Getting the Upper Hand on Pain: Preventing Hand and Wrist Pain Syndromes in Dental Professionals

A Peer-Reviewed Publication
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Educational Objectives
The overall goal of this article is to provide the reader with information on the incidence, risk factors, prevention and treatment of true carpal tunnel syndrome, as well as disorders in dentistry that mimic carpal tunnel syndrome but have a different etiology. Upon completion of this course, the reader will be able to do the following:

1. List and describe four of the primary risk factors associated with carpal tunnel syndrome
2. List and describe ergonomic interventions that can help prevent carpal tunnel syndrome
3. List and describe other conditions that may mimic carpal tunnel syndrome
4. Provide an overview of the diagnosis and treatment of carpal tunnel syndrome

Abstract
Chronic hand and wrist pain that can affect quality of life, productivity or career longevity is experienced by between 40 and 70 percent of dental professionals. Given that fewer dental professionals fully recover from hand pain than they do from neck, shoulder or elbow pain, it is imperative that injury be prevented. There are a number of risk factors for carpal tunnel syndrome that must be considered, as well as research-based ergonomic interventions. The use of ergonomic equipment and implementation of prevention techniques outside the operatory can help to reduce work-related pain and extend the career of the dental professional.

Introduction
“The right half of the brain controls the left half of the body. This means that only left-handed people are in their right mind.”
—Source Unknown

Hand, wrist and arm pain are much more prevalent among dental professionals than the general public, due to the sustained grips and prolonged awkward postures dentists and hygienists must employ throughout the day. Between 23 and 40 percent of dentists and nearly 75 percent of dental hygienists experience hand and wrist pain, nearly four times the prevalence found in the general working public. In the case of hygienists, hands, wrists and arms are the most common sites of pain reported. Since hands are integral to the work of dental professionals, understanding the etiology of this pain and its prevention are important. Fewer dental professionals fully recover from hand pain syndromes than they do from neck, shoulder and elbow pain. Therefore, prevention strategies and early attention to warning signs of the primary cumulative trauma disorders (CTDs) of the hand and arm are imperative to the dental professional’s health and career longevity.

The origins of pain in the hand, wrist or arm are often elusive and may not be due to a problem in the same area; in fact, the source of the symptoms may be nowhere near where the symptoms are perceived. For example, numbness in the fingers, which is one of the symptoms of carpal tunnel syndrome, sometimes has nothing to do with a problem in the hand or wrist but may be due to a problem in the cervical spine, thoracic outlet or trigger points in the forearm.

There are numerous causes of hand, wrist and arm pain, including tendonitis (e.g., De Quervain’s tenosynovitis), arthritis (e.g., osteoarthritis of the basilar joint), nerve compression (e.g., thoracic outlet syndrome, cervical radiculopathy, carpal tunnel syndrome, cubital tunnel syndrome), trigger points (e.g., radial tunnel syndrome) and equipment issues (e.g., non-ergonomic tools, poorly fitted gloves). However, the most commonly diagnosed CTD of the hand, wrist and arm among dentists and hygienists is carpal tunnel syndrome.

Carpal Tunnel Syndrome
Carpal tunnel syndrome (CTS) is the most common peripheral nerve entrapment in the arm and contributes to one of the most frequently performed hand surgeries in the United States. Caused by compression of the median nerve at the wrist, CTS can lead to pain, numbness or tingling in the thumb, index finger, middle finger and half of the ring finger. (Fig. 1)

Figure 1. Carpal tunnel

Pain or tingling in the distribution of the median nerve (shaded) is often indicative of carpal tunnel syndrome. Numbness is usually felt in the fingertips only.

One study found that while 71 percent of dentists experienced one or more CTS symptoms, only 7 percent were actually diagnosed with CTS. This should prompt dental professionals with CTS-type symptoms to educate themselves on all possible etiologies to avoid unnecessary surgery or ineffective therapies.
Inconsistencies abound in the literature regarding the cause, proper evaluation and course of care of CTS.15-17 Noted author and physical rehabilitation expert Dr. Rene Calliet states, “Differentiation of median nerve wrist compression from cervical radiculitis or thoracic outlet syndrome may be the most challenging in clinical practice.”15 This is largely due to the fact that the median nerve fibers run a long and twisting course around bone and through soft tissue from the cervical spine down to the fingertips. CTS symptoms may not always be indicative of a structural problem in the hand and wrist; often the problem originates more proximally in the muscles/tendons that stabilize the arm during repetitive work.17 Any compression or entrapment along the median nerve fibers can result in CTS-type symptoms in the hand.18

The carpal tunnel
The carpal tunnel comprises a row of bones on the back of the wrist, with a thick ligament in the front. For the hand to function properly, nine flexor tendons and the median nerve must be able to glide easily within this space. Of these structures, the median nerve is the softest and most vulnerable to pressure.

The positions that cause the most pressure in the carpal tunnel are easy to identify. If you straighten your right wrist, place your left thumb over the transverse carpal ligament and then bend your right wrist back, you can feel the ligament tighten over the tunnel. This is the position that compresses the tunnel most. If you then make a fist, the tunnel will get even tighter; if held in this position long enough, it may result in your hands and fingers going numb. If you bring your wrist to neutral and then forward, the tightness will slacken when you are in neutral and then slightly tighten again as you move downward. If you try the above exercise gripping a pencil, this “precision” grip creates more pressure in the carpal tunnel. Sustained gripping while extending the wrist is unhealthy for your median nerve. By performing this series of movements, you have just demonstrated two of the four primary risk factors for CTS in dental professionals—flexing the wrist forward and gripping a small instrument forcefully. The other two risk factors are high repetition (as in manual scaling) and duration (e.g., how many heavy calculus patients you schedule back-to-back). (Fig. 2) These risk factors cause microtrauma in the carpal tunnel; fibrosis and edema of the lining of the tendons at the wrist eventually cause increased pressure within the carpal tunnel and decreased blood flow to the median nerve within the tunnel. The swelling of the lining of the tendons is often painful, and it is the pressure on the median nerve at the wrist from this swelling that causes numbness in the fingers and weakness of the muscles at the base of the thumb.

The causes of CTS are numerous and include anatomic, physiologic, hereditary and traumatic factors that result in compression or irritation of the median nerve at the wrist. For instance, CTS is three times more prevalent in women than men, and it is most common between the ages of 30 and 60 and among diabetics and in obese people. However, the literature also reports an occupational cause in more than 47 percent of cases.20 CTS symptoms (pain, numbness and tingling) are often worse at night and first thing in the morning. Weakness in a precision grip may be present due to atrophy or weakness of the thumb abductor muscles.19 Over time, visibly decreased musculature may be noticed at the base of the thumb. Sensory impairment is usually experienced before motor loss, so early intervention is important. In addition to any therapies you may consider, it is imperative that you address ergonomic issues that are known to aggravate carpal tunnel symptoms to minimize your risk and to prevent CTS.

Figure 2. Four of the primary risk factors contributing to CTS in dentistry.

Keys to Success: Preventing Carpal Tunnel Syndrome
The four primary risk factors that contribute to occupational CTS in dentistry can be minimized with appropriate ergonomic interventions, as described below.

Avoiding sustained wrist flexion
Wrist flexion increases pressure in the carpal tunnel, and working with your wrist bent toward the little finger—called ulnar deviation—also increases this pressure.12-13 (Fig. 3a) When performing scaling or other treatments, trying to keep your wrist straight and moving your entire hand, wrist and
forearm as a unit transfers the load from smaller hand muscles to larger arm and shoulder muscles. Using a finger rest position (either intra- or extra-oral) to stabilize the instrument further reduces thumb pinch force and muscle workloads in the hand. Extra-oral fulcrums also facilitate neutral wrist posture and allow proper positioning for precision instrumentation. (Fig. 3b)

Figure 3a. Poor wrist posture

Poor (deviated) posture of the wrist is a primary risk factor for CTS in dentistry.

Figure 3b. Neutral wrist posture

Try to maintain neutral posture of the wrist, especially when scaling.

Rather than twisting the wrist to access hard-to-reach areas, try moving the instrument or handpiece in your hand. To access molar regions and distal pockets, select an instrument with multiple accentuated angles and a longer terminal shank (Fig. 4), which can reduce twisting the wrist to access these areas. It makes far more sense to use an accentuated angled instrument rather than angle your wrist. You can retrain yourself to maintain near-neutral wrist postures using a soft wrist wrap, such as a WrisTimer, to limit wrist flexion to anywhere from 0 degrees to 20 degrees. A soft wrist wrap can be adjusted to prevent varying degrees of wrist flexion, thereby retraining damaging wrist postures.

Figure 4. Ergonomic shank

Instruments with multiple exaggerated angles and longer terminal shanks can reduce the need to flex the wrist to access hard-to-reach distal pockets.

Going ultrasonic

Compared to manual scaling, ultrasonic scaling requires less force applied to the work surface and a less forceful precision grip. However, these ergonomic advantages are putting ultrasonic instruments at the forefront and in some cases overshadowing manual instruments as artifacts of the past. The importance of precision manual scaling in delivering quality dental care cannot be overstated, and the effectiveness of quality advanced periodontal instrumentation is often hard to match with an ultrasonic unit. Proper ergonomic periodontal instrumentation techniques should be a priority for hygienists to safely implement sufficient hand scaling into their patient care.

The percentage of time spent providing ultrasonic versus manual scaling care is an individual one that must take into consideration personal health (some individuals are more prone to CTS than others), patient periodontal history, workload, depth and size of pockets, and numerous other variables. Both manual and powered instrumentation have unique strengths that can be effectively combined during treatment. Furthermore, studies show that the duration of use of either ultrasonic or manual instruments is positively associated with upper extremity numbness/tingling.

From a preventive perspective, ultrasonic instrumentation should be used periodically over the course of the day to reduce muscle workload and provide rest to the intrinsic hand muscles. Also consider swiveling ultrasonic inserts, which can improve hand and arm posture as well as save time.

Instrument selection

Certain instrument features can reduce carpal tunnel compression:

Diameter – Instruments are available in a wide variety of handle diameters, ranging from about 5.6 to 11.5 mm.
Larger instrument handle diameters reduce hand muscle load and pinch force, although handle diameters greater than 10 mm (about 3/8 inch) have been shown to offer no additional advantage.26 Alternating between handle diameter sizes may also help prevent CTS symptoms. When selecting instruments, try to include large diameters as well as other sizes, but avoid very narrow diameter sizes (5.6 mm), as these increase carpal tunnel pressure. Sleeves that fit over mirror handles and increase their diameter have been shown to reduce muscle load;27 however, sleeves on scaling instruments may not have the same benefits, due to the additional force needed to perform scaling tasks.

**Weight** – Although instrument weight is not as significant a risk factor as handle diameter, lightweight instruments (15 g or less) help reduce the muscle workload and pinch force.26

**Texture** – Textured handle surfaces may help decrease forceful pinch grips.

**Sharpness** – Dull instruments can have a profoundly deleterious impact on your musculoskeletal health, as they require increased force. It is therefore essential to maintain optimally sharpened instruments and perform visual inspections regularly. There are several methods for sharpening, including mechanical and manual23 methods and using a high-speed handpiece.29

**Reduce your grip** – Forceful pinch grip has been shown to increase pressure in the carpal tunnel; this pressure is even higher when combined with wrist ulnar deviation.12 Hygienists and dentists should try to use a palmar grip when using the high volume evacuation (HVE) and dentists should, of course, use the palmar grip instead of the precision grip during extractions. Dentists with pain in the dominant hand should consider using the non-dominant hand intermittently for extractions, and they can begin by supporting the extracting hand with the dominant hand. Positioning on the opposite side of the patient for extractions may become more comfortable and easier when you are acclimatized to using the non-dominant hand, and it provides yet another opportunity to move around, thereby varying the load on your muscles, bones and joints.

**Cord management** – Using 360-degree swivel instruments to maintain optimal neutral wrist and finger position is helpful, as is positioning heavy cords over your arm through a counter-mounted loop or across an armrest to reduce muscle strain. Cord pullback can be prevented by positioning your delivery system and ultrasound unit close to you. It is also important to observe patient positioning strategies to maintain neutral wrist posture.

**Spread the work around** – Moving the muscle workload helps to avoid structural damage.29 One way to do this is by alternating between chairs with and without armrests. Using a chair with armrests moves the workload to the smaller muscles of the hand and wrist, while using no armrests incorporates the larger muscles of the arm and shoulder girdle into the movement.

**Temperature** – Avoid positioning your neck, shoulders and hands directly in the draft of an air conditioner, and avoid working in a particularly cold environment, since exposure to cold is another aggravating risk factor associated with CTS.

**Stretch** – Frequent stretch breaks were the most helpful intervention for hand/wrist pain in one dental study.30 Stretching helps to increase blood flow and reduce formation of trigger points. If you have mild carpal tunnel symptoms, you should be gently stretching three to five times per day.

**CTS Diagnosis**

Accurate diagnosis of CTS is difficult and requires evaluation by a highly skilled healthcare practitioner, preferably a board-certified hand surgeon. A certified hand therapist can also be extremely helpful in addressing adaptation, ergonomics, splinting and using various modalities to reduce your symptoms. Positive results from several tests (EMG and nerve conduction velocity testing, hand pain mapping, and sensitivity testing) and the presence of wrist/hand pain are highly suggestive of CTS.12 The following physical exam findings are often seen in people with this syndrome:

1. Tinel’s sign: an electric shock–type sensation in the hand when the median nerve is tapped gently at the wrist
2. Positive Phalen’s test: numbness in the hand in less than 60 seconds when the wrist is flexed 90 degrees
3. Weakness of the thenar muscles at the base of the thumb
4. In severe cases, persistent numbness in the distribution of the distal median nerve (thumb, index finger, middle finger) and continuous numbness can represent permanent damage to the nerve; surgery should be considered prior to this point, as surgery will reliably prevent further damage to the nerve, but recovery of a damaged nerve is not as predictable

**CTS Treatment**

Conservative treatment options for CTS include the following:

- Modification of activities to decrease tendon excursion
- Therapeutic interventions such as ice, massage, ultrasound or acupuncture
- Anti-inflammatories or cortisone injections
- An immobilizing splint across the wrist (often most helpful at night)
- Nerve or tendon gliding exercises
- B6 vitamins if the problem is due to a vitamin deficiency
- It is advisable to avoid strengthening the hands/fingers with repetitive finger flexion exercises, as these can increase carpal tunnel pressures and worsen pain.16,31 However, when completely pain-free, a program of very lightweight tubing exercises focused on the wrist flexor, extensor, pronator and supinator groups may be of benefit in preventing CTS and for trigger points.16
- Dentists and hygienists should implement ergonomic interventions, consider all CTS-mimicking conditions and undergo
conservative CTS therapies before considering CTS surgery. Surgical patients treated three to five years after the onset of symptoms are less likely to have complete symptom resolution. Therefore, early diagnosis and treatment are important. It is far easier to prevent carpal tunnel syndrome than to cure it.

**Pain Syndromes That Mimic Carpal Tunnel Syndrome**
Several problems may mimic CTS, including cervical radiculopathy, thoracic outlet syndrome, median nerve entrapment in the forearm and trigger points, and poorly fitting gloves. (Fig. 5)

**Figure 5. Problems that may mimic CTS**


**Trigger points and nerve entrapment**
Although muscle-referred pain is a well-documented and researched phenomenon, it is often overlooked as a possible source of pain syndromes. Trigger points in certain muscles may refer CTS-like symptoms into the hand and wrist.

Trigger points in the forearm muscles such as the pronator teres can cause compression on the median nerve and cause CTS-like pain in the hand and wrist. Since the median nerve runs through the pronator teres muscle, dental professionals who operate with the forearms in a pronated (palms-down) position are at greater risk for this nerve entrapment. Neuromuscular technique and myofascial release are two popular approaches that have been used to treat this type of pain. Initially, dental professionals should work with a healthcare professional, such as a certified neuromuscular therapist or a therapist who specializes in trigger point therapy, to resolve pain of this origin. After reduction of symptoms, dentists may learn to self-treat their trigger points, since their jobs are a perpetuating factor. Median nerve entrapment in the forearm can be treated successfully if a holistic approach is taken to address the sum of compression and tension on the nerves in the upper extremity.

**Thoracic outlet syndrome (TOS)**
TOS is a neurovascular disorder resulting from pressure on the nerves and/or blood vessels that supply the arm, fingers and hand. (Fig. 6)

**Figure 6. Thoracic outlet**

The thoracic outlet, showing nerves and arteries that supply the arm.

Tightness and/or trigger points in the pectoralis, anterior or middle scalenes may restrict the size of the thoracic outlet. Compression of this neurovascular bundle may cause numbness and tingling that can mimic CTS; however, TOS may also include vascular symptoms (edema, coldness or discoloration) in the hands and fingers. A thorough clinical evaluation is the most important component for diagnosis of TOS; this should include subjective and objective findings as well as a review of daily activities and work
hinds. The development of TOS has no involvement with the tendons and soft tissues at the wrist, but that is where the symptoms tend to be perceived. In addition to true TOS, patients may have thoracic outlet symptoms due to forward head posture, working with shoulders on a tilted axis, breathing from the chest and improper body mechanics.\textsuperscript{13,36} Thoracic outlet symptoms from these sources can often be resolved with physical therapy.

**Cervical radicular pain (cervical radiculopathy)**

Pain or paresthesia in the hand may also originate in the cervical spine.\textsuperscript{15} Nerve roots that supply the arm and hand may become compressed as they exit the spinal vertebrae, resulting in cervical radiculopathy. This may occur simultaneously with CTS (also known as “double crush” syndrome\textsuperscript{33}). Numbness in the hand may be produced by changes in neck position, and muscle stretch reflexes tend to be diminished. Electrodiagnostic studies in this situation would reveal a normal nerve conduction velocity; however, the EMG may be abnormal in the distribution of the involved nerve root.\textsuperscript{15} A skilled electromyographer, usually a neurologist or physiatrist, is essential for accurate test results. The cause of cervical radiculopathy, more often than not, is due to forward head posture combined with degenerative changes in the facet joints of the cervical spine.

**Poorly fitted gloves**

Improperly fitted gloves may cause CTS-type pain, primarily at the base of the thumb. Ambidextrous gloves are generally molded with the hand in a flat (neutral) position and were originally designed for brief medical examinations.\textsuperscript{37} When gloves are used for longer procedures, as in dentistry, the operator’s hand must pull the glove into a working position, which may compress the back of the hand and strain the muscles at the base of the thumb, simultaneously reducing the blood flow to the hand. Ambidextrous gloves exert one-third more force than do fitted gloves,\textsuperscript{37} and muscle ischemia, nerve compression and pain may result. Older practitioners may be more prone than younger practitioners to glove-related pain in the hands.\textsuperscript{38} Tight gloves may also result in the above symptoms.

**Summary**

The cause of hand pain in dental professionals may be multifactorial, and the etiology may not necessarily be related to a single structural problem at the wrist. There are numerous other pain syndromes of the hand/wrist and elbow to which dental professionals are predisposed, including De Quervain’s syndrome, osteoarthritis of the carpometacarpal joint of the thumb, lateral epicondylitis and others.

Regardless of the etiology of hand/wrist pain, dental professionals should realize that their occupation is a perpetuating factor for the development of this pain.\textsuperscript{13,26,32} Prevention is of great importance, and intervention strate-gies should become an integral habit in the operatory in the office and at home.

**References**

16. Whyte-Ferguson L, Gerwin R. *Clinical Mastery in

Resources
• This CE course is Chapter 5 from the author’s book, Practice Dentistry Pain-Free: Evidence-based Strategies to Prevent Pain & Extend Your Career – B. Valachi.
• It’s Not Carpal Tunnel Syndrome! – S Damany/J. Bellis: Physics Forceps extraction instrument at www.physicsforceps.com
• The following related resources are available on the author’s website: www.posturedontics.com: Osteoarthritis vs. DeQuervain’s Disease in Dental Professionals (newsletter archives) WrisTimer – for preventing carpal tunnel/Wrist/hand exercises for dental professionals.

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Ms. Valachi is a physical therapist, dental ergonomic consultant and author of the book, ”Practice Dentistry Pain-Free”. She is CEO of Posturedontics®, a company that provides research-based dental ergonomic education and also lectures internationally—including the 2009 International Dental Ergonomics Congress in Krakow, Poland. Clinical instructor of ergonomics at OHSU School of Dentistry in Portland, Oregon, Bethany has provided expertise on dental ergonomics to faculty and students at numerous dental universities. She has been widely published in various peer-reviewed dental journals and has developed patient positioning, chairside stretching and home exercise DVDs specifically for dental professionals. She offers free newsletters, articles and product reviews on her website at www.posturedontics.com.

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Questions

1. Hand, wrist and arm pain are much more prevalent among dental professionals than the general public, due to ________.  
   a. intermittent grips and sustained awkward postures  
   b. sustained grips and prolonged awkward postures  
   c. sustained grips and ergonomic postures  
   d. none of the above

2. Between ________ of dentists and nearly ________ of dental hygienists experience hand and wrist pain.  
   a. 8 and 20 percent; 55 percent  
   b. 13 and 25 percent; 65 percent  
   c. 18 and 30 percent; 75 percent  
   d. 23 and 40 percent; 75 percent

3. The origins of pain in the hand, wrist or arm are always due to a problem in the same area.  
   a. True  
   b. False

4. Carpal tunnel syndrome is the least common peripheral nerve entrapment in the arm.  
   a. True  
   b. False

5. For the hand to function properly, ________ flexor tendons and the median nerve must be able to glide easily within the carpal tunnel.  
   a. five  
   b. seven  
   c. nine  
   d. none of the above

6. Flexing the wrist forward and gripping a small instrument forcefully are two of the primary risk factors for carpal tunnel syndrome.  
   a. True  
   b. False

7. High repetition work (such as manual scaling) and long duration (e.g., how many heavy calculus patients you schedule back-to-back) are primary risk factors for carpal tunnel syndrome.  
   a. True  
   b. False

8. Trying to keep your wrist straight and moving your entire hand, wrist and forearm as a unit ________, and is an appropriate ergonomic intervention to help prevent carpal tunnel syndrome.  
   a. transfers the load from larger hand muscles to smaller arm and shoulder muscles  
   b. transfers the load from smaller hand muscles to smaller arm and shoulder muscles  
   c. transfers the load from smaller hand muscles to larger arm and shoulder muscles  
   d. none of the above

9. Using an accentuated angled instrument is preferable to angling your wrist while performing dental procedures.  
   a. True  
   b. False

10. Ultrasonic scaling requires less force applied to the work surface and a less forceful precision grip than manual scaling.  
    a. True  
    b. False

11. The duration of use of either ultrasonic or manual instruments is positively associated with upper extremity numbness/tingling.  
    a. True  
    b. False

12. Larger instrument handle diameters increase hand muscle load and pinch force.  
    a. True  
    b. False

13. Alternating between handle diameter sizes may help prevent CTS symptoms.  
    a. True  
    b. False

14. Textured and lightweight instruments help reduce pinch forces and forceful pinch grips.  
    a. True  
    b. False

15. While dull instruments require the use of more force, they do not have a deleterious effect on musculoskeletal health.  
    a. True  
    b. False

16. Forceful pinch grip has been shown to increase pressure in the carpal tunnel, but this pressure is lowered when combined with wrist ulnar deviation.  
    a. True  
    b. False

17. Hygienists and dentists should try to use a ________ when possible.  
    a. plantar grip  
    b. palmar grip  
    c. ulnar grip  
    d. none of the above

18. Using 360-degree swivel instruments helps to ________.  
    a. maintain neutral wrist and optimal finger position  
    b. maintain optimal neutral wrist and a lateral finger position  
    c. maintain optimal neutral wrist and finger position  
    d. all of the above

19. Alternating between chairs with and without armrests can help avoid structural damage.  
    a. True  
    b. False

20. Exposure to ________ is an aggravating risk factor associated with CTS.  
    a. warmth  
    b. cold  
    c. humidity  
    d. all of the above

21. Tinel’s sign is an electric shock–type sensation in the hand when the ________ is tapped gently at the wrist and is often seen in patients with carpal tunnel syndrome.  
    a. superior palmar nerve  
    b. inferior palmar nerve  
    c. median nerve  
    d. none of the above

22. Weakness of the thenar muscles at the base of the thumb is often seen in patients with carpal tunnel syndrome.  
    a. True  
    b. False

23. Therapeutic interventions for the treatment of carpal tunnel syndrome include ________.  
    a. ice  
    b. massage  
    c. ultrasound or acupuncture  
    d. all of the above

24. ________ is a conservative treatment option for carpal tunnel syndrome.  
    a. Nerve or tendon gliding exercises  
    b. Modification of activities to decrease tendon excursion  
    c. The use of anti-inflammatories or cortisone injections  
    d. all of the above

25. ________ may mimic carpal tunnel syndrome.  
    a. Cervical radiculopathy  
    b. Poorly fitting gloves  
    c. Thoracic outlet syndrome  
    d. all of the above

26. Median nerve entrapment is one of the conditions that does not mimic carpal tunnel syndrome.  
    a. True  
    b. False

27. Ambidextrous gloves exert one-third more force than do fitted gloves, and their use may result in ________.  
    a. muscle ischemia  
    b. nerve compression  
    c. pain  
    d. all of the above

28. Trigger points in the forearm muscles such as the pronator teres can cause compression on the median nerve and cause pain in the hand and wrist similar to that of carpal tunnel syndrome.  
    a. True  
    b. False

29. Older practitioners may be more prone to younger practitioners to glove-related pain in the hands.  
    a. True  
    b. False

30. Intervention strategies should become an integral habit in the operatory in the office and at home to help prevent carpal tunnel syndrome.  
    a. True  
    b. False
Educational Objectives
1. List and describe four of the primary risk factors associated with carpal tunnel syndrome.
2. List and describe ergonomic interventions that can help prevent carpal tunnel syndrome.
3. List and describe other conditions that may mimic carpal tunnel syndrome.
4. Provide an overview of the diagnosis and treatment of carpal tunnel syndrome.

Course Evaluation
Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?
   - Objective #1: Yes No
   - Objective #2: Yes No
   - Objective #3: Yes No
   - Objective #4: Yes No

2. To what extent were the course objectives accomplished overall?
   - 5 4 3 2 1

3. Please rate your personal mastery of the course objectives.
   - 5 4 3 2 1

4. How would you rate the objectives and educational methods?
   - 5 4 3 2 1

5. How do you rate the author's grasp of the topic?
   - 5 4 3 2 1

6. Please rate the instructor's effectiveness.
   - 5 4 3 2 1

7. Was the overall administration of the course effective?
   - 5 4 3 2 1

8. Do you feel that the references were adequate?
   - Yes No

9. Would you participate in a similar program on a different topic?
   - Yes No

10. If any of the continuing education questions were unclear or ambiguous, please list them.

11. Was there any subject matter you found confusing? Please describe.

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➤ Identify which exercises benefit dental professionals

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