with the rod flush to the plantar surface of the calcaneus [35].
Stephenson and colleagues [36] found that using the intersection of lines drawn from the second toe to the center of the heel in the sagittal plane and the junction of the anterior and middle thirds of the plantar heel pad in the coronal plane would give an entry point for the intramedullary rodding (IMR) that avoided damage to plantar neurovascular structures (Fig. 8 and Fig. 9).

Despite the multiple procedures described for ankle and subtalar arthrodesis, obtaining fusion is still difficult in these patient populations.
These patients usually have had multiple previous surgeries, skin problems, or talar viscosupplementation avascular necrosis (AVN).
Also, they frequently have comorbidities, such as diabetes, and are immunocompromised secondary to medication [40].
In this setting, adjunctive measures are often necessary to ensure union. Most procedures rely on autologous or allograft bone. In addition, many surgeons are using demineralized bone matrix on a routine basis. Donley and Ward [40] also described the use of an implantable bone stimulator for high-risk fusions. By using various bone grafts and stimulators, surgeons hope to avoid pseudoarthrosis and the need for additional revision surgery.

Postoperative management

Patients who had intramedullary fixation were placed in short leg casts and were non–weight-bearing from 6-12 weeks.

Results

Outcome from Russotti's [5] external fixator and Steinmann pin arthrodesis was 75% satisfaction and union in 18 of 21 patients.

Although challenges exist, fusion can be accomplished in difficult patient populations. Felix and Kitaoka [30] performed TTC fusion using screw fixation or external fixation on 12 patients who had rheumatoid arthritis (RA). All patients achieved union; however, some still reported pain.

Papa and colleagues [8] performed TTC, triple, ankle, and subtalar arthrodesis using either screws or external fixation on 29 patients who had diabetic neuropathy. Some 66% (19) of the patients went on to solid union at an average of 20 weeks. There were 20 complications in 19 of the 29 patients. Pseudoarthroses were found in 10 patients, but 7 functioned well with respect to the ability to stand and walk. The total clinical stability in that study was 89%.

Stability of the crossed lag screw technique versus intramedullary rodding was examined by Bennett and colleagues [43]. They tested four different arthrodesis constructs: three crossed 6.5-mm cancellous screws, two crossed cancellous screws, locked retrograde IMR, and locked retrograde IMR with supplemental anteromedial bone staple in synthetic bone. They found that micromotion stability was best in the three cancellous screw technique. Addition of the tibiotalar staple to the IMR conferred nearly the same stability as the three-screw technique.

Kile and colleagues [35] was one the first in the modern era to use a custom retrograde rod for arthrodesis of the TTC. In a study of 30 patients, 84% (26) were satisfied with the outcome Three patients were dissatisfied.

Gait

Some have expressed concern regarding the changes in gait and stress on contiguous joints attributable to TTC arthrodesis. Gellman and colleagues [14] simulated different arthrodeses in cadaveric feet and then measured the ensuing limitations of motion.

Pre-arthrodesis (normal) range of motion in the ankle and foot were as follows: 27° DF, 57° PF, 29° inversion, 22° eversion, 16° hindfoot varus, and 12° hindfoot valgus. Simulated TTC fusion resulted in complete elimination of hindfoot varus and valgus. Also, DF was reduced by 53%, PF by 71%, inversion by 50%, and eversion by 48%. Pantalar fusion resulted in continued reductions.

The remaining motion after TCC was largely a result of movement at Chopart's joint as evidenced by the continued reduction in movement after pantalar fusion.

Ankle fusion is known to increase energy expenditure by 10% [47]. It is known that extended fusions can cause difficulty walking on uneven ground.

Although there are no current biomechanical studies addressing gait after TTC, it is generally believed

to cause increased stress across contiguous joints with an increase in energy expenditure during ambulation.

Arthroplasty

TAA has regained popularity because of the problems associated with fusion for arthritis. Patients who have previous subtalar fusions are more prevalent secondary to increased longevity for systemic illnesses, such as RA and lupus, and decreased mortality in patients who have extremity trauma. Ankle arthroplasty is a possible solution to concurrent ankle and hindfoot arthritis or ankle arthritis with a previous subtalar fusion. TAA certainly seems to be a possible intervention for combined ankle and subtalar arthritis, but it must be used judiciously to avoid serious complications.

Complications

There was a 14-fold increase in the rate of nonunion in smokers compared with nonsmokers [50]. Additionally, medications, such as methotrexate or prednisone, are known to affect wound healing and bone healing [50].

Complications of TTC include nonunion, malunion, infection, and soft tissue problems
Other complications include contiguous joint degeneration, nerve injury, leg length discrepancy, symptomatic hardware, and dystrophic scars.
Complications of IMR include wound slough, infection, malunion, delayed union, nonunion, failure of hardware, plantar foot pain at the insertion site, neurapraxia because of entry site, and stress fractures at the proximal nail junction

Salvage of failed total ankle arthroplasty

Complications can also occur when TAA is used along with subtalar arthrodesis for treatment of combined ankle and subtalar arthritis. Complications associated with the TAA include infection, wound dehiscence, loosening, subsidence, tendon instability, and malleolar impingement [56]. Salvage can include revision and conversion to TTC arthrodesis. Kitaoka and Romness [56] revised 38 failed TAAs with TTC fusion. Eighty-nine percent union (33 of 38) was achieved. Eighty percent (24 of 38) of these patients had mild pain at an average of 8 years follow up. No patient required amputation.

Amputation

Syme or BKA is always a possible salvage for combined ankle and subtalar arthritis. It is a procedure that can allow the patient significant pain relief with a minimum of recovery time. The disadvantage to amputation is the increase in energy expenditure in a patient who may not be able to afford it. Mann states, “In the end, the surgeon must realize that in certain situations, an amputation may offer the patient an expeditious and elegant solution to an otherwise severe handicap.”

Summary

Combined ankle and subtalar arthritis is a difficult problem for which there are varied solutions. Each solution has its advantages and disadvantages. Treatment must be specifically tailored to the patient's

needs, comorbidities, and expectations. Because of the complicated nature of this condition and its treatment, complications are common and should be anticipated.

12.**Pedorthic and Orthotic Management of the Diabetic Foot** Volume 11, Issue 4 , December 2006, Pages 717-734

A successful diabetic foot care program focuses its efforts on prevention. Two very important aspects of the preventive approach are education and the use of proper footwear.

Unfortunately, it is not uncommon for a patient to seek foot care advice only after he or she has already developed a problem, such as a diabetic ulcer.

It can be quite challenging to convince a person who has never had a foot ulcer or has not experienced foot discomfort to restrict their footwear choices to only those shoes that are considered by their health care provider to be appropriate.
Total contact casting has achieved the status of a “gold standard treatment” for healing diabetic ulcers.
Purpose of this paper: intended primarily as long-term management for maintaining healed ulcers and fractures and for preventing future ulcers and fractures;

Pedorthics is the art and science concerned with the design, manufacture, fit, and modification of shoes and foot orthoses to alleviate foot problems caused by disease, overuse, or injury

The pedorthist is an invaluable resource for educating patients in shoe selection, including guidelines for proper fit, instructions for use, and appropriate materials and styles for an individual's feet. As a member of the diabetic foot care team, the pedorthist reinforces the information and instructions provided by the other team members.

The pedorthist also plays a part in the monitoring of a patient's progress and can be very helpful for follow-up between physician visits. He will also recommend follow-up with other team members as necessary.

An orthotist's role on the foot care team is much like that of a pedorthist's inasmuch as an orthotist is an excellent resource for patient education and for monitoring a patient's progress. Because the shoes and the selected bracing system must not only be compatible but complementary, the orthotist and the pedorthist work very closely with one another.

The roles of the pedorthist and the orthotist sometimes overlap, but more often each fills a void in the other's practice. While a pedorthist's scope of practice concentrates solely on the foot, an orthotist provides devices for the entire body.

Shoes
Improper footwear has been shown to be a common culprit for causing diabetic ulcers
• **To protect the foot**. An insensate foot
• **To relieve areas of excess pressure**. Repetition of high pressures during daily activities can lead to skin breakdown on the foot.

• **To reduce shock**. A reduction in the overall amount of vertical pressure, or shock, is especially important for a foot with bony prominences or abnormal bone structure, such as a Charcot foot.
• **To reduce shear**. Shear is the fore movement of the foot inside the shoe.
• **To accommodate deformities**. Deformities such as those resulting from Charcot arthropathy, plantar fat pad atrophy, and amputations need to be accommodated.
• **To stabilize and support deformities**. Many deformities need to be stabilized and supported to relive pain and prevent further destruction or progression of the deformity.

Shoe types

Nearly every diabetic footwear

1. In-depth shoes.[oxford-type shoe with an additional ¼ to ⅜ inches of depth].

The extra depth is also useful for accommodating deformities associated with the diabetic foot such as hammertoes or bony prominences resulting from Charcot arthropathy.

2.Shock-absorbing, lightweight soles and strong, supportive counters. The uppers of in-depth shoes are made from many different materials including cowhide and soft, supple deerskin.

There are also new synthetic upper materials that breathe and mold like leather.

3. Removable insoles, are available in multiple widths, and are more cosmetically acceptable than the traditional oxford-type shoe.

Custom shoes are fabricated by creating a positive model—a "last"—from a mold of the patient's foot. The shoe then is constructed on or molded around this last.

Shoe selection

1. For a patient that has no history of ulcerations, shows no signs of peripheral neuropathy, and has a structurally normal foot

a properly fitting off-the-shelf shoe made of accommodating materials may be all that is necessary

2. A patient with severe neuropathy needs a shoe made of a soft, moldable upper material and will probably require a shoe that will offer enough room for a custom foot orthosis.

3. If the patient has a very flexible flat foot, then a stiff supportive shoe is in order. A rigid, bony foot requires a soft accommodating shoe with a shock-absorbing sole.

4. The depth of the shoe is important not only in the toe area but across the instep as well. The shoe should not put pressure across the dorsum of the foot. Additionally, shoes with laces or hook-and-loop closure systems generally fit better than slip-on shoes. Persons with neuropathy should avoid slip-on shoes because they are, by design, too short and too tight.

Shoe fitting

Once a properly shaped shoe has been selected, the next step is determining the appropriate size. The

proper shoe size is the one that ultimately insures that the first metatarsophalangeal joint is seated comfortably in the widest part of the shoe. This is why arch length is such a valuable measure.

A properly fitted shoe will have ⅜ to ½ inch between the end of the longest toe and the front of the shoe. The shoe should also allow for a small amount of movement of the heel because the foot stretches and the calcaneous shifts during gait. Also, the upper material should not be stretched taut across the ball of the foot; there should be appreciable slack in the material.

Foot orthoses

Foot orthoses are also an important component in preventing foot ulcerations

1. Custom-made devices, made directly from a mold
2. They can be prefabricated, off-the-shelf devices.

Both can be made from a variety of materials differing in density, cushioning, shock absorption, support, and control.

A custom device is necessary for any patient who has any of the following: a significant degree of deformity, a loss of protective sensation, or a history of ulcers or Charcot arthropathy. A custom foot orthosis can achieve total contact with the plantar surface of the patient's foot

Obectives

- Provide shock absorption and shock attenuation
- Relieve areas of high plantar pressure by evenly redistributing
- Support, splint, and protect healed fractures sites
- Reduce shear through the use of the total contact concept

Accommodative foot orthoses

An accommodative orthosis typically is not one that will perform at a high level for a long period. Softer, less dense materials tend to wear out quickly, so this type of orthosis requires vigilant follow-up and needs to be repaired or replaced on a regular basis. This type of orthosis is good for someone who has very little or no deformity; is not a large, active person; and who needs only preventive padding in their shoes.

Plaster cast mold

CAD-CAM—The foot is scanned by a computerized system to create a virtual model of the patient's foot..

Accommodative foot orthoses are made of soft, moldable materials.

- Soft cross-linked polyethylene foams. These foams are heat-moldable
- Open-cell polyurethane foams. These materials are very good for reducing shear and absorbing shock.

  The drawback to polyurethane foams is that they are not heat moldable.
- Sponge rubber. Sponge rubber is available in varying densities and does not bottom out rapidly. Like the polyurethane foams, it is not heat moldable.

- Closed-cell expanded rubber. The negatives are that it cannot be heat molded and it may be allergenic.

In general terms, the moldable materials possess better pressure distribution properties than the nonmoldable materials, but they are not as durable and bottom out more rapidly[25]

Semirigid foot orthoses

They offer much greater longevity than the accommodative orthoses.
A semirigid orthoses for a patient with diabetes typically consists of a soft, cushioned protective top layer with a firmer, more supportive base material.

The rigid orthosis

supports the foot by using a thin layer of firm, inflexible material, and the semi-rigid device relies on a thicker layer of a semiflexible material that offers support as well as shock absorption and cushion.

A semirigid orthosis is also an invaluable tool for offloading plantar prominences like dropped metatarsal heads or bony prominences that are the result of Charcot arthropathy.

Semirigid orthoses typically are made of combinations of two, three, four or more different materials.

- Firm cross-linked polyethylene foams.
- Ethylene vinyl acetates. These materials are also heat moldable.
- Cork composites.

The soft polyethylene foams had better pressure-distribution characteristics when first applied, but that exposure to repeated pressures caused them to bottom out more rapidly than some of the more durable polymers.

Rigid foot orthoses

Rigid orthoses generally are contraindicated for persons with diabetes, especially if there is evidence of neuropathy or a history of ulcerations. They can be extremely difficult to fit.

Rigid orthoses often are made of thermoplastics, acrylics, or carbon fiber composites. They are not easily adjustable. Rigid orthoses are durable and offer excellent support and control.

Bracing options

The main functions of bracing in the diabetic foot are to correct deformity, reduce or eliminate motion, decrease stresses to the foot and ankle, and transfer forces [31].

The three main types of braces used in the care of the diabetic foot are:
1. Molded plastic ankle foot orthosis (AFO)

2. Metal hybrid attached to shoe
3. Charcot restraint orthotic walker (CROW)

A molded AFO is particularly useful because it fits inside a shoe. It will have its own molded footbed, so there is no need for an additional foot orthoses. The molded AFO is a valuable tool for protecting a Charcot foot after the arthropathic process has subsided [34]. The molded AFO often is the most cosmetically acceptable bracing option.
A metal hybrid has the advantage of variable joints at the ankle, thereby allowing for free motion to a certain set degree while limiting harmful motion. This joint setting, when used with a strong, wide stirrup and an extended steel shank and rocker sole in the shoe can reduce the bending forces seen at the midfoot. The metal brace stirrup is attached to the sole of the shoe, with medial and lateral metal uprights extending to either a leather or molded plastic calf lacer.

The CROW is a molded plastic bivalve brace with a walking sole attached. The CROW is made of molded thermoplastic and lined with a thick, soft layer of polyethylene foam. At a point in the healing process it can replace the total contact cast used to heal ulcers and fractures [35]. It typically is not a long-term bracing option. Ideally, the patient will wean out of the CROW and into an appropriate shoe with a molded plastic inside or a metal brace attached externally.

Rocker soles
One of the most commonly prescribed shoe modifications is the rocker sole. As its name suggests, the primary function of a rocker sole is to rock the foot from heel strike to toe-off without requiring the shoe or foot to bend.
There are six types of rocker soles; the actual shape and type of rocker depends the desired effect and the individual patient's foot problem. In general terms, the biomechanical effects of rocker soles are restoring lost motion in the foot and ankle caused by pain, deformity, stiffness, or surgical fusion, resulting in an overall improvement in gait and offloading plantar pressure on some part of the foot.
All six types of rocker soles can offload the forefoot, which is beneficial and can help prevent ulcers as diabetics with neuropathy experience increased pressure under the forefoot. In fact, the rocker is considered the most effective way to offload the forefoot..

There are two terms that need explanation to discuss rocker soles: (1) the *midstance*, or the section of the rocker sole that is in contact with the ground when standing erect and (2) the *apex*, or high point, of the rocker sole located at the distal end of the midstance [29]. These terms are illustrated in Fig. 4. Proper placement of the apex is critical to the success of the modification. The apex should be placed just proximal to any area for which pressure relief is desired. For example, if the desire were to offload the ball of the foot, the apex would be placed directly behind the metatarsal heads.

• Mild rocker sole—This is the most widely used rocker sole. Using a mild rock at the heel and at the toe, it can relieve mild metatarsal pressure and can assist in gait by increasing forward propulsion. The other types of rocker soles essentially are variations on this basic rocker

• Heel-to-toe rocker sole—This type of sole is shaped with a more accentuated rocker angle at both the heel and toe. It is intended to dramatically increase propulsion at toe-off, decrease pressure on heel strike, and reduce the need for ankle motion. This modification may be indicated for patients that have had an ankle or subtalar joint fusion, fixed claw or hammertoe deformities, midfoot amputation, or calcaneal ulcers

• Toe-only rocker sole—The toe-only rocker has no heel rock, only a rocker angle at the front with the midstance extending all the way to the back of the heel. This rocker is designed to increase weight bearing proximal to the metatarsal heads, provide a stable midstance, and reduce the need for toe dorsiflexion. It is useful for addressing forefoot issues in a patient who experiences difficulties with stability or proprioception.

• Severe angle rocker sole—As the name suggests, this rocker sole has a much more severe angle at the toe than the toe-only rocker sole. It has no heel rocker angle. This rocker sole significantly reduces weight-bearing pressures distal to the ball of the foot.
• Negative heel rocker sole—The negative heel rocker is shaped with a rocker angle at the toe, with the heel height actually lower than the height of the sole under the ball of the foot. This modification is contraindicated for persons with balance or proprioception deficiencies or the inability to attain the necessary ankle dorsiflexion because of arthritis, fusion, or tendoachilles contracture (Fig. 5E).

• Double rocker sole—consists of two shorter rocker soles with two short midstances. It is used to treat midfoot pathology.

Relast

Many off-the-shelf shoes can be relasted to accommodate severe deformities [39]. As discussed previously, custom shoes can be very expensive, and patients often are not receptive to the idea of wearing them. Relasting is a viable alternative to custom shoes for many patients.

This process involves customizing an off-the-shelf shoe by widening it through the midfoot or forefoot, to fit a foot that would otherwise not be able to use an off-the-shelf shoe. This is achieved by removing the outsole and making a cut through the sole, midsole, and innersole and widening the shoe according to a pattern of the foot. A new outsole is applied, and to the casual observer the shoe looks “normal.”

Relasting a shoe may be indicated for a severe rigid pes planus deformity or a midfoot that has widened owing to Charcot arthropathy.

13.**Osteomyelitis in the Diabetic Foot:** Diagnosis and Management Foot and ankle clinics of north America. December 2006, Pages 775-789

Foot infections are **the most common** reason for admission for patients with diabetes in the US
It is responsible for **60% of lower extremity amputations** in these patients
The direct cost of healing an infection that required amputation exceeded $30,000 in one study.
Optimal care of the diabetic foot requires a multidisciplinary approach
Often, the orthopedic surgeon is consulted to evaluate and manage the diabetic foot infection when osteomyelitis is found or suspected. Underlying bone infection is present in as many as 60% of infected diabetic ulcers
The evaluation and treatment of this common foot disorder is both difficult and controversial.

Pathophysiology

1. Follows a loss in skin integrity of the lower extremity [ulceration].
2. Ulcers are believed to have a multifactorial etiology. [neuropathy, insulin use, foot deformity, reduced skin oxygenation, higher body weight, poor arterial perfusion, and poor vision]
3. The triad of neuropathy, minor foot trauma, and foot deformity exists in two thirds of patients with lower extremity ulcers.3
4.Compared with a nondiabetic cohort, diabetic patients are at an 80% increased risk for cellulitis, a fourfold increased risk of osteomyelitis, and a twofold risk of both sepsis and death caused by infection
5. Staphylococcal species adhere to bone matrix via high-affinity receptors for bone matrix proteins such as fibronectin: evade host defenses and antibiotics by hiding intracellularly, slowing their metabolic rate, or forming glycocalix biofilms.
6.**I**t is frequently polymicrobial. Ge et al. [15] surveyed the microbiologic profiles of infected diabetic foot ulcers (825 patients) and found that 75% of wounds had multiple organisms, with an average of 2.4 organisms per wound. [*S aureus* and *E faecalis,* dominated (68%), but gram-negative aerobes (24%, *Ps aeruginosa* most common), anaerobes (6%), and fungal species (3%) were also present

7. Cultures obtained from soft-tissue specimens do not reflect accurately the pathogens involved in underlying osteomyelitis. Lavery and Sariaya [16]found that only 36% of soft-tissue cultures were completely accurate in identifying bone pathogens, even when samples were obtained during the same surgical procedure. As a result, the investigators recommend that physicians obtain both soft-tissue and bone specimens when cultures are used to guide therapy.

8. MRSA, are becoming increasingly prevalent in a variety of infections, and diabetic foot infection is no exception

Diagnosis

1.Clinical evaluation: Ulcer assessment [vascular or neuropathic]
The site, size, and depth of ulceration should be documented.

Probing for underlying bone or joint involvement, abscesses, sinus tracts

The classification system developed by Wagner

Grade I	A superficial ulcer without infection.
Grade II	A deep ulcer exposing tendon or joint
Grade III	Exposed bone, abscess formation, or osteomyelitis;
Grde IV	III + the extent of loss of vascularity of the foot

The infected part becomes red, tender, diffusely swollen, and warm. Fluctuance, purulent material, or a foul odor may be present. Granulation tissue appears less viable, and healing slows or halts. In the presence of ischemia, inflammatory changes often are reduced, but there is usually some evidence of inflammation or necrosis.

Although soft-tissue infections often are clinically obvious, the diagnosis of osteomyelitis in conjunction with diabetic foot ulcers can be very difficult. Systemic signs, such as fever, chills, leukocytosis, and malaise are unusual or late findings in foot infections, including those with osteomyelitis. These systemic signs should alert the physician to the possibility of a more serious or life-threatening infection

Two clinical findings have been shown to help predict the presence of osteomyelitis. Newman et al. [4] found that the larger and deeper the skin ulceration, the more likely underlying osteomyelitis exists. An ulcer area greater than 2 cm^2 had a sensitivity of 56% and specificity of 92% for diagnosing osteomyelitis in their patient population.

When bone could be palpated with the tip of a sterile probe inserted into the wound, osteomyelitis was likely. This so-called “probe to bone” test was relatively specific (85%) and had a positive predictive value of 89% [5]. These results, as well as the simplicity of the test, make this procedure very useful in clinical practice, and it has been adopted widely.

Laboratory studies

Leukocytosis is infrequent, occurring in fewer than 50% of those affected

ESR or C-reactive protein is sensitive for bone infection, but the specificity of such a finding is questionable

Imaging studies

plain radiographs: periosteal reaction followed by focal erosion of cortical or medullary bone. Unfortunately, these changes are generally not evident on plain films until 40% to 70% of the bone has been resorbed

When plain films are negative, radionuclide bone scanning :Technetium-99 methylene diphosphonate : the specificity of this test is poor, averaging less than 50%

Combination bone and leukocyte scans are also useful for differentiating osteomyelitis from neuropathic osteoarthropathy.

Magnetic resonance imaging (MRI) is the most widely used:

Sensitivity of MRI is very high, generally reported to be between 90% and 100%, whereas specificity ranges between 80% and 100% in most studies

MRI diagnosis of osteomyelitis is based on altered bone marrow signal. Marrow infection results in loss of fat and its normally bright signal on T_1-weighted images, as well as edema, which increases signal intensity on T_2-weighted or STIR images

. Unfortunately, although these changes are highly sensitive for osteomyelitis, a number of pathologic conditions such as fracture, tumor, inflammatory arthritis, neuropathic osteoarthropathy, or recent postoperative changes can result in similar bone marrow signal changes. To increase the specificity, MRI results then must be correlated with the overall clinical picture. When these classic changes occur in the absence of a fracture line or discrete lesion but in the vicinity of ulceration, sinus tract, or soft-tissue infection, the specificity for bone infection is increased .

Although expensive, MRI offers excellent anatomic detail and spatial resolution compared with other imaging modalities.

Biopsy and bone culture

Bone biopsy and culture often are used as the gold standard for identification of diabetic osteomyelitis. Percutaneous samples can be harvested under fluoroscopic or computed tomography guidance using a core biopsy needle through uninvolved skin. This technique is considered safe and to have a high diagnostic accuracy. The use of lidocaine to obtain specimens does not seem to interfere with results. The second method for obtaining material for biopsy is surgical excision. Whenever bone is resected from the diabetic foot, it should undergo both histologic examination along with Gram stain and culture. Histologic evidence of osteomyelitis consists of acute or chronic inflammatory cells along with bone fragmentation and necrosis.

Bone cultures often do not correlate with soft-tissue samples, and bone biopsy has been shown to be more useful for guiding antibiotic therapy versus soft-tissue culture alone. In spite of this advantage, the frequent clinical use of bone biopsy outside of the operating room is controversial. The procedure is expensive and invasive, and results may not be available for several days. In addition, small bones of the foot can yield poor core needle specimens and previous suppressive antibiotic therapy, and patchy bone involvement can lead to false-negative results. As a result, biopsy often is reserved for difficult cases or cases in which the causative organism and susceptibility are believed to be necessary to guide treatment.

Osteomyelitis versus neuropathic osteoarthropathy

Differentiation between osteomyelitis and neuro-osteoarthropathy (Charcot arthropathy) is a common diagnostic dilemma. Although difficult, distinguishing the two disorders is important because they are

treated very differently. Clinically, both osteomyelitis and Charcot arthropathy can present with swelling, warmth, and edema of the affected area.
The dependent erythema of neuro-osteoarthropathy is said to improve with elevation, whereas that of cellulitis will not. The presence or absence of skin breakdown is most helpful clinically in distinguishing these two conditions. Osteomyelitis is almost always preceded by a neuropathic skin ulcer and is most common in the forefoot. Neuropathic osteoarthropathy, however, is found much more commonly in the midfoot. Skin breakdown is rare and occurs typically as a complication of the later stages of the disease when deformity is present.

The plain film appearance of these two disorders has considerable overlap, and films may show negative results initially in both situations. Fragmentation, polyostotic involvement, and joint subluxation occur more commonly in Charcot disease, whereas osteomyelitis results in progressive destruction and periosteal reaction.

Differentiation of these conditions by MRI is better than with plain films but remains problematic. Osteomyelitis is more likely when changes are focal, centered within bone itself, and associated with adjacent ulcer, cellulitis, abscess, or sinus tract. Neuropathic osteoarthropathy is more likely with multiple foci or when changes are limited to joints, subchondral bone, and juxta-articular soft tissues. In difficult cases, bone biopsy and culture or combined indium-labeled leukocyte/technetium bone scans may be necessary to arrive at a diagnosis.

Multidisciplinary management

Diabetes mellitus is a multisystem disease, and its treatment requires a multidisciplinary team approach
1.Control of hyperglycemia is well known to be more difficult in the setting of an acute infection
2.Nephropathy, poor nutrition, and smoking can decrease immune function and delay wound healing and should be managed aggressively
3.Basic diabetic foot care should be arranged including screening, patient education, footwear, and ongoing skin and nail care.
4.Foot assessment: Vascular and neurological.
5.Surgical resection
6.Intravenous antibiotics.

Recently, however, there has been growing interest in the treatment of diabetic osteomyelitis using antibiotics, either alone or in combination with limited local debridement. Parenteral therapy for at least 6 weeks traditionally is recommended for diabetic osteomyelitis, although no good evidence exists to guide the duration of therapy or the timing of switching to an oral agent. Oral agents with good bioavailability such fluoroquinolones may be as effective as parenteral therapy . If all infected bone is excised, treatment as a soft-tissue infection for 1 to 2 weeks may be acceptable.

Most infected ulcers should undergo sharp local debridement through their entire thickness, whether in an outpatient setting, at the bedside, or in the operating room. All devitalized tissue and debris should

be removed, and pus should be drained. Undermined skin edges can create environments suitable for bacterial proliferation and should also be excised, allowing better assessment of underlying infection. Whenever possible, round wounds should be converted to more elliptical ones, which heal morereadily.

Surgical treatment

In the setting of deep infection in the diabetic foot, the temptation often exists to remove the problem by performing a “definitive” amputation. This approach certainly is indicated in some circumstances. Abscesses of the foot must be drained. For this purpose, longitudinal incisions allow easier extension, and plantar incisions should be avoided, if possible.

Necrotizing fasciitis is a rapidly spreading, destructive, polymicrobial soft-tissue infection that has been associated with diabetes mellitus. Affected patients typically exhibit intense pain that is out of proportion to examination findings, high fever, tachycardia, leukocytosis, and skin blistering.

A more limb-conserving amputation is almost always desirable. The amputation level is related directly to efficiency of ambulation. Energy is at a premium in the diabetic population because of frequency of heart disease and other comorbidities.

14. **Current Concepts: Treatment of Osteochondral Ankle Defects Foot and Ankle Clinics of North America** Volume 11, Issue 2 , June 2006, Pages 331-359

Osteochondral ankle defects cause :pain, swelling, and limited range of motion.
When surgical treatment is necessary, several treatment options exist. Arthroscopic debridement and drilling, arthroscopic autologous osteochondral transplantation (mosaiclasty), and autologous chondrocyte transplantation are discussed more extensively.

Definition: An osteochondral lesion of the talus (OLT) is a lesion involving talar articular cartilage and subchondral bone mostly caused by a traumatic event, leading to partial or complete detachment of the osteochondral fragment, with or without osteonecrosis.

Epidemiology:
Ankle account for approximately 4% of the total number of osteochondral defects
Age: 20- to 30-year-old men
Defects can be found on the medial and lateral sides of the talar dome
Incidence with lateral ankle sprain: 5%

Pathogenesis
König suggested that these loose bodies were the result of spontaneous osteonecrosis secondary to vascular occlusion of the subchondral bone. This has never been proved.
Canale and Belding [9] further emphasized trauma as a causative factor. 45% of basketball injuries, 25% of volleyball injuries, and 31% of football]
Lateral lesions cause more symptoms than medial ones. When the lesion is large and the affected piece is dissected, the joint mechanics are altered, which may lead to osteoarthritis.

Berndt and Harty
Stage I: a small compression fracture
Stage II: incomplete avulsion of a fragment
Stage III: complete avulsion of a fragment without displacement
Stage IV: displaced fragment

Mechanism of injury
Lateral defects by strongly inverting a dorsiflexed ankle. As the foot was inverted on the leg, the lateral border of the talar dome was compressed against the face of the fibula. Lateral osteochondral lesions are usually located in the anterior third of the talar dome, and medial lesions are mostly located in the posterior half.

An individual may have multiple lesions. The lateral lesions are typically shallow and wafer-shaped, indicating a shear mechanism of injury. In contrast, medial lesions are generally deep and cup-shaped, indicating a mechanism of torsional impaction. Medial lesions are usually asymmetric, whereas lateral

lesions are symmetric. Because of their shape, lateral lesions are more often displaced than medial lesions.

Clinical presentation

In the acute situation, symptoms of osteochondral ankle defects compare with those of acute ankle injuries. If symptoms do not resolve after 3 to 6 weeks, an (osteo)chondral defect of the talus should be suspected. These patients typically present with persisting symptoms and a limited range of motion.

Locking and catching are symptoms of a displaced fragment. In most patients who have a nondisplaced lesion after supination trauma, the symptoms in the acute situation cannot be distinguished from the soft tissue damage.

Chronic lesions classically present as deep lateral or medial ankle pain associated with weight bearing. Reactive swelling and stiffness can be present, but absence of swelling, locking, or catching does not rule out an osteochondral defect. Recognizable pain on palpation is typically not present in these patients. Some patients have diminished range of motion.

Diagnosis

1. Clinical assessment
2. X rays By repeating the imaging studies in a later stage, the abnormality sometimes becomes apparent.

A heel rise view with the ankle in a plantar-flexed position may reveal a posteromedial or posterolateral defect

A bone scan can differentiate between a symptomatic lesion and an asymptomatic lesion.

MRI is often used for detection of these lesions.

CT is useful for better defining the exact size and location of the lesion and, therefore, more valuable for preoperative planning. In diagnosing an osteochondral defect, CT has proved to be equally as valuable as MRI.

Operative treatment options

1. Debridement and bone marrow stimulation, potentially in combination with loose body removal (microfracture, abrasion arthroplasty, or drilling)
2. Securing a lesion to the talar dome (retrograde drilling, bone grafting, or internal fixation)
3. Stimulating the development of hyaline cartilage (osteochondral autografts [mosaicplasty], allografts, or autologous chondrocyte implantation [ACI])

The type of surgical treatment also influences the exposure. Most lesions can be treated by means of arthroscopy. Many posteromedial lesions do not have to be treated by malleolar osteotomy

Curettage and drilling or microfracturing

After debridement, multiple connections with the subchondral bone are created. They can be accomplished by drilling or microfracturing. The objective is to partially destroy the calcified zone that is most often present and to create multiple openings into the subchondral bone.

Operative technique

The standard anteromedial and anterolateral approaches

A 4.0-mm scoop and a 4.5- or 5.5-mm shaver are introduced.

When the osteochondral defect is located anteromedially, the 4.0-mm arthroscope is moved over to the anterolateral portal and the instruments are introduced through the anteromedial portal.

For an anterolateral defect, the arthroscope remains in the anteromedial portal and the instruments are introduced through the anterolateral portal.

Good or excellent results were found in 86% in the primary group and in 75% in the revision group.

Discussion

1. : The choice of treatment: depends on symptomatology, duration of complaints, size of the defect, and whether it concerns a primary or secondary OLT.

2.None of the current grading systems is sufficient to direct the choice of treatment

3. In recent reviews of the literature, the best current available treatment for primary osteochondral ankle defects is excison, debridement, and drilling

4. osteochondral transplantation and autologous chondrocyte implantation play a minor role because results of these techniques are not yet widely published.

5. Fixation with 1 or 2 lag screws is preferred in (semi)acute lesions in which the fragment is 15 mm or larger. In adolescents, refixation of an osteochondral defect should always be considered, even in fragments that are smaller than 15 mm.

6. In cases of failed primary treatment, an osteochondral transplant or cultured chondrocyte transplant can be considered.

15. Soft Tissue Complications Following Calcaneal Fractures Foot and Ankle Clinics of North America Volume 12, Issue 1 , March 2007, Pages 107-123

Open treatment of calcaneal fractures has increased in popularity over the past 10 to 15 years among orthopaedic surgeons but remains controversial secondary to the associated complications. In the literature, the most common soft tissue complications following calcaneal fractures include wound necrosis, compartment syndromes of the foot leading to late deformity, chronic pain from neurovascular injury, and various tendon problems.

Soft tissue complications, such as compartment syndrome, fracture blisters, full thickness skin necrosis, and peroneal tendon pathology, can be seen in patients treated nonoperatively

The complication of compartment syndrome of the foot seen in association with calcaneal fractures. In intra-articular calcaneal fractures that 13% had compartment pressures greater than 30 mm Hg.

Peroneal tendon tears, impingement, and subluxation have all been reported. Nerve complications, including tarsal tunnel and sural neuromas, have also been seen as sequelae of calcaneal fractures. Even less common, flexor hallucis longus impingement associated with a sustentacular fracture may be seen. Claw toe deformities are occasionally associated with calcaneal fractures, possibly secondary to a missed compartment syndrome of the foot.

Patient assessment

Diabetes mellitus are at increased risk. A fasting blood glucose and hemoglobin A1c are simple blood tests to obtain

Lack of distal pulses warrants further studies, such as arterial Doppler examination

Smoking. Smoking is a relative contraindication to surgical intervention and should be taken into account with all other factors.

Careful assessment of the soft tissue envelope is critical in the avoidance of postoperative wounds and infections.

The initial surgery should take place only after soft tissue swelling has subsided.

The surgical exposure should avoid fracture blisters, especially those filled with blood. When the wrinkle test is positive (the skin wrinkles around lateral foot with ankle dorsiflexion indicating adequate reduction in swelling), surgical intervention can be performed safely

Wound necrosis

The most commonly used approach for operative fixation of calcaneal fractures is the extensile lateral approach popularized by Benirschke and Sangeorzan. In studies reporting wound necrosis complications, the incidence ranges between 2% and 27% . The extensile lateral approach was advocated to lessen the number of postoperative wound complications . Extensile exposure allows for some relaxation of the lateral flap with less chance of postoperative breakdown. Use of 0.62-mm Kirschner wires, one placed longitudinally in the fibula and the other placed into the talar neck, may be helpful in providing gentle retraction of the soft tissues. The wires are then bent back providing an excellent retractor of the lateral skin flap.

Vacuum-assisted wound closure (VAC) in the treatment of calcaneal wound necrosis has vastly improved the orthopaedic surgeon's ability to manage this complication. Debridement remains the critical treatment

Hyperbaric oxygen (HBO) is currently being used in the treatment of chronic, nonhealing wounds. This typically is not advocated as the sole treatment but rather as an adjunct to other modalities, including local wound care and debridement.

A pedicled flap.

Compartment syndrome of the foot

Approximately 10% of calcaneal fractures
Myerson: concluded that the use of intermittent compression foot pumps decreases elevated compartment pressures associated with calcaneal fractures
The need for acute fasciotomies.

Early treatment of the claw toe deformities may include a simple toe flexor tenotomy to prevent further deformity. Late treatment is best provided with proximal interphalangeal joint resection and pinning or flexor to extensor transfer if the deformity is flexible.

Patient later presented with subfibular impingement of the peroneal tendons and subtalar joint arthritis (*A*). Lateral calcaneal wall decompression and subtalar fusion performed as delayed reconstruction (*B*).

Treatment of peroneal tendon tears involves either tubularization (if <50% of the tendon is involved) or tenodesis to the neighboring tendon (if >50% of the tendon is involved). Often lateral calcaneal wall decompression is necessary at the time of peroneal tendon repair as determined by the CT scan. This decompression is accomplished with a wide osteotome and mallet.
If peroneal tendon dislocation is noted, a fibular groove-deepening procedure with reefing of the superior extensor retinaculum may be indicated. Other procedures, such as those discussed by Chrisman and Snook .
FHL tendon scarring, tears, and impingement can also be seen over the medial hindfoot, especially in cases that involve a sustentacular tali fracture. CT scan should rule out a non-union. This rare late sequelae is best treated by exostectomy and tenosynovectomy or repair of the FHL as needed.

Summary

Soft tissue complications following calcaneal fractures can be frustrating to the patient and present reconstructive challenges for the surgeon.s A working knowledge of these complications and their management is necessary for the surgeon treating calcaneal fractures.

16. Acute and Chronic Syndesmosis Injuries: Pathomechanisms, Diagnosis and Management Volume 11, Issue 3 , September 2006, Pages 639-657

Incidence **10%**. High ankle sprain

Frequently are mis- or undiagnosed causing arthritis

Late calcifications of the distal TF syndesmosis **32%** of professional football players,

Anatomy and biomechanics

1. 4 major ligamentous structures.

AITFL originates from the Tillaux-Chaput tubercle on the tibia

The interosseous ligament (IOL) lies 0.5 to 2 cm above the joint line.

The interosseous membrane (IOM)

PITFL divided into a superficial (SPITFL) and deep portion[the transverse tibiofibular ligament (TTFL), lies anterior and inferior to the SPITFL] It forms labrum.

2.The superior part of the talus is wider anteriorly than posteriorly.

3. The talus **rotates externally an average of 5°** during both active and passive dorsiflexion.

4. The fibula moves : **2.4 mm distally** during the stance phase of gait.

5. A 1-mm lateral shift of the talus was enough to cause a **42% decrease of contact area**

6. **Sectioning studies** showed that the AITFL provided 35%, the TTFL 33%, the IOL 22%, and the SPITFL 9% of the overall stability of the ankle

Mechanism of injury

External rotation and hyperdorsiflexion.

Clinical evaluation

1. Mechanism of injury
2. Swelling and bruising
3. Local tenderness
4.The "squeeze test"
5. A far more reliable test is the external rotation test of the foot
6. X ray

Calcification within the syndesmosis

They concluded that the width of the tibiofibular clear space on both AP and mortise views appeared to be the most reliable variable for detecting early syndesmotic widening

Stress radiography

Bone Scintigraphy

Computed tomography and magnetic resonance imaging

Fixation techniques

Screw placement 2.0 cm above the tibiotalar joint line when comparing with screw placement 3.5 cm proximal to the ankle joint line

1. Through syndesmosis or just above syndesmosis. No difference.[Kukreti]
2. Cadaveric study: [Beumer]
   1No difference SS Vs Ti
   2 3 or 4 cortices.
   3. Diameter no difference

They also concluded that the syndesmotic screw could not prevent excessive syndesmotic widening when loaded with a load comparable with body weight, **and therefore, patients with a syndesmotic screw in situ should not bear weight.**

A recent prospective randomized study showed that fixation with two 3.5-mm tricortical screws provided better stability than fixation of the syndesmosis with one 4.5-mm quadricortical screw. However, screw removal seems to be easier with quadricortical fixation.

Taylor and coworkers [47] managed 44 football players conservatively: 23% of **patients had chronic ankle pain, 36% ankle stiffness, and 18% had persistent swelling** after an average follow up of 47 months. Patients with a longer recovery time showed ossification of the IOM. In regard to ankle function, the entire study population showed good to excellent results in 86%.

Author's preferred management

A longitudinal incision is made anteriorly over the distal joint space.

All branches of the superficial peroneal nerve

The tibiofibular space is directly visuatlise.

If adequate reduction of the talus is not possible, then a deltoid ligament tear must be considered.

Recommend using quadricortical 3.5-mm syndesmotic screws inserted parallel to the ankle joint line from the posterolateral aspect of the fibula and directed at a 30° anterior angle into the tibia. The comparison with the normal side can help in determining anatomic reduction.

Screw removal

Early screw removal is associated with failure of syndesmotic fixation

Removal should be performed at the earliest 3 months

Chronic syndesmosis injuries

1. Chronic, persistent ankle pain
2. A sensation of giving way
3. Difficulty with walking on uneven group.

4. Limited dorsiflexion, and persistent tenderness and swelling in the syndesmosis.

5. Diagnostic imaging or arthroscopy.

6. Axial CT imaging

Management

No studies have reported the outcome after isolated syndesmotic arthrodesis.

Pena and Coetzee [66] **recommend arthrodesis after 6 months,** and only if significant incongruency in seen on CT scan.

If the injury **is less than 6 month old,** he recommends debridement of the syndesmosis and repeat screw fixation.

Author's preferred management

A chronic syndesmosis injury is defined as persistent syndesmotic widening 3 months after injury.

I. The approach to reconstruction follows a systematic approach from a medial to lateral direction. First, the medial gutter is debrided either arthroscopically or via a medial miniarthrotomy.

The anterolateral distal syndesmotic space can be visualized arthroscopically, but, given the amount and density of the scar tissue, open debridement is preferred.

2.To approach the syndesmosis, an incision is made from the distal anterior aspect of the fibula extending 6 cm proximally along the anterior border. The superficial peroneal nerve is carefully retracted anteriorly at all times.

3.The distal syndesmosis is aggressively debrided to remove all scar and soft tissue. The syndesmosis is subsequently sprung open with a lamina spreader. The lateral border of the tibia and the medial border of the fibula are decorticated with an AO chisel to promote bleeding cancellous bony surfaces. The interval is then copiously packed with crushed cancellous allograft and demineralized bone matrix. The syndesmosis is then clamped with ankle in maximal dorsiflexion. Finally, an anatomically contoured three- or four-hole 1.3 tubular plate is applied laterally to the fibula and fixed with two or three fully threaded 3.5-mm syndesmotic screws engaging four cortices (Fig. 5A–D). The postoperative protocol involves at least 6 to 8 weeks of nonweight bearing, depending on the time to fusion. Range of motion exercises are begun in 4 to 6 weeks.

17. The Valgus Ankle Foot and Ankle Clinics of North America Volume 12, Issue 1 , March 2007, Pages 15-27

Nonoperative

1. In all stages of PTTD

Use of orthotics are the mainstays of conservative therapy.

In a fixed deformity, the orthosis must be accommodative

1. Calcaneal osteotomy +/- FH/FDL transfer. Ideal

2. Tibiotalocalcaneal arthrodesis

The talonavicular and calcaneocuboid joints are spared.

The ankle should be maintained at neutral to 10° of Dorsiflexion
The subtalar joint should be fused at 5° of valgus

Retrograde intramedullary nailing: (87%) reported a satisfactory result.
Function at a higher level than the pantalar group

3. Pantalar arthrodesis

In degenerative changes involving these joints.
This procedure is technically difficult, but provides an alternative to amputation

.4.**Distal malleolar osteotomy**

. Indications for supramalleolar osteotomy for reconstruction of the adult hindfoot include:

5.Total ankle arthroplasty

Indication: not clear
The ideal patient is older, usually older than 60 years

Correct: severe malalignment and then TAR

Summary

Nonoperative options are limited and should be reserved for patients who have comorbidities prohibiting surgical attention.
The associated deformities must first be corrected to protect the ankle realignment procedure. The goals of treatment are to maximize flexibility and produce a painless and plantigrade foot without the need for supplementary bracing.

18. **Components of the Wilson Osteotomy That Are Effective on Hallux Valgus Repair. The Journal of Foot and Ankle Surgery.** Volume 46, Issue 1 , January-February 2007, Pages 21-26

Wilson osteotomy of the first metatarsal is a technically simple and reliable operation for the correction of the hallux valgus (HV) deformity.
The major anatomic components of the osteotomy are the osteotomy angle and the distance of the osteotomy to the first metatarsophalangeal (MTP) joint. Lateralization of the first metatarsal head is the rationale for correction of the deformity. The main disadvantage of the technique is the considerable shortening of the first metatarsal.
The presented study indicated that the osteotomy angle and the lateral displacement of the metatarsal head have a significant correlation with the amount of HV correction. Distance of the osteotomy to the first MTP joint has no relevance with the repair of the deformity. A positive linear correlation was present between the osteotomy angle and the first metatarsal shortening. Because the amount of first metatarsal shortening has significant influence over the clinical result, the main aim in a Wilson osteotomy should be maximum lateral displacement of the metatarsal head with a minimum osteotomy angle.

The surgical technique was originally described in 1963 as an oblique osteotomy of the distal third of the first metatarsal. The osteotomy is at a 45° angle to the long axis of the first metatarsal. The Wilson osteotomy is an inherently unstable osteotomy . The original concept of this osteotomy did not include any type of internal stabilization; the operation therefore frequently necessitated prolonged plaster cast immobilization because of the lack of mechanical stability

Location of the osteotomy is another variable of the Wilson oblique osteotomy. An osteotomy placed too proximally was accused of insufficient correction (3 and 4). On the contrary, osteotomies closer to the joint carry a risk for limited mobility of the first MTP joint because of dissection of the capsule and para-articular tissues that cause poor surgical result (1, 10 and 11). However, it is not known whether there is any relatedness between the HV correction and the distance of the osteotomy to the first MTP joint.

Lateral displacement of the metatarsal head is the main rationale for correction of the deformity as in many distal metatarsal osteotomies (2 and 3). The significance of the lateralization on the deformity correction is necessary for evaluating the success of the HV repair.

. More shortening of the first metatarsal is obvious with a 45° osteotomy than with a 25° with the same amount of lateral displacement of the capital fragment in a simulated correction of the HV case.

Among the investigated variables, osteotomy angle was found to be the most significant factor on correction of the HV deformity. However, 22.5° mean osteotomy angle, which was half of the original angle, resulted in an average of 20° of HV angle correction. This amount of correction is comparable

with the average 19.25° of HV angle correction that was obtained by a 45° angled Wilson osteotomy

One of the major disadvantages of the Wilson oblique osteotomy is metatarsal shortening that inevitably occurs. Several authors have reported that the Wilson osteotomy causes callosities and metatarsalgia because of a shift of the forefoot load distribution onto the lateral metatarsals (8, 11 and 17). This is mainly attributed to the shortening of the first metatarsal. Merkel et al concluded that more than 10 mm of shortening resulted in a higher degree of patient dissatisfaction and an increased frequency of metatarsalgia (18). Geldwert et al found that first metatarsal shortening over 6 mm deteriorates the dynamic mechanism of the hallux, which leads to lateralization of weight bearing and an increase in loading under the second metatarsal (7). Similarly, Carr and Boyd considered 4 to 5 mm as the maximum amount of shortening that was acceptable (19). The amount of metatarsal shortening can be controlled by regulating the obliquity of the osteotomy (7). The less oblique the osteotomy, the less short the metatarsal becomes after the capital fragment is displaced laterally. Standardizing the osteotomy angle to 45° without cognizance about its effect on the amount of correction may cause undesirable clinical results by excessive first metatarsal shortening.

A correlation between the osteotomy angle and the amount of metatarsal shortening was found in the current study. This was a linear correlation with an equation of $y = 0.1806(x) + 1.5795$, where *y* was for the amount of shortening and *x* was the osteotomy angle (Fig 6). According to this equation, a 45° osteotomy angle should produce approximately 9 to 10 mm shortening of the first metatarsal, which is concordant with the literature. Klosok et al found an average shortening of 10 mm with a 45° osteotomy (14). The mean shortening of the first metatarsal was 8 mm in the study from Klareskov et al (16), and it was 8.5 mm in the study from Pouliart et al (11). In the current study, 22.5° of average osteotomy angle caused a mean of 5.1-mm first metatarsal shortening, which was within the acceptable limits for not disrupting the weight-bearing mechanism of the hallux (7 and 19).

II Free Paper

UNUSUAL PRESENTATION OF PROSTHETIC HIP JOINT INFECTION.

INFECTION.V.S.PAI. M.S.(Orth), M.Ch (Orth), Dip. National Board(Orth), FRACS

ABSTRACT

A case of massive thigh abscess communicating with the the hip in a patient with loosening and infection of the femoral component of the total hip prosthesis is described.

Key words: Total Hip Arthoplasty, Late infection

INTRODUCTION

Sepsis following joint replacement remains one of the most devastating complications encountered in orthopaedic surgery. The consequences of deep sepsis include not only failure of the involved joint but the prospect of additional operative procedures.

We report a case of prosthetic hip joint infection presenting in an unusual way. This patient present with an enlarging swelling of the right thigh which was diagnosed as proximal deep vein thrombosis at admission and a diagnosis of soft tissue sarcoma of the thigh was considered. Full work up of the patient revealed it to be a large abscess in the thigh secondary to late infection of a total hip arthroplasty.

CASE REPORT

A 57-year-old Maori woman was admitted in the medical ward with pain and swelling in the right thigh of two days' duration following travel in a van for 12 hours. There was no history of recent trauma. Two days prior, her general practitioner had prescribed antibiotics (Augmentin) for productive cough.

She suffered from asthma and was on steroid inhaler and had myocardial infarction in 1983. In 1984, she was treated for cervical cancer with radiotherapy and consequently developed avascular necrois in both hips. She had a cemented total hip prosthesis on right in 1988 and cementless left total hip in 1994. Since that time, here hips had been asymptomatic.

Examination at her present admission disclosed tenderness and diffuse swelling in the right thigh and calf. In the thigh the swelling appeared to more tense, tender and warm in the anterior aspect of middle third of the thigh. Knee movements were more painful than those of the hip. At the time of admission the midthigh circumference was 4 cm more than the opposite side and the calf circumference 3 cm more.

Laboratory findings showed a white blood cell count of 17,200/mm^3 with 85% segmented neutrophils. The erythrocyte sedimentation rate was 125mm/hour. There was increase level C reactive protein to 293 mg/L (Normal: 0-10mg/L). The blood glucose was within normal limits (6.2 mmol/l). Radiological examination revealed a significant lucency around the prosthesis in the femur as well as

the acetabulum (Fig 1). Reviewing her previous serial radiographs demonstrated progressive resorption of posteromedial aspect of the proximal part of the femur.

An initial ultrasound examination of the thigh revealed a thrombus seen in the proximal femoral vein. The femoral vein was echogenic and not compressible. A venogram was not performed as there was a previous history of asthmatic attack with the dye. She was started on a heparin/warfarin regime. Because symptoms intesified and laboratory reports were suggestive of infection, ultrasound examination was repeated and this revealed a definite enlargement of the deep group of quadriceps both medially and anteriorly. This was further confirmed with a computed tomographic (CT) scan. However, full assessment of the swelling was not possible due to artefacts from the prosthesis. As the fat planes were well preserved, there was a suggestion that this could be a soft tissue tumor. MRI showed a large deep abscess measuring 18 cm x11cm x 6 cm) within the R vastus intermedius extending from the level of prosthetic femoral neck to the mid thigh (Fig 2).

Meanwhile the patient was septic and spiking temperatures between 38° and 40°C. As an emergency, the swelling was explored through a lateral approach. An abscess cavity was found deep to the vastus lateralis and medialis in the upper two-thirds of the thigh and was extending proximally to the neck of prosthesis. About 1.5 L of frank pus was drained. Blood culture and the aspirate from the thigh grew Stap aureus that was sensitive to oxacillin. Oxacillin was administered intravenously and in next couple of days the joint was reexplored through a transtrochanteric approach. Both components were found to be loose and were removed easily with large amount of broken methylmethacrylate fragments. IV antibiotics were continued for six weeks and a second stage revision was performed using a cemented prothesis. The postoperative period was uneventful and she was discharged with oral administration of oxacillin and warfarin tablets.

At three months, she was mobilising with a single stick and was comfortable. There was no evidence of infection and the erthrocyte sedimentation rate was showing a downward trend. At exactly 4 months after surgery she died at home with an acute chest pain. No post-mortem examination was requested.

DISCUSSION

Persistent pain following a total hip replacement may suggest either loosening or infection of the prosthesis. Currently, the rate of sepsis following total hip arthroplasty is thought to be approximately 1% over the entire lifetime of the prosthesis[4,7] . This percentage includes operative, perioperative, and late spesis. Given the declining rate of early sepsis, the rate of late sepsis probably accounts for more than 50% of all linfections following total hip arthroplasty[7]. Several causes for late infection have been proposed: delayed activation of bacteria inoculated intraoperatively, direct invasion from an adjacent tissue infection and hematogenous spread from a distant primary focus[3,4,6,8,9,10] . Occassionally infected hip present with an a cutaneous sinus which is usually located in or around the surgical scar[5]. Bright-Thomas[2] reported a case of prosthetic hip joint infection presenting as perianal sepsis. Achong[1] reported a case of periprosthetic Clostridium difficile hip abscess involving the pseudocapsule and trochanteric bursa. Plain radiography, isotope scanning, aspiration and arthrography are the prime imaging techniques employed in establishing the diagnosis[4,6]. Supportive

evidence for infection may be found in a raised blood leucocyte count, erythrocyte sendimentation rate or C-reactive protein levels, although all of these can prove insensitive[4].

Diagnosis of late sepsis poses little difficulty. However, this case demonstrates the difficulty that can occur in establishing the diagnosis of prosthetic joint infection in the presence of unusual clinical findings. In this study, patient was initially diagnosed having either as proximal DVT or soft tissue sarcoma on the basis of the unusual clinical presentation and the findings of the ultrasound and CT scans. However, subsequent laboratory report and the MRI scan confirmed it to be a huge deep abscess which originated from the infected prosthesis.

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ILLUSTRATIONS:

Fig 1: Anteroposterior roentognogram of the hip demonstrating a significant lucency around the prosthesis in the femur as well as the acetabulum.

Fig 2: . MRI showed a large deep abscess within the R vastus intermedius.

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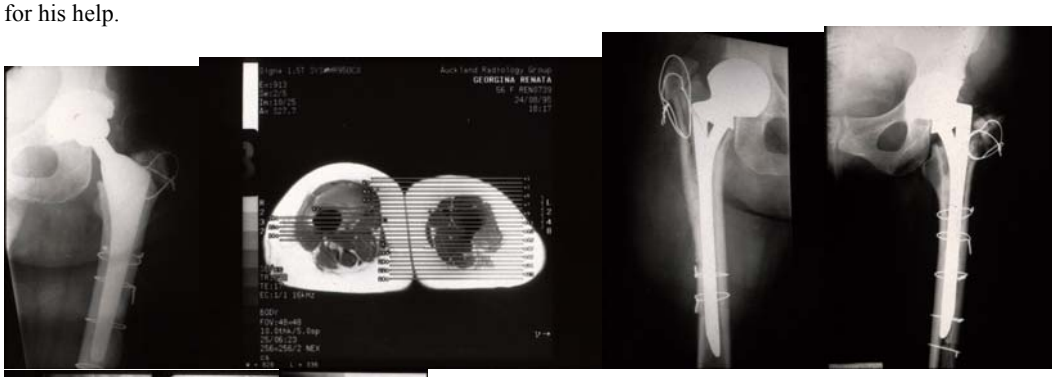
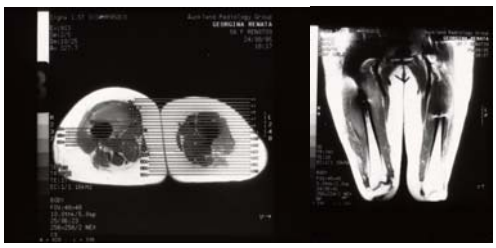




III Notes CARTILAGE

JOINTS

A normal joint is designed to carry out a range of movements.

Synovial joints have a dense fibrous capsule which may be reinforced by ligaments

The joint is lined by synovium and filled with synovial fluid for nutrition and lubrication.

Articular cartilage at the bone ends are suited to distributing load and decreasing friction.

CARTILAGE

Cartilage has a specialised extracellular matrix.

This matrix consists of water,collagen, proteoglycans and glycoproeteins and lipids.

There are several different types of cartilage:

Articular cartilage

Fibrocartilage

Elastic cartilage.

Articular hyaline cartilage

Consists of a glassy and homogenous matrix with lacunae containing chondrocytes.

Articular cartilage contains more collagen than other types of hyaline cartilage.

Mostly Type II collagen

It lines the bones of synovial joints and functions in load distribution and decreasing friction.

The articular cartilage matrix is avascular, aneural and alymphatic

Provides good resistance to compression forces

Fibrocartilage

contains abundant thick bundles of mostly type I collagen

This type of cartilage is found at ligament and tendon insertions into bone, in menisci, intervertebral discs, the symphysis pubis, temporomandibular and sternoclavicular joints.

Fibrocartilage provides good resistance to shear and compression forces.

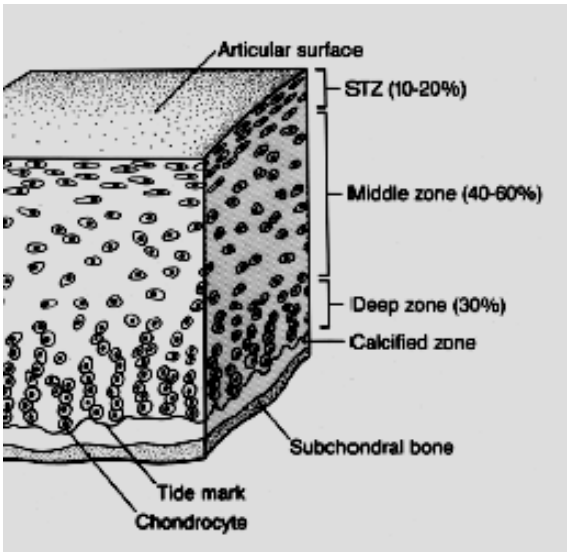
Elastic cartilage

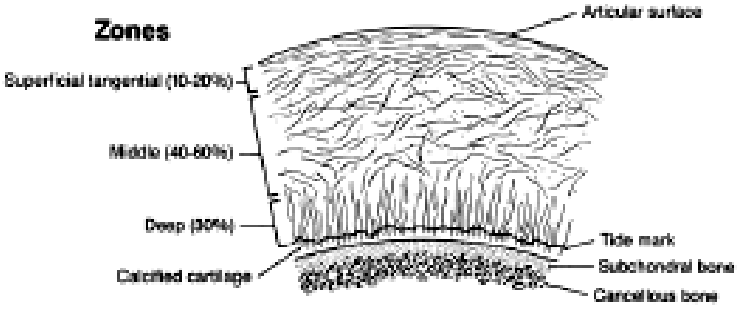
is characterised by the presence of elastic fibres within the matrix which increase elasticity in tissues

Present in external ear and trachea.

	Bone	Hyaline Ca	Fibro cartilage	Tendon	Ligament
Water	8%	65-80%	65%	65%	65%
Collagen	I	II	II/I	I	I
Proteoglycan	<1	13%	0.6%	1-5%	<5%
Glycoprotein	2%	2%	3%	2-5%	
Ca PO4	70%	-	-	-	-

Articular Cartilage





Components

Chondroblasts which are derived from mesenchymal cells become trapped in lacunae and develop into chondrocytes.

Chondrocytes are important in the control of matrix turnover through production of:

collagen

Proteoglycans: important constituent of the matrix

PG_4. PG_6 and KSO_4

Enzymes for cartilage metabolism.

Matrix

Articular cartilage is a highly hydrated material.

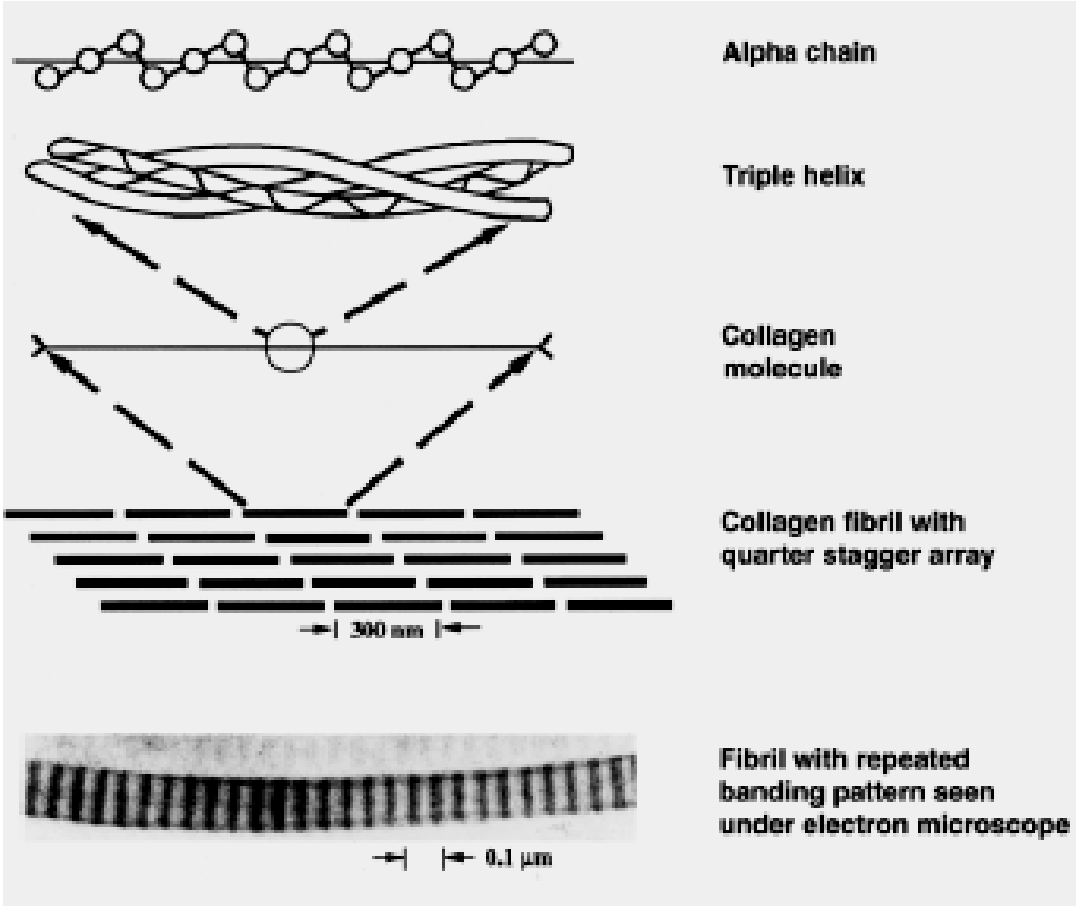
Weight bearing capacity is made possible through regional changes in water content which allow deformation of the cartilage surface in response to stress. Water distribution varies, making up 65% of wet weight at the deep zone and 80% at the surface.

Water provides nutrition and lubrication of cartilage.

Water content decreases with normal ageing. Water content increases in osteoarthritis

Collagen forms a cartilaginous framework which provides tensile strength.:90-95% is type II collagen

Amino acids arrangement in the collagen: Gly- Lys-- Pro--Glycine



Proteoglycans [Pg]

Half life of three months

It provides compressive strength with collagen

PG with Collagen: regulate matrix hydration by providing a porous structure to trap and hold water

It is composed of subunits of glycosaminoglycans (GAG's) -

chondroitin-4-sulfate (decreases with age)

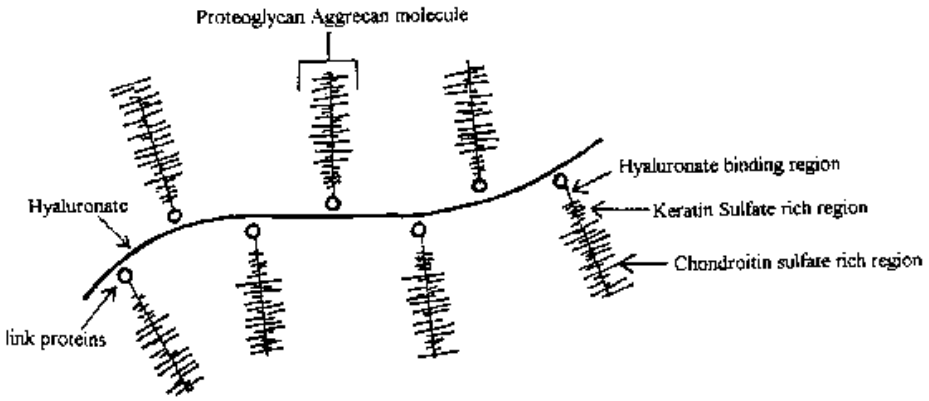
chondroitin-6-sulfate

keratan sulfate (increases with age)

GAG's are bound to a protein core by sugar bonds to form a proteoglycan aggrecan molecule.

Aggrecan molecules are further stabilised by link proteins which bind them to hyaluronic acid to form a proteoglycan aggregate.

PROTEOGLYCAN AGGREGATE

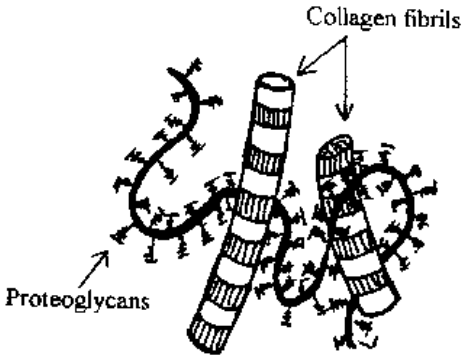


Adhesives

Molecular interactions between chondrocytes and collagen fibrils are mediated by fibronectin, chondronectin and anchorin CII.

Lipids are present in cartilage but their function is unknown.

Collagen molecules and proteoglycans interweave to form cartilage (image 3)



INTERWEAVING OF PROTEOGLYCANS AND COLLAGEN FIBRILS

Articular cartilage: Histology 4 Layers

Zone I.	Superficial Gliding Zone
Zone II	Transitional Zone
Zone III	Radial Zone
Zone IV	Tide Mark
Zone V	Calcified cartilage

ARTICULAR CARTILAGE

	Zone I (10%)	II (60%)	III (30%)	IV
Cell size	Flat	++	+++	+
Collagen size/ number	Thin/++++	Thick/++	Thick/+	With salt
Arrangement of collagen	Tangential	Spiral	Vertical	
Proteoglycan	Lowest +	++	+++ Highest	+
Water	Highest 80%++++	+++	++65%	+

Regulation of Growth

Cartilage synthesis is regulated by growth factors.

1. Platelet-Derived Growth Factors (PDGF)
2. Transforming Growth Factor Beta (TGF-□)
3. Fibroblast Growth Factor (b-FGF)
4. Insulin-Like Growth Factor-I (IGF-I)

. Changes with Ageing

	Immature Cartilage	**Aged Cartilage**	**Osteoarthritis**
1. Chondrocytic activity	+++	+	+++
2. Proteoglycan	C4SO4.	C6PO4/KSO4.	C4SO4
3. Collagen	Less	More cross link	Loss of collagen
4. Water concentration	High	Low	High

Synovium

Synovium is composed of vascularized connective tissue that lacks a basement membrane and contains two predominant cell types which reflect the function of the tissue.

Type A cells - important in phagocytosis

Type B cells - fibroblast-like cells which produce synovial fluid.

Synovial Fluid: ultrafiltrate of blood plasma plus hyaluronic acid and glycoproteins

Does not contain fibrinogen - thus no clotting

SYNOVIAL FLUID

Normal	Septic	Chr inflam
3.5 ml	++++	+++
Clear	Turbid yellow	Opalescent Yellow

Viscosity (235)	Low	Low
WBC (200)	100000	20000-50000
PMNC (20%)	90	50
Culture –ve	+ve	-ve
Glucose same as blood	Very low	slightly Low
Total Protein	Elevated	Elevated

Meniscus

The meniscus functions to deepen the articular surface of a number of synovial joints. By doing so it increases the contact area available for load distribution. These joints include:

Acromioclavicular
Sternoclavicular
Glenohumeral
Hip

Knee

We will focus here on the meniscus of the knee joint.

Anatomy

The meniscus is a triangular, semilunar structure. Its peripheral border is attached to the joint capsule. In the knee, the medial meniscus is semicircular and the lateral meniscus is circular.

The meniscus is composed of fibrocartilage.

Fibrochondrocytes: These synthesise and maintain the extracellular matrix, and are responsible for anaerobic metabolism.

Collagen: type I

Blood supply

The geniculate arteries supply the menisci. The outer 25% of the menisci are supplied by a circumferentially arranged plexus, and the remaining 75% receive supply via diffusion of synovial fluid.

Tears that occur in the peripheral vascularised region (red zone) will heal via fibrovascular scar formation by fibrochondrocytes. Tears that occur in the central avascular regions (white zone), however, can't heal.

Function of Meniscus

Shock Absorber	Efficient shock absorber than cartilage	
Load bearing	In Extension	50% of load through the meniscus
	In Flexion	85% of load through the meniscus
	After Meniscectomy: increased load per unit area and can lead to arthritis.	
Anterior instability	With ACL, medial meniscus is important for stability	
Joint lubrication	Joint conformity favors fluid film and lubrication	
Proprioception	Nerve endings in the meniscal horn is important	

Medial meniscus is attached to medial collateral ligament and therefore is less mobile than lateral meniscus. Therefore, medial meniscal tear is more common than lateral meniscus.

IV Current concepts

DISI: 1Bone–Tissue–Bone Repairs for Scapholunate Dissociation JHS Review article Feb 2007 Mayo clinic

DISI : Several surgical options

These have included benign neglect, reduction and percutaneous pinning, primary repair, partial fusions, tendon weaves, and combinations of these.

Recent advancements in scapholunate repair and anatomy have been **aimed at a more physiologic repair**.

Currently more commonly used grafts are **bone–retinaculum–bone, third or second metacarpal–carpal bone,** or hamate–capitate grafts, all performed with or without screw augmentation.

The lack of long-term outcome measurements for these BTB surgeries makes it difficult for the hand surgeon to determine the appropriate use of these treatment modalities, but early reports have indicated that the BTB graft will be an important part of scapholunate dissociation treatment.

Scapholunate dissociation is arguably the most common.

The treatment of chronic dissociation is even more controversial.

All of these procedures currently are investigational; however, early to medium-length follow-up reports of these techniques all have been favourable

The **dorsal region of the scapholunate ligament** offered the greatest constraint to differential translation, whereas both the dorsal and palmar regions showed statistically significant combined constraints to differential rotation between the scaphoid and the lunate.

Technique Bone–retinaculum–bone graft
Dorsal approach
Trough fashioned in the scaphoid and the lunate after the SL interval was reduced anatomically and held in place with K-wire fixation.
The K-wires are in the volar portion of the 2 bones to prevent protrusion in the trough.
The BTB graft is placed in the trough and held in place with 2 small screws.
Sufficient K-wire fixation has been placed to maintain the scapholunate angle and the interval on lateral and anteroposterior fluoroscopy.
The 2 internal fixation screws are seen well placed within the lunate and the scaphoid.
cast immobilization.

I Dorsal Retinacular graft : lister tubercle and retinaculum

2.Metacarpal-Carpal–Based Bone–Tissue–Bone Grafts

These articulations are relatively immobile and **therefore were seen as expendable if needed for SLIL reconstruction**.

1. Same dissection used for the SLIL repair.
2. These grafts also provide a cartilaginous replacement for the SLIL
3. Stiffness and strength : The second metacarpal–trapezoid ligament and the third metacarpal–capitate ligament most closely approximated the stiffness and strength of the SLIL.

3.Vascularized Metacarpal-Carpal–Based Bone–Tissue–Bone Grafts

A typical third metacarpal–carpal graft can be harvested based on the radial-sided intermetacarpal artery

4.Carpal-Based Bone–Tissue–Bone Grafts

the capitohamate joint would provide an adequate ligament.

5. Augmented Dorsal Retinaculum Grafts

an augmented repair using a Herbert screw

The surgical technique involved open reduction and re-attachment of the ligament to the bone, combined with Herbert screw fixation across the scapholunate joint. The screw was left *in situ* for 12 to 18 months, allowing sufficient time for ligament healing and restoration of carpal stability.

Summary

Unquestionably, the early results for these procedures are excellent compared with other historical options; however, no randomized control groups have been established.

The procedures are not technically beyond the scope of all hand surgeons, and except for the vascularized option, are not beyond the capabilities of any orthopedic surgeon.

Other surgeons have stated that the reason that these procedures function is because of an arthrodesis between the scaphoid and lunate and that long-term outcomes will be poor. It is unlikely that fusion is the mode of success for these procedures. It is

The BTB repair, in whatever form the surgeon chooses, is a good option for scapholunate repair and will be part of the future armamentarium of all hand surgeons.

VI MCQ

A. Carpometacarpal arthritis

1. A simple trapeziectomy: provides excellent pain relief, but subsidence into the trapezial void was blamed for findings of postoperative instability and weakness.

2. Arthrodesis of the CMC joint: shown to provide excellent stability and pain relief. With arthrodesis, however, comes the inherent loss of motion and risk of nonunion.

3. Interpositional arthroplasties have been proposed to maintain motion while filling the void created by trapezial excision.

4.Silicone implant arthroplasty has waned in popularity because dislocation, breakage, and synovitis have complicated its use.

5.Popular present surgical treatment is Hematoma distraction arthroplasty consisted of piecemeal excision of the entire trapezium and 5 weeks of K-wire immobilization of the thumb metacarpal in opposition and slight distraction.

6. The reconstruction of a disrupted anterior oblique ligament, implicated in the development of basal joint arthritis : techniques of tendon tunneling and suturing for ligament reconstruction, with or without tendon interposition. Questions have been raised whether these more complicated procedures are necessary.

7. A meta-analysis of 5 surgical procedures for CMC osteoarthritis (trapeziectomy, trapeziectomy with interpositional arthroplasty, trapeziectomy with ligament reconstruction, LRTI, and joint replacement) showed that no single procedure produced greater pain relief or strength than the other procedures, although those patients who had trapeziectomy alone had fewer complications.

8.**Subsidence:**Although the scaphoid–thumb metacarpal distance continued to decrease with time from surgery, the progressive subsidence was not symptomatic.

2.Flexor Pulley injury

1. Closed flexor pulley injuries have been reported in rock climbers.

2. Excellent outcomes were achieved through conservative therapy

3. Pulley ruptures may cause bowstringing of the flexor tendons, resulting a functional deficit

4.Diagnostic accuracy is improved with ultrasound and/or magnetic resonance imaging (MRI)

5. The TB distance was measured in longitudinal planes at the midaspect of the proximal phalanx to assess the A2 pulley and at the midaspect of the middle phalanx to assess the A4 pulley. Longitudinal and transverse planes were used to measure the TB distance at the proximal aspect of the proximal interphalangeal joint to assess the A3 pulley. A TB distance greater than 2.0 mm for the A2, greater than 3.5 mm for the A3, and greater than 2.0 mm for the A4 pulleys was defined as being consistent with a pulley rupture

5. Multiple pulley ruptures require surgical repair.

3. Elbow capsulotomy for post traumatic stiffness

1. The average improvement in ulnohumeral motion after the index surgery for capsular release was 53°.

2. Open elbow capsulectomy for posttraumatic elbow stiffness restores a near-100° flexion arc on average.

3.Second elbow releases provide limited additional motion in most patients [25°]

4. Functional range of elbow: 30-130° and rotation of 50° each direction

5. Outerbridge Kashiwagi is a common procedure

6. Morrey's modification is gold standard

7. Bad results are due to persistent ulnar neuropathy.

3. Ankle instability

1. Mechanical instability is the only form that may potentially benefit from surgery

2. The ATFL courses obliquely from posterolateral to anteromedial with respect to the tibiotalar joint. It thus resists internal rotation of the talus and not just anterior translation.

3. Anterior soft tissue ankle impingement can be attributable to hypertrophic fibrosis of the injured ligament impingement typically affects the ATFL

4. The CFL stabilizes the ankle and subtalar joint against inversion in the dorsiflexed ankle; therefore, stress examination of the CFL consists of inverting the hindfoot with the ankle dorsiflexed.

5. The most common anatomic technique is the modified Brostrom procedure, which consists of reefing of the ATFL and CFL

6. Arthroscopic treatment of anterior ankle soft tissue impingement is highly successful and the results are reliably reproducible.

7. Most posterior impingement pathology can be approached surgically from posterolateral approach

4. Diabetic foot.

1.The ankle joint should have 20° of dorsiflexion (DF) and 40° of plantar flexion (PF). Subtalar motion has been difficult to define, with a range of 20° to 60° reported and a 2:1 ratio of inversion to eversion

2. Diabetes is responsible for **60% of lower extremity amputations** in these patients

3. Underlying bone infection is present in as many as 60% of infected diabetic ulcers

4. Compared with a nondiabetic cohort, diabetic patients are at an 80% increased risk for cellulitis, a fourfold increased risk of osteomyelitis, and a twofold risk of both sepsis and death caused by infection

5. Recommend that physicians obtain both soft-tissue and bone specimens when cultures are used to guide therapy rather than swab report from the ulcer

6. An ulcer area greater than 2 cm^2 had a sensitivity of 56% and specificity of 92% for diagnosing osteomyelitis in their patient population

7. Differentiation between osteomyelitis and neuro-osteoarthropathy (Charcot arthropathy) is a common diagnostic dilemma. The dependent erythema of neuro-osteoarthropathy is said to improve with elevation, whereas that of cellulitis will not

8. Necrotizing fasciitis is a rapidly spreading, destructive, polymicrobial soft-tissue infection that has been associated with diabetes mellitus.

5. Osteochondral lesion of the ankle

1. Incidence with lateral ankle sprain: 5%
2. Lateral lesions cause more symptoms than medial ones. When the lesion is large and the affected piece is dissected, the joint mechanics are altered, which may lead to osteoarthritis
3. Lateral Vs Medial:
   Lateral defects: 1. Inverting a dorsiflexed ankle. 2. Usually located in the anterior third 3. Thin wafer due to sheaar 4. More symptomatic 5. More displaced
   Medial defects: 1. In a plantar flexed position 2. Mostly located in the posterior half. 3. Deep cup shaped due to torsion 4. Less symptomatic 6. Less displaced.
4. CT is useful for better defining the exact size and location of the lesion and, therefore, more valuable for preoperative planning. In diagnosing an osteochondral defect, CT has proved to be equally as valuable as MRI
5.In recent reviews of the literature, the best current available treatment for primary osteochondral ankle defects is excison, debridement, and drilling

6. Soft tissue complication following Calcaneal fracture

1. Approximately 10% of major intra-articular calcaneal fractures have compartment syndrome
2. Wound dehiscence after ORIF 10-20%
3. Early claw: Rx is Flexor tenotomy
   Late fixed claw: PIP fusion
4. FHS adherence can occur
5. Best lateral approach to minimize skin problem is Lateral extensile approach
6. Peroneus rupture <50%: needs tubulisation and >50% needs neighbouring tendon transfer

7. High Ankle sprain [syndesmotic injury]

1. Incidence **10%**. High ankle sprain
2. 30% of footballers have ossification at syndesmosis reflecting a prior undetected syndesmosis
3. Relevant anatomic featureres:
   a. The talus rotates externally an average of 5° during both active and passive dorsiflexion.
   b. The fibula moves : 2.4 mm distally during the stance phase of gait.
   c.. A 1-mm lateral shift of the talus was enough to cause a 42% decrease of contact are
   d. Sectioning studies showed that the AITFL provided 35%, the TTFL 33%, the IOL 22%, and the SPITFL 9% of the overall stability of the ankle
4. Syndesmotic fixation is not related to
   1. Through syndesmosis or just above syndesmosis.

2. SS Vs Ti screw

3 2 or 3 or 4 cortices.

4. Diameter no difference

5.The syndesmotic screw could not prevent excessive syndesmotic widening when loaded with a load comparable with body weight, and therefore, patients with a syndesmotic screw in situ should not bear weight.

6. Professional football players treated conservatively for high ankle sprain, at 4 years showewd: : 23% of patients had chronic ankle pain, 36% ankle stiffness, and 18% had persistent swelling

7. Screw should be removed only after 3 months

8. Chronic syndesmosis diastasis: when widening persists after 3 months: needs medial clearance; syndesmotic clearance, bone graft and screw fixation to achieve arthrodesis.