



# Musculoskeletal Health of the Woman Dentist: Distinctive Interventions for a Growing Population

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**ABSTRACT** Female dentists face unique musculoskeletal demands and inherent gender differences that may place them at higher risk for occupational pain and injury than their male counterparts. By familiarizing themselves with unique muscle imbalances, specific pain syndromes, and positioning challenges to which they are predisposed, female dentists may take pre-emptive action and initiate ergonomic intervention in the operatory and specific exercise at home to reduce the risk of developing musculoskeletal disorders.

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In an occupation that has historically been dominated by men, we must acknowledge that a majority of today's dental team members are now women. While it is obvious the assistant and hygienist roles in the dental team have always been primarily filled with females, recent trends indicate an increasing percentage of dentists are now women compared to days past when it was nearly exclusively a man's position. For example, in 1982, only 2.6 percent of practicing dentists in the United States were female. In 1994, the percentage grew to 10.2 percent; and by 2004, 18.35 percent of practicing dentists were female.<sup>1</sup>

There exists a plethora of research suggesting a causal link between the ergonomics of dental care delivery and numerous musculoskeletal problems.<sup>2-15</sup> The nature of clinical dentistry promotes working for extended periods in awkward,

prolonged postures. The literature reveals that prolonged, static postures can lead to muscle imbalances, tissues ischemia, and formation of painful muscular trigger points.<sup>16-20</sup> These changes can result in a chronic pain-filled professional career that could end with a serious musculoskeletal disorder. Studies show that an average of 2 out of 3 dentists experience pain in a 12-month period and that 30 percent of dentists who retire early are forced to, due to a career-ending disability.<sup>2-15,21</sup> While the above problems should concern all dentists, physiological gender differences may cause women dentists to experience slightly different pain syndromes and may require different intervention and wellness strategies than their male counterparts.

Dentists, as a group, tend to be more prone to occupational pain than the general public. For instance, only 10 percent to

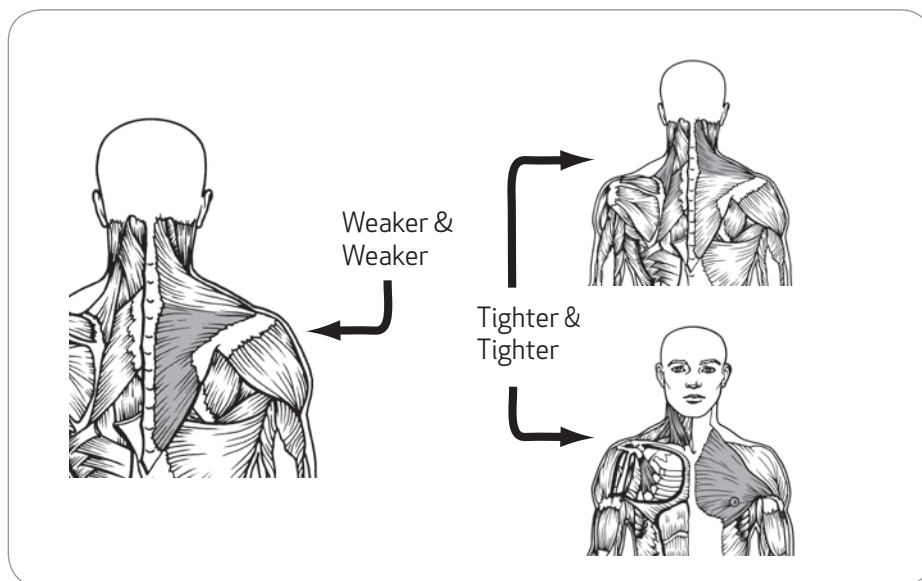
17 percent of the U.S. general public experiences low back pain in a given year, while 37 percent to 60 percent of U.S. dentists report low back pain.<sup>8,12,15,22</sup> The author found it particularly interesting that there are few, if any, U.S. dental studies on general prevalence of pain that compare men and women, while nearly every foreign study on the topic includes these parameters. This indicates a need for more research to assess frequency, severity, location, and etiology of occupational pain among women dentists in the United States.

Although a recent Dutch study indicates that gender differences such as hormonal and reproductive factors and estrogen level are associated with chronic musculoskeletal pain, women dentists still tend to have a higher incidence of occupational pain than other female workers.<sup>2,3,23</sup> Female dentists also experience higher overall pain frequency and severity than their male counterparts, with hand/wrist and hip pain being particularly problematic for female dentists.<sup>2,4,6,8,10,11,13</sup>

There are numerous problems that are unique to the female gender among dentists that can significantly impact their musculoskeletal health.

### Muscle Imbalances

In order to operate with optimal posture for prolonged periods of time, dentists must have excellent endurance of the trunk and shoulder girdle stabilizing muscles. For example, the middle and lower trapezius muscles (**FIGURE 1**) tend to fatigue quickly with forward head, rounded upper back, and elevated arm postures as often observed in the operatory.<sup>24</sup> This is particularly problematic among women in dentistry. On the average, women's muscles can exert only two-thirds the force men's can so when female dentists intermittently assume nonneutral postures there is generally less



**FIGURE 1.** Shoulder girdle stabilizers tend to weaken quickly with forward head and rounded shoulder postures. When this occurs, other muscles must compensate and become ischemic and painful. (Valachi, "Practice Dentistry Pain-Free," Posturedentistry Press, 2007. Reproduced with permission.)

muscle to stabilize the body.<sup>25</sup> Combine this risk factor with the need for the substantial muscle endurance required to balance the body in an optimal working posture against the additional weight of breasts, and the stage is set for a muscle imbalance. Without excellent endurance of the shoulder stabilizing muscles, these risk factors can cause the female dentist to easily slouch into poor posture during the course of the workday.

When the stabilizer muscles fatigue, resulting in slouching, other muscles (upper trapezius, levator scapula, and upper rhomboids) must compensate and perform a job for which they are not designed.<sup>24</sup> These muscles become overworked, tight, and ischemic (**FIGURE 1**). Over time, the stabilizing muscles become weaker, while the compensating muscles become stronger, and a muscle imbalance is born. This muscle imbalance can cause improper movement of the shoulder blade, or ischemia of the compensating muscles, resulting in neck or shoulder pain.

*(Before embarking on any new strengthening or stretching exercises, always consult a health care professional. All exercise is not suitable for everyone.)*

### INTERVENTION

Endurance strengthening of specific trunk muscles (transverse and oblique abdominals, quadratus lumborum, erector spinae and multifidus), shoulder girdle stabilizing muscles (middle and lower trapezius muscles, serratus anterior), and specific rotator cuff muscles is imperative for women dentists' health. This type of strengthening utilizes high repetitions with little recovery time between sets and low resistance or weight.<sup>26</sup> There are numerous ways to target the shoulder stabilizing muscles. One method is using an elastic exercise band, which is usually latex and available in flat bands or round tubing. Wrap the band around both hands (to avoid prolonged gripping on handles, which increases compression in the carpal tunnel) by pulling it diagonally down while squeezing the shoulder blades downward and together (**FIGURE 2**). Make sure one's ears are over the shoulders throughout the exercise. Always use very light resistance when strengthening postural stabilizing muscles, and repeat the exercise 10 to 15 times. With all exercise, it is a good idea to seek guidance from a health care professional. Strengthening



**FIGURE 2.** The Downward Pull is an example of an exercise to build endurance of the scapular stabilizers, primarily the lower trapezius. (Valachi, "Smart Moves for Dental Professionals on the Ball," *Posturedontics, LLC, 2004*. Reproduced with permission.)

exercises should only be performed when there is no musculoskeletal pain and when the full range of motion of the neck and shoulder is present.<sup>20</sup> Overstrengthening the wrong muscles can lead to worsening of pain syndromes and imbalances.

In addition to strengthening, female dentists should also incorporate postural awareness exercises into their daily routine. Implementation of a microscope or procedure scope will also greatly aid in preventing this muscle imbalance. Loupes users should ensure their units have an optimal declination angle (angle at which the scope is inclined downward), properly measured working distance (measured with forearms about parallel with the floor), and large frame size (so the scope can be mounted low in relation to the pupil). It should be noted that some loupe manufacturers offer significantly better declination angles than others.

### Proximity Problems

A large chest can create modesty issues, causing the dentist to position herself further from the patient. The increased reaching distance and weight of the extended arm is a risk factor for shoulder muscle fatigue

and cannot be maintained for long periods of time.<sup>27</sup> The farther the dentist positions herself from the oral cavity, the shorter the endurance time of the shoulder muscles.<sup>27</sup> Pregnant dentists also experience this positioning problem due to the increased size of the abdomen. In pregnant women, a work area positioned further from the body is also a risk factor for low back strain.<sup>28</sup>

### INTERVENTION

Most importantly, the woman dentist must realize that close proximity is inherent to the profession. A strategically placed ceiling-mounted TV monitor may help distract from this issue for both dentist and patient. For dentists desiring further proximity from the patient, armrests can help remove unsafe workloads from the neck and shoulder muscles due to the weight of the extended arm.<sup>27,29,30</sup> Dentists should be careful not to place armrests too far forward as it will encourage rounded shoulder posture, thereby defeating the ergonomic benefit.

### Upper Trapezius Pain

One EMG study of the neck, shoulders and arms showed that the highest activity during dental work occurred in the trapezius muscles.<sup>31</sup> As has been seen, these muscles are highly prone to muscle imbalance, ischemia, and trigger points. It is also the muscle most susceptible to emotional stress.<sup>32</sup> During such times, the operator may unknowingly hold the shoulders in an elevated posture, causing a sustained contraction in these muscles. Positioning patients too high can also cause the dentist to operate with elevated shoulders. Add to this milieu women's bra straps that can dig into the upper trapezius muscle-compressing nerves, creating painful trigger points and headaches due to the weight of large breasts.<sup>19,33</sup> And finally, purses that are consistently slung over one shoulder, can cause unilateral strain in one trapezius muscle.<sup>19</sup>

### INTERVENTION

The upper trapezius muscle is an especially painful and problematic area among women dentists, so numerous interventions are helpful. Learn to sense tension that develops in this muscle and release it throughout the day using the progressive relaxation technique; by alternate contraction and relaxation of muscles, the individual learns to detect where muscular tension is occurring in the body, and effectively relax the muscle. Developing good practice management skills can also go a long way in reducing emotional stress.<sup>34,35</sup> Shoulder circles are also helpful in reducing accumulated upper trapezius tension. Roll the shoulders forward, back, up and down, each time return the shoulders to a relaxed, neutral position. Positioning patients lower can be achieved by utilizing loupes with a proper working distance.

Compression on the upper trapezius due to bra straps can be resolved with a sports-type (racer-back) style bra with wide straps that connect in the middle of the upper back.<sup>33</sup> The weight is translated to a wide support band around the ribs and may help reduce pain when worn during work. Single-shoulder purses, especially heavy ones, should be avoided. A backpack-style purse distributes the weight more evenly, and should be considered by female dentists.

### Shorter Stature

Another gender-specific issue for women is that they tend to be shorter in stature than their male counterparts.<sup>25</sup> This is an important difference because many manufacturers have historically designed equipment, such as the operator stool, to fit the average male operator. This trend is slowly reversing and more manufacturers offer multiple cylinder heights to accommodate both tall and short operators.



**FIGURE 3.** A saddle stool may enable closer proximity to the patient by opening the hip angle and may also solve seating problems for shorter operators.

#### INTERVENTION

Women of slighter stature must ensure that the chair they sit on is retrofitted with a short size hydraulic cylinder to prevent perching on the edge of the seat pan. The same holds true regarding depth of the seat pan. Dental stool seat pan depths range from 14 inches to 18 inches, which accommodates a wide range of sizes. Shorter dentists should consider trying a shorter seat pan (14 inches to 15 inches deep), since this will enable them to sit all the way back on the seat pan and utilize the lumbar support.<sup>36</sup> A saddle-style stool may also be helpful for shorter dentists in gaining proper seating support as well as closer proximity (**FIGURE 3**).

#### Hip Pain

Occupations that involve prolonged sitting, such as dentistry, may predispose individuals to hip pain, which can have numerous etiologies including: osteoarthritis, trochanteric bursitis, piriformis syndrome, and referred pain from trigger points.<sup>20,37</sup> Prolonged sitting may lead to adaptive muscle shortening causing tightness in the hip and low back muscles, affecting flexibility and joint mobility.<sup>20</sup> Hip



**FIGURE 4.** An example of a hip stretch that targets the piriformis muscle. Cross right leg over left knee and gently pull the left leg toward you until a gentle stretch is felt. Hold for 20 to 30 seconds. Repeat on the other leg. (Valachi, "Practice Dentistry Pain-Free," Posturedentics Press, 2007. Reproduced with permission.)

tightness can also create painful trigger points in select back and hip muscles.<sup>38</sup> Especially problematic among women is piriformis syndrome. In about 15 percent to 20 percent of the population, the sciatic nerve runs through the piriformis muscle so tightness in the muscle can cause sciatic pain — shooting pain into the hip, buttock, and down the back of the leg.<sup>20</sup>

#### INTERVENTION

In a seated profession, it is a good idea to move the hip regularly out of a flexed position. Dentists should intermittently stand for exams, extractions, injections and impression making as well as perform specific hip stretches, (**FIGURE 4**) especially extension and rotation, on a regular basis, to avoid hip dysfunction caused by prolonged sitting. Functional strengthening of the gluteus medius is also important in seated occupations.

#### Hand/Wrist Pain

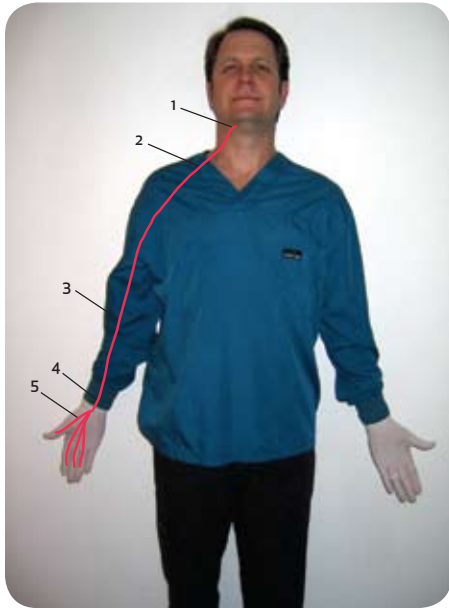
Carpal tunnel syndrome is three times more prevalent in women than men and most common between the ages of 30 and 60. It is thought to be caused by compression of the median nerve at the wrist and can lead to pain, numbness, or tingling in

the thumb, index, middle, and half of the ring finger.<sup>22</sup> Sustained wrist flexion, strong gripping on a small diameter instrument, dull instruments, heavy instruments or pulling against short tubing are just some of the numerous causes. It should also be mentioned there are several pain syndromes that mimic carpal tunnel, but actually have a different etiology (**FIGURE 5**). Since surgery is often times only partially successful, dentists should first educate themselves on the mimicking pain syndromes.<sup>39</sup>

#### INTERVENTION

Try to keep one's wrist neutral. Rather than twisting the wrist to access hard-to-reach areas, try moving the instrument or handpiece in one's hand or consider selecting an instrument with multiple accentuated angles and longer terminal shank, which can reduce twisting the wrist to access these areas.

Larger instrument handle diameters reduce hand muscle load and pinch force. However, handle diameters greater than 10 mm (about 3/8 inch) have been shown to have no additional advantage.<sup>40</sup> Although instrument weight is not as significant a risk factor as handle diameter, lightweight



**FIGURE 5.** CTS symptoms can result from impingement, compression, or stretch at numerous points along the median nerve: 1) cervical radiculopathy, 2) thoracic outlet syndrome, 3) trigger points, or 4) carpal tunnel syndrome. Poorly fitted gloves (5) may also cause CTS-type symptoms. (Valachi, "Practice Dentistry Pain-Free," *Posturedentics Press*, 2007. Reproduced with permission.)

instruments (15 grams or less) help reduce the muscle workload and pinch force.<sup>41</sup> Forceful pinch grip has been shown to increase pressure in the carpal tunnel; this pressure is even higher when combined with wrist ulnar deviation.<sup>42</sup> Use 360-degree swivel instruments to maintain optimal neutral wrist and finger position.

Dentists with pain in their dominant hand should consider using the nondominant hand intermittently for extractions. Begin by supporting the extracting hand with your dominant hand. As you become more comfortable and transition to using the nondominant hand alone for extractions, you may find that positioning on the opposite side of the patient for extractions is easier and provides yet another opportunity to move, shifting the workload from one group of muscles to another.

Frequent stretch breaks were the most helpful intervention for hand/wrist pain in one dental study<sup>43</sup> (**FIGURE 6**). Stretching helps to increase blood flow and reduce formation of trigger points.

## Pregnancy

Women experience physiological changes during pregnancy. The center of gravity is shifted forward, resulting in altered posture and a susceptibility to low back pain. Spinal joints and ligaments that normally provide stability become weak and lax, and the body increasingly relies on the muscles to maintain upright standing and seated postures.<sup>44</sup>

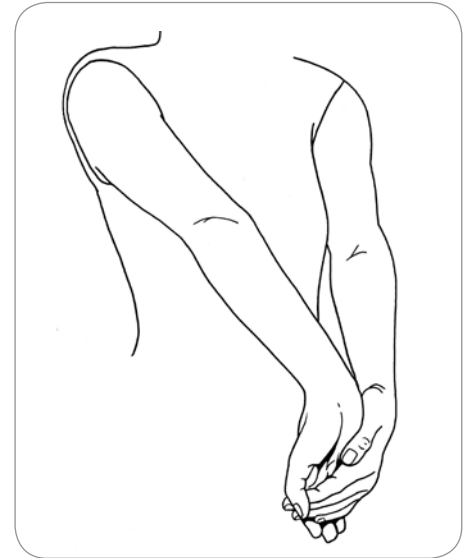
Two of the most common musculoskeletal side effects of pregnancy are low back pain and carpal tunnel syndrome.<sup>28</sup> The extra fluid in the body can compress the median nerve, causing carpal tunnel syndrome symptoms in 28 percent of pregnant women.<sup>28</sup> Most pregnant women have some degree of musculoskeletal discomfort and 25 percent have temporarily disabling symptoms.<sup>45</sup> The pregnant worker is most susceptible to injury during the third trimester when the abdomen is largest.

Much ergonomic equipment is designed to accommodate the smallest to the largest workers. However during pregnancy, these adjustments may not be sufficient. Existing guidelines for work height positioning in other occupations are not suitable for pregnant workers as it is difficult to position the work surface at certain recommended proximities and heights.<sup>46</sup> This may be applicable in the dental operator as well.

If preventive ergonomic actions are not taken early in pregnancy, these risk factors may worsen as the pregnancy progresses.

## INTERVENTION

Due to weakening of joints and ligaments, good, neutral operating posture during pregnancy is of paramount importance due to the high degree of strain placed on the back and neck when leaning forward. This means careful attention to positioning patients appropriately for mandibular versus maxillary procedures, and utilizing patient chairs



**FIGURE 6.** Carpal tunnel stretch: Turn the palm upward and hold the palm as you slowly extend the elbow until straight. Hold 2-4 breath cycles. (Valachi, "Smart Moves in the Operator: Chairside Stretching," *Posturedentics, LLC*, 2004. Reproduced with permission.)

with narrow upper backrests and small, thin headrests to gain close proximity.

Stability exercises are important for women dentists but become even more imperative for injury prevention during pregnancy. Core stability training is an important intervention to prevent and treat back/pelvic pain during and after pregnancy.<sup>47</sup> Exercises and precautions for pregnant women differ from nonpregnant individuals. A physical therapist who specializes in gynecology will be able to offer numerous exercises and specific precautions that should be adhered to by pregnant women.

Although regularly changing positions is good throughout pregnancy, pregnant dentists should avoid standing for prolonged periods of time, especially late in the pregnancy when the low back curve increases. Standing for more than four to six hours/day or working more than 36 hours/week may lead to preterm deliveries.<sup>28</sup> Prolonged sitting is also a risk factor during pregnancy, so frequent, short breaks are advised for the pregnant dentist, during which walking or simple movement may be performed. In addition, a reduction in work

hours and scheduling longer breaks between patients may help reduce discomfort.

During pregnancy, it is important that the low back be supported while sitting. A dental stool with a good lumbar support (the most convex portion of the backrest) is essential. This will require a short seat pan that enables the dentist to sit all the way back on the stool, maintaining contact with the lumbar support. When properly adjusted, the lumbar support should nestle in the natural low back curve. This will require a backrest that tilts forward. At home and while driving, support the low back with a small pillow or rolled-up towel.

## Conclusion

Research clearly shows that both male and female dentists face challenges to their musculoskeletal health due to the nature of their work. Prolonged, static postures in the operatory are nearly unavoidable and can predispose dentists to pain and injury. Women dentists are possibly at higher risk for significant musculoskeletal problems because of several gender-specific issues reviewed in this article. Pregnancy for these dentists poses additional challenges to their musculoskeletal health due to the hormonal and physical changes that occur during the term. Several strategies have been proposed in this article to help ameliorate some of these challenges. With heightened awareness of the risk factors unique to their gender, women dentists can take pre-emptive action and implement specific prevention strategies both in and outside the operatory to avoid pain, injury or early retirement. ■■■■

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