INTRODUCTION
This first chapter provides an overview of various types of headache and neck pain. The content establishes a language for discussing headache and neck pain and creates the structure for the following chapters. Since headache and neck pain often occur together it is prudent to understand, assess, and treat the conditions in unison. Massage therapy applied to address the symptoms and causes of headache and neck pain can be very beneficial so long as the treatment is based on accurate information and safe and best practices.

HEADACHE
Headache is a common symptom with a multitude of causes. Headaches can be caused by stress, muscle tension, chemical imbalance, disordered breathing syndromes, nutritional disruption, side effects from medication, vascular dysfunction, sinus disorders, tumors, and many more internal and external influences. There are two basic headache types (Figure 1.1):

- Vascular type: fluid pressure with pain experienced as throbbing from the inside of the head out, usually classified as migraine although migraine is only one type of vascular headache.
- Tension type: soft tissue shortening, typically called muscle-contraction headache, although as we will learn, headache is more complicated than a short muscle problem. This headache is experienced as a squeezing on the outside of the head.

Because the brain has no sensory innervations, headaches do not originate in the brain but in the tissues surrounding the brain and in the muscles of the shoulders, neck and scalp. The pain of a headache is produced by pressure on the sensory nerves, vessels,
meninges, or the muscle–tendon–bone unit. This pressure is caused by two main factors:

- fluid pressure from various sources including dilation of blood vessels
- soft tissue shortening including connective tissue changes and muscle shortening.

Massage is most effective for the soft tissue shortening headache type and less so for the fluid pressure type.

**Population distribution for headache**

Headache is common and people of all ages and from all cultures experience headache (Box 1.1). Children often experience headache related to a vascular disruption (migraine type) or emotional problems that increase the stress response (soft tissue shortening type). Often children will have digestive upset in response to headache, i.e. they have a headache in their belly. Most can relate to being children and attempting to avoid school with a stomach ache.

Therapeutic massage provides a noninvasive and safe method for dealing with tension and stress related to headache pain.

**Predisposing factors for developing headache**

Three mechanisms seem to be related to developing headaches:

- A protective mechanism in response to what the body perceives as an external environmental stress. How the body responds to temperature, humidity,

and other environmental influences can predispose sensitive individuals to developing vascular headache. Common triggers of vascular headaches are stress, heat, food, or a lack of sleep. People with a predisposition to headache may have a lowered threshold of response to these external stressors.

- Response to disease due to infections caused by bacteria, viruses, and other pathogens related to the inflammatory response. Consider the muscle aching and headache typically experienced with influenza.

- Postural distortion, repetitive or sustained movement, and trigger point referred pain patterns.

**HEADACHE CATEGORIES**

For clinical purposes, the International Headache Society (IHS) divides headaches into two broad categories:

- **Primary** or benign (not due to an underlying cause): headaches with no organic or structural etiology, including tension headache, vascular (migraine) headache, cluster headache, and medication-overuse headache (MOH). Most primary headaches develop slowly over minutes, if not hours.

- **Secondary** (due to an underlying cause): headaches due to an underlying structural or organic disease such as related to a benign or malignant brain tumor, a brain aneurysm, hematoma, meningitis, brain abscess, cerebral hemorrhage, encephalitis or other infection, or various diseases of the brain, eye, ear, nose, etc. Fortunately, less than 5% of headaches are caused by tumors, and not all people with tumors experience headaches. Symptoms of serious headache that require immediate medical attention are a sudden, sharp, intense or severe pain, sudden lack of balance or falling, confusion, inappropriate behavior, seizures, and difficulty speaking.

**Safety first**

While not common it is important to recognize that headache can be a symptom of a much more serious condition that requires immediate medical attention. Individuals with a headache that involves any of the following need to be immediately referred for prompt medical care:

- sudden, severe headache
- sudden, severe headache associated with a stiff neck
- headache associated with fever
- headache associated with convulsions
- headache accompanied by confusion or loss of consciousness
- headache following a blow on the head
headache associated with pain in the eye or ear
persistent headache in a person who was previously headache free
recurring headache in children
headache which interferes with normal life.

Primary headache

Tension-type headache
Tension-type headaches are the most common, affecting approximately 75% of all headache sufferers. The pain is typically generalized all over the outside of the head, often with accompanying neck and shoulder pain and stiffness. There appears to be a slightly higher incidence of this type of headache among women. It appears that at least one factor contributing to tension-type headache is hyper- and habitual sensitivity of spinal nerves at the dorsal horn (central sensitization) (Bendtsen 2000).

There are two kinds of tension-type headache:

- Daily headache: If chronic, this type of headache should be promptly treated to avoid developing an addiction to pain-relieving drugs. It is often accompanied by depression or other emotional problems, and sleep disturbance.
- Episodic headache: Occurs occasionally, sometimes associated with hormone fluctuations, physical activity, or changes in sleep or food consumption.

Causes of tension-type headache
- Muscle–tendon strain and trigger point development at the attachment of the trapezius and deep neck muscles at the occipital bone or at the attachment of the frontalis muscle on the frontal bone (occipital or frontal headaches).
- Old injuries or trauma to the neck can create headaches many years later. Repeated strain or minor injury to the neck may be all that is necessary to precipitate the headache.
Strain in the temporomandibular joint muscle complex. Temporomandibular joint dysfunction (TMJD) involves the muscles that move the lower jaw and the temporomandibular joints where the lower jaw connects to the skull. Physical and emotional stress is a common causal factor. Common symptoms of TMJD include pain behind the eyes, in the sinuses, and in the ears (without infection), chronic neck and shoulder pain, stuffy sensation and noise or ringing in the ears, ‘locked’ jaw, burning sensation in the throat, tongue and nose, and dry mouth.

Connective tissue structures that support the head may be implicated in headache if they are shortened and pull the head or scalp into nerves, creating pain. Conversely, if connective tissue support structures are lax and fail to support the neck and head, nerve structures may be compressed as well.

Trigger point referred pain patterns including trigger points in scalene, suboccipital, sternocleidomastoid, upper trapezius, masseter, pterygoids, temporalis, occipital frontalis and other muscles of the region (Fernández-de-las-Peñas et al 2006).

Predisposing factors include:
- headgear and hats that put pressure on pain-sensitive structures
- squinting under bright lights or in the sun
- dehydration
- blood flow changes
- overbreathing tendency
- blood sugar changes
- impact trauma that increases neck muscle tension
- changes in activity that strain upper body muscles and joints
- sleep disturbance
- teeth grinding
- emotional strain.

Vascular-type headache

Migraine. Migraine is considered a vascular headache because it is associated with changes in the size of the arteries inside and outside of the brain. Some researchers believe that migraine is an inherited disorder that somehow affects the way serotonin is metabolized in the body. Serotonin is the primary neurochemical trigger in migraine-type headache. For women, migraine tendency is also the way that serotonin interacts with female hormones.

Migraine headache pain appears to be caused by dilation of the cranial vessels when a biochemical change in the brain, stimulates the trigeminal nerve. This triggers serotonin release in the blood vessels and the brain, which alters blood flow, bypassing the capillaries and going through shunts to the veins, resulting in distension. The nerves around the blood vessels release chemicals which cause inflammation, eliciting pain signals into the brain.

The pain is knife-like, throbbing, and usually only on one side of the head. Visual distortion, such as flashing lights, is caused by vasoconstriction preceding the vasodilation and pain. A migraine is associated with nausea; vomiting; sensitivity to light, sound, and smells; sleep disruption; and depression. Hands and feet may feel cold and sweaty. The length of a migraine attack can last from several hours to several days. These attacks can be incapacitating. During a migraine, people often prefer to rest or sleep alone in a dark, quiet room. Applying cold packs to the head or pressing on the bulging artery in front of the ear on the painful side of the head may provide temporary pain relief.

Attacks can occur at any age, but usually begin between the ages of 10 and 40 and commonly reduce in frequency and intensity after age 50. Some people experience several migraines a month, while others have only a few migraines throughout their lifetime.

Migraine types. Migraine headaches are classified according to the symptoms they produce. The two most common types are migraine with aura and migraine without aura.

- **Migraine with aura**: An aura is a group of neurologic symptoms that sometimes occurs 10–30 minutes before the head pain begins. Most auras are visual and are described as bright, shimmering lights around objects or at the edges of the field of vision, zigzag lines, wavy images, or hallucinations. Others experience temporary vision loss.

  Nonvisual auras include motor weakness, speech or language abnormalities, dizziness, vertigo, and tingling or numbness (paresthesia) of the face, tongue, or extremities.

  About one in five migraine sufferers experiences an aura. There is a correlation between migraine with aura and the development of cardiovascular disease.

- **Migraine without aura**: Migraine without aura is the most common type and may occur on one or both sides of the head. Fatigue and mood changes may be experienced the day before the headache. Nausea, vomiting, and sensitivity to light (photophobia) often accompany migraine without aura.
Additional migraine headache types include the following:

- Basilar artery migraine involves a disturbance of the basilar artery in the brainstem. Symptoms include severe headache, vertigo, double vision, slurred speech, and poor muscle coordination. This type occurs primarily in young people.

- Carotidynia, also called lower-half headache or facial migraine, produces deep, dull, aching, and sometimes piercing pain in the jaw or neck. There is usually tenderness and swelling over the carotid artery in the neck. This type occurs more commonly in older people.

- Ophthalmoplegic migraine begins with a headache felt in the eye and is accompanied by vomiting. The eyelid droops (ptosis) and nerves responsible for eye movement temporarily become paralyzed. Ptosis may persist for days or weeks.

- Status migraine is a rare type involving intense pain that usually lasts longer than 72 hours. Hospitalization is often required for effective treatment.

- Hemiplegic migraine is a rare but severe type of migraine with aura and often begins with temporary motor paralysis and/or sensory disturbances on one side of the body, which may be accompanied by numbness or the 'pins and needles' sensation. When the headache appears, the initial neurologic symptoms may disappear.

- Retinal migraine starts with a temporary, partial, or complete loss of vision in one eye. It is followed by a dull ache behind that eye that may spread to the rest of the head.

- Abdominal migraine is difficult to diagnose because the pain is felt in the abdomen. Nausea, vomiting and diarrhea may occur, and the pain usually occurs in the middle of the abdomen. This migraine type occurs mostly in children.

- Menstrual migraines are primarily caused by estrogen, the female sex hormone that specifically regulates the fluctuations that occur throughout the menstrual cycle. When the levels of estrogen and progesterone change, women will be more vulnerable to headaches. Menstrual migraine can occur before, during or immediately after the period, or during ovulation. Because oral contraceptives influence estrogen levels, women on birth control pills may experience more menstrual migraines.

- Premenstrual syndrome (PMS) headaches are associated with a variety of symptoms that distinguish them from the typical menstrual migraine. The symptoms include headache pain accompanied by fatigue, acne, joint pain, decreased urination, constipation, lack of coordination, an increase in appetite and a craving for chocolate, salt, or alcohol. Emotional disturbance can occur including panic attacks, decreased sexual desire, impaired judgment or memory, sensitivity to rejection and even paranoia. These symptoms usually disappear when menstruation begins.

- Pregnancy-related headache. Pregnancy seems to protect women against migraines because the female hormones – estrogen and progesterone – remain fairly constant throughout pregnancy. However, some women do get vascular-type headaches. As this type of migraine typically occurs during the first trimester of pregnancy, when the fetus would be most susceptible to drug-induced deformities, all medications should be avoided.

- Headaches after labor and delivery. It is very common for new mothers to suffer from headaches, usually tension type. Migraine sufferers may also get postnatal migraines, although the headache will probably be milder than a typical full-blown attack. Postpartum headaches correlate with the sharp fall in estrogen and progesterone levels that follow labor and delivery.

- Menopause related. While migraines tend to become less frequent as women get older, they can also spontaneously increase or worsen during menopause. It is the drop in estrogen that triggers the migraine.

- Estrogen replacement therapy headache. Female hormones (estrogen and progesterone or estrogen alone) taken to treat menopausal symptoms may immediately worsen headaches, or prolonged use may worsen them over time. Men being treated with estrogen-type medications for prostate conditions including cancer may experience hormone-related headaches.

**Additional vascular headache types.** Not all vascular headaches are migraine type. The pressure causing the headache pain is caused by vasodilation but for reasons other than the influence of serotonin. Non-migraine vascular headaches include the following:

- **Benign exertion headache.** Benign exertion headache is brought on by running, lifting, coughing, sneezing, or bending. The headache begins at the onset of activity, and pain rarely lasts more than several minutes.

- **Toxic headache produced by fever.** Pneumonia, influenza, measles, mumps, and tonsillitis are among the diseases that can cause severe toxic vascular
headache. Toxic headaches can also result from the presence of foreign chemicals in the body.

- **Cluster headache**: Cluster headaches are relatively rare, affecting about 1% of the population. They are distinct from migraine and tension-type headaches with 90% of the sufferers being male. A history of heavy smoking and drinking is common, and alcohol often triggers attacks. The pain is extremely severe but the attack is brief, typically lasting no longer than 2 hours. The pain occurs around one eye, which unusually becomes inflamed and watery. There may also be nasal congestion on the affected side of the face. Cluster headaches come in groups or clusters lasting weeks or months and often occur at about the same time each day. A person can go into long periods of remission. No cause has been determined for this type of headache, but most can be controlled with adequate treatment.

*Note*: Referred pain from trigger points in the sternocleidomastoid, suboccipital, and various head and facial muscles can mimic vascular headache pain patterns.

Columns A and B in Box 1.2 show the symptoms commonly seen in two types of headache. Some people have both these types of headache. It is common for a tension-type headache to accompany a vascular-type headache.

## Additional headache types

While tension and vascular headaches are the most common, other headache types include rebound headache, withdrawal headache, and sinus headache.

### Rebound headache.

Rebound headache may occur among people with tension-type headaches as well as in those with migraines. The cause seems to be the result of taking prescription or nonprescription pain relievers daily or almost every day. If prescription or nonprescription pain relievers are overused, headache may ‘rebound’ as the last dose wears off, leading one to take more and more pills.

### Withdrawal headache.

This headache occurs as the body adjusts to a chemical change from removing a chemical substance from the body. Typically the headache occurs from changes in vascular function, muscle tone, and detoxification. Common substances that can cause withdrawal headache are elimination of caffeine, various neurotransmitter-based medications, recreational drugs, and alcohol. Withdrawal headaches subside as soon as the withdrawal process is complete.

### Sinus headache.

Sinuses are spaces in the bones of the face and are filled with air. Their secretions must be able to drain freely into the nose. When a sinus becomes inflamed, localized pain with pressure and throbbing in the face as opposed to the head will occur.

## NECK PAIN

The neck contains many vital anatomic structures, the most critical being the airway, the spinal cord, and the blood vessels that supply the brain. The neck is a complex and crowded area where all of the structures have to be maintained in an optimal relationship to each other.

### General anatomy of the neck

The neck anatomy includes the cervical vertebrae. This is an area of many joints that combine to allow flexion, extension, rotation, and many combinations of these movements (Figure 1.2). These movements orient the head and ultimately the eyes, ears, and nose in many different directions. The soft tissues in this area have to supply stability to maintain the position of the head as well as mobility for both large and small precise movements.

There are many vessels and nerves in this area, including the cervical and brachial plexus (Figure 1.3). Impingement is common, with referral patterns into the head, neck, down into the chest, and arm. If the

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**Box 1.2 Symptoms in tension- and vascular-type headaches**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>A (Tension)</th>
<th>B (Vascular)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild to moderate</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Moderate to severe</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Intense, pounding,</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>throbbing and/or</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>debilitating</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Distracting but not</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>debilitating</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Steady ache</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Location of pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One side of head</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Both sides of head</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Associated symptoms</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>and/or sounds</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Aura before onset of</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>headache such as</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>visual symptoms</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

For more information, contact the National Headache Foundation at www.headaches.org.
cervical plexus is impinged, the person most likely will have headaches, neck pain, and breathing difficulties. The muscles most responsible for pressure on the cervical plexus are the suboccipital and sternocleidomastoid muscles. Shortened connective tissue at the cranial base also presses on these nerves. Many cutaneous (skin) branches of the cervical plexus transmit sensory impulses from the skin of the neck, ear area, and shoulder. The motor branches innervate muscles of the anterior neck. Impingement causes pain in these areas.

The brachial plexus is situated partly in the neck and partly in the axilla and consists of virtually all the nerves that innervate the upper limb. Any imbalance that increases pressure on this complex of nerves can result in pain in the shoulder, chest, arm, wrist, and hand. The muscles most often responsible for impingement on the brachial plexus are the scalenes, pectoralis minor, and subclavious muscles. The muscles of the arm also occasionally impinge on branches of the brachial plexus. Brachial plexus impingement is responsible for thoracic outlet symptoms, which often are misdiagnosed as carpal tunnel syndrome.

Whiplash illness and injury, stingers, and burners often cause impingement on the brachial plexus.

**Muscle structure of the neck**

Understanding muscle location and action help one understand the way muscle dysfunction can cause neck pain.

- **Local muscles**: The local muscles produce fine precise movement and stability, and are located deep and near bone. The attachments are contained within the cervical region and base of the skull. The local muscles serve to stabilize the cervical vertebrae and guide movement, making it more precise. It is often this deeper layer of muscle that creates the tight, ‘want to crack the neck’ sensation.

- **Global muscles**: The global muscles, being more superficial, comprise the first and second layer of tissue and are involved in large movements, movements requiring strength and, if necessary, stability. The global muscles attach in the cervical area as well as into the head, torso, and upper limbs.

The neck has both local and global muscle patterns that can become problematic. In addition, the connective tissue structures of the area are a major factor in dysfunction.

The area consists of three or four tissue layers depending how you interpret the anatomy. The occipital base area is the transition point from the head to the neck. Transition areas usually involve fairly mobile jointed areas. The joint in this area is the atlas. Local muscles are involved in the stability of this area and consist primarily of the suboccipital group. These muscles also act as proprioceptive feedback stations on the position of the head in relationship to the rest of the body and are involved with the ocular, tonic neck, and pelvic reflexes for maintaining posture and balance. In some instances, the suprahyoid muscle may also work to balance the head, exerting a small counterforce to the suboccipital muscles.

The global muscles that can influence the occipital base are the sternocleidomastoid, platysma, semispinalis, splenius capitis, and trapezius. Local muscles include the scalenes, levator scapula, longissimus cervicis, semispinalis cervicis, iliocostalis cervicis, splenius, longus colli, and infrahyoids, as well as the multifidi, rotatores, interspinales, and intertransversarii at each individual vertebra (Figure 1.4).

The muscles that insert on the ribs often become short with upper chest breathing patterns. The outcome of this would be chronic overbreathing and breathing pattern syndrome symptoms. Sympathetic dominance will increase muscle motor tone in the area.
It is difficult to list individual muscles that can influence any particular area since the body is such an interconnected structure; however, these are the main muscles that affect local joint stability and proprioceptive information and global movement of this area. These muscles often develop trigger points which can refer pain as well as be a source of localized pain and dysfunction. Trigger points develop as an adaptive mechanism and, especially in the neck, stability is a major concern. As trigger point development can contribute to stability, it is therefore important to understand the reason for trigger point development as well as the entire interaction of short and long muscle/soft tissue.

**SUMMARY**

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KEY POINTS

Headache and neck pain are common conditions:

- Headache and neck pain often occur together and relate to each other.
- Stress is a common causal factor for headaches and neck pain.
- Headache is simply classified as vascular type and soft tissue tension type.
- Headache can be primary or secondary due to other disease and disorder.
- Primary headache can be caused by soft tissue dysfunction or vascular dysfunction.
- Many different activities, environmental factors, and changes in physiologic function can predispose one to headache.
- Neck pain can occur from traumatic or repetitive strain.
- Neck pain is usually due to postural dysfunction.
- Neck pain can be due to soft tissue dysfunction or nerve entrapment.
- Massage can address symptoms and dysfunction related to headache and neck pain.

Additional information

NINDS conducts research relating to headaches at its laboratories at the National Institutes of Health (NIH), and supports additional research through grants to major medical institutions across the country. NINDS also supports and conducts studies to improve the diagnosis of headaches and to find ways to prevent them.

Organizations

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Figure 1.4 Scalene anticus is removed from the left side of this drawing to reveal attachment of scalenus medius deep to it. The styloid process has also been removed anterior to rectus capitis lateralis. (Reproduced with permission from Gray’s Anatomy 1999.)
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Related NINDS publications and information
21st Century Prevention and Management of Migraine Headaches: Summary of a workshop on 21st

References