(e) ISSN Online: 2321-9599
(p) ISSN Print: 2348-6805

REVIEW ARTICLE

# STAY FIT AND HEALTHY: ERGONOMICS

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**ABSTRACT:**
Ergonomics is a discipline focused on making products and tasks comfortable and efficient for the user. Occupational health hazards are unavoidable in many professions, dentistry being one such profession. Hence, ergonomics brings the solution to these hazards. A dentist deals with prevention, diagnosis and treatment of diseases, injuries and malformations of the teeth, jaws and mouth. If not done in an ideal ergonomic condition it might lead to musculoskeletal disorders, strain, stress, etc. Improving the ergonomic delivery of dental services and accounting for working conditions in dental offices enhances the well-being and safety of patients, staff and practitioners.
**Key Words:** Ergonomics, MSDs, Posture, CTSD.

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This article may be cited as: Shah SS. Stay fit and Healthy: Ergonomics. J Adv Med Dent Scie Res 2016;4(6):167-170.

| Access this article online | |
|---|---|
| Quick Response Code | Website: www.jamdsr.com |
| | DOI: 10.21276/jamdsr.2016.4.6.40 |

## INTRODUCTION:

The word 'Ergonomics' comes from two Greek words ergon meaning work and nomos meaning laws. Today however the word is used to describe the science of 'designing the job to fit the worker, not forcing the worker to fit the job.' Ergonomics has also been described as 'the applied science of equipment design, as for the workplace, intended to maximize productivity by reducing operator fatigue and discomfort.'1 The value of ergonomics is easily understood by anyone who has tried to do a job using the wrong tools. The increased difficulty causes the job to take longer, leading to frustration, loss of temper and risk of slip of the hand and injury. In the wider world of dentistry problems arising from poor design of instruments, machines or workplaces may lead to large scale inefficiencies, risk-taking and increase in accidents and near-misses. Occupation related diseases are increasing day by day and one amongst them is musculoskeletal disorders (MSDs) due to improper ergonomics in dentistry.2 Knowledge of ergonomics is thus of great value in preventing ill-health and injury from work.

## MUSCULOSKELETAL DISORDERS (MSDs):

The world health organization defines MSD as "a disorder of the muscles, tendons, joints, intervertebral discs, peripheral nerves and vascular system, not directly resulting from an acute or instantaneous event hut installing gradually and chronically."1,2 Cumulative trauma disorders (CTDs) are health disorders arising from repeated biomechanical stress to the hands, wrist, elbows, shoulders, neck and back.[3]

**Some Symptoms of Musculoskeletal disorders (MSDs):**

- 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

**Some Signs of MSD**

- Decreased range of motion
- Loss of normal sensation
- Decreased grip strength
- Loss of normal movement
- Loss of co-ordination

**Some Risk factors of MSDs**

- Repetition
- Forceful exertions
- Awkward postures
- Contact stress
- Vibration
- Poorly designed equipment workstation
- Improper work habits
- Genetics
- Medical conditions
- Poor fitness level
- Physical/mental stress
- Lack of rest/recovery
- Poor nutrition

• Environmental factors
• Poor lighting

With specific reference to dentistry, the risk factors include: stress, poor flexibility, improper positioning, in frequent breaks, repetitive movements, weak postural muscles, prolonged awkward postures and improper adjustment of equipment.

**Mechanisms MSDs in dentistry**
**Prolonged Static Postures (PSPs):**
When the human body is subjected repeatedly to PSPs, it can initiate a series of events that may result in pain, injury or a career-ending MSD.

**Muscle Ischemia/Necrosis and Imbalances:**
During treatment, operators strive to maintain a neutral, balanced posture and find themselves in sustained awkward postures. These postures often lead to stressed and shortened muscles which can become ischemic and painful, exerting asymmetrical forces that can cause misalignment of the spinal column (Al Wazzan et al, 2001).[4]

**Hypomobile Joints:**
During periods of PSPs or when joints are restricted due to muscle contractions, synovial fluid production is reduced and joint hypomobility may result.

**Spinal Disc Herniation and Degeneration:**
In unsupported sitting, pressure in the lumbar spinal discs increases. During forward flexion and rotation, the pressure increases further and makes the spine & disc vulnerable to injury (Al Wazzan, et al 2001).[4]

**Neck and Shoulder Injury:**
Repetitive neck movements and continuous arm and hand movements affecting the neck and shoulder demonstrate significant associations with neck MSDs.

**Carpal-Tunnel Syndrome (CTS):**
It has been associated with both repetitive work and forceful work.Symptoms can appear from any activity causing prolonged and increased pressure (passive or active) in the carpal canal (Shugars et al, 1987).5

**Low Back Pain:**
Low back discomfort has been associated with dental work in numerous studies.

**Psychosocial Factors:**
Dentists with work related MSDs show a significant tendency to be more dissatisfied at work. They are burdened by anxiety, poor psychosomatic health and thus feel less confident with their future (Shugars et al, 1987).[5]

**Prevalence of MSDs:**
The 12-month period prevalence of lower back pain among Queensland dentists (53.7%), was similar with that reported in many other countries, such as Denmark, Israel, and the United States. MSD rate reported by Saudi Arabian counterparts were (73.5%). The 12-month period prevalence of neck-related pain among Queensland dentists (57.5%) was similar to that reported by dentists in many other countries, such as Denmark (65%) and Saudi Arabia (65%), but higher than a survey of Israeli dentists (38.3%). 12-month period prevalence of shoulder pain (53.3%) was as prevalent among Queensland dentists as lower back or neck pain. This finding is similar to an investigation of dental workers in the United States military (53%), aswell as another study of Danish dentists (65%). Study from Sweden found that dentists were exposed to a high load on the trapezius muscles bilaterally, as well as prolonged forward bendingof the head.

**MSDs Classification:**
1. Nerve Entrapment Disorders: carpal tunnel syndrome, ulnar neuropathy.
2. Occupational Disorders of the Neck and Brachial Plexus: tension neck syndrome, cervical spondylosis, cervical disc disease, brachial plexus compression.
3. Shoulder disorders: trapezius myalgia, rotator cuff tendonitis, rotator cuff tears, and adhesive capsulitis.
4. Tendonitis of the Elbow, Forearm and Wrist: deQuervain´s disease, tendonitis, tenosynovitis,epicondylitis
5. Hand-Arm Vibration Syndrome: Raynaud's disease.
6. Low Back Disorders: chronic low back pain.

**Role of ergonomics in dentistry:**
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.[6]
In dentistry, bad working habits, repetitive tasks – such as scaling, root planning, and uncomfortable physical postures contribute greatly to musculoskeletal disorders, stress, and loss of productivity. Four-handed dentistry is ergonomically the most favorable way to provide dental services since it minimizes undesirable movements of the operating team and expedites the progress of most dental procedures. Available research supports the idea that ergonomic hazards can be managed or alleviated effectively using a multifaceted approach that includes preventive education, postural and positioning strategies, proper selection and use of ergonomic equipment and frequent breaks with stretching and postural strengthening techniques.[7]

**Applications of Ergonomics**
**Prevention Of MSDs**
Through ergonomic advances made over the years, dental professionals have been able to modify and optimize their working environments. Ergonomic improvements in seating, instrumentation, magnification, lighting, and glove use have offered a proactive measure for ensuring a proper balance between job requirements and worker capabilities.
1. Seating
2. Patient Chair
3. Instrumentation
4. Dental Hand pieces

5. Equipment Layout
6. Ultrasonic Tools
7. Cord Management
8. Syringes And Dispensers
9. Mouth Mirror
10. Magnification
11. Lighting
12. Gloves
13. Compressed Air

**Importance of posture:**
The human spine has four natural curves; Cervical lordosis, Thoracic kyphosis, Lumbar lordosis and Sacral kyphosis. Poor postural alignment accelerates wear and tear of vertebrae, discs, muscles and ligaments; leading to pain syndromes. Disc pressure dramatically increases when sitting and in bent forward and rotated positions. This is a position frequently seen among dental professionals. When a dentist sits in a chair and leans forwards towards the patient, lumbar curve flattens. The spine is not supported by bony structures, and is literally hanging on muscles, ligaments and soft tissues at the back of spine. Excess forces occur on low back, leading to muscle strain and painful trigger points. Also, sitting with thighs parallel to floor while leaning causes the pelvis to roll backward and flatten the low backcurve, increases muscle strain and disc pressure. Thighs sloping downwards helps maintain the normal low back curve, decrease low back muscle strain and hence decrease low back pain. The best way to reduce pressure in the back is to be in a standing position. However, there are times when the dentist needs to sit. When sitting, the main part of the body weight is transferred to the seat. Some weight is also transferred to the floor, back rest, and armrests. Where the weight is transferred is the key to a good seat design. When the proper areas are not supported, sitting in a seat all day can put unwanted pressure on the back causing pain. The lumbar spine (bottom five vertebrate in the spine) needs to be supported to decrease disc pressure. Providing both a seat back that inclines backwards and has a lumbar support is critical to prevent excessive low back pressures.The combination which minimizes pressure on the lower back is having a backrest inclination of 120 degrees and a lumbar support of 5 cm. The 120 degrees inclination means the angle between the seat and the backrest should be 120 degrees. The lumbar support of 5 cm means the chairbackrest supports the lumbar by sticking out 5 cm in the lower back area.

**Some Tips for Working With Good Posture** (Yamalik, 2007):
**(1) Maintain an erect posture:** by positioning chair close to the patient, one can minimize forward bending or excessive leaning over the patient. Place feet flat on the floor to promote a neutral or anterior tilt to your pelvis, which keeps back aligned and promotes the natural curvatures of back.[8]

**(2) Use an adjustable chair with lumbar, thoracic and arm support:** A good chair is essential for maintaining good posture. A chair should have important features like, adjustable height, width, tilt, backrest, seat pan and armrests, because in most dental offices, many people of different sizes use the same workstation.

**(3) Work close to your body:** Position the chair close to the patient and position the instrument tray close tothe chair. This way, dentist does not have to overextend himself to reach the patient or instruments, putting excessive stress on back, shoulders and arms. Think of the 90° rule of having elbows, hips, knees, and ankles all forming 90° angles.

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

**(5) Avoid excessive finger movements:** When one can combine the excessive forces needed to hold the instruments with the amount of repetitions that he/she can perform each day, one can see the tremendous toll that this takes on the small muscles of fingers.[9] Retraining of shoulders and arms to position hands. rather than making the small, forceful movements with fingers.

**(6) 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. Allow each side of your body to share the stress rather than performing the same motion in the same way which causes cumulative trauma in the overused side.

**(7) Adjust the height of your chair and the patient's chair to a comfortable level:** If dentists chair is too low and the patient's chair is too high, this causes elevation of shoulders and can lead to neck problems and can pinch nerves. Alternately, if dentists chair is too high and the patient's chair is too low, flexion of neck down and bend wrists back to compensate can lead to neck and hand problems. Remember the 90°rule and keep elbows at a 90° angle with wrists straight and shoulders relaxed.

**(8) Consider horizontal patient positioning:** If workstation allows the patient to recline into a horizontal position, it will allow a dentist to sit above the patient's head with good ergonomic posture and he can use each arm equally in more natural position.
**(9) Check the placement of the adjustable light:**
Position the adjustable light to avoid strain on the neck

**(10) Check the temperature in the room:**
Temperature of workspace should not be too cold because this will decrease the circulation and blood flow of extremities.

Most often, the dental work environment is damp and cold, so be certain to wear gloves and warm up the hands before working.10

**Body Strengthening Exercises (Valachi &Valachi, 2003):**

**A.** Stretching and strengthening the muscles that support the back and neck and those used in the forearm, wrist, and hand will help them remain strong and healthy.

**B.** Periodic stretching throughout the workday.

**C.** Resting hands frequently is believed to be one of the most important factors in preventing CTS

**D.** To relieve eyestrain caused by focusing intensely at one depth of vision for long periods, look up from the task and focus eyes at a distance for approximately 20 seconds.

**E.** Move the head down slowly and allow the arms and head to fall between the knees; hold for a few seconds; raise slowly by contracting the stomach muscles and rolling up, bringing the head up last.

**F.** Try head rotation for neck stiffness. Head rotation involves tilting the head from right to left, as well as forward and backwards without forcing the motion beyond a range of comfort.

**G.** Shoulder shrugging can be used to stretch the shoulder muscles that may be stressed from holding oral evacuator, instruments and telephone handset. Pull the shoulders up toward the ears, roll them backward and then forward in a circular motion.[11]

**CONCLUSION**:

The successful application of ergonomics assures high productivity, avoidance of illnesses and injuries, and increased satisfaction among workers. Unsuccessful application, on the other hand, can lead to work-related musculoskeletal disorders (WMSDs). Good ergonomic design of tools, processes and furniture does improve personnel comfort, health, morale, productivity and readiness. So, take charge of your health and stay fit and healthy !

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**Source of support:** Nil **Conflict of interest:** None declared