



## Ergonomics in Dentistry-A Literature Review

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### ABSTRACT:

The prevalence of work-related Musculoskeletal disorders (MSDs) in Dentists is increasing day by day. Dental practitioners have to work with instruments, equipments and working postures that do not fit the required way of working and/or individual characteristics. These disorders affect occupational health, productivity and the careers of dental professionals. The ergonomic limitations play a distinct role in such musculoskeletal injuries. Application of Ergonomic principles in the design of work systems is the key to prevent occupational injury. Ergonomics draws on a number of scientific disciplines, including physiology, biomechanics, psychology, anthropometry & kinesiology. This literature review includes healthy practices at the dental work place to reduce Musculoskeletal disorders (MSDs), through various applications of ergonomics in dentistry.

### Introduction:

British psychologist Hywel murrell coined the term ergonomics, at the 1949 meeting at the United Kingdom admiralty, which later led to the foundation of the ergonomic society. [1] **Ergonomics** is a wide-ranging field that seeks to design tools, equipment and tasks to optimize human capabilities.

According to The International Ergonomics Association, ergonomics is defined as follows: [2] Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

When ergonomics is applied successfully, it ensures high productivity, avoids illnesses and injuries, and increased satisfaction among workers. Unsuccessful application, can give rise to work-related musculoskeletal disorders (MSDs).

The term work-related musculoskeletal disorders (MSDs) refers to musculoskeletal disorders to which the work environment contributes significantly or to musculoskeletal disorders that are made worse or longer lasting by work conditions or workplace risk factors. Common examples of such workplace risk factors include jobs requiring repetitive, forceful or prolonged

exertions of the hands; frequent or heavy lifting, pushing or pulling, or carrying of heavy objects and prolonged awkward postures. The level of risk depends on the intensity, frequency and duration of the exposure to these conditions. [3]

Musculoskeletal disorders are more common in dental professionals due to prevalence of different postures in dental procedures, repeated work, prolonged stature, unsupported sitting and gripping smaller and thin instruments for longer time. [4] Limited access during dental procedures is also known to be the one of the reasons for causing musculoskeletal disorders. [5]

### Application of ergonomics in dentistry

There are various risk factors in dentistry leading to work related musculoskeletal disorders. [6-9]

#### Fixed body position and improper posture during work

Working in awkward, contorted postures and positions increases physical stress on the body and reduces its strength, thereby making it more difficult to do a task. Fixed body position over a long period of time exerts stress on the musculoskeletal system, ultimately leading to injuries.



## Repetitive movements

Performing the same motion or series of motions continually or frequently, for an extended period of time with little variation such as prolonged scaling and polishing and repetitive hand tool usage can also lead to injuries. Highly repetitive tasks can lead to fatigue, tissue damage, discomfort, and, eventually injury. This can occur even if the level of force is low and the work postures are not awkward

## Excessive force

Forced concentration on small parts of the body such as during caries excavation or extraction can lead to fatigue and injury to the part.

## Vibration

Dentists are required to use vibrating tools such as airotor or micromotor for prolonged periods. The reason is that when holding a vibrating tool, muscles begin to tire due to over stimulation. As this occurs, the operator must squeeze harder in order to continue to operate the tool which in turn increases internal force application of the surrounding musculature.

## Guidelines to Prevent Work Related Musculoskeletal Disorders

### Workstation

The Ergonomic Standard mandated by the Occupational Safety and Health Administration (OSHA) recommended that the most efficient and effective way to remedy “ergonomic hazards” causing musculoskeletal strain should be through engineering improvements in the workstation. [10,11] Instruments and materials should be easily accessible to the dentists. The chairs should be easily adjustable. Efforts should be made to reduce noise in the workplace.

### Operator position

The operator position is of utmost importance.

### Tips for Working with Good Posture [12]

- 1. Maintaining an Erect Posture:** position the chair close to patient, minimize forward bending or excessive leaning over the patient, place the feet flat on the floor for a neutral or anterior tilt to your pelvis, which keeps back aligned and promote its natural curvature (Figure. 2).
- 2. Use an adjustable chair with lumbar, thoracic, and arm support.**
- 3. Work close to your body:** does not overextend to reach the patient or instruments, putting excessive stress on back, shoulders and arms. Think of having elbows, hips, knees, and ankles all at 90°angle.

### 4. Minimize excessive wrist and finger movements:

Try to keep them in a neutral position (palms facing each other, shoulder width apart with wrists straight), which puts wrist, fingers, muscles and tendons in a much better relationship to perform the work.

**5. Alternate work positions between sitting, standing, and side of patient:** Switching positions allows certain muscles to relax while shifting the stress onto other muscles and increasing your circulation.

**6. Adjust the height of your chair and the patient's chair to a comfortable level:** too low dentist's chair than patient's chair causes elevation of shoulders leading to neck problems and can pinch nerves. Alternately, too high causes flexion of neck down and can lead to neck and hand problems.

### Patient Position

- Supine position of patient is usually the effective way by which operator achieves neutral posture
- Stability should be looked for
- Drop down arm rests
- Patient should be positioned in such a way that the patient's mouth should be only slightly above the dentist's elbow level
- There should be supplemental wrist/forearm support for operator
- Articulating head rests should be provided
- Hands free operation
- Swivel feature—allows chair to rotate in the operatory
- Large knobs should be eliminated as they, disturb the position of operator by hitting the dental chair (Osuna, RDH, BS, & FAADH, 2006).

### Instrumentation

Use Larger Diameter, balanced Instruments with hollow or resin handles: They increase tactile sensitivity and reduce clinician fatigue. Thin instruments are difficult to grasp and increase the chance of muscle cramping.

- Instrument sharpness: An instrument with a sharp blade will be less fatiguing to the clinician and contribute to the efficacy of work. Dull instruments require more force to be exerted.
- Handles should be textured to reduce slippage, but should not be contoured. Round, knurled handles are preferred.
- Grip design: Grip span should be curved and comfortably fit the palm of the hand (4”-5”)

### Automatic Handpieces

- Lightweight, balanced models (cordless preferred)
- Sufficient power
- Built-in light sources
- Easy activation and maintenance



## Work practices

### Four Handed Dentistry

Method of practicing dentistry ergonomically by combining the skills of dental assistant with other work practices.

The work area around the patient is divided into four zones of activity. Zones of activity are identified using the patient's face compared to face of a clock. The four zones are: the operator's zone, assistant's zone, transfer zone, and static zone. (Finkbeiner, 2001)

The operator's zone for a right-handed operator extends from 7 to 12 o'clock, the assistant's zone from 2 to 4 o'clock, the instrument transfer zone from 4 to 7 o'clock, and the static zone from 12 to 2 o'clock.

### Use of magnification [15]

Broadly, the concept of magnification- enhanced dentistry incorporates the use of two types of optical magnification systems:

#### a) loupes

#### b) surgical operating microscope

It has been noted that the dentist posture is ergonomically better while using magnification lenses compared to their posture while using regular safety glasses

Use of normal safety glasses necessitates 20-degree forward head bending which leads to flattening of low back curve; in contrast, use of magnification scope utilizes zero-degree forward head bending, hence better results are provided.

## Scheduling

Schedule Rest Breaks Between Patients

Rotate Between Tasks

Schedule Enough Time for Each Patient

Switch Between Positions Throughout the Day [5]

## Stretching and exercise

Representative physical preventive measures for work-related musculoskeletal disorders include exercises such as stretching and professional massage to stretch and relax the muscles. Stretching reduces muscle tension, increases blood circulation, and increases flexibility such that the body can be moved comfortably. [16,17] In addition, it is advantageous to apply to the work environment because it does not require special skills or equipment and is not limited by and space. [18] Regular exercise and physical activity strengthen the muscles and improve balance and coordination. Strong muscles also give stability and improve balance and coordination. Exercise also improves blood supply to the muscles and increases their capacity to use oxygen.

## Conclusion

Though the reasons for work related musculoskeletal disorders are numerous among dentists, the main

contributing factor is poor posture. Working ergonomically helps prevent work-related injuries. The clinician must optimize working environment to help eliminate awkward postures, physical wear and tear, and fatigue. By combining ergonomic magnification with postural strengthening, positioning techniques, working practices, chair side stretching, the multifactorial problem of work-related pain in dentistry can most effectively be addressed. Thus, successful application of ergonomics not only helps the dentists to improve their health, it also increases satisfaction as well as quality of work.

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