Repetitive Motion Injuries in the Salon and Spa

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Faculty

Charlene H. Grafton, RN, BS, MS, CCM, is licensed in two states as a Registered Nurse and was nationally certified as a Case Manager. She has worked as a Qualified Rehabilitation Provider and an Independent Nurse Case Manager. She was selected as Who's Who by American Colleges and Universities, American Nursing and also by the International Tennis Federation. Also, she is a Veteran of the Army Nurse Corps, First Lieutenant. Ms. Grafton has demonstrated her natural leadership style through volunteer work and participation on various Boards of Directors, such as the Jaycee Jaynes, Nevada Community Enrichment Program, Southern Nevada Continuity of Care Association, Florida's Governor's Council on Fitness and Sports, Nevada Tennis Association, National Senior Women's Tennis Association, Health Insight (Medicare and Medicaid) and the Executive Women's Golf League. In addition, she has presented papers and shown her teaching abilities by speaking at local, state, regional, national and international forums on a variety of subjects, including teaching techniques, lateral dominance, fitness and case management. As a writer, she has published two books about dominance and researched in areas of coordination, laterality, and sidedness from gifted to learning disabilities/problems and functional independence. Her work has also appeared in trade magazines.

Division Planner

Leah Pineschi Alberto, licensed cosmetologist and instructor of cosmetology, has been educating students in Northern California since 1975. In addition, she has been responsible for training educators in cosmetology, esthetics, and manicuring for more than 30 years.

Mrs. Alberto began her career with Don's Beauty School in San Mateo, California. She held a 30-year position at Sacramento City College and is currently a State Board expert with Cinta Aveda Institute. She is a salon owner, a former Department of Consumer Affairs examiner, and a speaker at the Esthetics Enforcement Conference.

The health and safety of the community of stylists, salon owners, and school owners has been the focus of Mrs. Alberto's career. She served on the State Board Task Force on Pedicure Disinfection commissioned by Governor Schwarzenegger to investigate the cleanliness of the pedicure industry. The Task Force was responsible for developing foot spa safety regulations in response to illnesses and deaths resulting from unsafe pedicure practices.

Mrs. Alberto is currently a member of the California Cosmetology Instructors Association and has her own consulting business.

Audience

This course is designed for all cosmetologists, estheticians, and nail technicians in Georgia.

A complete Works Cited list appears on page 17.

Accreditation

Paragon CET is approved by the Georgia State Board of Cosmetology and Barbers to provide continuing education for Master Cosmetologists, Barbers, Estheticians, Hair Designers, and Nail Technicians. Provider License No. CEP-000116. Registered Course No. C2021-116-02 .

Designation of Credit

This course has been approved by the Georgia State Board of Cosmetology and Barbers for 2 CE hours.

About the Sponsor

The purpose of Paragon CET is to provide challenging curricula to assist professionals to raise their levels of expertise while fulfilling their continuing education requirements, thereby improving the quality of service to their clients.

Course Objective

The purpose of this course is to provide awareness of repetitive motion injuries that can occur in persons who work in salons and spas, with a focus on specific signs and symptoms and on interventions available to treat and/or prevent the condition.

Learning Objectives

Upon completion of this course, you should be able to:

1. Define carpal tunnel syndrome, and identify the causes and contributing factors.
2. Identify conditions that may mimic carpal tunnel syndrome.
3. Describe the methods and tools currently used to diagnose carpal tunnel syndrome.
4. Discuss the recommended treatment options for carpal tunnel syndrome.
5. Discuss potential prevention strategies for those who may be at risk for developing carpal tunnel syndrome.

INTRODUCTION

While carpal tunnel syndrome is possibly the most common nerve disorder diagnosed today, it is not a new condition born of the information technology age [1]. Compression of the median nerve of the hand was first reported in 1854 by Sir James Paget. In 1880, James Putnam reported on a series of patients who were experiencing pain and paresthesia in the median nerve of the hand. In 1913, Pierre Marie and Charles Foix offered a description of the pathology of median nerve compression, and in 1933, Sir James Learmonth reported the first release treatment for median nerve compression [2].

Determining the causes of carpal tunnel syndrome remains an area of ongoing research, discussion, and disagreement among healthcare professionals. Historically, some have concluded that carpal tunnel syndrome is purely an occupational disorder with clear-cut associations to repetitive manual movements or work tasks. Others have concluded that the causes of carpal tunnel syndrome are unknown, unproven, or based on multiple factors.

Despite the ongoing disagreement about its causes, the U.S. Department of Labor Bureau of Labor Statistics reports that carpal tunnel syndrome exacts a significant toll each year on the health and productivity of the U.S. workforce. The rate of reported cases, while declining in recent years, accounts for the second highest number of days away from work among all work-related muscle/skeletal disorders [12]. More than 7,500 cases of occupational injury or illness resulting from carpal tunnel syndrome and involving time away from work (median: 28 days) are reported each year, resulting in lost wages, increased healthcare costs in local communities, and added costs to state worker's compensation programs [13; 14].

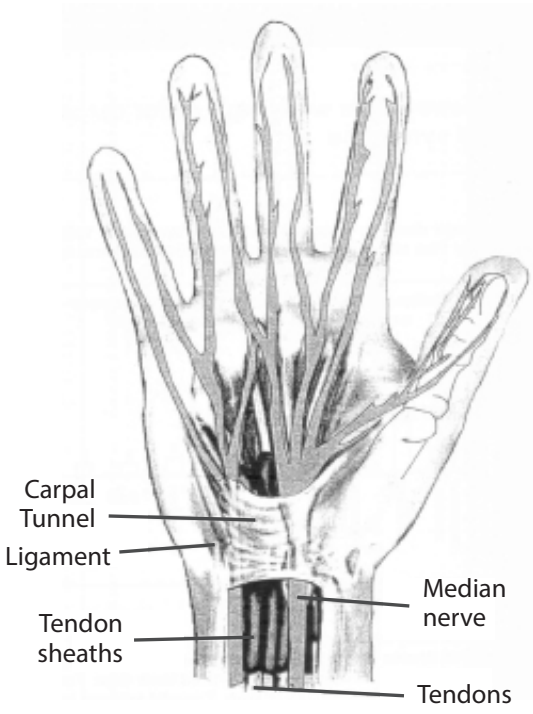
The purpose of this course is to provide information about the causes of carpal tunnel syndrome and to review current methods of diagnosis and treatment and recommended prevention strategies. It begins by defining carpal tunnel syndrome, which includes a discussion of common symptoms, causes and contributing factors, and conditions that mimic carpal tunnel syndrome. Current diagnostic methods and tools are reviewed, and current treatment options and recommended prevention strategies are discussed. The course concludes with a case study that describes the course of treatment for a cosmetologist who experiences chronic symptoms of carpal tunnel syndrome.

CARPAL TUNNEL SYNDROME DEFINED

Carpal tunnel syndrome is generally associated with such umbrella terms as repetitive stress injuries, work-related upper extremity disorders, muscle/skeletal disorders, entrapment neuropathies, and cumulative trauma disorders [16; 18]. Specifically, carpal tunnel syndrome is a painful disorder of the wrist and hand that occurs when the median nerve (which runs from the hand to the forearm) becomes compressed [1; 19].

The carpal tunnel is a narrow passageway (about as wide as your thumb) on the palm side of the wrist. Surrounded by bones and ligaments, the carpal tunnel houses and protects the tendons of the hand, which control the movement of the fingers, and the median nerve, which controls sensations to the thumb and fingers (Figure 1). When the wrist is bent at a right angle, the carpal tunnel becomes much smaller, which can put pressure on the median nerve. If the median nerve becomes pinched or compressed (due to swelling or irritation in adjacent tissues or tendons), the result can be pain, numbness, hand weakness, and in extreme cases, loss of hand function.

CARPAL TUNNEL ANATOMY



Source: Author Figure 1

Cases of carpal tunnel syndrome affecting both hands have been reported but are uncommon; typically only one hand (the dominant hand) is affected [1; 20; 21]. Carpal tunnel syndrome is rare in children; it usually occurs only in adults [9]. However, among adults, it is three times more likely to occur in women than in men [9].

The symptoms of carpal tunnel syndrome typically appear gradually and may include [9; 20]:

- Numbness, burning, or tingling in the fingers and palm of the hand
- Pain in the wrist, palm, or forearm, especially during use
- Decreased grip strength
- Weakness in the thumb
- Sensation of swollen fingers, whether or not swelling is apparent
- Difficulty distinguishing between hot and cold

Symptoms may cause waking during the night with the urge to "shake out" the hand or wrist. Symptoms may occur with activities that require prolonged grasping and/or flexing of the wrist (such as hair cutting). Left untreated, carpal tunnel syndrome can progress to persistent numbness and permanent loss of hand function. In severe and chronic cases, irreversible muscle damage or weakening may occur [1; 9; 23]. Complete sensory loss in the hand has also been reported.

CAUSES AND CONTRIBUTING FACTORS

Researchers have identified a variety of factors that may cause or contribute to the development of carpal tunnel syndrome. These factors include the presence of other health conditions, engagement in an occupation or activity that involves repetitive use of the hand, and the presence of a range of personal/physical factors that may indicate a predisposition to carpal tunnel syndrome [1; 3; 9; 13; 19; 20; 26; 28; 30]. There is general agreement that carpal tunnel syndrome is caused by many different factors and that the exact cause is unknown [31]. Also, the role of individual contributing factors in the development and severity of carpal tunnel syndrome is uncertain. In some instances, no cause can be identified [9]. Today, experts believe that the syndrome may be the result of fluid retention, hormonal changes, and swelling in the hands, arms, and wrists. Many body changes and disorders may be the cause of these three factors [47].

HEALTH CONDITIONS

Several health conditions are associated with the presence of carpal tunnel syndrome and may be contributing factors in its development. The most commonly noted co-occurring health conditions are noninflammatory synovial fibrosis, metabolic syndrome, diabetes, thyroid disorders, rheumatoid arthritis, pregnancy, and menopause.

Noninflammatory Synovial Fibrosis

When the cause of carpal tunnel syndrome is unknown, it often occurs with a condition called noninflammatory synovial fibrosis [33]. The joints of the hand (including the wrist and fingers) are synovial joints, meaning that the joints contain fluid-filled cavities that protect the bones and allow for more flexibility in motion. If the tissues of these joints become thickened (synovial fibrosis), pressure may be placed on the median nerve. The finding that many people with carpal tunnel syndrome have noninflammatory synovial fibrosis supports the belief that chronic or repetitive injury to the median nerve, resulting in tissue swelling, compression of the nerve, or injury to the outside layers of the nerve, is a primary factor in the development of carpal tunnel syndrome [9; 19; 32; 34; 35; 36]. Studies of patients with carpal tunnel syndrome have revealed changes in the properties of joint tissue, irregular patterns of tendon movement, and an absence of the normal interconnections between tissue layers that surround the median nerve [32; 36; 37].

Metabolic Syndrome

Metabolism is a word used to describe all of the chemical reactions in your body, especially the use of food for fuel and the chemicals and hormones involved with providing energy to the body. Metabolic disorders have a well-documented association with carpal tunnel syndrome [1; 19; 28; 39; 40; 41]. This is particularly true of disorders that directly affect the nerves of the body by increasing their vulnerability to compression [9]. Metabolic syndrome is a group of risk factors in one person, and it is characterized by abdominal obesity (a waist circumference greater than 40 inches in men or greater than 35 inches in women), high blood pressure, high cholesterol, and diabetes. When a person experiences all of these risk factors, he or she is at increased risk for developing carpal tunnel syndrome [1; 19; 28; 39]. The incidence of metabolic syndrome has been found to be higher in patients with carpal tunnel syndrome. Also, in patients with metabolic syndrome, the symptoms may be more severe [39].

Diabetes

Diabetes has been linked with several debilitating disorders of the hand, including carpal tunnel syndrome [20; 40]. Carpal tunnel syndrome occurs more often in individuals with diabetes than in those without. Presence of the syndrome appears to be related more to the duration of the diabetes than to the patient's gender or age, meaning that the longer a person has diabetes, the greater the risk for carpal tunnel syndrome [40; 41]. However, more recent research found that diabetes was not an independent risk factor for carpal tunnel syndrome, despite the increased prevalence of diabetes in the carpal tunnel group [4]. So, more studies are necessary to find out if there is a clear relationship between diabetes and carpal tunnel syndrome.

Thyroid Disease

Studies have demonstrated that disorders of the muscles and bones, including carpal tunnel syndrome, frequently accompany thyroid conditions; however, many of these studies were not well conducted [5; 9; 28; 44]. Symptoms of carpal tunnel syndrome commonly appear in people with hypothyroid (low levels of thyroid hormone in the blood), even if the thyroid gland is functioning normally [5; 28]. The combination of hypothyroidism and carpal tunnel syndrome appears to be more prevalent in the elderly [46]. It is important to note that the risk of developing carpal tunnel syndrome increases when thyroid disease is untreated [47].

Gout is another health condition associated with carpal tunnel syndrome [38; 48]. Gout is a type of arthritis caused by a build-up of sodium urate (uric acid) in the joints and external ear. In some people, the arthritis may be long-term and can affect more than one joint. It is caused by excessive uric acid in the body, which is normally eliminated via urine. If the body is unable to process the excessive uric acid, crystals can begin to form around the joints (in the synovial fluid), causing pain, swelling, and redness. Certain foods, a history of rapid weight loss, diabetes, sickle cell anemia, obesity, and kidney disease have been associated with gout.

Individuals (particularly men) with a history of gout are at increased risk for developing carpal tunnel syndrome, even when appropriate medical treatment is given [38].

Hemodialysis

Carpal tunnel syndrome has become an increasingly recognized problem in patients who undergo long-term hemodialysis, a method whereby a machine is used to clean the blood when the kidneys are unable to do so [50; 51]. A strong correlation has been noted between the duration of hemodialysis and the appearance of carpal tunnel syndrome. A direct connection between an artery and a vein (referred to as an arteriovenous fistula) may be used in hemodialysis patients to allow access to the vascular system. When used, this procedure has been identified as one of the possible causes for the development of carpal tunnel syndrome [50; 52; 53].

Rheumatoid Arthritis

Rheumatoid arthritis is a long-term disease characterized by inflammation of the joints and surrounding tissues; in some cases, it can also affect other organs. The cause of rheumatoid arthritis is unknown, but it is believed to be the result of immune dysfunction, meaning that the body's immune system is mistakenly attacking its own tissues. It has also been associated with carpal tunnel syndrome [9; 54]. People with rheumatoid arthritis and carpal tunnel syndrome are reportedly more likely to have enlarged areas of the median nerve than arthritic patients and healthy persons without carpal tunnel syndrome. However, whether rheumatoid arthritis has a role in the development of carpal tunnel syndrome is uncertain [8; 55].

Pregnancy and Menopause

Female gender is an independent risk factor for carpal tunnel syndrome, probably because the carpal tunnel is smaller in women than in men. Fluid retention during pregnancy or menopause is frequently associated with development of the disease [1; 19; 39; 47; 54; 56]. When onset is during pregnancy, symptoms usually appear in both hands and during the third trimester. Previous pregnancy does not increase the risk for carpal tunnel syndrome, but patient weight gain during pregnancy does. Pregnancy-induced carpal tunnel syndrome usually resolves spontaneously within 6 to 12 weeks after giving birth [20; 56].

OCCUPATION/ACTIVITY

Carpal tunnel syndrome has been reported among a variety of occupations, including clerical workers (e.g., cashiers, data entry workers, typists), assembly line workers (manufacturing, sewing, finishing, cleaning, meat packing), computer workers, and salon and spa professionals [3; 9; 10; 20; 25; 26; 27; 59; 60]. Information about the association of carpal tunnel syndrome with repetitive activity is now so widely available and easily obtained that many workers will self-diagnose before seeing a doctor or therapist.

Although the link between specific work activities and carpal tunnel syndrome has not been firmly established, studies have shown that intensive (i.e., greater than 4 kg of hand force), repetitive motion (at intervals less than 10 seconds), vibration, and extreme postures of the hand and wrist during any job may contribute to the development of carpal tunnel syndrome by temporarily increasing pressure in the carpal tunnel, which can potentially damage the median nerve and impair normal hand function [3; 27; 54; 59; 61; 67].

Considerations for Nail Technicians

According to the New South Wales Department for Women, nail technicians may experience many problems with upper body injuries caused by having to maintain awkward postures of the upper body and limbs while performing highly repetitive tasks [42]. Ergonomic assessment of the work of nail technicians found there are high injury risk factors attached to the nail technician's duties [42]. This includes repetition, forcefulness of hand movements (as in filing and buffing), uncomfortable postures held for long periods (such as a bent neck), and lack of recovery time between sessions. Scientific studies show neck, shoulders, arms, hands, and fingers are at significant risk of injury unless efforts are made to reduce the problem areas.

Risk factors for the development of carpal tunnel syndrome when working as a nail technician include a large number of clients serviced most days, the size of the workstation, working within the client's comfort zone (within 12 inches of the client), and the use of detailed postures (like the pinch posture for cleaning and filing nails). Nail technicians also tend to rest their elbows on the edge of the table, which can rest the shoulders but can compress the nerve in the elbow [43].

Considerations for Hair Stylists, Braiders, and/or Wrappers

The repetitive movements of hair cutting (e.g., gripping shears), combing, brushing, and blow drying can also cause damage to the nerves in the hand and arm. Some shears will put pressure on the fingers and hand, and for those with greater client loads, this can result in carpal tunnel syndrome. Although the pressure may not be significant when experienced for short periods, the accumulation of continuous pressure over days, months, and years can cause significant damage.

The repetitive motion of hair braiding and wrapping is also a concern. Some hair braiders work for hours on a single client, making the same movement hundreds of times. Clearly, this puts them at risk for repetitive motion injuries such as carpal tunnel syndrome.

Considerations for Skin Care Specialists, Estheticians, and Massage Therapists

The action of massaging, whether it is over a small area (such as the face) or over a client's entire body, can result in the accumulation of stress on the nerves and tendons in the hands and arms that lead to carpal tunnel syndrome. This is a particular concern for massage therapists, who repeat the same movements continuously for many hours per day [57]. According to the Associated Bodywork and Massage Professionals, thousands of massage therapists are suffering from carpal tunnel syndrome [57]. As a result, these professionals may limit hours by working part time or may leave the massage therapy profession after 4 to 6 years to avoid additional injuries.

PERSONAL/PHYSICAL FACTORS

Obesity and Fitness

Obesity and lack of physical fitness (particularly no activities involving wrist strain) are considered to be primary risk factors in the development of carpal tunnel syndrome [1; 7; 8; 40; 67; 68; 69; 70]. Obese individuals are more likely than non-obese individuals to have chronic health conditions, including diabetes, hypertension, and osteoarthritis [73]. The presence of these conditions, rather than excess body weight alone, may be the reason for a higher prevalence of carpal tunnel syndrome in obese individuals [74].

Gender

As noted, women are much more likely than men to develop carpal tunnel syndrome [7; 9; 67]. The dominant hand is usually affected first and produces the most severe pain [7]. The increased incidence in women may be partly due to hormonal factors, but in general, it is believed to be related to a propensity to and higher frequency of muscle/skeletal problems among women [75]. The type of work performed may also be a contributing factor. Women with carpal tunnel syndrome also have a higher absence rate from work and are disabled longer than men.

Heredity

Inherited variations in the size and shape of the hand and wrist, or in the size of the carpal tunnel and its contents, may predispose some individuals to carpal tunnel syndrome [20; 31; 77]. Individuals with disease in both hands are reportedly also more likely to have family members with carpal tunnel syndrome or other muscle/skeletal issues than those with either no carpal tunnel syndrome or disease in only one hand [78].

Age

The incidence of carpal tunnel syndrome increases with age. This is believed to be a result of median sensory latency and more severe compression of the median nerve [79]. The disability duration also reportedly increases with age, with a peak incidence between 45 and 60 years of age [40; 68; 80].

Smoking and Alcohol Consumption

Smoking and alcohol consumption are believed to be two of the many personal lifestyle choices that may contribute to an increased risk for carpal tunnel syndrome [18; 54; 56]. However, their respective roles in its development are unclear.

CONDITIONS THAT MIMIC CARPAL TUNNEL SYNDROME

There are many conditions with presenting symptoms that may mimic carpal tunnel syndrome. Consideration of these conditions during the assessment process will ensure accurate diagnosis and effective treatment.

HAND-ARM VIBRATION SYNDROME

Hand-arm vibration syndrome (HAVS) is often misdiagnosed as carpal tunnel syndrome due to similar symptoms and causes. It can be even more confusing when the two syndromes occur at the same time. HAVS consists of an array of injuries to the nerves, muscles, and tendons of the wrist and hand and commonly afflicts occupational groups who use handheld vibrating tools. The symptoms of HAVS include tenderness or pain and swelling of the fingers; numbness, weakness, or tingling in the fingers; reduced sensitivity to heat and cold; and loss of dexterity and coordination in the fingers [81].

OTHER MEDIAN NERVE COMPRESSION SYNDROMES

Pronator syndrome (compression of the median nerve by the pronator teres muscle in the elbow) and anterior interosseous nerve syndrome (damage of the motor branch of the median nerve, also at the elbow) are median nerve compressions that may cause pain, tenderness, aching in the wrist, difficulty moving the index and middle fingers, a feeling of poor coordination, and burning or tingling that extends into the hand. These syndromes are rare but should be suspected if a patient with carpal tunnel syndrome fails to respond to treatment [82].

CERVICAL SPONDYLOSIS

Cervical spondylosis is a disorder caused by abnormal wear on the cervical vertebrae, resulting in chronic degeneration of the cervical spine and eventually weakness, compression of one or more nerve roots, and pain in the neck and arm [83]. Tingling, burning, or crawling feelings in the hand are common. Because these symptoms are also common in carpal tunnel syndrome, additional symptoms should be evaluated to properly distinguish between cervical spondylosis and carpal tunnel syndrome. Patients with cervical spondylosis generally have a higher incidence of neck and lower limb pain than patients with carpal tunnel syndrome [84].

CUBITAL TUNNEL SYNDROME

Cubital tunnel syndrome is caused by pressure on the ulnar nerve at the elbow. When the pressure increases enough to disturb normal nerve function, pain, numbness, and tingling may occur in the forearm or hand. Most often this pain is present in the ring and little fingers. Other symptoms that mirror carpal tunnel syndrome include decreased grip strength, weakness while pinching, and a feeling of clumsiness [1; 9; 85]. Individuals with cubital tunnel syndrome are more likely than individuals with carpal tunnel syndrome to present with significantly weakened muscles [23].

TENOSYNOVITIS

Tenosynovitis, also known as deQuervain's tendonitis, occurs when the tendons at the base of the thumb become irritated or inflamed. This causes the tunnel around the tendon to swell and results in pain and difficulty grasping and holding objects. Overuse is the most common cause [86]. New repetitive activity, hormonal fluctuations associated with pregnancy and breastfeeding, and wrist fractures are possible causes of tenosynovitis [87].

Stenosing tenosynovitis, also referred to as "trigger finger," occurs when the pulley/tendon relationship between the hand and fingers is restricted by thickening or swelling at the base of the fingers. This creates pain and a distinctive catching, popping, or locking action in the finger or thumb. A cycle of triggering, inflammation, and swelling is common. Like carpal tunnel syndrome, stenosing tenosynovitis has been associated with other health conditions, such as gout, diabetes, and rheumatoid arthritis. In many cases, the actual cause is not clear [88].

DIAGNOSING CARPAL TUNNEL SYNDROME

Early diagnosis of carpal tunnel syndrome is important to prevent muscle weakening or damage to the median nerve that cannot be reversed by treatment [1; 9]. The process of diagnosing the condition, including a physical examination by a doctor, routine laboratory tests, and imaging, can also help to identify or rule out other health conditions that may have similar signs and symptoms and require specialized treatment. The physical examination will include specific testing, such as Phalen's test or Tinel's test, that can produce the symptoms of carpal tunnel syndrome [9; 20; 89; 90; 91].

PHYSICAL EXAMINATION

Several tests are available that allow doctors and physical therapists to check the nerves and tendons of the hand. While these tests are important to diagnosing carpal tunnel syndrome, additional testing will be necessary to confirm any findings.

One of these tests is called the Phalen's test or the wrist-flexion test. In this test, an individual will be asked to flex the wrists while extending the fingers. The backs of the hands will be together, while the fingers will be pointed down. When tingling or numbness occur within one minute, it is possible that the person has carpal tunnel syndrome [9; 23]. A positive result on Phalen's test (the presence of tingling or numbness) may indicate severe carpal tunnel syndrome [92]. The test is not a reliable indicator of carpal tunnel syndrome in individuals with diabetes [93].

Another useful tool is Tinel's test, also referred to as Tinel's sign. This test consists of a doctor pressing or tapping on the median nerve in an individual's wrist. If tingling in the fingers or a shock-like sensation occurs, carpal tunnel syndrome is suggested [9; 23]. A positive result on Tinel's sign is not an indication of the syndrome's severity [92].

A new test, the scratch collapse test, has shown to be a better predictor of carpal tunnel syndrome than Tinel's sign [94; 95]. With this test, the skin over the area of nerve compression is lightly scratched as the individual attempts to rotate both shoulders outwards while another person (e.g., a doctor) provides resistance. Momentary loss of resistance on the affected side is considered a positive test.

Other tests that may be part of the physical examination include the flick sign and the hand elevation test. In testing for the flick sign, the individual flicks the hand and wrist as if shaking a thermometer. If tingling or a shock-like sensation occurs, carpal tunnel syndrome may be present; however, this test may not be conclusive in some people [96]. During the hand elevation test, the individual elevates the hand above the head as high as comfortably possible for about one minute. Symptoms of tingling and numbness indicate carpal tunnel syndrome. The hand elevation test has been found to be as accurate as Phalen's test and more specific than Tinel's test [7; 97].

Finally, the infraspinatus test (IsT), normally used to diagnose rotator cuff injuries, was also found to be reliable in diagnosing carpal tunnel syndrome. With this test, the individual maintains his or her arm at the side, with the elbow at a ninety-degree angle. He or she resists pressure as another person pushes the forearm inward toward the abdomen. Pain indicates that carpal tunnel syndrome may be present [113; 114].

ELECTROPHYSIOLOGICAL STUDIES AND IMAGING

After the diagnosis of carpal tunnel syndrome is suggested, it should be confirmed with additional testing [1; 6; 7; 9; 89]. Available methods include electrodiagnostic (electrophysiological) studies, ultrasonography, magnetic resonance imaging (MRI), computed tomography (CT), and pressure-specified sensorimotor devices (PSSDs).

Electrodiagnostic Study

The electrodiagnostic (EDX) study is a two-part electrical test used to check nerve health in people with complaints of pain, weakness, numbness, or tingling. During the first part of the test, an electrode placed near the elbow side of the tunnel generates a mild electrical current. The current travels in the nerve through the carpal tunnel to the hand. The time it takes the electrical current to travel to the hand indicates the health of the nerve; a longer travel time indicates nerve damage. The second portion of the test consists of placing small needles into some muscles that are supplied by the median nerve. The electrical impulses of the muscles are measured both at rest and upon contraction. Poor or abnormal muscle performance indicates severe carpal tunnel syndrome [1; 48].

Ultrasonography

Ultrasonography is a method in which high frequency sound waves (ultrasonic echoes) produce images or photographs of organs and tissues. Ultrasonography can reveal impaired movement of the median nerve. Doppler ultrasonography changes the sound waves into images that can be viewed on a monitor and measures the direction and velocity of the object being studied. Gray-scale ultrasonography measures the strength of ultrasound echoes and records the strongest echoes as white and the weakest echoes in shades of gray [48]. Color Doppler ultrasonography is believed to be more accurate than gray-scale in diagnosing carpal tunnel syndrome [103].

Magnetic Resonance Imaging

MRI has been used in the development of a biomechanical model of the wrist and carpal tunnel, which can help during evaluation of the median nerve [109; 110]. Although MRI is less accurate than EDX studies for confirming carpal tunnel syndrome, it has proved to be useful in determining the severity of the disorder in people with symptoms of no known cause, in explaining persistent symp-

toms following surgery, and in predicting whether a patient will benefit from surgery [76; 111; 112]. The routine use of MRI is not recommended for diagnosing suspected carpal tunnel syndrome [56; 101].

Computed Tomography

CT scans use x-rays to produce detailed, cross-sectional images of selected structures inside the body [48]. In the diagnosis of carpal tunnel syndrome, CT imaging provides a view of any structural problems that might be affecting the carpal tunnel and median nerve [105; 108]. However, the routine use of CT technology is not recommended for diagnosing suspected carpal tunnel syndrome [101].

Pressure-Specified Sensorimotor Device

A PSSD measures motor function and sensory loss. Research supporting PSSDs as diagnostic tools is lacking, and the routine use of PSSDs in the diagnosis of suspected carpal tunnel syndrome is not recommended [101; 104; 105].

TREATMENT OF CARPAL TUNNEL SYNDROME

Surgery, corticosteroids, nonsteroidal anti-inflammatory drugs (NSAIDs), diuretics, wrist splints, exercise, ultrasound therapy, laser therapy, and yoga are among the methods that have been recommended for the treatment of carpal tunnel syndrome [72; 98; 99; 100; 102]. Although no single method has been universally accepted, there is agreement that the treatment of carpal tunnel syndrome should begin as early as possible and should include attention to underlying causes, such as diabetes or rheumatoid arthritis. There is also agreement that successful treatment depends on compliance with the treatment program [9; 106].

TREATMENT GOALS AND ASSESSMENT TOOLS

Before deciding on a course of treatment, it is important to decide the desired outcome. Is the goal symptom improvement only? Is it a permanent modification of leisure time and/or work activity? Is it a return to work? Establishing goals prior to treatment can allow you to measure success and track progress [20].

NON-SURGICAL TREATMENT

Non-surgical treatments for carpal tunnel syndrome are typically used by people with mild-to-moderate symptoms and those who are waiting to undergo surgery [63; 72; 106]. Non-surgical treatment methods are generally considered successful in treating carpal tunnel syndrome when the individual's symptoms and functional ability improve within 2 to 7 weeks. If improvement is not seen within this time frame, surgery or additional non-surgical treatment may be necessary [106].

Local corticosteroid injections and splinting have demonstrated short-term benefit and relief of symptoms in patients with mild or moderate carpal tunnel syndrome and should be tried before surgery [60; 62; 63; 106]. Taking steroid pills has been somewhat effective in the treatment of carpal tunnel syndrome, but it is not considered as effective as injections [106].

Corticosteroid injections have been found to improve symptoms and function after 2, 4, 8, and 12 weeks. As noted, they demonstrate a better overall improvement in the symptoms of carpal tunnel syndrome compared with corticosteroid pills, but they do not appear to provide a better long-term outcome (after 6 months) than splinting or pain medications.

Splinting has been found to improve patient symptoms and function when measured after 2, 4, and 12 weeks. As such, splinting should be tried before surgery. However, it is not recommended for use after routine carpal tunnel release surgery [63; 106].

Over-the-counter pain medications such as aspirin and acetaminophen (Tylenol) are used to treat a variety of pain conditions, including carpal tunnel syndrome, but opinion varies as to their effectiveness and safety for long-term use [48; 58; 62]. Specifically, some pain medications have been associated with gastrointestinal and cardiovascular risks and toxicity with long-term use [107].

Diuretics ("water pills") and vitamin B6 may also help with temporary relief of symptomatic carpal tunnel syndrome, but their long-term benefits are unproven [56; 62; 63]. Acupuncture, yoga, exercise, laser therapy, activity modification, and ergonomic workplace modifications also have been mentioned as non-surgical treatment alternatives, but most experts agree that further research is needed to determine the viability and efficacy of these methods [9; 17; 49; 62; 63; 100; 106].

SURGICAL TREATMENT

Carpal tunnel release surgery is the preferred treatment for patients with chronic or severe carpal tunnel syndrome. There are two types of surgeries available: open or endoscopic [9; 99; 106]. Both types of surgery are generally performed on an outpatient basis under local anesthesia. Open release surgery involves making an incision of up to 2 inches at the base of the palm of the hand and cutting the carpal ligament, which creates a larger carpal tunnel and releases pressure on the median nerve [9; 45]. Endoscopic surgery involves making a small, one-half inch incision at the wrist and introducing a small camera attached to a tube beneath the carpal ligament. Using the scope as a guide, the ligament is cut, again relieving pressure on the median nerve [9; 17; 45]. With the endoscopic surgery, the recovery time is shorter and there is minimal scarring and tenderness. Because this technique allows for quicker return to regular function and is associated with less pain after the surgery, it is often preferred. Release surgery is usually a final treatment, but carpal tunnel syndrome can recur in a minority of people.

Patients with carpal tunnel syndrome in both limbs may require surgical release in both hands. When compared to surgeries on each hand at different times, simultaneous release has been shown to offer comparable disability durations and substantial cost savings [21]. Even with resolution of the pain and inflammation of carpal tunnel syndrome, there may be other lasting effects. Whichever surgery plan is chosen, it is important to note that individuals will be required to complete physical therapy to restore wrist strength. Rarely, the wrist will be weakened as a result of the ligament having been cut. Some people may have infection, nerve damage, stiffness, and pain at the scar. It may be necessary for some individuals to adjust job duties or even change jobs after recovery from surgery.

PREVENTION STRATEGIES

Although the number of cases of carpal tunnel syndrome among U.S. workers has been declining, the resulting number of reported days away from work remains high [13]. Lost work time and decreased employee productivity have led employers to develop organizational approaches to managing employee health, safety, and productivity, with an emphasis on prevention and returning employees to work as quickly as possible [29; 30]. These approaches include ergonomic principles to job and workstation design, the use of ergonomically sound equipment (including ergonomic shears and workspaces), and the use of exercise regimens and safety programs [24; 22; 17].

The concept of work-related carpal tunnel syndrome, though unproven, has had a significant societal impact in the United States [11]. The Occupational Safety and Health Administration (OSHA) has developed a four-point approach designed to reduce and prevent illness and injury resulting from muscle/skeletal disorders in the workplace. OSHA's four-point approach includes [15]:

- Guidelines designed to prevent/reduce workplace muscle/skeletal disorders
- Enforcement designed to prosecute serious ergonomic violations in the workplace
- Outreach and assistance designed to assist businesses with the management of ergonomic issues
- A National Advisory Committee on Ergonomics, created to advise OSHA on ergonomic guidelines and identify gaps in research

There are a multitude of general recommendations that apply many types of workers and work environments [17]:

- Take multiple "microbreaks" (about 3 minutes each) from work throughout the work day that include stretches (e.g., wrist, fingers, hand, forearm, shoulders, neck) and breathing exercises. These are good times to incorporate exercises aimed at reducing eye fatigue.
- Maintain a good posture relative to the type of work being performed. For computer workers, this means sitting with the spine against the back of the chair with the shoulders relaxed, neck flexible, and head upright, with the work at eye level.
- Wrist position is critical. Wrists should not remain flexed, greatly extended, or deviate from side to side for prolonged periods of time.
- Workspaces and furniture should be designed to be comfortable for the worker. Specially designed chairs and desks can promote correct posture and potentially save money.
- The grip and force used on tools, implements, and controls (including shears, brushes, and emery boards) should be as light as possible.

TIPS FOR NAIL TECHNICIANS

The New South Wales Department for Women has developed several tips for decreasing the risk of carpal tunnel among nail technicians. There are suggested practices for both employers and employees to minimize the potential for injury. Nail technicians should [42]:

- Vary tasks as much as possible to allow recovery time for muscles
- Adjust the height of the chair to ensure that your arms are in a comfortable position and your head is not constantly bent too far forward as you work
- Manage bookings to rotate the lengthy, demanding tasks if possible
- Store all objects between knee and shoulder height
- Avoid swiveling your body while working and try to move your feet in the same direction as you are turning
- Do finger stretching exercises and rotation of wrists, shoulders and neck

Employers should also ensure that the environment and equipment provided to employees are ergonomic and support risk-reduction practices. This includes [42]:

- Encouraging staff to wear comfortable clothing, including footwear
- Ensuring that work stations are at the right height for the relevant tasks, such as manicure tables at the right height and reception desks at a comfortable standing height

- Providing height-adjustable chairs with good back support
- Choosing to locate materials and equipment in practical and comfortable places rather than focusing solely on what looks good

Whenever possible, nail technicians should remain in a neutral position. The back and neck should be straight, and the elbows, thighs, knees, and feet should be at 90-degree angles, as neutral positions come at 180-degree and 90-degree angles for the body [43]. The back should be straight, the head up, and the wrists flat.

Because nail technicians often work in the customer's comfort zone rather than their own, it is important to include the client in ensuring ergonomics and comfort. The client should sit as close to the work station as possible, and work should be done within the technician's functional range of motion (without unnecessary stress, stretching, or discomfort) [43].

TIPS FOR HAIR STYLISTS, BRAIDERS, AND/OR WRAPPERS

Among hair stylists and associated professions, carpal tunnel syndrome can occur due to holding hairdressing shears incorrectly, using low-quality shears, holding a strained position (as when blowing hair out), and the repetitive gripping associated with hair cutting, braiding, and wrapping [64]. In many cases hair stylists believe that arm, neck, finger, and wrist pain are just a part of the job and are resistant to changing techniques or tools. But taking steps to eliminate the causes of the pain is important to ensure that long-term, irreversible damage does not occur.

One key point for carpal tunnel syndrome prevention in hair stylists is the selection of a good pair of shears [65]. Each scissor should be custom-fitted to the individuals, taking into account the size and shape of the stylist's hand and fingers. Well-fitted shears will not slide on the hand or put pressure on the tendons and ligaments and will cut smoothly. The size, weight, and comfort of the shears should be assessed. It may be helpful for some stylists to use swivel shears in order to minimize awkward wrist positions.

The European Union has developed a checklist for hair stylists and employers to use to evaluate the safety of the hair salon workplace [66]. The questions related to muscle/skeletal disorders include [66]:

- Do clients' and hairdressers' seats and washbasins enable a good working posture for the variety of different tasks carried out by a hairdresser?
- Are (sufficient) hairdressers' seats/sitting aids available in the salon?
- Does the amount of working space (e.g., around the washbasin and client seat) cause uncomfortable working postures?
- Are special child seats or seat enlargers used for children?
- Are clients' and hairdressers' seats easily adjustable and do all employees know how to adjust the seats to obtain an upright working posture?
- Do scissors meet the ergonomic criteria (do they have a little finger support, are they nickel-free and sharp)?
- Do employees work in solid shoes (without heels) that give good support and enable a good working posture?
- Is there sufficient variation in the work, enabling the employees to work in different postures?
- Do employees take regular breaks (i.e., 5 minutes each hour)?
- Do employees complain about the climate (e.g., temperature, fresh air) or smell in the salon?
- Is there sufficient light for safe and efficient task performance?

TIPS FOR SKIN CARE SPECIALIST, ESTHETICIANS, AND MASSAGE THERAPISTS

Many massage therapy schools teach body mechanics, in which you learn the proper ways to stand, lean, and use your hands when doing the work [71]. These same techniques may be helpful for estheticians who are involved with skin massage. As with other professions, the use of an ergonomically sound workspace is important. This includes keeping tools and products within comfortable reach, adjusting the height of chairs, and taking adequate rest times between clients.

COPING WITH CARPAL TUNNEL SYNDROME

Chronic pain, debilitation, and the loss of a profession are all possible results of severe carpal tunnel syndrome. In addition, they can all contribute to feelings of sadness, loss, and low self-esteem. Making difficult decisions regarding occupational or leisure activities and losing activities that may have been sources of pleasure and relaxation make individuals with carpal tunnel syndrome at risk for developing depression.

Learning to cope with carpal tunnel syndrome is a vital aspect of recovery. Some people may benefit from obtaining professional health from a therapist or counselor that can teach them relaxation and stress management techniques. In addition, support groups can be a source of comfort and strength for carpal tunnel syndrome sufferers. There are online support groups and forums available to any individual with questions or looking for a community with shared experiences. Any person who experiences thoughts of despair, self-harm, or helplessness should seek immediate medication or psychological help.

CASE STUDY

Ms. A is a hair stylist, 54 years of age, who has been employed for 25 years in the salon industry. She has missed little work and continues to perform her regular duties, which include spending many hours washing, cutting, and dying hair. Ms. A also spends time each day at her home computer. For the last five months, she has been experiencing chronic pain, tingling, and numbness in her right hand and wrist as well as pain, tingling, and numbness in her neck and shoulders. She is often extremely tired at the end of her work days, and she does not exercise regularly. Ms. A indicates that she is unable to take aspirin or acetaminophen due to a peptic ulcer, and she has had no success alleviating symptoms with other medications. She has a long history of high blood pressure and has recently been diagnosed with rheumatoid arthritis. She is scared that if the pain continues to worsen, she will be unable to continue styling hair or working at her current salon.

Comments: Ms. A's gender, age, medical history, and symptoms are positive risk factors for carpal tunnel syndrome. She should see a doctor immediately. The doctor will conduct a physical examination including laboratory tests and imaging to confirm the high blood pressure, rheumatoid arthritis, and carpal tunnel syndrome.

Ms. A makes an appointment to see her doctor. The doctor performs a Phalen's test and finds significant weakness in her right hand. A two-part EDX study is ordered and confirms the initial diagnosis of carpal tunnel syndrome. The doctor injects a single dose of cortisone (a steroid) at the right wrist for temporary relief while Ms. A considers the other treatment options. After the injection, Ms. A has no pain, tingling, or weakness for about four weeks. However, after the four weeks, she begins to experience symptoms again and feels that her work is suffering. She elects to undergo outpatient endoscopic carpal tunnel release. This requires that Ms. A refrain from using the computer (specifically, no typing or operating the mouse) for one month.

Because she must also avoid other repetitive hand use for a minimum of four weeks, she will not be working for the one-month recovery period. Three weeks after the surgery is completed, Ms. A has little pain and almost no tingling sensations, and she sees significant improvement in her hand and wrist strength as a result of her physical therapy. She reports being pain-free six weeks after the surgery and returns to work. Ms. A has also modified her work procedures to ensure that her carpal tunnel syndrome does not return by scheduling break times between clients, limiting the number of clients she sees each day, and investing in newly fitted shears. After two months, Ms. A is working regularly and has been able to cook and play tennis with no related pain. A follow-up examination after one year shows no recurrence of symptoms.

CONCLUSION

Carpal tunnel syndrome is possibly the most common nerve disorder diagnosed today and is a significant risk for salon and spa professionals. Determining the causes of carpal tunnel syndrome remains an area of ongoing research and may be a combination of genetics, co-existing health conditions, and occupational and personal lifestyle factors. There are many tools and prevention strategies available for salon professionals that can help to prevent carpal tunnel syndrome despite the risk factors associated with working in hair, skin, and nail professions. Making sure that you are using correct techniques and the available tools can ensure that you will have a long career in your chosen profession.

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