Quality Resource Guide

Ergonomics in the Dental Office

Author Acknowledgements

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Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Recognize musculoskeletal disorders that are common among dental professionals.
2. Identify risk factors for musculoskeletal disorders.
3. Identify basic principles of ergonomics specific to the dental workplace.
4. Describe the ideal body posture for a seated office workstation and the clinical dental station.
5. Describe modifications and techniques for minimizing risk factors and musculoskeletal disorders (MSDs).
6. Discuss suggestions to manage symptoms of MSDs.

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The following commentary highlights fundamental and commonly accepted practices on the subject matter. The information is intended as a general overview and is for educational purposes only. This information does not constitute legal advice, which can only be provided by an attorney.

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The content of this Guide is subject to change as new scientific information becomes available.

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Introduction

In 1713, Italian physician, Bernardino Ramazinni, stated:

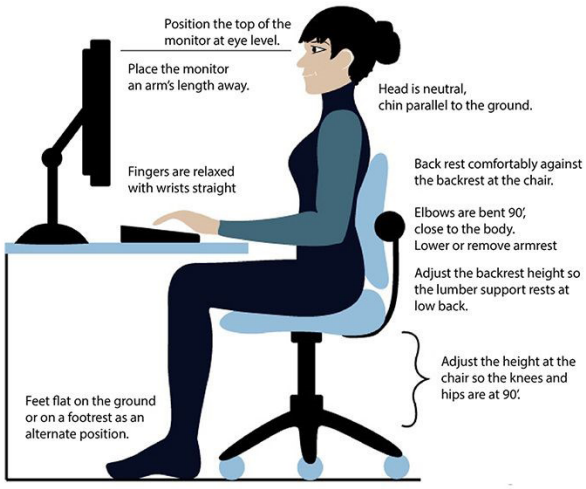
"Various and manifold is the harvest of diseases reaped by certain workers from the crafts and trades that they pursue. All the profit they get is fatal injury to their health, mostly from two causes. The first and most potent is the harmful character of the materials they handle. The second, I ascribe to certain violent and irregular motions and unnatural postures of the body, by reason of which, the natural structure of the vital machine is so impaired that serious diseases gradually develop therefrom." [1]

Unfortunately, over 300 years later, this is still an accurate observation for many professions, including dentistry. These "serious diseases that gradually develop" have been given many names, including cumulative trauma disorder, repetitive strain injury, overuse syndrome, work-related disorder and musculoskeletal disorder (MSD). There is no consensus on what they are called, but MSD is the term most often used in the dental literature.

Epidemiological studies continue to find positive relationships between workplace risk factors and the development and severity of upper extremity MSDs. These risk factors include awkward and sustained postures, task repetition, task force, duration of exposure, job stress/dissatisfaction, and other psychosocial factors.[2] These disorders cause physiological changes including tendonitis and soft tissue inflammation which can result in edema and pain, as well as nerve compressions that can cause tingling, numbness and pain. MSDs include carpal tunnel syndrome, cubital tunnel syndrome, lateral epicondylitis, trigger finger/thumb and degenerative arthritis.

Musculoskeletal pain is the most common complaint of an individual experiencing MSD. One systematic review yielded an overall pooled annual prevalence among dental professionals of 78 percent. Pain was reported in the neck (58%), low back (56%), shoulder (43%, thumb (33%) and wrist (27%).[3] The prevalence of symptoms by location found in another systematic review of the literature was as high as 73% (neck) and 65% (shoulder) for dentists, 83% (neck) and 76% (shoulder) for hygienists and up to 62% for neck and shoulder for dental assistants.[4]

Figure 1



The risk factors for MSDs for dental professionals include:

- **Awkward/Imbalanced Postures** (neck, shoulder, arms, and wrists)
- **Static Postures** (low back, neck, shoulders, hand grasp)
- **Repetition** (frequent, intermittent repetitive movement of the hand, wrist, or forearm)
- **Force** (grasping dental instruments)
- **Mechanical Stresses** (glove constriction at wrist and fingers, vibration)[5]

Risk factors common to any seated workstation include repetition, awkward/imbalanced postures, and static postures. The modern dental practice has two types of seated workstations that are susceptible to these risk factors:

- The computer workstation utilized by office personnel as well as dental practitioners
- The clinical workstation, utilized by the dentist, dental hygienist, and dental assistant.

Understanding the risk factors is essential to knowing how to alleviate or minimize them. While the goal is to prevent them, one can implement strategies at any time to lessen their effects on one's body. These strategies include ergonomic principles and methods to maintain a healthy physique.

Ergonomic Principles

Ergonomics is the study of how to improve the fit between the physical demands of the workplace and the employees who perform the work.[6] It is making the environment, workstation and work tasks fit the worker as much as possible. The following is a description of the MSD risk factors and the ergonomic principles and strategies that can be implemented to lessen the risk:

Awkward/Imbalanced Postures

Awkward/imbalanced postures should be addressed by maintaining neutral postures that prevent stress on joints and body tissues. For a seated workstation, this means keeping the head and neck positioned at the midline and as neutral as possible, with no more than 15-20 degrees of forward flexion at the neck. Beyond that, the neck muscles must work to keep the head up against gravity leading to muscle fatigue, pain,

and discomfort. The shoulders should be relaxed and not elevated toward the ears. The arms should hang beside the trunk and not be held out at an angle greater than 30 degrees from the body. The elbows should not be bent or flexed more than 90 degrees and the wrists should be neutral and not angled toward the thumb or little finger. The low back can be supported by lumbar support at the beltline and the buttocks should be back in the pan of the chair rather than perched out on the front of the chair. The hips and knees should both be at about 90-degree angles. The feet should be supported on the floor or a flat surface such as a footrest versus on the ring or castor of the chair. (**Figures 1 and 2**) Adjustable chairs and desks are key to enabling each worker to assume the recommended postures.

Figure 2

Neck

- Computer workstation – the top of the computer monitor should be at eye level and approximately an arm's length away. It should be directly in front of the person, so neck rotation is unnecessary to see the screen. When using two monitors, they should be side by side. If one is using a laptop, it should be positioned on a docking station that brings the screen up to the appropriate height.
- Dental workstation – the patient's chair should be high enough that the practitioner does not have to bend or flex their neck to see the work field. The use of loupes can alleviate this issue. Adjusting the angle of the loupes' lens instead of flexing the neck has been found to decrease neck and back pain.[4] The use of improperly selected or adjusted surgical loupes which compromise either the optimal musculoskeletal working distance or optical declination angle of the user, or which do not support co-axial viewing, can also increase the risk for MSDs.

Shoulders, Elbows, and Wrists

- Computer workstation – the keyboard should be at a level that allows the arms to be relaxed at the sides, elbows bent to about 90 degrees and the wrists at neutral when the fingers are on the keyboard. The mouse should be close enough to the keyboard that the same positioning can be maintained for the wrist and elbows, and "lifting" of the arm from the shoulder is not required to reach it. The wrists and hands should "float" while typing and rest on the desk surface only when taking a break. A foam wrist cushion will prevent compression at the wrist from having to rest it on the desk edge. A separate keyboard and mouse may be used with a raised or docked laptop to achieve this similar positioning.
- Dental workstation – the patient chair should be reclined to the level that will allow the practitioner to keep his/her arms relaxed, without raising their shoulders toward the ears, and not holding them out from the body more than 30 degrees. The elbows should not bend greater than 90 degrees. The wrist of the instrument hand should be as neutral as possible and not angled toward the thumb or small finger.[6]

Spine

- Computer workstation – the natural curves of the spine should be maintained while sitting, with lumbar support at the waist or belt line.
- Dental workstation – the patient should be positioned so that the practitioner does not have to bend or twist the torso. when reaching. Movement should be at the hips and not by hunching or rounding the back. If using a stool that has no back support, the natural curves of the spine should be maintained.

Hips, Knees, and Feet

- Hips and knees should be flexed or bent at 90 degrees for both the computer workstation and the dental station. If feet are not flat on the floor or are dangling, the chair is adjusted too high. Foot support can be used to "bring the floor to the feet' if properly adjusting the height of the chair is not possible. The practitioner's legs should fit under the patient's head when reclined in the chair.

Static Postures

For computer work, it is recommended that a single posture not be maintained for more than 20-30 minutes without changing or altering it, even if for just a brief period. This can be accomplished by varying tasks and taking short stretch breaks during tasks that take longer than that time.[6] For the practitioner, an imbalanced posture should not be maintained for longer than 25-30 seconds.[7]

Repetition

- Computer workstation – typing on a computer is highly repetitious and should be alternated with other work tasks to alleviate the length of time keying. It is recommended that any task be limited to 20-30 minutes at one time.

- Dental workstation – instrumentation requires repetitive motions of the wrist and forearm. Frequent breaks and stretching of the wrist and fingers are recommended.

Force

- Dental workstation – firm grasping of dental instruments and use of excessive pinch force is a common risk for dental professionals. The use of instruments with lighter and larger diameter handles can lessen the amount of force it takes to hold and use them.

Mechanical Stresses

(Glove Constriction and Vibration)

- Dental workstation – the necessity of wearing gloves creates a risk for constricting tissues and limiting blood flow in the fingers if they are too tight. It is important to choose the right size of gloves to prevent these problems.
- The prolonged use of vibrating instruments may be associated with damage to nerve fibers. It recommended that use be limited to short periods and varied with other tasks.

Other Strategies

In addition to ergonomic education and training, studies have shown regular physical activity to decrease musculoskeletal symptoms and pain. This can include stretching exercises, walking, jogging, other aerobic exercises, and yoga.[4] Simple stretches that can be done between patients should counteract the postures used during patient care, such as arching the spine backward (to oppose the forward posture), pulling the scapula together in the back (to oppose the protracted posture), neck rolls, and lifting the arms above head at the shoulders (to oppose adducted, flexed postures and lift the ribcage for improved breathing), and opening/spreading the fingers and fisting them (to oppose gripping posture and improve circulation).

Sleep postures are also important. Supportive mattresses and pillows that keep the neck and spine aligned in neutral prevent awakening with aches and pains.

Lastly, employ a buddy system in the workplace that allows co-workers to monitor each other's posture to increase awareness and encourage adjustments and modifications as needed.

Conclusion

Prevention of MSDs is critical. Due to the high prevalence of MSD among dental professionals and the fact that they develop for some individuals while still in school, ergonomic education, tool modification (particularly the use of properly selected and adjusted loupes) and physical activity must be implemented as early as possible to decrease and prevent symptoms. These conditions can lead to absenteeism from work, loss of productivity and performance, or even long term disability.[8]

Please see Table 1 for a self-evaluation you can do to assess your risk factors and application of ergonomics.

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Table 1

Self-evaluation for Dental Professionals

Posture	**YES**	**NO**
1. Is your head straight or tilted slightly forward?	------	------
2. Are your elbows less than 30° in from or away from your body?	------	------
3. Are your mid and low back supported?	------	------
4. Are your hips and knees bent at approximately 90° or less?	------	------
5. Are your feet flat on the floor?	------	------
6. Are your wrists straight whenever possible?	------	------
7. Do you stretch or periodically move your delivery system?	------	------
8. Are you able to adjust your chair?	------	------

Instrumentation	**YES**	**NO**
1. Do you use the same handle size for all instrumentation?	------	------
2. Do you use a firm or forceful pinch for the majority of your instrumentation?	------	------
3. Do you keep your fingers flexed or bent between instrument changes?	------	------
4. Do you use the same type of fulcrum throughout the appointment?	------	------
5. Do you hyper-extend your thumbs and excessively move your fingers?	------	------
6. Are your instruments dull or rarely sharpened?	------	------
7. Are your instrument cords usually tangled?	------	------
8. Do your ultrasonic scaler or cavitron vibrate noticeably?	------	------
9. Do you use direct vision?	------	------
10. Do you wear a one-size-fits all glove?	------	------
11. Are the gloves snug-fitting at the wrist?	------	------
12. Do you find it difficult to maintain your grasp after difficult sessions?	------	------
13. Do you have difficulty changing instruments quickly?	------	------

SCORING: *Posture:* preferable answer is “yes” for each statement. *Instrumentation:* preferable answer is “no” for each statement.

Adapted from Saunders MJ, Turcotteb CA. Ergonomic strategies for dental professionals. Work: 55-72, 1997. Revised 2021

POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **The most commonly reported symptom of musculoskeletal disorders for dental professionals is:**
   a. Numbness and tingling
   b. Hypersensitivity
   c. Stiffness
   d. Pain

2. **Which region of the body is most often reported for pain in dental professionals?**
   a. Thumbs
   b. Shoulders
   c. Neck
   d. Lower back

3. **Which equipment modification is the most effective for reducing neck pain?**
   a. Use of loupes
   b. Use of large diameter instruments
   c. Use of a lumbar support
   d. Use of an adjustable chair

4. **To reduce neck discomfort while using a computer workstation, the top of the monitor is recommended to be at:**
   a. nose level and directly in front.
   b. eye level and directly in front.
   c. nose level and 45 degrees to one side.
   d. forehead level and 45 degrees to one side.

5. **In addition to ergonomic education and tool modification, which of the following has been shown to most reduce symptoms of musculoskeletal disorders?**
   a. Rest periods
   b. Task variation
   c. Medication
   d. Physical exercise and stretching

6. **Which of the following conditions is not common among dental professionals?**
   a. Cubital tunnel syndrome
   b. Carpal tunnel syndrome
   c. Lateral epicondylitis
   d. Thoracic outlet syndrome

7. **For the ideal body posture, what range is considered acceptable for forward neck flexion?**
   a. 15-20 degrees
   b. 20-30 degrees
   c. 30-40 degrees
   d. 40-50 degrees

8. **What is the recommended maximum time that any posture should be sustained when working at a computer workstation before changing or altering the body's position?**
   a. 20 minutes
   b. 30 minutes
   c. 60 minutes
   d. 90 Minutes

9. **According to one survey, the annual prevalence of pain among dental professionals is?**
   a. 50%
   b. 78%
   c. 85%
   d. 96%

10. **Which of the following is a common mechanical stress for dental clinicians?**
    a. Gloves that are too small
    b. Poor lighting
    c. Cold temperature in clinic
    d. Exposure to x-ray

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