Dentists: Your Back Requires Back-Up Now!!!

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Abstract

Back problems are the most common physical ailments faced by individuals all over the world at some times in their lives. Human beings suffer from back problems mainly by defying the evolutionary heritage of upright posture and becoming sedentary creatures. Back problems rank high on the list of ailments that are self inflicted. Dentists experience more neck, shoulder and lower back pain than do practitioners in other occupational groups. Dentists are more prone to these back problems mainly because of improper working pattern and environment. These back problems can result in poor quality of care, a dentist gives to his/her patients. But, by making some modifications in the working posture & conditions along with some aerobics and meditation, a dentist can prevent spinal problems and can render quality care to the society for extended period of time.

Introduction

Most of people do not relish their periodic visits to the dentists nor do they eagerly await their upcoming dental appointment. In these situations, sympathy usually lies fairly and squarely with the patients. What many people fail to appreciate, however, is that these situations place considerable musculoskeletal demands on these health professionals, whenever they are treating people in an attempt to improve their quality of life. Dental professionals commonly experience musculoskeletal pain during the course of their careers. While the occasional backache or neckache is not a cause for alarm, if regularly occurring pain or discomfort is ignored, the cumulative physiological damage can lead to an injury or a career-ending disability. The musculoskeletal health of dental professionals has been the subject of numerous studies worldwide, and their focus has been on the pain experienced by the practitioner.

For the patient, a dental visit typically involves sitting in a reclined or even supine position and the dentist often has to contort the body to perform the oral work. Dental profession typically involves working in a standing position and requires prolonged stopping over a reclined or even supine patient. Also, dentist must use a variety of hand tools in a delicate manner. The kind of posture related musculoskeletal problems, reported by dentists, are comparable to those found in other professions involved in prolonged standing work in poor posture.

Thus, the dental team is at high risk of neck & back problems due to limited work area and impaired vision associated with the oral cavity. These working restrictions frequently cause a dentist to assume stressful body postures to achieve good access and visibility inside the oral cavity. Also, dental procedures are usually long and require much more concentration during work.

Prevalence of musculoskeletal Pain among dentists

In a 2010 study, Pargali [1] found that 73 percent of dentists complained of back and neck pain. Even after the evolution to seated four-handed dentistry and ergonomic equipment, studies [2-6] have found back, neck, and shoulder or arm pain present in up to 81 percent of dental operators. In the practice of dentistry, stress, tension and postural practices can contribute to back & neck problems to the dentist. Various work-related factors among dentists have been established as predisposing the disorders i.e. overstrained and awkward back postures for back pain, repetitiveness for neck and shoulder disorders, and psychosocial stressors for back, neck and shoulder complaints [7]. A slight hand neuropathy has also been reported caused by exposure to high frequency vibration tools [8].

Musculoskeletal pain, particularly back pain, has been found to be a major health problem for dental practitioners [9-13]. Several studies have reported a similar prevalence of musculoskeletal disorders (MSD) amongst dentists. In a survey of Danish dentists for example, 50% and 65% reported a one year prevalence of low back pain and neck/shoulder pain, respectively [5]. A study from New South Wales (NSW), Australia, found an even higher prevalence of MSD among dentists, with 82% reporting at least one musculoskeletal symptom in the past month and 64% reporting backache during the previous month [9]. Similarly, a 12 month period prevalence of 54% for low
back pain was recently reported amongst dentists in Queensland, Australia [14]. Similar health problems have also been reported during studies of dentists in the United States of America [15] and amongst Norwegian dental hygienists [16]. A Saudi study, however, reported a slightly higher rate of MSD among their subjects (74%) [17].

The 12 month period-prevalence of neck-related pain among Queensland dentists (58%) [14], was similar to that reported by dentists in many other countries, such as Denmark (65%) [5] and Saudi Arabia (65%) [16] but higher than a survey of Israeli dentists (38%) [18]. The Queensland study also examined MSD at seven other body sites, revealing that the 12 month period-prevalence of shoulder pain (53%) was as prevalent among dentists as lower back or neck pain [14]. This finding is similar to an investigation of dental workers in the United States (US) military (53%) [15] as well as another study of Danish dentists (65%) [5]. In addition, about one third of Queensland dentists reported hand pain [14], which is lower than the 76% of dental workers reporting one or more symptoms of carpal tunnel syndrome in the aforementioned US military study [15], although dentists were shown to incur a lower risk than either dental hygienists or dental assistants.

Some investigations suggest that the prevalence and location of pain and other symptoms may be influenced by posture and work habits, as well as other demographic factors [9, 19]. Part-time dentists for example, were found in one Thai study to have a higher proportion of musculoskeletal problems, when compared to their full-time counterparts [6]. The number of years since graduation has also been shown to be negatively correlated with musculoskeletal pain. The finding that younger and less experienced dentists were more likely to report MSD of the neck, upper back and shoulders was also found in a study of dentists in Queensland, Australia [14]. This was not observed in a study of dentists in New South Wales, Australia, however [9], although female dentists were found to rate the severity of their most severe symptom higher and to report more frequent pain and headaches [9].

Possible explanations were that experienced dentists are probably better at adjusting their working position and techniques in order to avoid musculoskeletal problems, when compared to their less experienced counterparts, or that they simply developed coping strategies to help deal with the pain. A more likely explanation; however, is simply that those dentists with severe musculoskeletal problems would have ceased working, and would thus not have been captured in a cross-sectional survey of dentists [20].

Regarding biomechanics, a previous Swedish study found that dentists were exposed to a high load on the trapezius muscles bilaterally, as well as prolonged forward bending of the head [21]. Prolonged static postures are thought to be associated with various MSD [18]. Interestingly, analysis of loads on the wrists of Swedish dentists, suggest that their postures were constrained, but that overall dynamic loads were low [21]. Previous research from the NSW survey has suggested that modification of work practices in dentistry, including taking rest breaks, does not seem to influence the prevalence of reported symptoms associated with MSD [9].

**Spinal dynamics**

In standing postures, the spine has four natural curves when viewed from the side: cervical lordosis, thoracic kyphosis, lumbar lordosis and sacral kyphosis (Illustration 1) [22]. The curves are interdependent; a change in one curve will result in a change in the curve above or below it. Since the sacral curve is composed of five fused vertebrae, its movement is extremely limited. However, the remaining curves—especially the lumbar and cervical curves are more mobile and can be influenced more easily. When the curves of the spine are present and balanced against the center of gravity, the spine is supported mostly by the bony structures of the vertebrae resting on top of one another. When these curves become either exaggerated or flattened, the spine increasingly depends on muscles, ligaments and soft tissue to maintain erect.

The most important joint in the vertebral column is the inter-body joint. A well constructed, circular cushion of specialized fibro-cartilage called ‘inter-vertebral disc’ is sandwiched between adjacent bodies. These inter-vertebral discs are of tough elastic fibers on the outside and a soft gelatin like substance mostly water, inside. The discs serve as shock absorber between vertebrae. Over time, discs lose their ability to absorb water and become less flexible. Also, small stresses and strains cause tiny tears in the outer casting of the discs. These tears heal with scar tissue which is weaker and less flexible than the original tissue. The inter-vertebral disc is a marvel of nature and can tolerate large amount of compressive loads and bending and twisting stresses. During flexion, the inter-body joint carries more weight while during extension, the facet joint carries more loads.

During working, dentist maintains varying positions for
prolonged periods of time, one can only speculate the amount of loading/stress suffered by the lumbar spine. The majority of mechanical failures of spinal structures results from either single or recurrent misuse of the back in these mechanically disadvantageous postures. During treatment, however, dentists should strive to maintain a neutral, balanced posture (Illustration 2). Even with the best ergonomic equipment, operators can find themselves in sustained awkward postures. These postures often consist of forward bending and repeated rotation of the head, neck and trunk to one side (Illustration 3). Over time, the muscles responsible for rotating the body to one side can become stronger and shorter, while the opposing muscles become weaker and elongated. The stressed shortened muscles can become ischemic and painful, exerting asymmetrical forces on the spine that can cause misalignment of the spinal column and decreased range of motion in one direction over the other. To effectively prevent injuries in dentistry, prevention strategies and ergonomic techniques must address these postural and positioning difficulties, as well as subsequent detrimental physiological changes: muscle imbalances, stiff joints, muscle necrosis and spinal disk degeneration.

Causes of back problems

Back pain is one of the most common and troublesome of complaints. Its exact cause is legion and an exact diagnosis is often difficult [23]. Back problems have been cited as the second most common reason for missing work in an industrial population in the United States [24]. It has been stated that the most common site of pain among dentists and dental auxillaries are in the areas of cervical & lumbar vertebrae [9, 25, 26]. The shape of vertebral column, aging, changes, weak muscles, postural practice, movements, lifting techniques and mechanical stress have been identifies as factors that can contribute to the neck and back pain in general [12].

According to Walters, 1976, stress, postural practices (bending and twisting trying to gain better access and visibility within the oral cavity) as well as prolonged working time lead to fatigue [27]. Various other investigators have pointed out the common postural faults among dentists and dental auxiliary personal, such as craning, excessive bending and twisting of neck, bending forward from the waist, elevation of the shoulders and general bending and twisting of neck & back [28-32].

Dental auxillaries also experienced back pain associated with their work. Though, level of pain experienced by dentists is usually greater than that felt by auxiliary personal, but as the working day progresses, discomfort experienced by both the dentist & dental auxillaries, significantly increases in severity [33].

In 1989, Bassette [12] concluded that despite the use of improved dental equipments, operating in a seated position using the four handed dentistry technique and increasing the frequency of exercise, the incidence of back problems has not decreased over the last 15 years. He went on to state that for many dentists, backaches are likely to be related to muscular tensions and poor working postures, Bassette, as a preventive measure, recommended that dental students should be taught relaxation techniques early in their clinical training and also they should be taught correct working positions at chairside.

The most common type of back pain comes from straining the muscle bands immediately surrounding the vertebral column in lumbar region. Although such strains can occur anywhere along the spine, they happen most often in the curve of lower back and next most common site is the base of neck.

Recommendations

Neck & back problems among dental professionals are not of severe nature, however, in order to minimize or even prevent such ailments, conscious efforts must be made to reduce stress on the spine by modifications in working posture and working environment [33]. Besides, preventive aerobic and relaxation exercises should also be included in the weekly activities of dental professionals [17]. Such a practice would-

1. Help dental professionals avoid future physical limitations or handicap and
2. Help them remain productive for longer periods of time during their professional lives. This will also help them improving the quality of care they can render to their patients if they are pain free during clinical procedures.

POSTURAL AWARENESS TECHNIQUES

A. Maintain the low back curve

The following practices [34] can help maintain the lower back curve:

- Tilt the seat angle slightly forward up to 15 degrees to increase the low back curve. This will place your hips slightly higher than your knees and increase the hip angle to greater than 90 degrees, which may allow for closer positioning to the patient.
- Sit close to the patient and position knees under the
patient’s chair if possible. This can be facilitated by tilting the seat and using patient chairs that have thin upper backs and headrests.

- Use a saddle-style operator stool that promotes the natural low back curve by increasing the hip angle to approximately 130 degrees. Using this type of stool may allow you to be closer to the patient when the patient chairs have thick backs and headrests.
- Adjusting the chair so your hips are slightly higher than your knees and distribute your weight evenly by placing your feet firmly on the floor. The forward edge of the chair should not compress the backs of your thighs.
- Using the lumbar support of the chair as much as possible by adjusting the lumbar support forward to contact your back.
- Stabilize the low back curve by contracting the transverse abdominal muscles. To do this while sitting, sit tall with a slight curve in the low back, exhale, pull your navel toward the spine without letting the curve flatten. Continue breathing while holding the contraction for one breath cycle. Repeat five times.
- Pivot forward from your hips, not your waist. Stabilize the low back curve by performing the previous exercise before pivoting forward.

B. Adjust operator chair properly

Operators need to know how to adjust the features of their chairs to obtain maximal ergonomic benefits.

- Adjust your chair first. A common mistake operators make is positioning patients first, and then adjusting their chairs to accommodate the patients.
- Position the buttocks snugly against the back of the chair. The edge of the seat should not contact the backs of the knees.
- Place feet flat on the floor and adjust the seat height up until thighs gently slope downward while the feet remain flat on floor. This helps maintain the low back curve and enables you to position your knees under the patient more easily.
- Move backrest up or down until the lumbar support nestles in the natural lumbar curve of the low back. Then angle the lumbar support forward to facilitate contact with the low back.
- Tilt the seat forward about five to 15 degrees. If you are beginning to work with the seat tilt function, start with a slight tilt and later increase the degree of tilt as is comfortable.
- Adjust armrests, which are designed to decrease neck and shoulder fatigue and strain, to support elbows in the neutral shoulder position.

POSITIONING STRATEGIES

A. Avoid static postures

According to Lehto and colleagues [35], the concept of a single correct work posture may be physiologically invalid, as the human body may be made for movement and ever-changing postures. Some dental schools and educational programs stress the importance of using one “home” position while working.

While it is important to use ergonomically correct positions and postures, some studies suggest that several home positions may be better than one [5, 36]. Spending long periods in static positions increases a worker’s susceptibility to injury due to the mechanisms we discussed in a previous article. Increasingly, the literature supports the idea that workers should vary their work positions as often as possible to shift the workload from one group of muscles to another [36].

B. Alternate between standing and sitting

Standing uses different muscle groups than does sitting; therefore, alternating between the two positions lets one group of muscles rest, while the workload is shifted to another group of muscles. Alternating between standing and sitting also can be an effective tool in preventing injuries.

C. Reposition the feet

Subtle changes in foot position can shift the workload from one group of low back muscles to another, allowing the overworked tissues to be replenished with nutrients.

D. Avoid twisting

Operatory design plays an important part in how often dentists perform detrimental twisting movements during the workday. Rear delivery systems encourage extensive trunk twisting and shift of vision to retrieve instruments, and side delivery systems require moderate twisting. When possible, dentists should position instruments within easy reach. Operators should try to retrieve items with the closest hand, especially with rear delivery systems, to avoid twisting or reaching across the body. Repeated unilateral twisting in one direction may result in muscle imbalances or structural tissue damage, leading to low back pain.

PERIODIC BREAKS AND STRETCHING

Directional stretches can be performed in or out of the operatory and can be incorporated into a daily routine that facilitates balanced musculoskeletal health. Directional stretching involves a rotation, side bending or extension component that generally is in the opposite direction of that in which the operator frequently works (Illustrations 4a-d). This strategy addresses the muscle imbalances that tend to develop. Frequent stretching breaks address the detrimental physiological changes that can develop while working in optimal or awkward postural static postures: ischemia, trigger points, muscle imbalances, joint hypo-mobility, nerve compression and disk degeneration. Furthermore, stretching

- increases blood flow to muscles
• increases production of joint synovial fluid
• reduces formation of trigger points
• maintains normal joint range of motion
• increases nutrient supply to vertebral disks
• creates a relaxation response in the central nervous system
• warms up the muscle before beginning to work
• identifies tight structures that may be predisposed to injury.

STRENGTHENING EXERCISES

Strong muscles support the vertebrae better, allowing them to handle greater loads. Weak, unconditioned muscles make the back work less efficiently. Instead, some of the load that muscle ought to bear is shifted to the vertebrae and disks. An aerobic and/or weight training program are good. Stationary bicycling, walking and swimming at least thrice a week will keep the back in good shape. Any exercise done consistently is better than no exercise at all. Besides, weight bearing exercises help prevent osteoporosis. Dentists should perform specific strengthening exercises for the trunk and shoulder girdle to enhance the health and integrity of the spinal column, maintain good working posture, optimize the function of the arms and hands and prevent injuries.

Areas to strengthen include the trunk stabilization muscles, primarily the transverse and oblique abdominal muscles and multifidus muscles; the stabilizing muscles of the shoulder girdle, mainly the middle and lower trapezius muscles; and the downward gliding muscles of the rotator cuff, the infraspinous, subscapular and teres minor muscles. Areas to stretch include the chest musculature, hamstring muscles, low back muscles, buttock (piriform) muscles and hip flexor (iliopsoas) muscles. This combination of strengthening and stretching addresses a unique pattern of muscle imbalances that can develop among dental professionals [34].

Guidelines for exercise

Certain guidelines should be observed when beginning any exercise program:

• Consult a physician before beginning any exercise program.
• Do not perform strengthening exercises for painful or fatigued muscles.
• Begin exercise gradually, starting with the minimum number of repetitions
• Stop exercise immediately if numbness, tingling, dizziness or shortness of breath occurs.
• Perform strengthening exercises three to four times per week and stretching exercises daily.

Aerobic exercises should be performed three to four times a week for at least 30 minutes. One major contributing factor to MSDs is decreased flow of nutrients and oxygen to muscles. Aerobic exercise increases blood flow to all of the tissues in the body and improves their ability to use oxygen. In addition, aerobic exercise improves cardiovascular and cardio-respiratory function, lowers heart rate and blood pressure, increases high-density lipoprotein (good) cholesterol, decreases blood triglycerides, reduces body fat, improves stress tolerance, increases mental acuity, improves sleep quality and may increase longevity [37]. Operators should choose aerobic exercises that they enjoy. It is advisable to do at least two types of aerobic exercise regularly, for both variety and the benefits of cross-training [38].

Dental personnel may need to take a break from exercise if it aggravates back pain. It is recommended that dental personnel confirm with their doctor regarding which exercise should be used to relieve back pain, to stay fit and prevent injuring oneself again. The presence of any leg pain or other evidence of nerve injury should serve as an indication to consult a physician before beginning exercise.

Relaxation exercises

Stress may produce a state of chronic muscle contractions that decrease circulation and increase the concentration of toxic products (lactic acid & Potassium ions) of muscle activity. These toxic products in turn stimulate nerve endings to generate low back pain. Deep breathing and progressive muscle relaxation exercises may serve to diminish this stress reaction. Below are some brief relaxation exercises that dentists and their auxiliary personnel may wish to employ anytime during the day, break time or in between patients.

• Exercise I

Performing a breathing exercise is one of the simplest ways to relax in any situations. Take 5-10 minutes to sit quietly and breathe deeply. Just close your eyes and take a long deep breath. Let it out very slowly. Now, take a second, long deep breath. As yet, let it out, feel yourself releasing the tensions in your mind and in your body. Just relax yourself, relax more and more, as you continue.

• Exercise II

Clench your hands. While keeping them clenched, pull your forearms tightly up against your upper arms and raise your shoulders against your neck. While keeping these muscles tensed, shut your eyes fairly tight and
take a deep breath and hold it for 5 seconds. Then let everything go all at once. Feel yourself letting go of all your tensions.

**Conclusion**

MSDs are inherent in dentistry. Serious detrimental physiological changes in the body can result from these abnormal postures, including muscle imbalances, muscle necrosis, trigger points, hypomobile joints, nerve compression, and spinal disk herniation or degeneration. These changes often result in pain, injury or MSDs. Preventing chronic pain in dentistry may require a paradigm shift within the profession regarding clinical work habits, including proper use of ergonomic equipment, frequent short stretch breaks and regular strengthening exercise. During clinical procedures, dentists should acquire a bio-mechanically ideal posture in which spinal structures are stressed least and the muscular energy spent is minimum. By acquiring a bio-mechanically ideal posture, practicing aerobic and relaxation exercises, dentists and auxiliary personnel can minimize or even prevent spine problems. In this way, they can increase their working efficiency which in turn, will help them improving the quality of dental care they can render to their patients.

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**References**

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Illustrations

Illustration 1

The four primary curves of the spine. (Adapted from Saunders and Saunders [22])

Illustration 2

Example of an optimal working posture that should be maintained to reduce stress on muscles, ligaments, tendons, spinal disks and surrounding tissue.
Illustration 3

Example of an awkward posture that frequently is repeated in the same direction.

Illustration 4

Examples of chairside directional stretches. a. Upper trapezius stretch, b. Neck and shoulder combination, c. The untwister, d. Downward squeeze
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