UPGUARD3000 Neck Support

(Patent Pending)

Frequently asked questions

***Who shouldn't wear the "UPGUARD3000" Neck Support?**
Individuals suffering from Severe Rheumotoid Arthritis, Ankylosing Spondylitis, Reiter's Syndrome, Psoriatic Arthritis, Downs Syndrome, Enteropathic Arthritis or any condition that predisposes an individual to upper neck instability.
If there is any question, consult physician prior to using.

***Warnings**
If the potential of flame or heat exists the use of C401 (disposable sweat cover) must be used. If there is no possibility of open flames or heat, our C403 flannel cloth sweat cover is recommended.
Note. The C401 disposable flame retardant sweat cover meets the NFPA-701 and CGSB 4.2 standard. This disposable cover cannot be laundered and should be discarded after each use.

Why should I wear the "UPGUARD3000" Neck Support?
If you suffer from neck pain or a "stiff neck" from looking up the new "Neck Support" product may offer you relief! It may prevent onset of muscle strain due to fatigue.

What will the "UPGUARD3000" Neck Support do?
"The UPGUARD3000" has been designed by a doctor to make it easier to "look up" for extended periods of time. The UPGUARD3000 helps preserve the anatomical integrity of the neck while in sustained or repetitive extension motions. The new "UPGUARD3000 Neck Support", via its strap attachment, rests on the upper thorax (top of the back) and approaches the neck when the head is extended, or tilted backwards. The support serves as a reminder to restrict motion rather than completely block motion. With the support resting on the upper back, the extension range of motion can be limited.

Who should wear the "UPGUARD3000"?
Workers who adopt a sustained, or abnormal working positions particularly those that have to "look up" or "out" for extended periods of time.

Which working trades may benefit from the "UPGUARD3000"?
Many trades may benefit from "The UPGUARD3000 Neck Support" including; utility workers, maintenance workers, cleaners, foresters, dry-wall installers, painters, window- washers, mechanics, plumbers, electricians and many more. Many sport enthusiasts may find the "UPGUARD3000" valuable as well. Rock climbers and sailors have found it helps relieve neck strain.

How do you wear the "UPGUARD3000" Neck Support?
Simply place the "UPGUARD3000" on your shoulders over the upper thorax (top of back) and clip the two fasteners to either your belt or pant tops. The movable slide adjusters should be adjusted to provide a loose fit that does not "pull" on the shoulders.
Many workers' find that moving the clips further out towards the hips will provide better stability.

How do I clean the "UPGUARD3000"?
"The UPGUARD3000 Neck Support" may be cleaned with mild soap and water, allow webbing to completely dry before re-using.

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UPGUARD3000 Neck Support

Features	Benefits
Polyurethane Gel Foam™ Foam	Offers gentle yet firm support Hypo allergenic Excellent cold weather performance
Closed cell foam	Will not absorb sweat
Heavy-duty polypropylene straps	Long wear and maintenance free
Nickel-plated, large capacity clips	can be attached to belt's, pants and many fall arrest devices.
Curved neck support	designed to fit under most hard hats and climbing headgear
Light Weight	Easy to wear for long periods of time
Disposable FR sweat cover available	Meets NFPA-701 and CGSB 4.2 FR standards

“Cervical Spine Protective Support”

Prepared by: Dr. D.G. Racicot, B.Sc., D.C.

At last! A promising new support for the most complicated articular system in our body – the neck. Commonly described as being similar to a hydraulic shock absorber, that is, muscle is the shock absorber before the joints degenerate and/or discs herniated. The role of a neck "support" versus a "brace" varies according to the individuals purpose. Muscle disorders, and the prevention of, require gentle "support" to alleviate muscle loading (stretching and contracting). Significant bony or ligamentous disorders that impair stability of the neck require "bracing" to prevent displacement or neural damage. This particular neck device acts to "support" the neck at specific levels that are at risk to injury caused by extension of the head/neck complex that occurs when an individual looks upward.

Fig 1 UPGUARD3000 by NSC

In 1954, Hult published "The Munkford Investigation" regarding the epidemiology of neck pain. He discovered that 80% of male industrial and forest workers had experienced neck pain.(1) Since that time many epidemiology studies have reported that neck pain is extremely frequent in both industry and the general public. In fact, it is likely that at some time everyone will suffer from neck pain, often recurring, that amounts to some annoyance. There is a small percentage of people who perceive their neck pain as important enough to seek medical attention, or feel it impairs their capability to work. The prevention of disability claims is inspired not solely on preservation of the human frame but also financial repercussions. Physical injury to a neck can result in loss work time, medical expenses, and higher insurance premiums. A common denominator between industry and the individual is that prevention of neck injury benefits everyone.

Neck supports historically do not receive support from above the head or from the thorax below. This new neck support, via its strap attachment, rests on the upper/top of the thorax and approximates the neck when the head is extended, or tilted backwards. The support serves as a reminder to restrict motion and protect against end range extension motion of the neck. With the support against the upper back, the extension range of motion can be limited. This neck support has been technically designed to preserve the anatomical integrity of the neck in sustained or repetitive extension motions. Unlike historical foams that compress and gels that displace, polyurethane gel-foam acts by compressing individual cells that when uncompressed immediately return the material to precompression density. The effects on connective tissue activity (muscle, ligament, tendon, joints), adaptive stretching and shortening of fibers, have yet to be analyzed via

electromyographic (EMG) studies, although early radiographic studies (x-ray) have displayed some promising results.

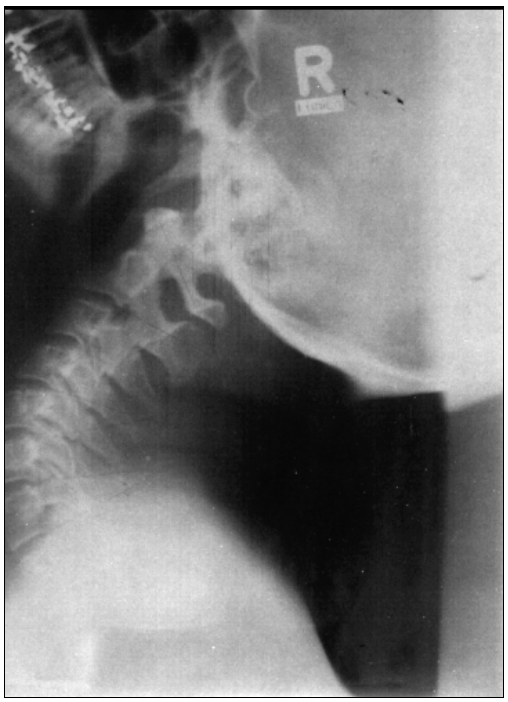

Figure 2 Without support

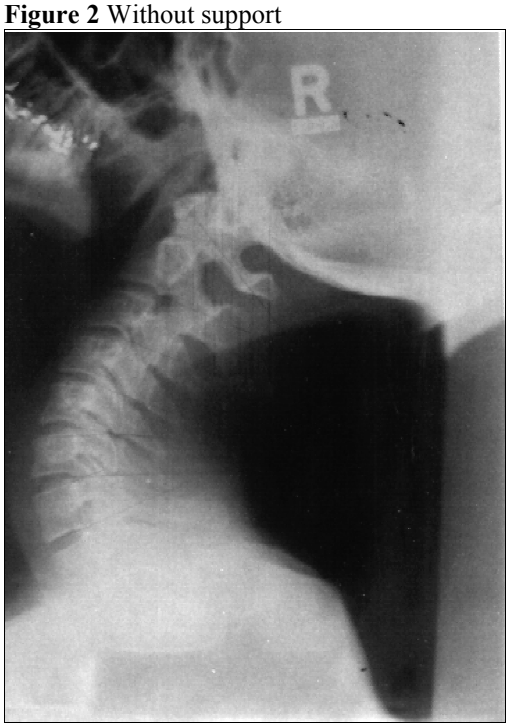

Figure 3 With support

X-rays show what is occurring within many of the neck structures With the aid of the UPGUARD3000 versus without support comparison x-rays it appears reasonable to predict what is occurring within many of the neck structures.

Historically it is the load distribution (forces) within the neck that ultimately produces failure of the articular-soft-tissue integrity of the neck and ultimately lead to injury/disability. The relationship between motion and load in the neck is quite complex and has eluded investigators both past and present. In accordance with Panjabi and Myers in a 1995 "Cervical Spine Protection Report" prepared for NOCSAE, it is believed that no single device, or model, adequately meets all the biomechanical criteria necessary to allow the evaluation of neck injury risk or the evaluation of the efficiency of an arbitrary safety device in preventing neck injury. Of particular importance to the design of this new support is the relationship between the distribution of forces in relation to the head, neck and thorax. By decreasing the load directly upon the extended neck, there is an increased ability of the neck to escape the risk of injury (2).

A variety of factors contribute to injury biomechanics of the neck. These include; mechanical properties of the should-thorax in relation to the neck, the initial position of the neck, the direction of loading upon the specific neck structures, the degree of constraint imposed by the neck support, the rate of loading, differences in age, gender, size, and structural integrity (including bone mineralization, presence of degeneration, and muscular adaptation). (2)

More specifically, according to Dr. Stuart McGill, optimal tissue health requires an envelope of loading, not too much or too little. An individual cannot avoid the mechanical injury but can minimize the risk of injury by:

1. Reducing peak and cumulative spine compressive loads, i.e.: vertebral body.
2. Reduce repeated full range flexion to full range extension, i.e.: disc.
3. Keep within tolerable levels of peak and cumulative shear forces i.e.: Z joints are neural arch.
4. Keep within tolerable levels, slips etc., to reduce the risk of injury to ligaments, i.e.: quick, anticipated movements. (3)

The UPGUARD3000 functions by reducing the load transmitted to the neck structure that occurs during neck extension at specific structural sites, specifically, the lower neck.

In accordance with Dr. McGill the spine being used in a deviated posture causes a large majority of injuries. The strategy of neck injury prevention is to develop spine posture awareness and control so that a deviated posture does not occur. (10) This neck support, with it compressive nature, will allow as much extension at the neck as is required by the individual to look upwards. Firm devices, that physically block neck motion, cause the low back to hyperextend to compensate for the restricted neck extension range of motion. Correct spine posture is critical to prevent neck injury.

Proper posture, vision, and neck mobility allow people to look upward. The dominant forces acting on the neck while in sustained extension and the point to where structural failure occurs is dependant upon the weight of the head, the effects of gravity on the head/neck/thorax complex, the degree of extension, the duration of extension, how quick the head moves into extension, and the existing structural integrity of the neck. Looking upwards, neck extension, causes a close packed position as the paired inferior facets of the zygapophysial joints (Z-joints) glide posteriorly on the superior facet of the vertebrae below, thus narrowing the foramen, and creating a tendency to compress nerve roots.

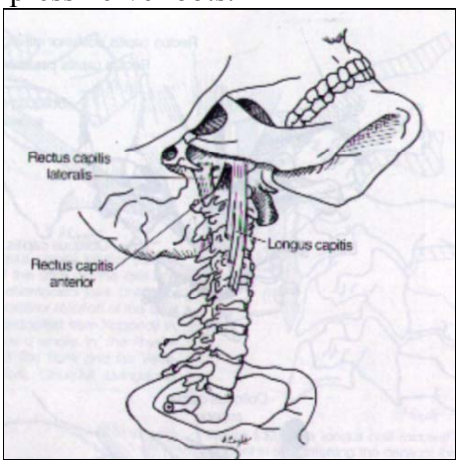

Figure 4 (11)

Limiting factors of extension range of motion in the neck include vertebral spinous processes and lamina as they are approximated /imbricated, a tightened anterior longitudinal ligament that runs up and down the anterior vertebral body and anterior discs and the joint capsules/linings of the Z-joints as they are compressed. Also occurring in extension is slackening of the posterior longitudinal ligament, ventral displacement of the nucleus within the intervertebral disc, loosening of the interspinous ligament and ligamentum flavum and loosening of the posterior neck musculature. Approximately half

of the flexion extension, or front to back, range of motion of the neck occurs at the C0-1 and C1-2 segments with remaining half of flexion-extension being distributed throughout the remain C2 through C7- T1 segments. There is a strong predilection for injury of "wear and tear" to occur in the lower levels of the neck, specifically C5-6. (3)

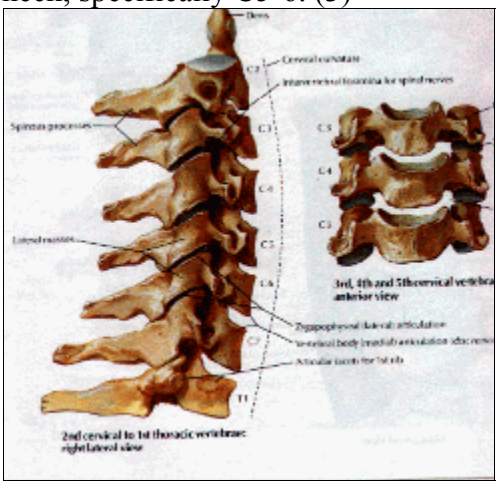

Figure 5 (12)

Neck complaints and disorders can vary significantly due to the intricate bone muscle complex.

Common symptoms of neck dysfunction include: sub-occipital headache, tension headache, cervicogenic headache, motion induced neck pain, shoulder-scapular-arm-hand pain, vision disturbances, tinnitus, dizziness, neurological symptoms such as arm weakness, muscle atrophy, numbness, paraethesias, difficulty sleeping due to pain, disturbed concentration and memory. Myelopathies can occur due to spinal cord involvement that triggers autonomic responses like bowel, bladder, and lower extremity dysfunction.

Common signs of neck dysfunction include: stiffness of the neck, rounded shoulders with the head forward, a flexed neck, asymmetry of the neck/shoulders, neck tilt or rotation, rigidity due to loss of motion or postural abnormalities, muscle tightness/spasms, swelling, enlargement of joints, tenderness to touch, misalignment of joints, improper biomechanics of motion or altered kinesiology, postural deficits and imbalances between agonist/antagonists, synergist and stabilizers, and muscle activation sequence defects.

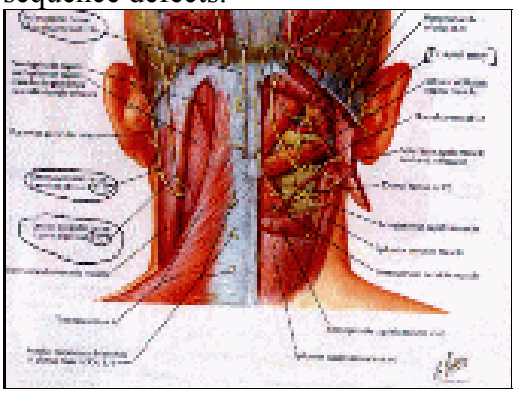

Figure 6 (12)

Common events that may lead to neck insult include: prolonged static positions, unusual or repetitive extremity work, lifting/pulling heavy, awkward objects, strainful sleep patterns, motor vehicle accidents, sporting activities, residuals of previous injury, improper training, poor conditioning and ill-fitted equipment.

Perhaps the largest issue regarding neck support is preventing the overuse of the neck. An abundance of neck sprain and strain injuries can be avoided by limiting the extent of repetitive, sustained, or abnormal positions, thus reducing disabling and costly injuries. With occupational illness on the rise, industry is continually seeking methods to reduce injury to the worker. It is difficult to pin point a

moment in time when a neck injury has occurred since many overuse illnesses do not manifest themselves immediately. It can take years before faulty biomechanics in the neck present objective and/or subjective signs and symptoms. Whatever the precipitating factors in an overuse situation, the problem comes from sustained micro-trauma that disrupts the body's ability to heal. When chemical mediators are allowed to persist beyond five days an overuse syndrome can occur. The sustained micro-trauma does not allow the body's inflammatory process to run its course. If inflammation persists healing does not occur and pain, dysfunction, weakness, reflex inhibition, splinting, recruitment and muscle imbalances occur (5). Often these changes are not realized until after macro-structural changes are noticeable.

Overuse injuries usually have insidious onsets and are initially ignored. This creates a problem because by the time an individual seeks care the problem is usually "layered". Recruitment patterns and altered biomechanics create diagnostic confusion since pain is often perceived away from the source. This is why education is so important. The best treatment is prevention. Second best is early detection and correction of aggravating factors with effective, goal-oriented, evidence based treatment and rehabilitation. It is much easier to treat an acute injury opposed to an overuse injury. People often work for years habitually ignoring any discomfort of underlying tissue changes in biomechanical/postural activity. In time these changes aggravate and the problem becomes "acute", a bone my fracture or a ligament or muscle-tendon junction tears via a serial failure of structure. (5) Failure of structure leads to an inflammatory response, pain referral patterns, weakness, and a myriad of other events already discussed. It is important for individuals, physicians, and employers to recognize, understand, appreciate and correct biomechanical imbalances before they emerge as acute, or overuse injuries.

Once the injury is established goals of treatment should be directed towards:

1. Control of the inflammatory process
2. Reduction of pain
3. Facilitation of healing.
4. Avoiding aggravation.

Bland indicates that there are six categories of neck injuries including:

1 Acute traumatic injury
2 Overuse injury
3 Chronic injury
4 Acute exacerbation of a pre-existing injury
5 Sub-clinical adaptations to activity
6 Intermediate prevent of injury

See [APPENDIX I] for detailed descriptions of these six categories. (5)

According to Panjabi and Myers injury is a permanent change in the mechanical properties of the spine or its components (ligaments, discs, facet, capsules, muscles, tendons, nerves, arteries). They have proposed three mechanical viewpoints to consider when analyzing a neck. Kinematic studies provide motion injury tolerance by document motions. Kinetic studies form load-deformation curves documenting both motion and load simultaneously.

Trauma studies documenting physiological load that causes injury, thus providing load injury tolerances. (6)

It has been estimated that a compressive load on the human cervical spine ranges from 120 N to 1200 N during activities of daily living. (7) Patwardhan et al. state that the load carrying capacity of the ligamentous cervical spine sharply increases under a compressive follower load, or compressive load tangential to the spine. Their experiment showed how an entire cervical spine can be curved/lordotic yet withstand large compression loads without damage or instability. In reality, the human cervical spine can withstand substantial compressive load. The compressive load approaches three times the weight of the head due to muscle co-activation forces in balancing the head in the neutral, relaxed position. The compressive load increases during flexion and extension and is estimated to reach 1200 N in activities involving maximal isometric muscle efforts. (6)

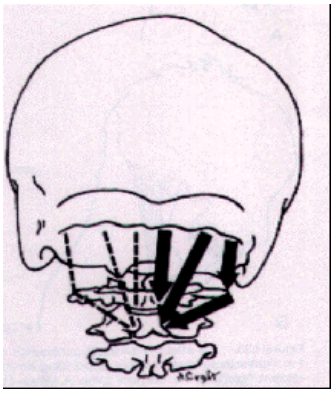

Figure 7 (11)

Patwardhan et al. showed the cervical spine buckling at a vertical load of 10 N. (7) This is far below what occurs in reality. In a sagital (front to back) plane, when a compressive load is applied along a vertical path to a whole cervical spine specimen, bending moments and shear forces are introduced because of the inherent curvature of the cervical spine, and the specimen undergoes large changes in its curvature at relatively small loads. Further loading of the specimen can cause damage to soft tissues and bony structures. Consequently, it has been postulated that for the cervical spine to sustain, without hyper mobility, the large compressive loads witnessed in reality, the internal shear forces, and the bending moments within the neck must be small. It was reasoned that the resultant internal compressive load of the cervical spine must be tangential to the curve of the neck, passing through instantaneous centers of rotation of the cervical segments. The cervical spine will support a much larger compressive load if the load is applied along a path that approximates the tangent to the curve of the neck, compared with the vertical load path. The conclusion of this study was that load carrying capacity of the ligamentous cervical spine sharply increased under an internal compressive load. (7) This study helps explain how a whole cervical spine ca be curved/lordotic and still withstand large compressive loads. The effect of internal compressive loads should thus be maximized by wearing this new neck support because it contacts the cervical spine tangentially to joint motion. Larger loads should be sustained without failure in the neck through utilizing this new support.

From initial radiographic comparison of the new neck support “with use” versus “without use” there are some promising physical findings regarding neck extension. Radiographic differences, while wearing the neck support during extension, included less spinous process approximation in both the upper and lower cervical spine.

Figure 8 – UPGUARD3000 The Neck Support Co.- Support with head in reclined position

Also evident from the film comparison are: decreased loading of the posterior elements of the neck, reduced stretch of the anterior neck musculature, reduced shortening of the posterior neck musculature that indicate more load should pass through the disc as opposed to the posterior elements. Decreased posterior neck muscle contractions should cause less ischemia, and consequently a decreased nocioceptive (pain) response. By decreasing the extension of the upper cervical spine segments, there is less load transmitted to the posterior elements. It has also been reported that anteroposterior sliding at the Z-joints associated with capsular strains may be responsible for compromising joint integrity. (8) Less load on the lower neck, specifically C5-6, should result in a marked decrease in neck failure and disability. Muscle spasms and inflammatory process should be minimized while wearing the UPGUARD3000 by limiting the amount of Z-joint anteroposterior motion with extension of the head. Other effects of this neck support include keeping the articular structures separated that can prevent facet arthorpathies and nerve root compression. It decompresses the intervertebral space reducing disc derangement and subsequent disc degeneration. It protects against ischemia, protecting against the initiation of musclar-tendonous-ligamentous-capsular sprains and strains of the neck.

Due to inherent assumptions and simplifications, current studies cannot predict biomechanical responses in complex loading odes. (9) Where does current research of the neck structure and function leave individuals who suffer neck related pain and dysfunction, or employees high cost of neck injuries, or the physician attempting to diagnose and treat neck related disorders? Education leading to prevention is our answer. When sampled the Model 3000 limited end range extension and was extremely successful in alleviating pressure felt in the back of the neck.

[APPENDIX I] Neck Injuries Classified Into 6 Categories (4).

1. Acute Traumatic Injury: A result of trauma. It is any damage to the tissue that has occurred in a well defined and limited time frame. The time, place, and mechanism are quite clear.

2. Overuse Injury: Known as "repetitive trauma" disorders, the cumulative trauma disorders, the repetitive strain disorders, and the regional musculoskeletal disorders. This is a failure of the homeostasis of the tissue due to repeated and prolonged micro-trauma that creates a tension overload on the tissues. Repetitive micro-trauma overwhelms the body's ability to organize and sustain a proper healing response. Normal tissue is replaced, or infiltrated, with scar tissue and angiofibrotic hyperplasia. Given time, it results in altered biomechanics, clinical adaptive changes in flexibility, balance, strength and performance.

3. Chronic Injury: Consists of pain patterns and weakness persisting beyond normal tissue healing times. Proper tissue complexes were not approached, treatment time was inadequate for accepted organization and stabilization of the injury and/or re-integration and rehabilitation effects were limited or non-existent. This results in a wide range of biomechanical faults, compensations, recruitments, and positive feedback loops.

4. Acute Exacerbation of a pre-existing injury: A previous injury site is easier to exacerbate or re-injure. It may involve over loading a precious tissue complex. Whatever the precipitating event, the result is an acute inflammatory reaction from overload or repetitive/sustained activity.

5. Sub-clinical Adaptation to activity: Maladaptations create tissue stresses and overloads that can resulting a host of problems ranging form acute injury to degenerative changes. The problem is muscle imbalances are inflexibilities couple to tissue overloads and adaptations.

6. Intermediate Presentations of Injury: People attempt to maintain their jobs and activities of daily living to a point where irritations are sustained. The presentation is acute, repeated aggravations, sub-acute aspects and emerging chronicity are all overlaid with a variable number of compensations, pathophysiological alterations and biomechanical imbalances/faults. This spectrum confuses people due to the unpredictable pain-spasm-pain cycle created by nervous system involvement.

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