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ADDITIONAL ANKLE INJURY STUDIES

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The following case studies are submitted as an adjunct to the presentation by Dr. Robert S. Levine, "Mini Series of Ankle Injuries" presented at the 16th Annual International Workshop for Human Subjects for Biomechanical Research 10/16/88 in Atlanta, Georgia:

Case 1 (RAI #143). Date of accident the Fall of 1971. The patient was a 54 year old woman, 5'1½" tall, weighing 145 lbs who was injured in a head-on collision. The patient was unrestrained. She sustained the following injuries: Bilateral open trimalleolar fracture-dislocations, 6 cm laceration left knee, Superficial laceration right lower leg, Fracture right 7th rib, Multiple facial lacerations.

The patient was driving a 1969 Ford Galaxy 2 door which impacted head-on the right front corner of a 1969 Pontiac Executive. The Pontiac made a left turn coming from the opposite direction into the path of the patient's vehicle. The weight of the '69 Ford Galaxy was 3865 lbs and of the '69 Pontiac Executive was 4550 lbs.

The patient subsequently developed traumatic arthritis of her ankles and has a severe permanent disability inspite of bilateral open reductions and internal fixations.

The patient's ankle injuries were caused by inversion injuries of both ankles. She stated that she had both feet on the brake pedal at the time of the impact. Her facial injuries were caused by steering wheel and windshield impacts.

Captions Figure 1. A 54 year old female driver sustained bilateral open ankle fracture- dislocations when her car was impacted head-on by a 1969 Pontiac Executive coming from the opposite direction.

Figure 2. X-ray of patient's right ankle showing a trimalleolar fracture-dislocation. Pt sustained identical injury in other ankle.

Figure 3. Pt's fracture-dislocation compounded through a laceration on the lateral aspect of her ankle.

Figure 4. Pt sustained multiple facial lacerations about her mouth due to steering wheel impact.

Figure 5. Pt's ankle fracture-dislocations were caused by her feet rolling off both sides of the pedal inverting both ankles.

Case 2 (JDS #6750). A 23 year old man who was injured in a head-on collision in early winter 1967. Height and weight unknown. The patient was unrestrained. He sustained the following injuries: Comminuted fracture right os calcis, Fracture of right cuboid and navicular, Deep abrasions right knee, Fracture right maxilla, Multiple contusions and abrasions of face, Sprain both wrists.

The patient was driving a 1965 Ford LTD which collided head-on with a 1966 Pontiac which made a left turn coming from the opposite direction into the path of the patient's vehicle. The weight of the '65 Ford was 3625 or 3820 depending on engine size. The model and weight of impacting vehicle are not known. The patient was hospitalized and his foot immobilized in a cast. He was gradually mobilized and discharged after 10 days hospitization. His injuries have healed well and he is essentially free of disability.

Injury mechanism - The patient's knee pocketed in the lower dashboard. His foot was driven upwards by rearward and upward displacement of the toepan caused by rearward displacement of the engine - See Figure 6.

Captions Figure 1. 23 year old male sustained a minimally displaced fracture of right os calcis.

Figure 2. Patient also sustained fractures of cuboid and navicular bones.

Figure 3. Patient sustained deep abrasions of knee due to impact with lower dashboard.

Figure 4. The patient was driving a 1965 full size Ford, estimated delta v 30 miles per hour.

Figure 5. Patient's right knee impacted and pocketed in the lower dashboard.

Figure 6. Patient's fractured oc calcis, navicular and cuboid were caused by upward movement of the toepan underneath his right foot after his knee had been fixed in the dashboard.

CASE 1

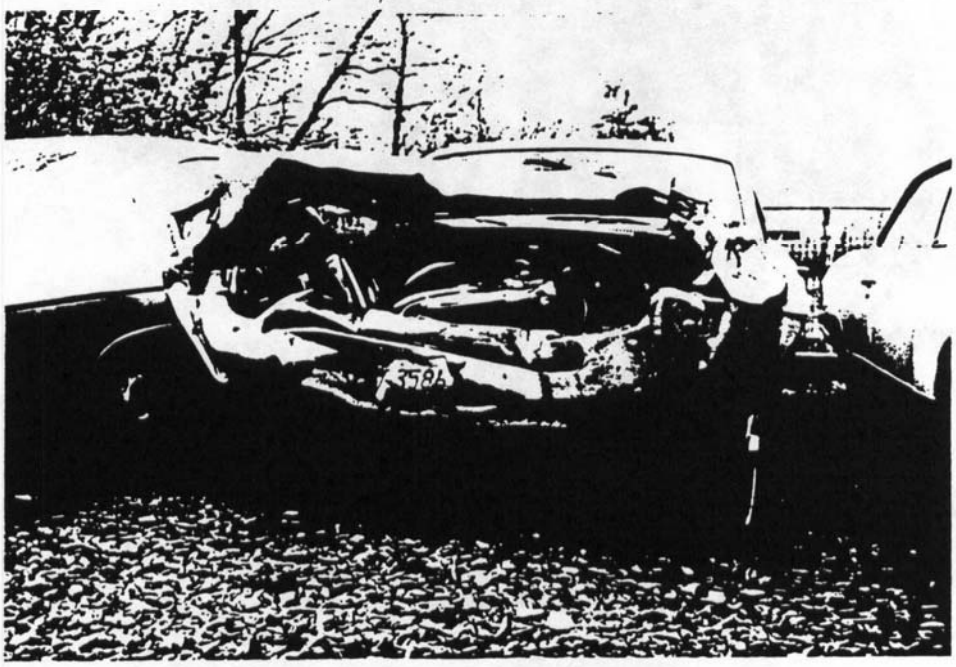

Figure 1. A 54 year old female driver sustained bilateral open ankle fracture- dislocations when her car was impacted head-on by a 1969 Pontiac Executive coming from the opposite direction.

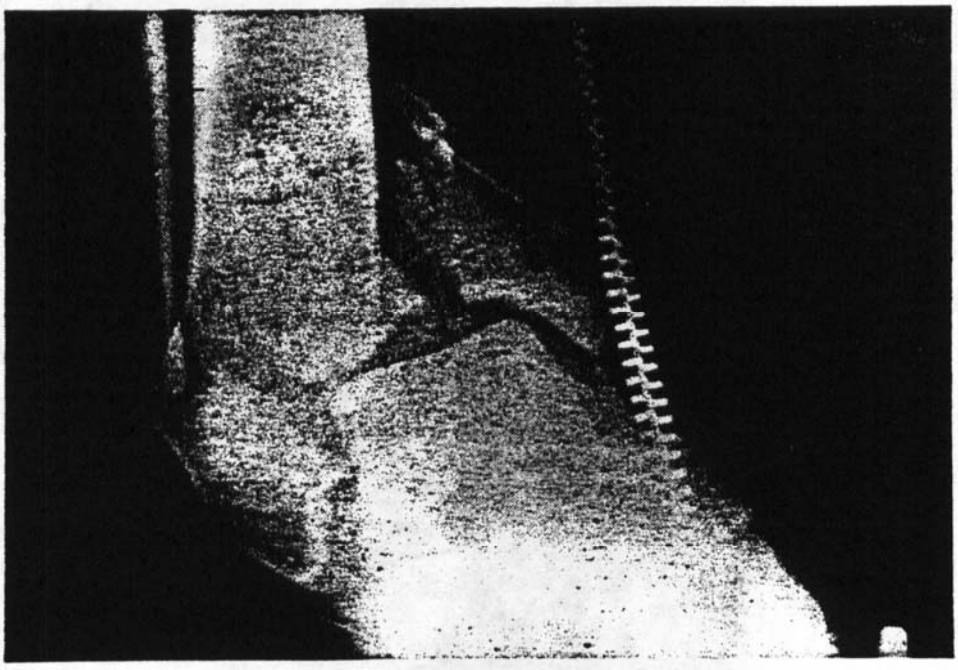

Figure 2. X-ray of patient's right ankle showing a trimalleolar fracture-dislocation. Pt sustained identical injury in other ankle.

CASE 1

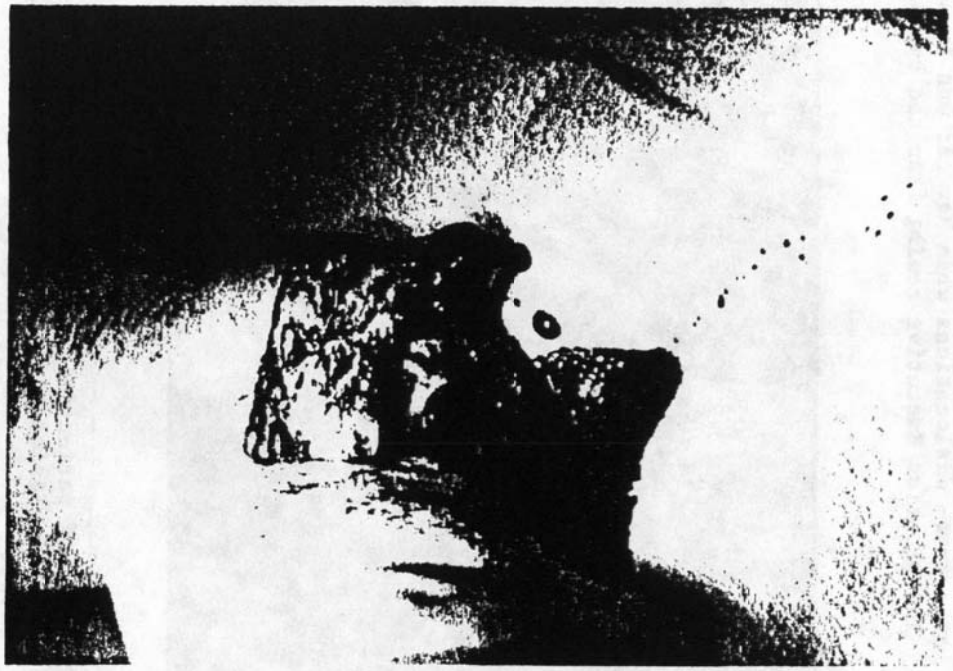

Figure 3. Pt's fracture-dislocation compounded through a laceration on the lateral aspect of her ankle.

Figure 4. Pt sustained multiple facial lacerations about her mouth due to steering wheel impact.

CASE 1

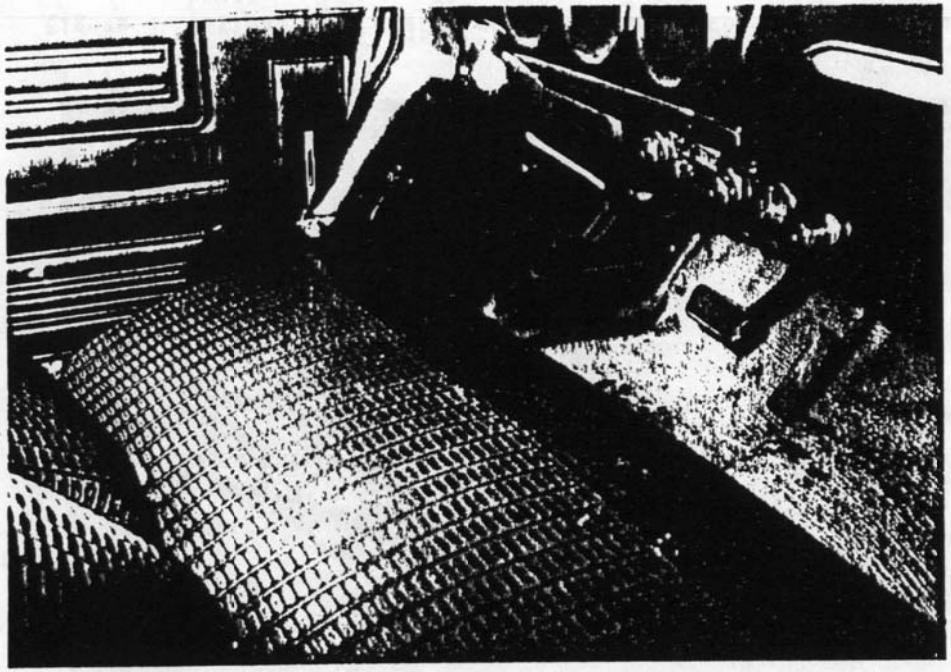

Figure 5. Pt's ankle fracture-dislocations were caused by her feet rolling off both sides of the pedal inverting both ankles.

CASE 2

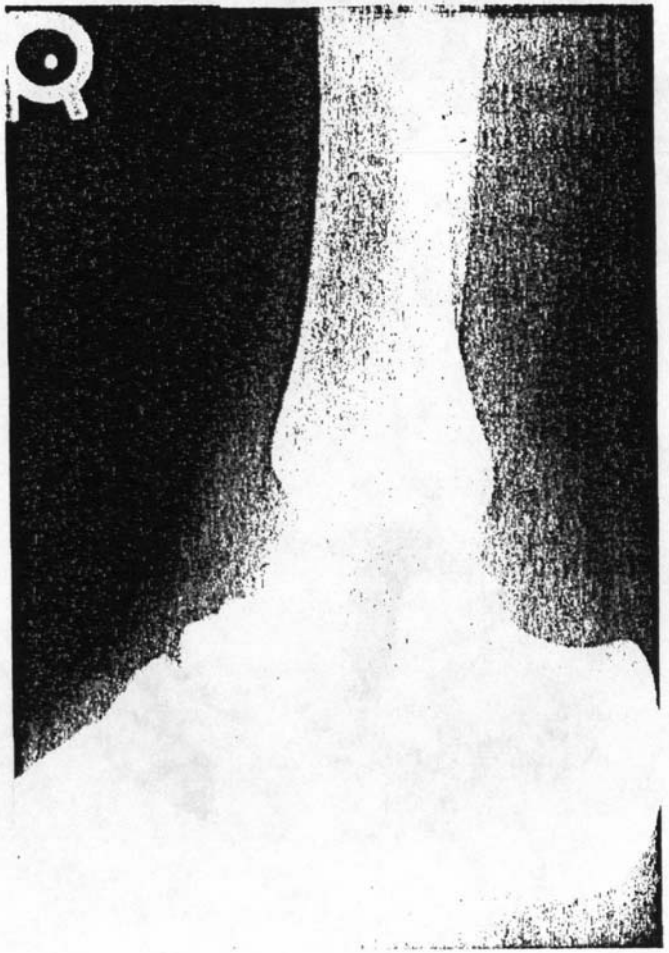

Figure 1. 23 year old male sustained a minimally displaced fracture of the right os calcis.

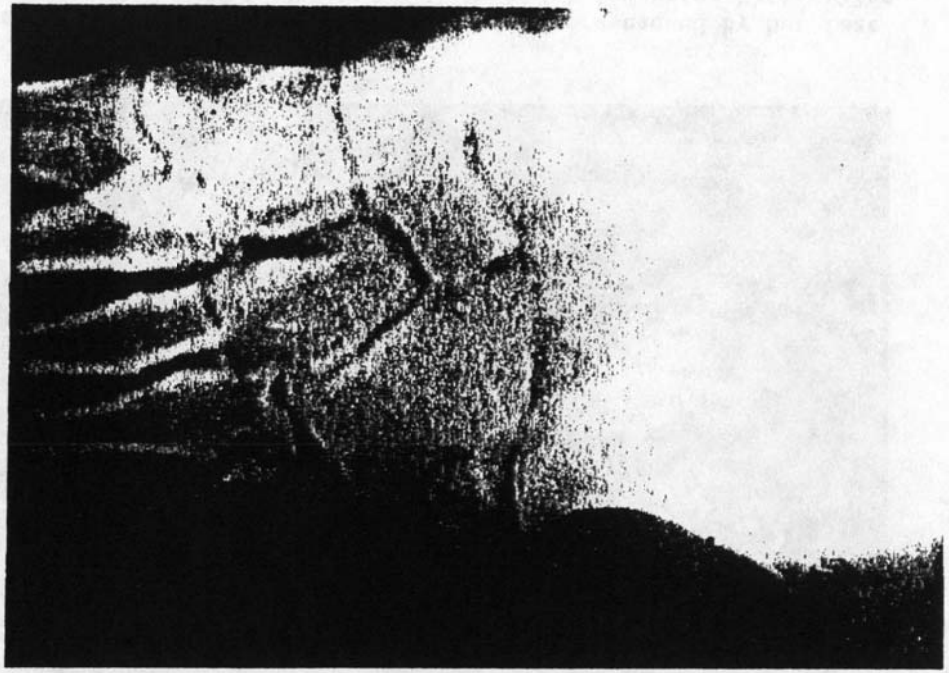

Figure 2. Patient also sustained fractures of cuboid and navicular bones.

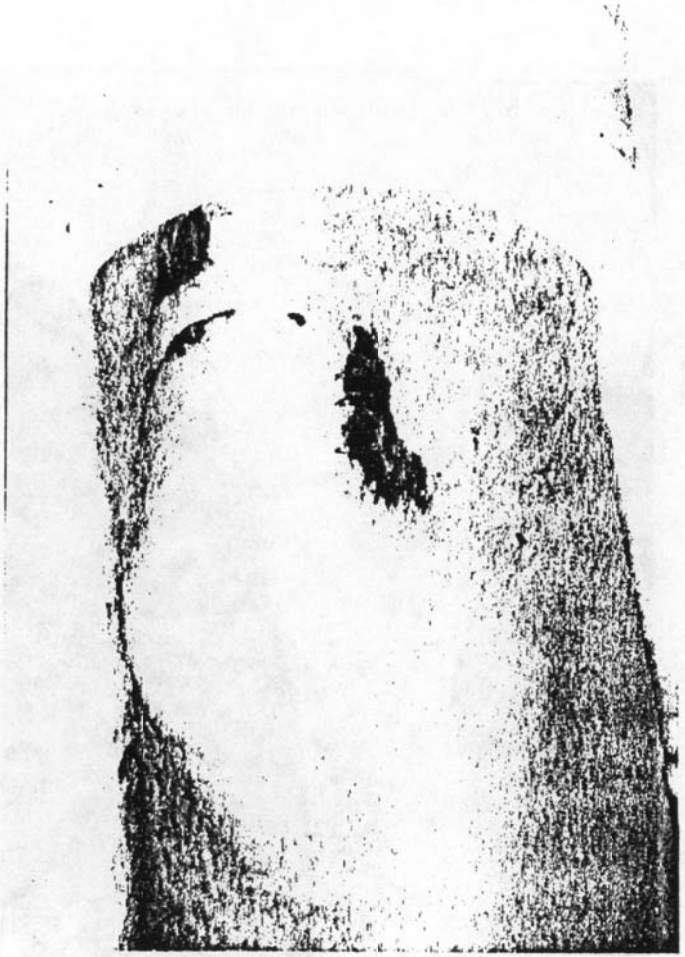

Figure 3. Patient sustained deep abrasions of knee due to impact with lower dashboard.

CASE 2

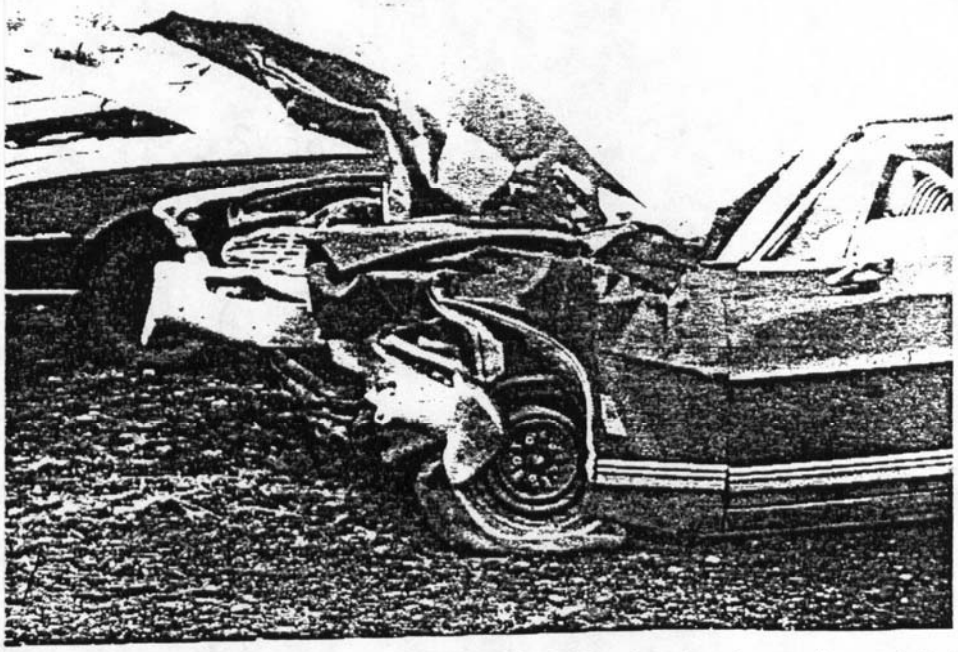

Figure 4. The patient was driving a 1965 full size Ford, estimated delta v 30 miles per hour.

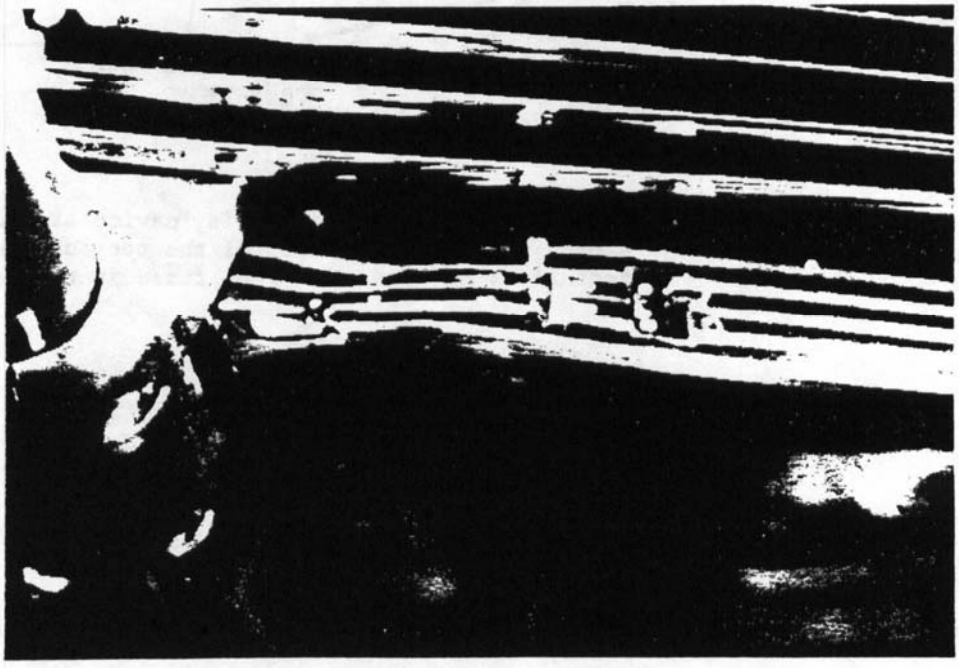

Figure 5. Patient's right knee impacted and pocketed in the lower dashboard.

CASE 2

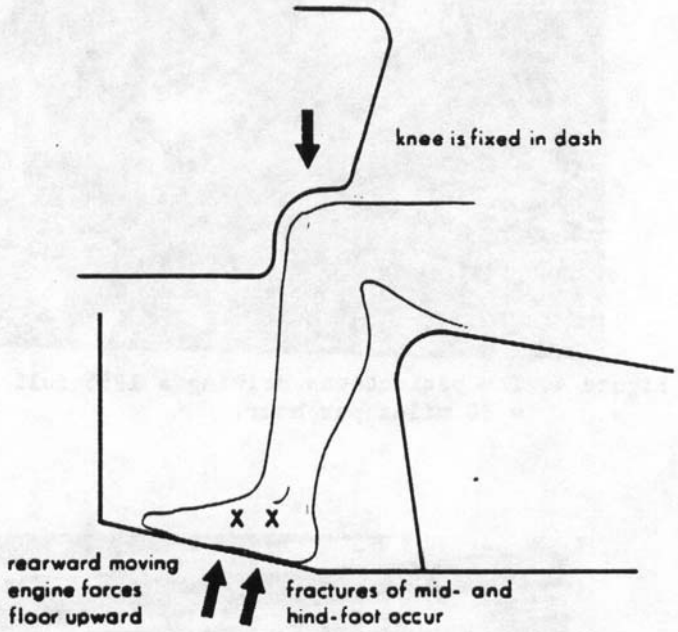

Figure 6. Patient's fractured oc calcis, navicular and cuboid were caused by upward movement of the toepan underneath his right foot after his knee had been fixed in the dashboard.

DISCUSSION

PAPER: Mini Series of Ankle Injuries

SPEAKER: Robert Levine, Wayne State University
John States, University of Rochester

Q: Arthur Hirsch, Chi Associates, Inc.

I don't have so much a question as to remark on our experience back in the 50's and 60's with regard to deck slaps on ships. We had crushed calcanei and severe comminution of the calcaneus bones when men were exposed to the explosive loading from mines against our mine sweepers. It was not a rare occurrence if the force was directed upward into the legs of people who were putting all their weight on one leg. It's a vertical loading right up through the axis of the body. It seems like all of the load goes into the calcaneus. I would guess to see it in automobiles would be quite rare.

A: Levine

That's a typical jumpers' injury. When you see people jump from bridges they often get an os calcis fracture or they may get a pylon fracture. They sort of drive the whole talus up the tibia. They are very difficult fractures to treat.

Q: States

Art Hirsch raises a question of the frequency of these types of fractures in motor vehicle accidents. I can't answer off the top of my head but my impression is that they represent about 10 percent of the severe ankle injuries. The ankle dislocations that we saw in the first three cases are much more common. Does that reflect your experience, Bob?

A: Levine

I have not seen that many ankle injuries. I'm looking for them now very carefully. Hopefully we will see more in the next few years and be able to present a big series.

Q: Mike Walsh, CRS Research

Bob, in your work at Wayne, you say you are seeing these types of fractures when you are impacting the foot at 3 to 8 meters per second. John, you indicated that that may have been a slower mechanism of loading because of the engine loading up. I think that the fractures that you showed were more in keeping with the type of fractures that were presented from quasi-static loading at last year's meeting. Do you think there's a velocity dependence on the type of fractures that you are seeing?

A: States

I suspect that there is a velocity dependence. It is not at all clear to me what it is at this point. Bob, do you have a comment on this?

A: Levine

I think it's also a foot position problem. That first slide was an inversion injury. Ankle fractures have been classified classically by how the foot moves. Adduction fracture is where the ankle moves inward. The ankle actually went from straight to inward. The foot was rolling from its normal neutral position inward. So it would be an inversion injury. John said that this patient's foot had slipped off of the brake pedal. So she went off to the side and her foot rolled inward causing this inversion injury to her ankle. I think that part of the injuries we're going to see depends on the mechanism that we see. These mechanisms have all been pretty well described in the orthopaedic literature as inversion, eversion, rotation, abduction and adduction. Usually you can tell the mechanism of the injury by the pattern of the fracture.