




Head Loading and Neck Pain in UK Military Aircrew

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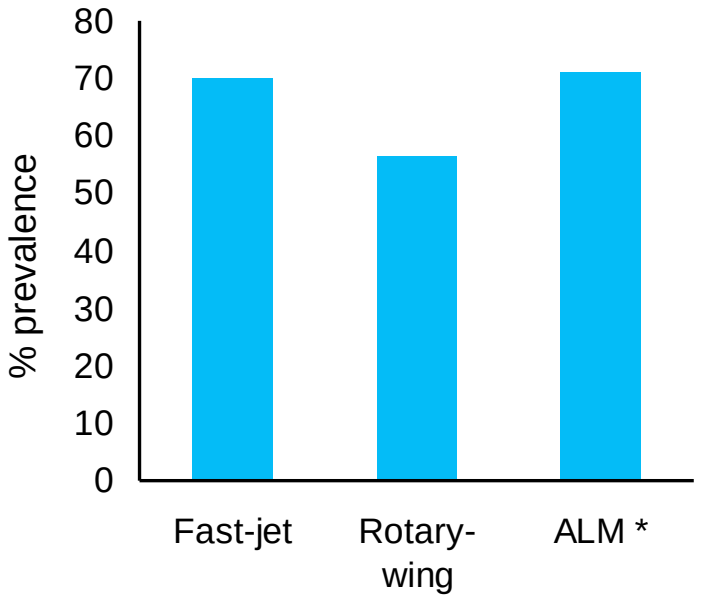
The Problem

- Neck pain causes personal suffering
- Reduces operational performance
- Incurs high financial cost to the MOD:
  - Medical care
  - Lost training time
  - Loss of highly trained personnel
  - Litigation

Prevalence

- The risk of flight-related neck pain in RAF aircrew is high
- No physical characteristics are associated with neck pain
- The risk of neck pain is associated with:
  - Fast-jet: High G?
  - Rotary-wing: Flying hours with NVGs
  - ALM: NVG use
- Few aircrew report their neck pain to medical personnel, and less than 30% seek treatment



** ALM, air loadmasters*

Neck Pain

Environment
G
Vibration

Equipment
NVGs
Helmet
Stole/LSJ

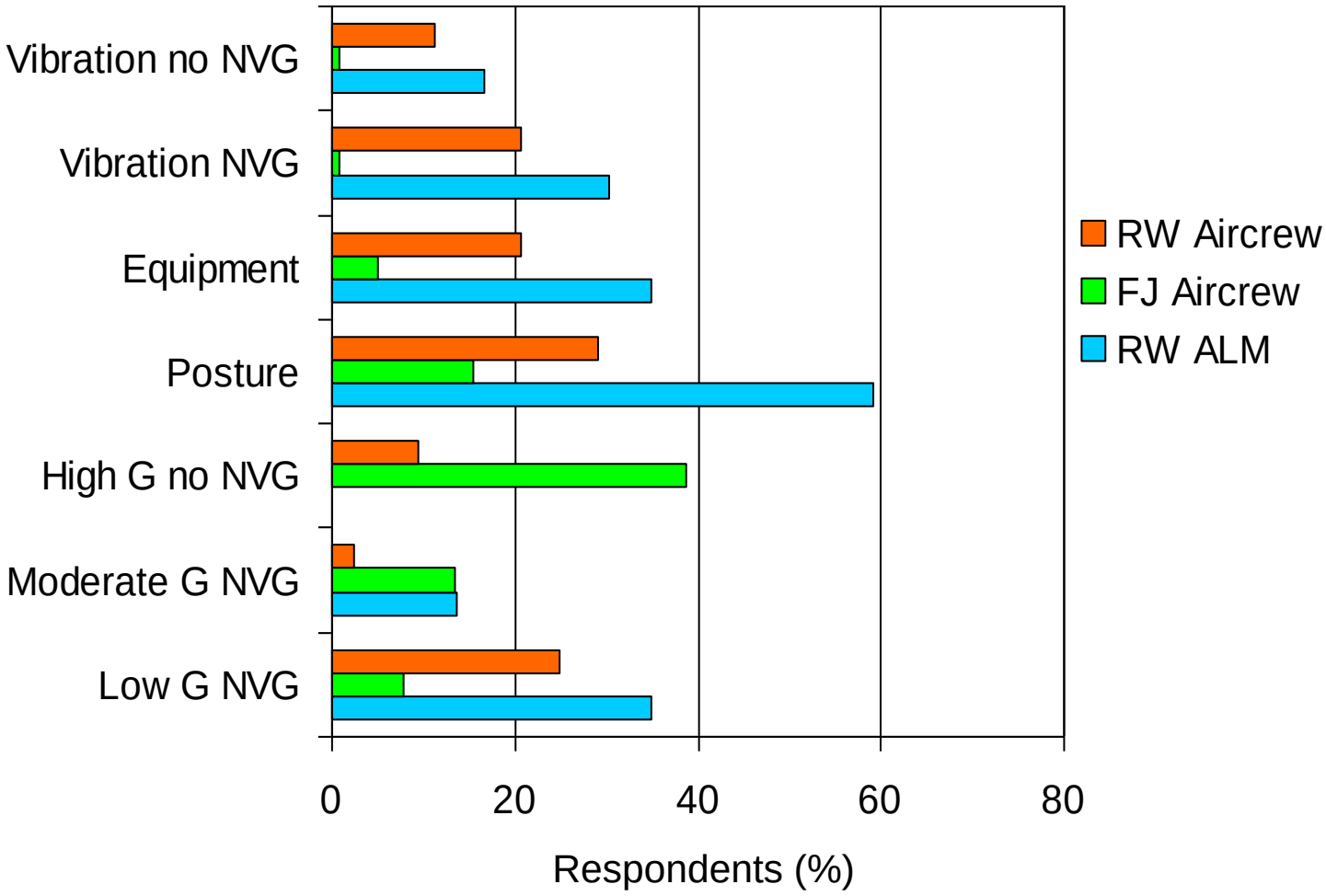
Poor Posture
Forward head

Head Position
“Check six”
Scanning

Operational Demands
Work Rest Schedules

C-Spine Degeneration

Perceived Causative Factors

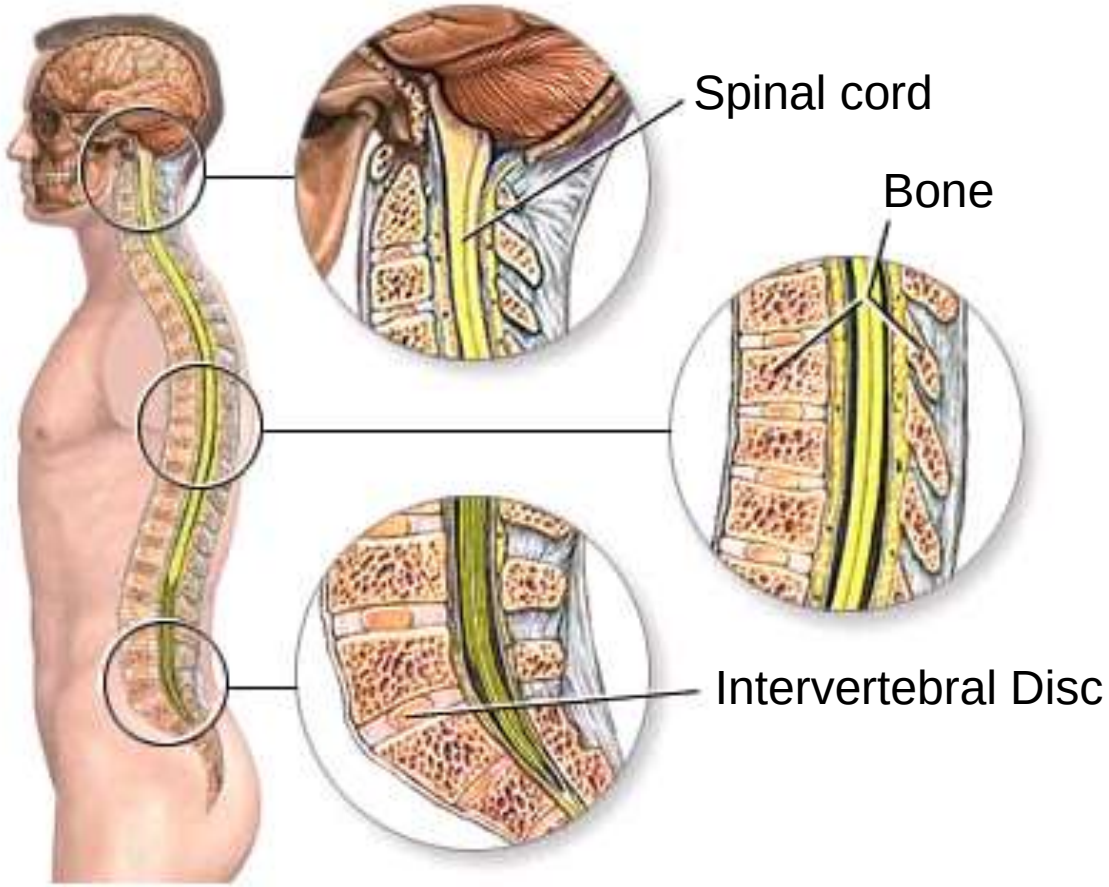


Causes of Neck Pain

- **Acute**: sudden onset of high loads leading to rupture or fracture

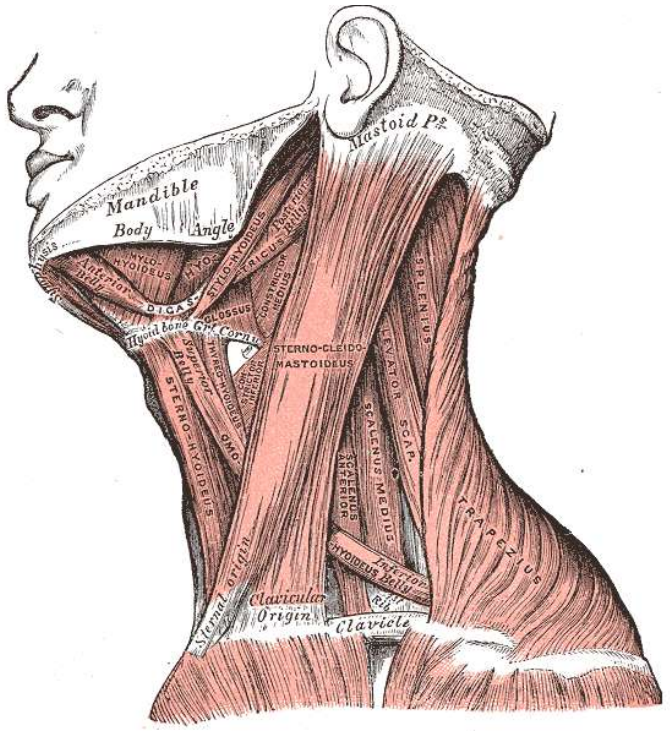
- **Chronic**: sustained low load leading to muscle soreness / fatigue or degenerative changes

The Spine



The Spine

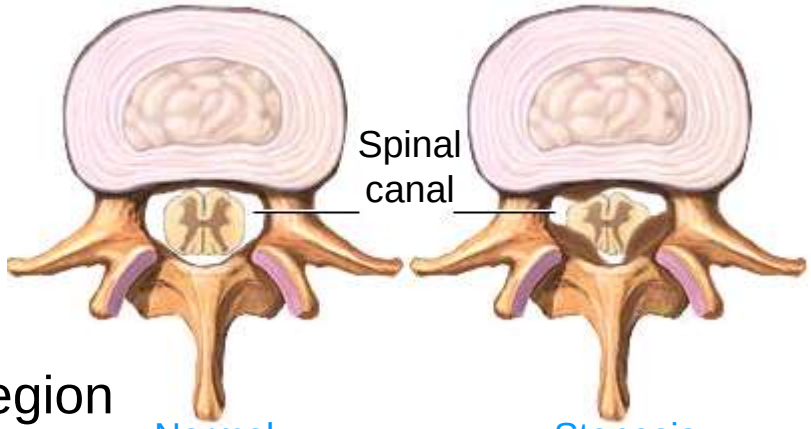
- Structures affected:
  - Muscle, ligaments, tendons
  - Spine: facet joint, intervertebral discs
- Symptoms
  - Neck pain
  - Tingling, numbness or weakness
  - Headaches



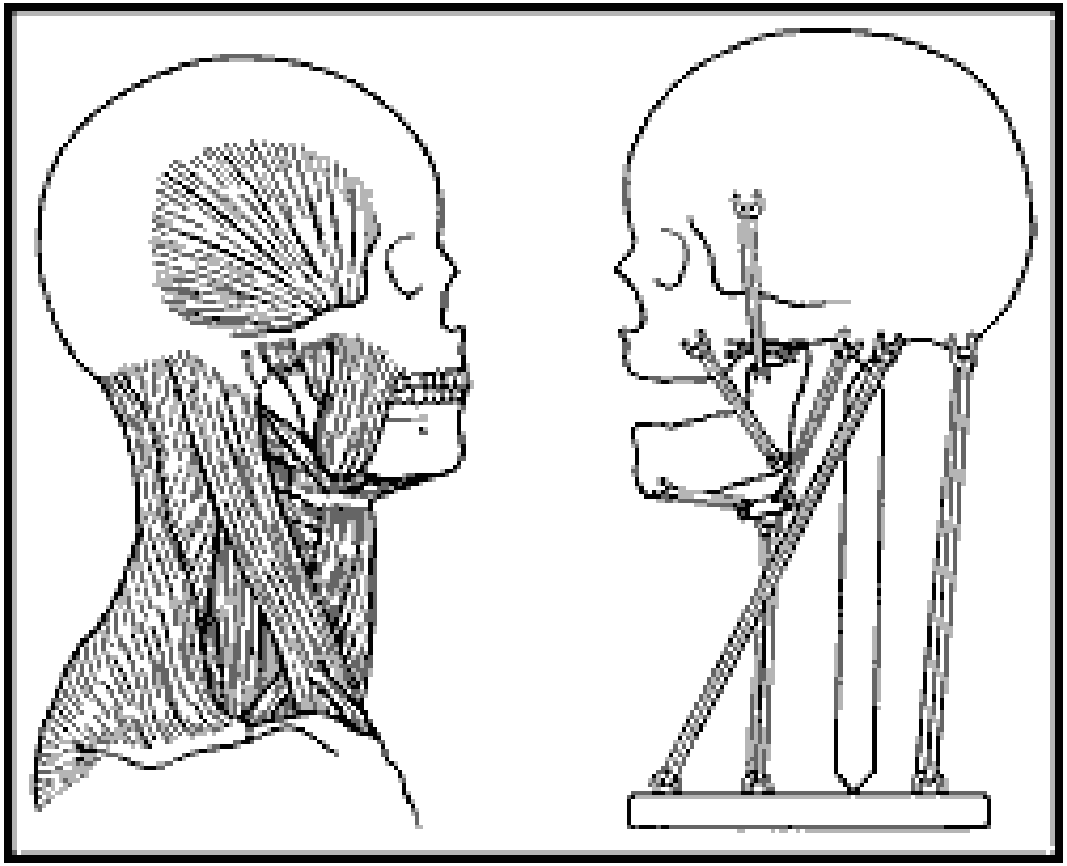
The Spine – Degeneration

- Disc degeneration
- Herniation
- Osteophyte development
- Spinal stenosis
  - Pressure on spinal cord
  - Nerves pass through cervical region (impair organ function)

Stenosis is a narrowing of the spinal canal



Head and Neck Loading



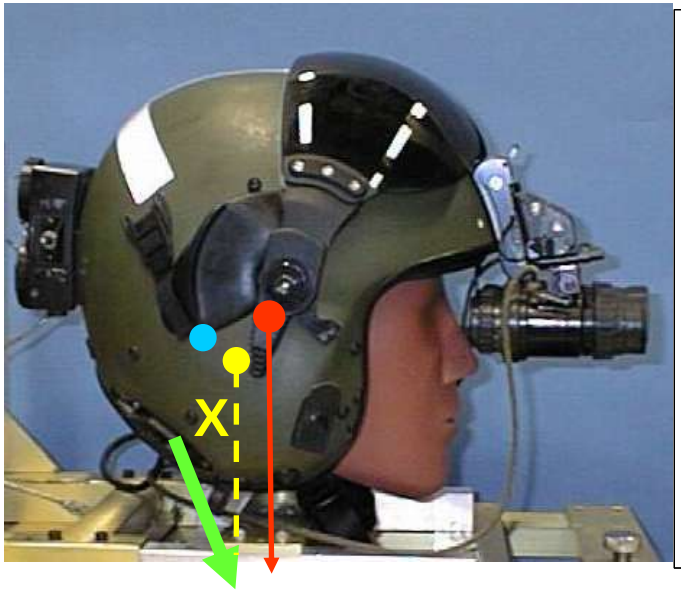
Head and Neck Loading

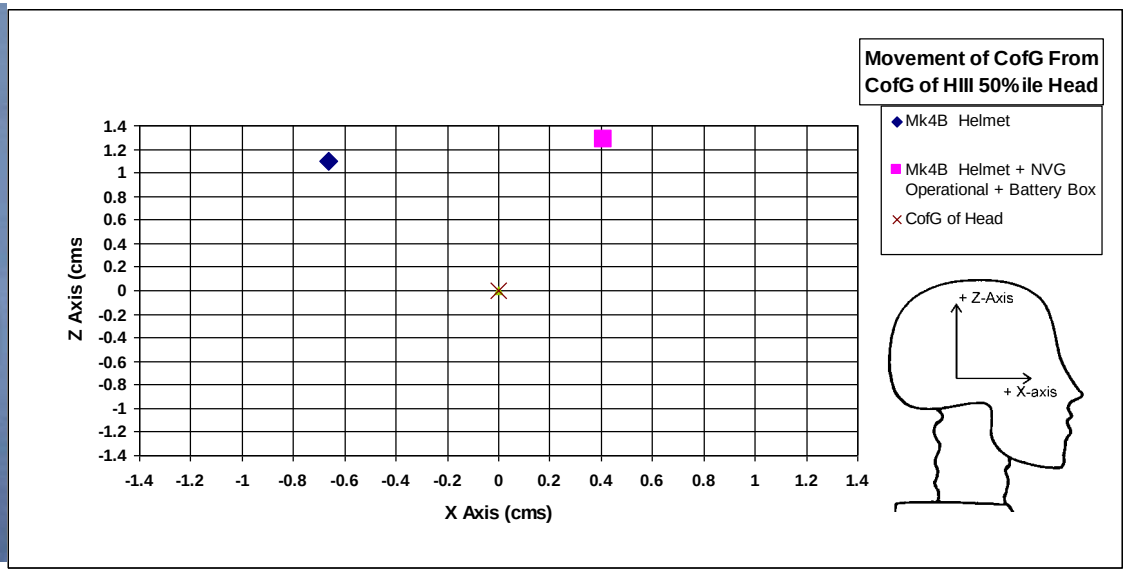
- An average Sherpa in the Himalayas carries more than his own body weight
  - Men: 50 kg
  - Women: 40 kg

Head and Neck Loading

- African women carry head loads equivalent to ~ 70% of their own body weight
- The least stress on the spine occurs when the head is centered over the spinal column,
  - Neutral alignment
- Spine can withstand **high compressive forces** along its length
- Intervertebral discs act as **shock-absorbers**

Head and Neck Loading

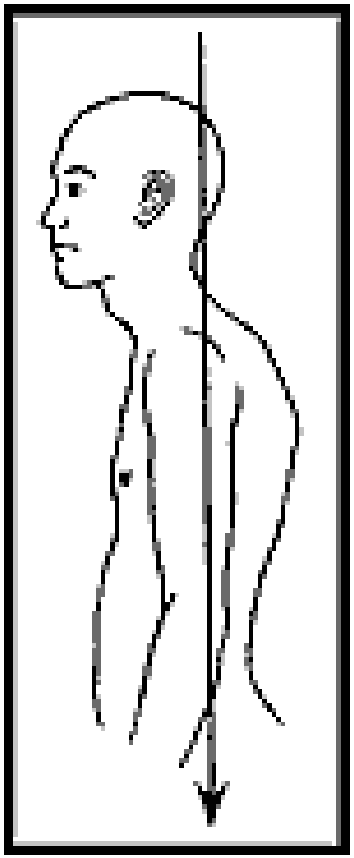




● - Head Centre of Gravity

X - Occipital condyle (balance point)

Posture

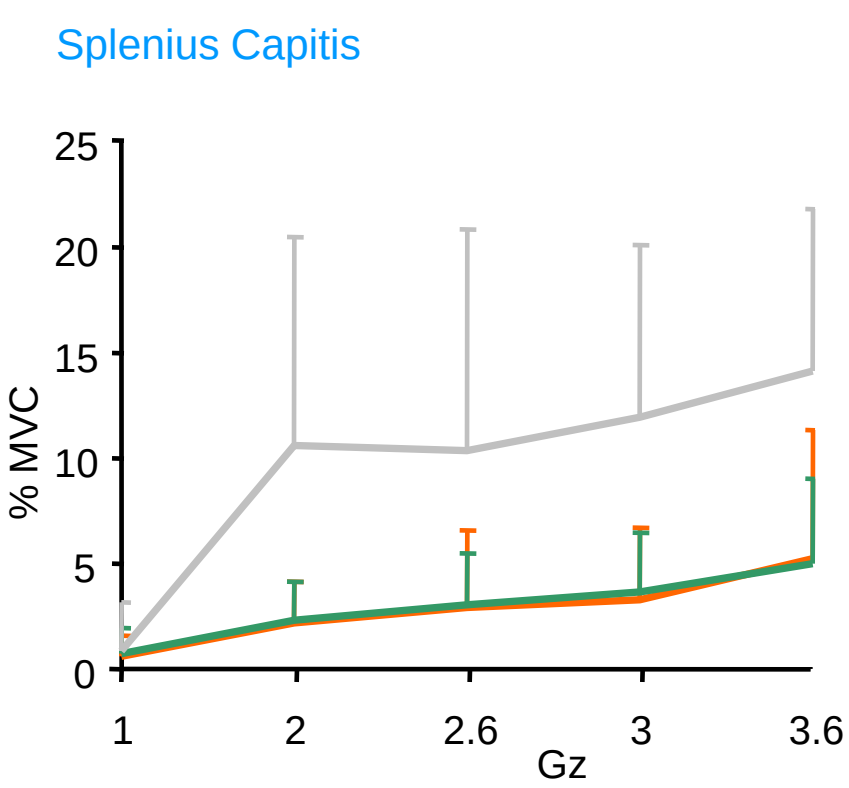


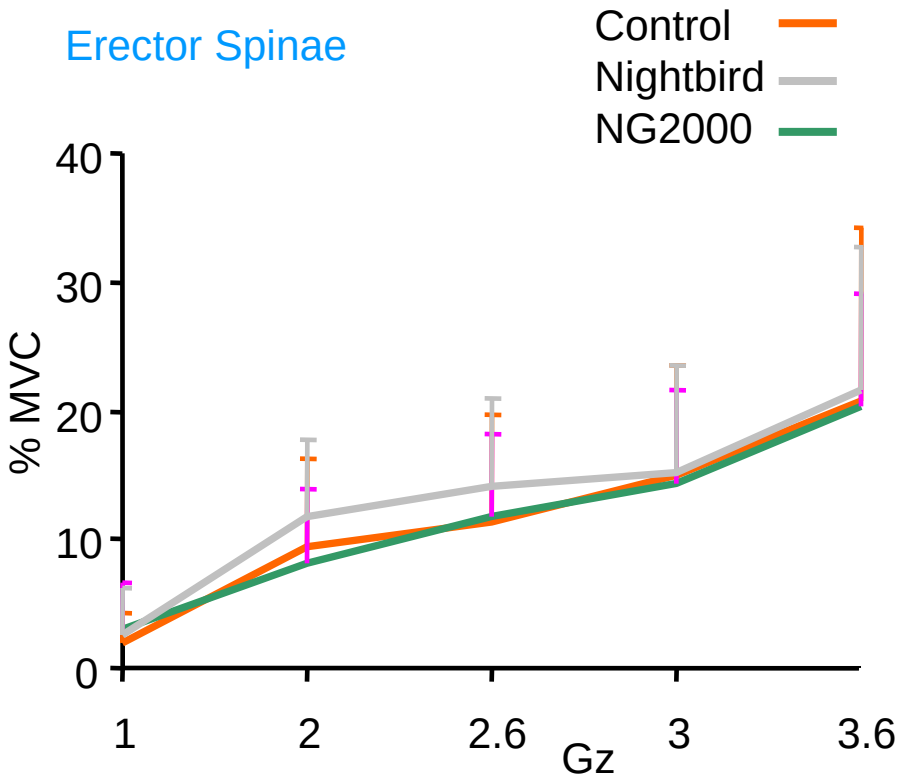
Head Position

Head Position

Head Movement

Head Loading and G





Rotary Wing Air Loadmasters

Surveillance

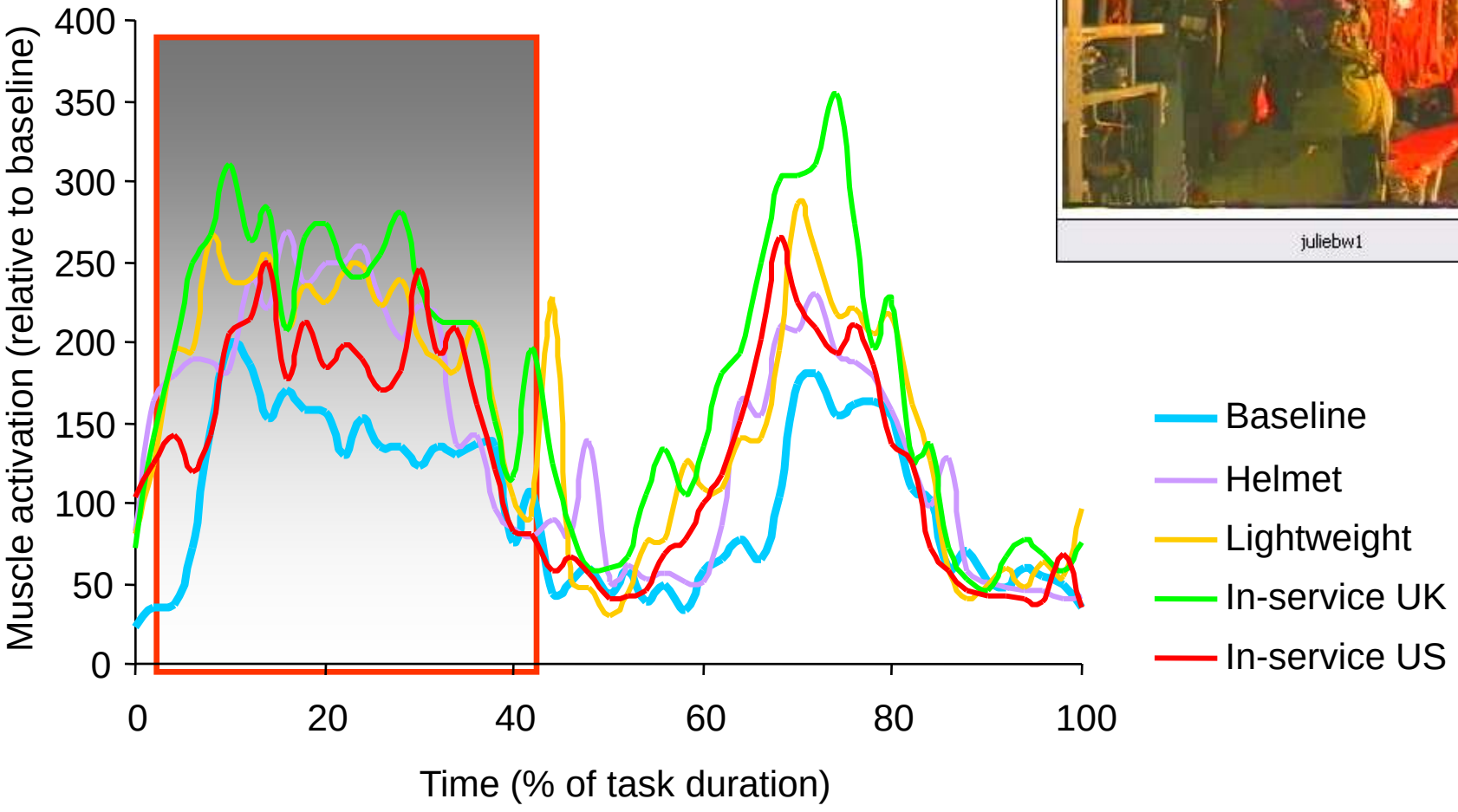
Heavy Lifting

Troop Management

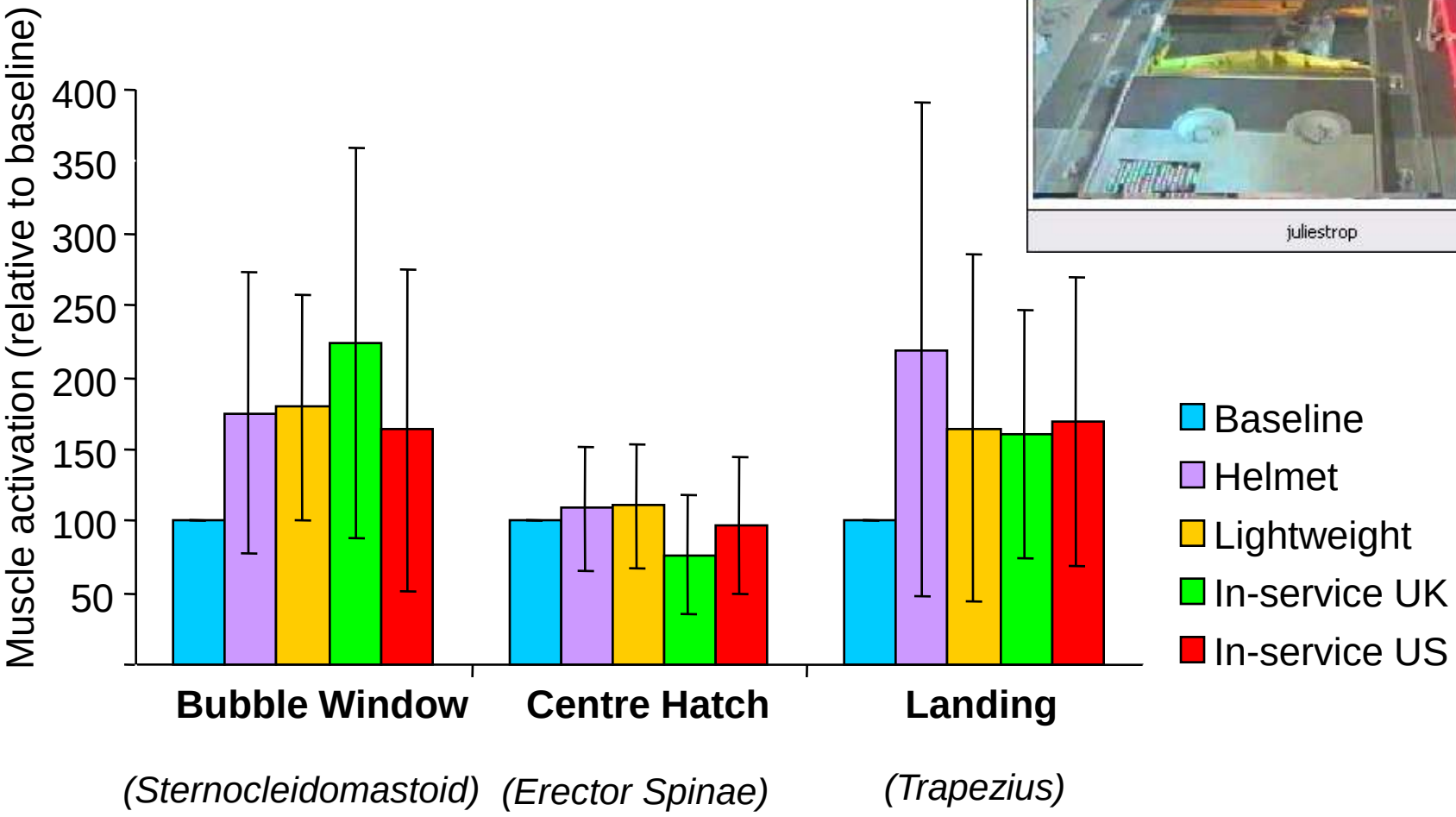
Rotary Wing Air Loadmasters

Contributing Factor	% pain (C7)	% pain (left / right side)
NVG	82	81
Stole / LCJ	51	41
Body Armour	49	47
Helmet	35	40

Head Loading in Air Loadmasters



Head Loading in Air Loadmasters



Neck Strength Training in Preventing Neck Pain








Conclusions

- The risk of flight-related neck pain in RAF aircrew is high
  - Fast jet: High G
  - Rotary wing: NVGs
- Reducing the mass of helmets and optimising the centre of mass will assist in mitigating the risk of flight-related neck pain
- Strategies to effectively reduce the onset of neck pain need to include training, improved equipment and cockpit design