Joint Stiffness: Natural History and Usual Treatment

Q: What Problem Does ERMI Solve?
A: Rehabilitation Failure

THE PROBLEM: STIFF AND FROZEN JOINTS

Approximately 5-10% of people fail to recover normally after a significant trauma or injury to a joint (e.g. knee, shoulder) despite superior operative skills and superior and appropriate conventional rehabilitation. These people have an abnormal tissue reaction called arthrofibrosis. Excessive scar formation within the joint causes persistent or progressive joint stiffness.

When unrecognized or ineffectively treated, joint stiffness due to arthrofibrosis can result in a condition of stiff joints, or stiff knees, and also called adhesive capsulitis, commonly referred to as frozen shoulders. Arthrofibrosis is often the underlying cause or permanent impairment of normal motion in shoulder, elbow, knee, and ankle accompanied by chronic pain and functional disability.

Practically speaking, frozen joints make it difficult for people to perform activities or normal everyday life, especially walking, driving, managing their responsibilities at home, and doing their jobs.

Subsequent efforts to correct the problem can be costly to healthcare system and frustrating for the patient at a minimum.

USUAL TREATMENT: SEQUENCE OF REHABILITATION EFFORTS

High risk patients who have had major tissue trauma from severe injuries to joints (fractures,
dislocations) or surgery (total joint replacement, rotator cuff repair, anterior cruciate ligament reconstruction) should be carefully monitored during the initial phases of conventional treatment to identify lack of appropriate progress. If an abnormal recovery pattern persists despite appropriate physical therapy and a home exercise regimen, more aggressive treatment is required. There are limited options typically used in this sequence:

- Forceful physical therapy manipulation and stretching is often the first choice, but sometimes may threaten the integrity of surgical reconstruction or cause painful flare ups and rebound stiffness. Painful physical therapy can also reduce patients' willingness to comply with treatment and prolong their use of narcotics.
- Supplementing therapy with a patient-controlled mechanical stretching device for home use can restore range of motion and build patients' confidence in their ability to help themselves, but only if the device is effective and actually used. Low intensity stretch devices are often prescribed and lower cost, but patient compliance and outcomes are questionable for severe motion loss patients. Using a more powerful ERMI device here often avoids the need for any further treatment.

If joint stiffness and motion loss persist, manipulation under anesthesia or surgery to lyse adhesions may be performed. These procedures are costly and can trigger another cycle of trauma followed by abnormal scarring. In 20-25% of cases, the procedures are unsuccessful and more treatment is required.

[References]

REFERENCES

2. Christensen et al., Journal of Arthroplasty, 2002
5. Haidukewych et al., Journal of Arthroplasty, 2005
8. Loew et al., Journal of Shoulder and Elbow Surgery, 2009

SIZE OF THE PROBLEM

Overall, roughly 10% of all patients have some early difficulty regaining range of motion
Despite conventional therapy. However, the likelihood of arthrofibrosis is increased with certain conditions.

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After major knee surgery, that number ranges between 1% and 17% of patients.\(^1\)

After more complex traumatic events such as multiple ligament injuries, tibial plateau fracture, or supracondylar femoral fracture, the percentage rises to 35-58%.\(^2\)

After ankle fracture, 75% end up with range of motion problems. Also common after hallus valgus surgery or calcaneal fracture.

Approximately 1.4 out of every 1,000 people or 435,000 Americans each year end up with adhesive capsulitis of the shoulder.

**IMPACT ON DAILY LIFE**

People vary somewhat in their native range of motion but there are minimum requirements for normal function. Many job tasks demand a wider range of motion than do basic activities of daily living (ADLs). The two joints most commonly involved are the **shoulder** and the **knee**.

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**Shoulder**: The shoulder is a complex joint with motion in many directions: forward flexion, extension, abduction, adduction, and external as well as internal rotation. All of these are required in order to position the hand for important tasks. Restricted range of motion at the shoulder can profoundly limit reaching, lifting, and essential ADLs such as dressing, bathing, and personal grooming. The most common losses are in external rotation, flexion and abduction. The shoulder range of motion required for performance of most ADLs is as follows:

- 120° flexion
- 45° extension
- 130° abduction
- 115° cross body adduction
- 60° external rotation with arm 90° abducted
- 100° internal rotation with arm at the side

**Knee**: The knee primarily moves in two directions: flexion and extension. Limited range of motion in either direction affects activities of daily living, especially ambulation. For example, the amount of knee flexion usually required for certain everyday activities is as follows:

- Normal gait (67°)
- Navigating stairs (98°)
- Rising from chairs (99°)
Getting in/out of a car, low chair (105°)

The inability to straighten or bend the knee of one leg creates a functional leg length imbalance and requires compensatory in other joints and the opposite leg, leading to additional problems. Decreased ROM after surgery often predicts poor functional outcomes and increases the risk of traumatic osteoarthritis.

ECONOMIC CONSEQUENCES: DOWNSTREAM COSTS AND HEALTHCARE SYSTEM

Failure to prevent frozen joints often means that surgical procedures are done to release the scar tissue. The cost of this is an underappreciated downstream consequence.

Knees: For example, in a study of 60,000 knee patients, up to 58% of the outlier cases -- those with persistent severe motion loss -- required one or more surgical procedures that might have been avoided. This equates to nearly 50,000 potentially avoidable hospitalizations and $392 million in procedure-related services for knee patients plus the cost of other avoidable services before and after that hospitalization.