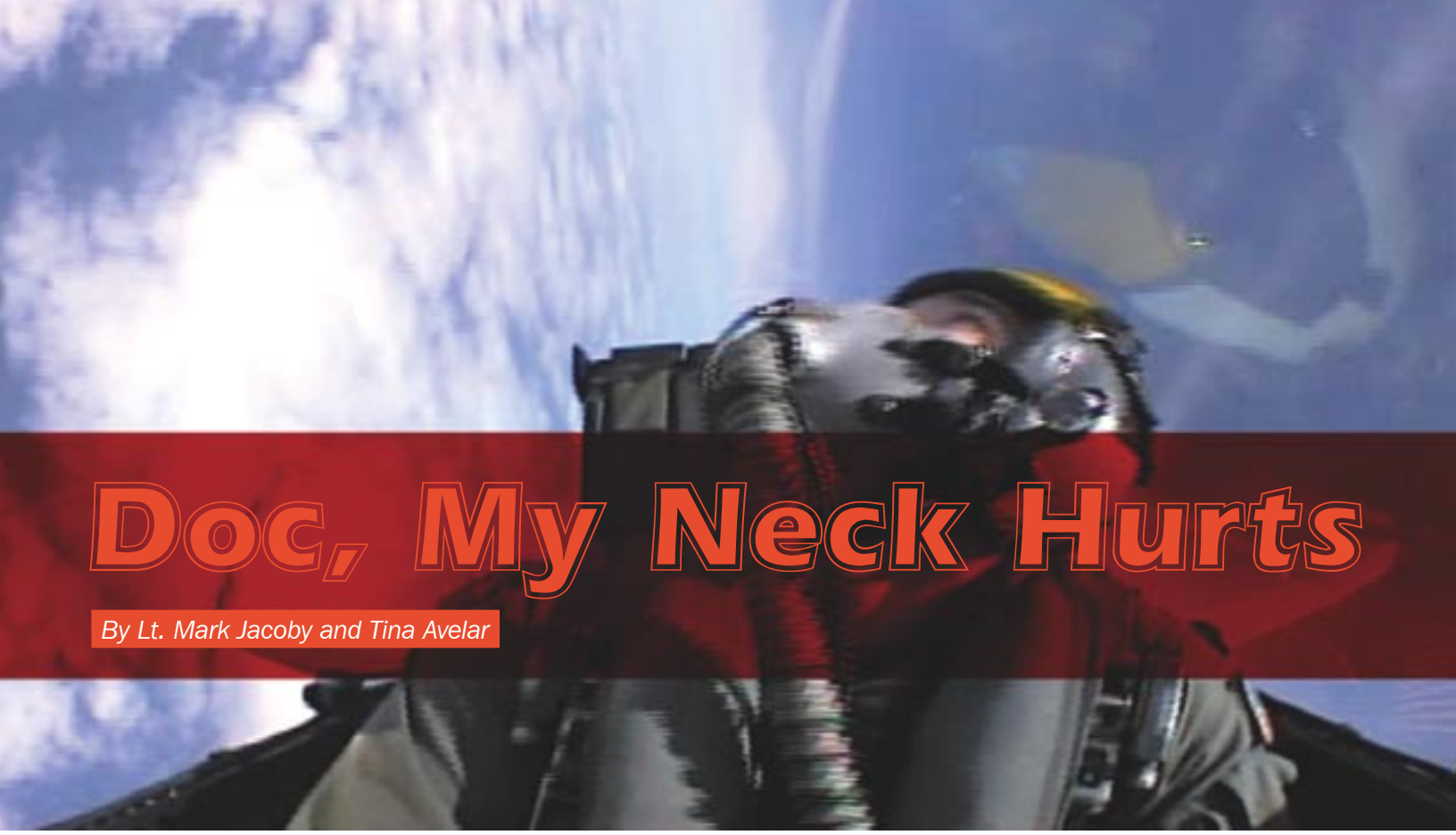

Doc, My Neck Hurts

By Lt. Mark Jacoby and Tina Avelar

Introduction

As a flight surgeon and physical therapist, respectively, with a fleet-replacement squadron (FRS), we know neck injuries are a common occurrence among aircrew. When questioning instructor and student pilots, a majority complained of neck pain at some point during their flying careers. The causes of their complaints included high G forces, inadequate stretching, weak neck muscles, and a failure to preposition the head before hard turns. Given the impact this problem has on aircrew, we want to share some information and educate the aviation community.

Risk Factors

Whether you are the pilot-in-command or a crew member, each aviator is at risk for experiencing complications from G forces. Risk factors may increase the chance of developing a disease and can be categorized as either controllable or uncontrollable. For aviators, the controllable risk factors are those which can be changed to prevent injury; they include smoking, weak neck muscles, prior injuries, inadequate warmup exercises, and poor posture. Research suggests smokers have a three-to-four-times-higher risk of developing neck injuries. Nicotine and carbon monoxide contained in cigarettes can exacerbate preexisting disc degeneration by inhibiting the discs' ability to absorb nutrients they need from the blood. The result can be prematurely dehydrated, less pliable (degenerative) intervertebral discs. Making lifestyle modifications can decrease your risk of injury.

There also are risk factors that cannot be changed. These uncontrollable factors include fatigue, coughing, sneezing, heavy lifting, vibrations, high G head turns, unexpected hard turns, repeated exposures of G forces greater than four Gs, and the use of required equipment, such as helmets and night-vision goggles (NVGs).

G Forces

You'll recall from your aerospace-physiology lectures that G forces are the result of inertial forces acting upon the body. This is the same force pulling you toward the earth. The most familiar type of this force is acceleration, the change in velocity per unit time, and is known as gravity (G). On earth, this pull causes the body to have a certain weight. When an airplane accelerates,

Risk factors

Controllable	Uncontrollable
Weak muscles	Fatigue
Strength/flexibility	Coughing/sneezing
Prior injuries	Heavy lifting
Inadequate warm up	High “G” head turns/ unexpected hard turns
Posture	Repeated exposure of G forces > four Gs
Smoking	Equipment design

slows down, or changes direction, the occupants appear to move, be thrown, or centrifuged (they experience an acceleration) in the opposite direction. During dynamic flight, it is important to realize the added effect G forces have on the body. For example, if your head weighs 10 pounds at 1 G, it will weigh 60 pounds under 6 Gs. This force places tremendous stress on the supporting structures of the neck.

Neck Anatomy

The neck is composed of seven bones (C1-C7), known as cervical vertebrae. These vertebrae serve as framework upon which the skull rests. Between each vertebrae are flexible, gel-like pads called intervertebral discs. These discs help give your spine its curves and flexibility; a curved, flexible spine is stronger than a straight, rigid one. These discs also separate and join your vertebrae together. Without them, your spinal bones would grind together whenever you walked.

Discs also affect your height. You are about one-quarter to one-half-inch taller when you wake up than when you go to sleep. Why is that? Because gravity makes your discs thin a little when you walk and sit during the day, and they expand a little while you lie in bed. Astronauts gain about one inch in height as a result of weightlessness.

The back of each vertebrae form a tube-like canal of bone that runs down the length of the back. The spinal cord and nerves travel through this space, called the spinal canal. A pair of spinal nerves exit each vertebra through small openings, called foramina (one to the left and one to the right). The nerves connect to the muscles, skin and tissues of the body, providing sensation and movement to all parts of the body. The spinal cord and nerves are further supported by muscles and ligaments attached to the vertebrae.

Causes of Neck Pain

There are several causes of neck pain. The most common is a traumatic injury, such as whiplash. This injury consists of a tear or bleeding in the supporting neck muscles, ligament ruptures, or disc material tearing away from the vertebra. Other causes involve the intervertebral-disc space and includes disc bulge, herniation or degeneration. Neck pain can be divided into acute versus chronic causes.

Most acute injuries in the cockpit occur when maneuvering your head under high G forces. The severity of the neck injury will depend upon how much damage occurs to the muscle, nerve or intervertebral disc. This damage can range from small partial muscle or ligament tears to overstretched nerves and shearing-stress injury of the intervertebral discs. Outside of the cockpit, whiplash is a common acute injury sustained during an auto accident. This is typically termed a hyperextension and/or hyperflexion injury, because the head is forced to move backward and/or forward rapidly beyond the neck's normal range of motion. The unnatural and forceful movement affects the muscles and ligaments in the neck. Muscles react by tightening and contracting, creating muscle fatigue, which results in pain and stiffness.

Chronic injuries occur over time and with prolonged high G-force exposure. Compared to the nonflying community, many aircrew begin to develop signs of arthritis and disc herniation much earlier when compared to nonflying personnel. Loss of intervertebral-disc space and stimulated-bony formations, known as osteophytes, are early signs of damage.

Osteoarthritis is a common joint disorder causing progressive deterioration of cartilage. The body reacts by forming new bone, termed osteophytes (bone spurs), that impact joint motion. When tissue damage does occur, chemicals are released. These chemicals stimulate pain receptors and induce inflammation. Most people experience some sort of pain or stiffness. If the injury affects the nerves, as in a disc herniation compressing a nerve root, you can experience neurological symptoms, such as shooting-electrical pains down your arm.

You need to see the flight surgeon immediately for any numbness, tingling, notable muscle weakness, severe and/or sharp pain, or after seven to 10 days of mild pain and decreased range of motion.

Depending upon your symptoms and physical exam, the flight surgeon may elect to order imaging studies, such as X-rays, CT, or MRI, for further evaluation. Also, you will be treated with analgesics, ice, heat and/or massage, strengthening and/or stretching, and rest. It is important to have your flight surgeon examine you; don't try to self-diagnosis or self-treat your injury. If your injury is minor, you may be treated with an anti-inflammatory, such as Motrin, and still be allowed to fly. For more serious injuries, you will be med down until your symptoms have resolved.

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When to see the flight surgeon

Immediate
Any numbness, tingling or electrical-like shooting pain
Notable muscle weakness or decreased grip strength
Severe and/or sharp pain
After 7 to 10 DAYS
Mild pain
Decreased range of motion

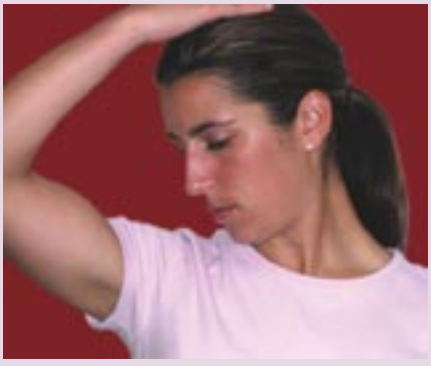
Prevention and Treatment

Having read this far, you may be asking yourself, "Is there anything I can do to prevent my neck from hurting?" As mentioned earlier, one of the controllable-risk factors includes stretching and strengthening. Unfortunately, other than by word of mouth, no formal education or training protocol exists, instructing aircrew on such stretching and strengthening exercises. Following are a few key areas to address before, during and after your flight. Stretches can be performed with or without overpressure from one's hand. If you experience stretching pain when you get into each position, no overpressure should be applied.

1. Muscle Endurance Training and Stretching

(a) Stretch the upper trapezius and levator scapulae muscles both pre and postflight. Using general muscle stretching principles, it is recommended to hold each stretch for at least 30 seconds to allow the muscle fibers to lengthen properly. These stretches should be repeated three times per side for a gradual static stretch. It is advised to stretch both pre- and postflight for maximum benefit.

Upper trapezius stretch



Levator scapulae stretch

(b) Strengthen the deep stabilizing muscles in the front of your neck. Lie on your back and produce a static contraction by performing a head-nodding motion, bringing your chin toward your throat. You should feel your neck lengthen and a little more pressure on the back of your head. The small muscles in front of your throat should contract. Hold this contraction for 10 to 20 seconds, and repeat 10 times. Other positions can be used, such as on hands and knees, once the neck flexors build endurance.

Starting position

Ending position

(c) Build isometric strength in the cervical extensors, lateral flexors, and deep rotators by holding static contractions, with moderate pressure into your hand, for 10 to 15 seconds. Repeat five times; perform twice per day.

Push head back into your hand and left (cervical extensors) (lateral flexors)

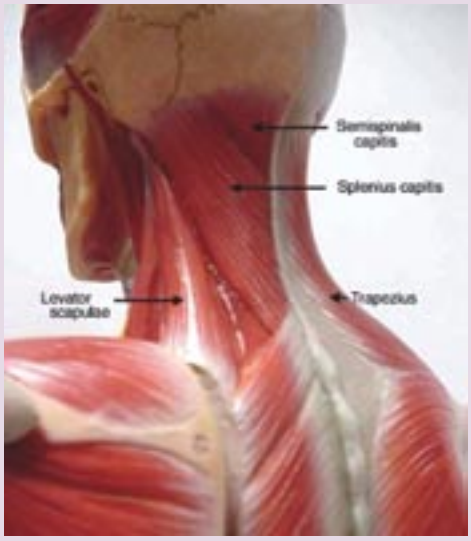
Push head toward right side

Push your cheek into your hand as if producing a turning motion, without moving your head (deep rotators)

(d) Participate in regular sessions of aerobic training. This has been shown to improve a pilot's "staying power" by allowing rapid recovery from any straining maneuver while pulling high G forces.

2. Posture

Build postural-muscle endurance to support the cervical and upper thoracic spines. Exercises such as seated rows, lat pull downs (performed three sets of 15 repetitions at a moderate weight), and squeezing your shoulder blades together for 10 seconds, 10 times per day, will help improve the strength and endurance of you posture muscles. These exercises will prevent a head forward, shoulders-rounded posture that can place more stress on the neck.



3. Prepositioning the Neck

Bracing your head and upper body on the headrest before pulling high +G forces, maintaining your neck position for the duration of the +G turn, and using the canopy rail while steering with your left hand to make a right turn are all methods that can be used to prevent acute, inflight, neck injuries.

The bottom line is that your job requires a highly stable neck. Stretching and exercise provide optimum physiologic performance. Weak neck muscles cause neck fatigue, stiffness and pain, and higher risk of injury. Strong neck muscles mean less frequent and less critical neck injuries.