INTRODUCTION: Exposure to microgravity during long-duration (6 months) spaceflights lengthens the spine\(^1\)\(^2\) and is associated with a 21-fold greater incidence of herniated nucleus pulposus (HNP), in the cervical region, compared with age-matched ground controls.\(^3\) Concurrent muscle atrophy or deconditioning may also contribute to increased HNP risk.

PURPOSE: To evaluate cervical intervertebral disc (IVD) heights and paraspinal muscle (PSM) morphology following a 6-month International Space Station (ISS) mission and a 30-day post-flight recovery period.

MATERIALS AND METHODS: Supine cervical spine MRI scans were produced pre-flight, immediate post-flight and at least 30 days post-flight recovery for 4 astronauts visiting the ISS. Functional cross-sectional area measurements of the axial cervical PSM at the C5-C6 level were performed. The fractional portion of lean muscle area was measured\(^4\) from a standardized total region of interest containing the posterior cervical extensors (multifidus, semispinalis cervicis, semispinalis capitis, splenius capitis, and upper trapezius). (Figure 1). IVD heights were measured at the anterior, middle and posterior sections from the C2-C3 to C7-T1 disc levels. (Figure 2). Student’s t-tests were used to determine significant changes at p<0.05. Data from a 5\(^{th}\) and 6\(^{th}\) astronaut is pending.

RESULTS: These preliminary results show cervical IVD heights increased slightly, on average 0.5±0.4mm, during the 6-month exposure to microgravity and a recovery on average of 0.1±0.4mm over the following 30 to 45 days relative to post-flight return. There were no appreciable differences between the anterior, middle and posterior aspects of the disc. (Table 1). An average 17% decrease in cervical lean muscle cross-sectional area was measured post-flight (p=0.08). A 4% recovery from immediate post-flight (21% of total loss), was observed after 30 days post-flight (compared to pre-flight data, p=0.13). (Figure 3).

DISCUSSION: This early data revealed PSM atrophy and essentially unchanged cervical IVD heights. The data compares to the lumbar spine, where PSM decreased by 14%, with a 9% (67% of total loss) recovery\(^4\). Lumbar spine IVD heights were also not appreciably changed. Such results give insight into back pain and IVD HNP risk, and suggest a possible countermeasure strategy. Data collection is presently ongoing.

SIGNIFICANCE: This research is important in understanding spinal deconditioning during both spaceflight and inactivity on Earth.

REFERENCES: