

Ergonomics: Route to Healthy Dentistry

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Abstract: *Due to the clinically limited working space in dentistry, work - related musculoskeletal diseases are one of the most prevalent health issues among dentists and the leading cause of early retirement (oral cavity). To prevent occupational harm, work systems must be designed using ergonomic principles. Many scientific fields, including as physiology, biomechanics, psychology, anthropometry, and kinesiology are incorporated within ergonomics. This review article states the significance of ergonomics in the field of dentistry.*

Keywords: ergonomics, MSDs, exercises, stretches, posture

1. A Brief Highlight on Ergonomics

Today's generation and their lives are filled with stress, anxiety, and depression. The toughest part is that they are not only suffering from mental issues but now physical problems have also started to play a very important role in present day. Once, it was said by Jim Rohn, "Take care of your body. It is the only place you must live" and to a great extent this saying is missing nowadays in everyone's life. In today's scenario, the medical and dental professionals are highly facing physical issues. Dental work requires enormous physical and mental concentration and prolonged working hours that make dental practitioners to follow improper working posture.¹ Inappropriate operator's position and patient's position, while treating the patients on dental chair along with prolonged working hours may lead to multiple occupational hazards specially work related MusculoSkeletalDisorders (MSDs) among dentist population.²To overcome this kind of health hazards, dentists and their team should work in an ergonomic environment.

The term ergonomics is derived from "Greek" words "ergon" and "nomos" in which "ergon" means work and "nomos" means natural laws.³ Thus Ergonomics is a study of how the human body can be best used for maximum comfort, efficiency, safety, and productivity.⁴ Ergonomics is highly relevant to preventive and occupational medicine, management of musculoskeletal injuries and rehabilitation. It helps people understand their limitations within the working area and helps them to find out the way to perform safely, effectively, and comfortably within the working environment.³

Why are dentists retiring so early?

Dentists are retiring at an earlier stage because of the following reasons:

- 1) Musculoskeletal disorders (29.5%)
- 2) Cardiovascular disease (21.2%)
- 3) Neurotic symptoms (16.5%)
- 4) Tumors (7.6%)

- 5) Diseases of the nervous system (6.1%).

To maintain work capability, efficiency, and a high standard of clinical care over the course of a dental professional's career, good working ergonomics are crucial. The field of ergonomics in dentistry covers a wide range of topics, including the interplay of the dental team, environmental factors like lighting, sound, and odour, as well as tools and software that are used. The patient chair, dental unit, operating light, dynamic and hand instrumentation, cabinetry, and ancillary equipment must all be adaptable parts of the treatment environment. For various working practises, clinical procedures, and patient types, they need to adapt and ensure good working postures, adequate lighting, and simple access to required equipment and materials.



Musculoskeletal Disorders (MSDs)

MSDs are "work related disorders of the musculoskeletal system having chronic gradual onset involving muscles, tendons, ligaments, joints, nerves, cartilage and spinal discs."⁵ They are also known as Cumulative Trauma Disorders (CTDs) or Repetitive Motion Injuries (RMI). MSDs (Figure 1) are an increasing healthcare issue globally, being the second leading cause of disability.⁶

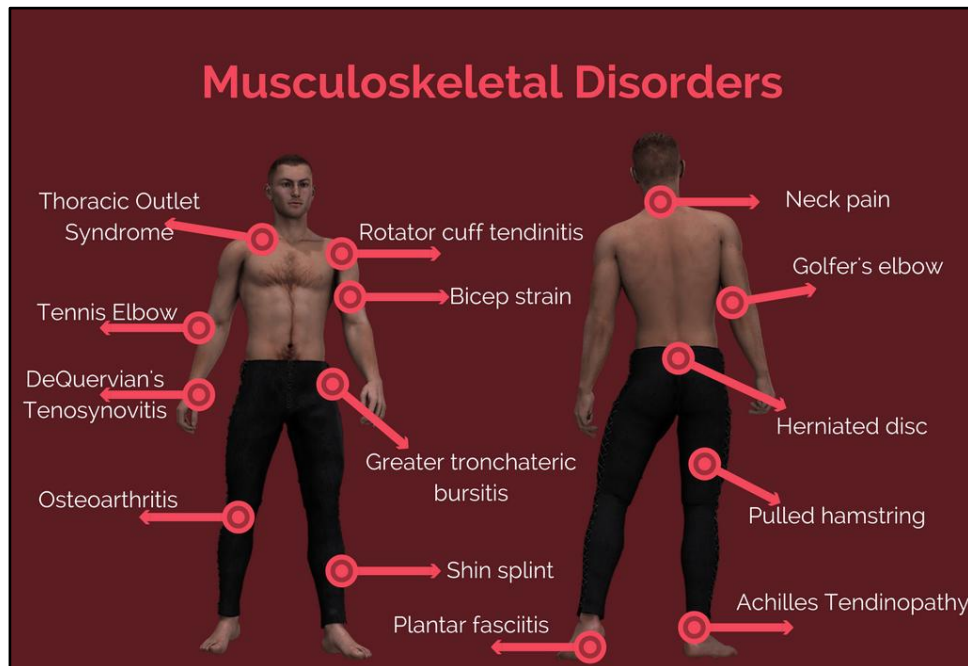


Figure 1: Musculoskeletal Disorders

Classification of Musculoskeletal Disorders

Table 1: Classification of Musculoskeletal Disorders⁷

Nerve Disorders	Disorders of the neck	Disorders of the Shoulder	Disorders of the Elbow, Forearm & Wrist	Hand - Arm Vibration Syndrome	Disorders of the Back
Carpal tunnel syndrome, Ulnar neuropathy	Tension neck syndrome, Cervical spondylosis, Cervical disc disease, Brachial plexus compression	Trapezius myalgia, Rotator cuff tendonitis, Rotator cuff tears, & adhesive capsulitis.	deQuervains disease, Tendonitis, Tenosynovitis, Epicondylitis	Raynaud's disease	Low back pain (LBP), Upper back pain

Various Risk Factors for Musculoskeletal Disorders

These includes:

Risk Factors for MSDs	Dental Procedures
Repetitive motions	Scaling, polishing
Awkward postures	Handling of objects with the back bent/twisted than straight
Static postures	Static neck, back & shoulders
Forceful exertions	Tooth extraction
Duration	Grasping small instruments for prolonged periods
Contact stresses	Repeated contact with hard or sharp objects
Vibration	Prolonged use of vibrating hand tools

Signs and Symptoms of MSDs

- Decreased range of motion
- Loss of normal sensation
- Decreased grip strength
- Loss of normal movement
- Loss of coordination
- Excessive fatigue in the shoulders and neck
- Tingling, burning or other pain in arms
- Weak grip, cramping of hands
- Numbness in fingers and hands
- Clumsiness and dropping of objects
- Hypersensitivity in hands and fingers.

Goals of ergonomics in dentistry

- Reducing the risks of musculoskeletal disorders (MSDs).
- Improving worker safety.
- Increasing worker comfort.

- Minimize worker fatigue.
- Improving the quality of work.

Application Of Ergonomics In Dentistry

The following paragraphs provide a brief overview of ergonomic advancements in seating, instrumentation, magnification, lighting, gloves, working postures, and techniques that ensure a proper balance between job requirements and work capabilities.

1) Dentist's Stool: ⁸

The design and use of the stool becomes essential to maintaining balance because the operator works most frequently while seated as shown in Figure 2.

- The stool used by the operator needs to have a wide base.

- b) The seat should be adjusted so that the operator's feet are flat on the ground and that the operator's thighs are 100° to 110° from the trunk.
- c) The forward curve of the lower back should meet the backward curve of the middle back, where the backrest or lumbar support should be adjusted to fit in the centre of the operator's lower back.



Figure 2: Ergonomic Dental Stools

2) Patient's chair

- a) If a patient is seated with their oral cavity at a height equal to the clinician's heart while seated, the best results will be obtained. The advantage will be reduced and the rate of shoulder fatigue will increase if the oral cavity is positioned above the level of the heart. On the other hand, lowering the oral cavity below the suggested height will cause nonneutral working postures, such as forward and/or lateral bending of the torso and over-declination of the head.⁹
- b) In order to properly treat the upper arch and lower arch, the patient should be lying flat (200 from supine position). To get the occlusal plane oriented correctly, use a contoured neck cushion.¹⁰
- c) When the patient is properly positioned, operator's shoulders, elbows, and wrists should be in a neutral position such that:
- upper arms are close to the body
 - elbow / forearm angle is close to 90°
 - wrists are in line with the forearm with no more than $20 - 30^{\circ}$ extension as shown in Figure 3.

The chair should be raised so that the operator's thighs can freely turn beneath the patient's chair.⁸

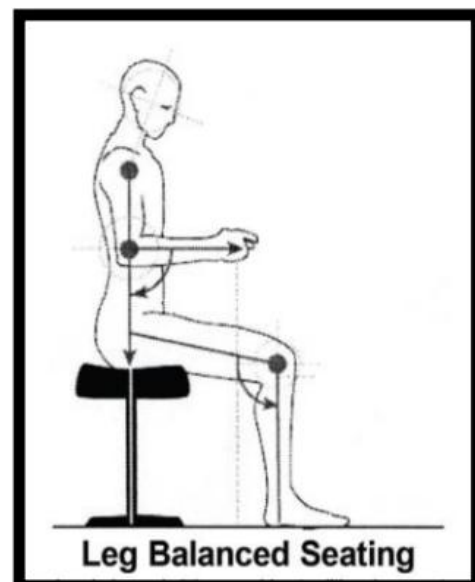


Figure 3: Leg balanced seating

3) Proper working posture

A neutral working posture is one that supports the clinician's unaltered musculoskeletal balance. Instead of using static operation, this entails dynamic positioning where the clinician moves around the oral cavity. Changing positions helps other muscle groups work while also improving vision and access to the oral cavity. Static and awkward postures can be avoided by navigating around the patient on the clinician's stool. Most medical professionals try to use a variety of what are known as the "o'clock positions" around the patient's head.⁸

In order to reduce structural damage from prolonged static posture, movement is crucial in clinical operations.¹

- a) Modify the patient's position to reduce waist bending or twisting.
- b) Switch up your job duties or positions. For instance, switch between standing and sitting.¹

c) Use mirrors or indirect vision to avoid uncomfortable positions.¹

Recent Trends & Techniques in Ergonomics in Dentistry

1) Four - Handed Dentistry

In their study, Akesson *et al.* found that practising four - handed dentistry significantly reduced stress. The dentist should maintain a position around the operating field while moving their hands, arms, and bodies sparingly. They should also keep their eyes as focused as possible on the working area. The dental assistant should be the focal point of the equipment and instruments, advocating over - the - head and over - the - patient delivery systems that allow for better access during procedures as shown in Figure 3.²



Figure 4: Four Handed Dentistry

2) Alternate between standing & sitting

Standing makes it possible to ease back tension. The dentist occasionally needs to sit, though. Most of the body weight is transferred to the seat when one is sitting. One group of muscles can rest while the workload is transferred to another group of muscles by switching between the two positions. Standing and sitting at different times can be a useful injury prevention strategy.¹²

3) Using matt surfaces

To prevent tiring glittering effects on the dentist's eyes, dental equipment & instruments must have matte surfaces. To avoid over - adapting the eyes and to avoid eye fatigue, dental equipment should be painted in light colours for the best contrast.¹²

4) Proper size & fit of gloves

Gloves need to be the right size, flexible, and light. A potential cause of carpal tunnel syndrome, ill - fitting gloves can hurt the hands, especially the base of the thumb as.

5) Stretching & exercises¹³

Regular exercise, stretching, and relaxation techniques (such as yoga, biofeedback, and meditation) improve quality of life by preventing injuries and reducing stress. Various stretches for dental professionals are shown in Figure 5

Body Strengthening Exercises

- The muscles that support the back and neck, as well as those used in the forearm, wrist, and hand, can be kept strong and healthy by stretching and strengthening them.
- Stretching breaks throughout the working day.

- One of the most crucial elements in preventing CTS is frequently resting the hands.
- Look up from the task and focus your eyes for about 20 seconds at a distance to relieve eyestrain brought on by prolonged, intense focus at one depth of vision.
- Slowly lower the head and allow the arms and head to fall between the knees. Hold the position for a short period of time, then slowly roll up while contracting the stomach muscles, bringing the head up last.
- To treat stiff necks, try rotating your head. In order to rotate the head, the head must be tilted from right to left, forward and backward, and only to the extent that is comfortable.
- Shoulder shrugging is a technique for stretching shoulder muscles that may be tight from holding an oral syringe, instruments, or a phone. Roll the shoulders in a circular motion backward, then forward, pulling them up towards the ears.



Figure 5: Various stretches for dental professionals

2. Conclusion

Due to the high visual demands and lengthy static postures associated with dentistry, and particularly general dentistry, there is a substantial risk of developing musculoskeletal diseases. Using dental workstations, chairs, and equipment that are ergonomically designed can help prevent MSDs, which are common among dentists. Dental practitioners must always adopt an ergonomic posture and incorporate yoga or other forms of exercise into their daily routines in order to keep healthy and fit and avoid getting multiple sclerosis (MSDs).

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