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Organisers: Dr Harry Li and Mr Tony Antonios
Attendees: Dr H Li, Mr T Antonios, Miss L Osagie, Mr C Jones, Mr M Arastu, Mr P Ramesh, and Mr K Sharif
Kingston Hospital NHS Trust Journal Club

Presented paper:
Ramsey PL, Hamilton W. Changes in tibiotalar area of contact caused by lateral talar shift.
J Bone Joint Surg [Am] 1976;58-A:356-7.

Summary
Fractures or ligament injuries about the ankle may result in widening of the medial part of the mortise. Long-term follow-up studies after ankle injuries have shown that significant residual talar displacement predisposes to an unsatisfactory result.

Hypothesis
An altered area of contact between the articular surfaces of the tibiotalar joint may contribute to the poor result.

Population

- 23 amputated legs from peripheral vascular disease patients
- Any specimen with infection or gangrene in the ankle joint was excluded

Method

1. The fibula was removed and all soft tissues about the ankle were excised, including the ligaments and capsule.
2. The tibia was transected five centimetres above the ankle joint.
3. To determine the area of contact, the distal tibial articular surface was coated with carbon black.
4. A compression clamp delivered an axially-directed load of 70 kg on the joint for thirty seconds.
5. When the load was released, a deposit of carbon black was present on the talus, marking the area of contact with the distal end of the tibia.

6. The outline of the deposit was traced on wax wrapping paper placed on the talus, and then transferred to graph paper to measure the area of contact by counting the enclosed squares.

7. The above steps were reproduced for talar shifts of 0, 1, 2, 4, 6 mm of lateral displacement.

Results

The greatest reduction in contact area occurred during the initial one millimetre of lateral displacement with the average reduction being 42 %.
With further lateral displacement of the talus the contact area was progressively reduced but the rate of change for each increment of shift was less marked.
Since the stress per unit area increases as the total contact area decreases, a decrease in contact area may be a factor contributing to a poor result when talar displacement is 1 mm or more.

Critique

Strengths

- Clear evidence to support the good anatomical correction of talar shift
- Study is reproducible
- Each specimen could have been retested with varying amounts of lateral talar displacement with the same degree of ankle tilt and flexion
- Anatomical variations of the 23 patients may be representative of the variety of patients we treat in fracture clinics

Weaknesses

Population

- Amputations of patients suffering from peripheral vascular disease – are not representative of general population
- All ligaments and soft tissue removed which in a live patient would increase the stability of the ankle joint

Axial loading for 30 seconds

- This study measures stress on a static joint, it does not look at the effects of stress of the ankle joint in motion

The outline was traced on wax wrapping paper, then transferred to graph paper and surface area of squares counted.

- Computing power was limited in 1976
- There may be error in the two transfers onto graph paper
- There may be human error in calculating the contact surface area from graph paper
- This is a 2 dimensional model and does not account for stress risers at a particular point in the joint

The talus was adjusted as neutral as could be determined.

- Could be more precise

Long-term follow-up studies after ankle injuries have shown that significant residual talar displacement predisposes to an unsatisfactory result.

- The published long-term study references are historical from the 1960s and the findings are questionable when compared with modern day Level 1 or 2 evidence.
- There have been no attempts to reproduce this study
- What criterion determines a poor result?

Summary and application to clinical practice

- Significant lateral talar shift following fracture/dislocation will result in poor outcome
- This is a in part due to decreases tibia-talar contact area therefore increasing stress load on the joint
- It is important to reduce and ankle in the neutral position
- In operative intervention, the goal is for full anatomical correction with no talar shift.

We suggest that a more recent study be reproduced with greater computing power and involving a 3 dimensional dynamic model.