



## ERGONOMIC DENTISTRY: A PARADIGM SHIFT TOWARDS A HEALTHY LIFESTYLE. A REVIEW.

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### ABSTRACT

The modern dentistry has advanced with giant steps but work related musculoskeletal disorders (MSDs) are still a significant occupational health problem for the dental profession. Repetitive strain injuries are on a rise in dentistry. The positions in which dentists repeatedly put themselves through their work, place them at great risk for developing musculoskeletal pain in their shoulders and neck, hand and wrists, lower back, forearms and elbows. MSDs contribute significantly to sick leave, reduced productivity and leaving the profession. Proper ergonomic design is necessary to prevent repetitive strain injuries (RSI), which can develop over time and can lead to long term disability.

**KEYWORDS :** Ergonomics, Musculoskeletal Disorders (msds), Disability, Prolonged Static Posture, Prevention.

A healthy dentist is one of the most important component in a successful dental practice. Despite the fact, that though 88% of dentists report good or excellent health<sup>1</sup>, some studies show that one out of ten dentists reports having poor general health and three out of ten dentists report having poor physical state.<sup>2</sup> Musculoskeletal disorders are on a rise in dentistry. Extended working hours, prolonged standing or unsupported sitting, bad posture, improper work habits and instruments that are difficult to handle etc. are some major contributing factors. As a result, certain nerve and muscle problems may arise that could prevent dentists from providing highest quality of service and threaten their professional careers.

The International Ergonomics Association defines ergonomics as follows: 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.<sup>3</sup> Dental treatment is performed, in a very inflexible work posture due to the narrow work area. Studies indicate that back, neck and shoulder or arm pain is present in upto 81% of dental operators.<sup>4</sup> Very little attention is given on impact of dental work on development of nerve and muscle pathologies such as tendinitis, synovitis, tenosynovitis & bursitis.<sup>5</sup> A study by the American Dental Association (1997) showed that 9.2% of the subjects had serious upper limb damage of which 20% required surgery and 40% had to reduce their work hours.<sup>6</sup>

Researchers have found symptoms of discomfort for dental workers occurred in the wrists/hands (69.5%), neck (68.5%), upper back (67.4%), low back (56.8%) and shoulders (60.0%).<sup>7</sup> The numbers of patients with musculoskeletal pain of the upper limb in dentists are growing, so that the prevalence of it from 58% in 2001,<sup>8</sup> has reached to 81% in 2006.<sup>9</sup> A review by Hayes et al. (2009) reported the majority of damage in upper limbs (back, shoulder, and neck).<sup>10</sup> In the study of Chamani et al., the prevalence of pain in dentists over a year was reported to be 50.9%, 43.6%, and 37.3% in the neck, wrist, and back regions, respectively.<sup>11</sup>

Most dentists today work in the sitting position and treat the patient in the supine position. When operators sit, pain occurs not only in their back, but also in their neck, shoulders and arms. While the occasional backache or neck ache 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.<sup>12</sup>

Some improper postures that are taken by dentists are working with neck tilted to one side, elevated shoulders,

excessive twisting, too much forward bending and working in same position for more than half an hour. These positions put pressure on nerves and vessels, cause excessive strain on muscles, and cause wear and tear on the joint structures. So, working with good posture is very important.<sup>13</sup> Prevalence of pain in the neck and shoulder is due to the nature of dental practice. Leaning forward to an angle of 15° or sometimes 30° and remaining in this posture for a long period of time along with elevating the shoulders (with more than 30° abduction or flexion) exerts much pressure on the neck and the shoulder.<sup>14</sup>

### Symptoms of MSDs:<sup>15</sup>

1. Pain, swelling, tenderness and loss of strength.
2. Excessive fatigue in the shoulders and neck.
3. Tingling, burning, or other pain in arms,
4. Weak grip, cramping of hands.
5. Numbness in fingers and hands.
6. Clumsiness and dropping of objects.
7. Hypersensitivity in hands and fingers.

### Signs of MSDs:<sup>16</sup>

1. Decreased range of motion.
2. Loss of normal sensation.
3. Decreased grip strength.
4. Loss of normal movement.
5. Loss of co-ordination.

### Off-the-Job activities that can contribute to MSDs:<sup>16</sup>

1. Home computer use.
2. Repetitive activities using the fingers Sports activities.
3. Prolonged/awkward postures at home.
4. Activities involving repeated heavy lifting, bending, twisting.

### Mechanisms of 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.<sup>17</sup>

#### Muscle Ischemia/Necrosis and Imbalances:

During treatment, operators strive to maintain a neutral, balanced position 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.<sup>17</sup>

#### 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.<sup>17</sup>

**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.<sup>17</sup>

**Neck and Shoulder Injury:**

Repetitive neck movements and continuous arm and hand movements affecting the neck and shoulder demonstrate significant associations with neck MSDs.<sup>17</sup>

**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.<sup>18</sup>

**Low Back Pain:**

Low back discomfort has been associated with dental work.<sup>18</sup>

**Psycho-social 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.<sup>18</sup>

**Tips For Working With Good Posture:**<sup>19</sup>

1. One must work close to his/ her body. The dentist's chair must be positioned close to the patient to minimize forward bending thus reducing stress on the back, shoulders and arms.
2. Always try to maintain erect posture with feet flat on the floor.
3. Alternate work positions between sitting, standing and side of the patient. This allows certain muscles to relax while shifting stress onto other muscles and increasing circulation.
4. Height of dentist's chair and patient's chair should be adjusted to a comfortable level. If the dentist's chair is too low and patient's chair is too high, it causes the dentist to raise his shoulders and leads to neck problems and pinched nerves. If the position is other way round excessive bending of neck and wrists leads to neck and wrist problems.
5. Light adjustment should be proper so that one does not have to strain his neck to see inside the patient's mouth.
6. If the chair can be adjusted into a horizontal reclining position, it allows the dentist to work in a more comfortable posture. Generally patients should be placed in a semi-supine position for mandibular procedures and a supine position for maxillary procedures.
7. The work place should not be too cold because this will decrease circulation and blood flow to the extremities, aggravating the previously existing problems.
8. Use an adjustable chair with lumbar, thoracic and arm support.
9. Minimize excessive wrist movements.
10. Avoid excessive finger movements

**Postural awareness techniques:**<sup>20</sup>**Maintain the low back curve:**

This facilitates proper posture and reduces pressure on disks and muscles. The following practices can help maintain the low back curve:

**1. Tilted Seat Plan:**

It opens the hip angle by 110°. Retrofit a non-tilting seat such as commercially available Fit-sit ergonomic cushion for accomplishing this.

**2. Saddle Stools:**

Consider using saddle style operator stool that promotes the natural low back curve by increasing the hip angle to

approximately 130°. It is ideal for confined operator spaces. The doctor is now halfway between standing and sitting, so low back pressure is even less than when seated in traditional operator chairs.

**3. Lumbar Support of the Chair:**

Must be used as much as possible by adjusting it forward to contact your back.

**4. Avoid Static Postures:**

Dentists should vary their work positions as often as possible to shift the workload from one group of muscles to another.

**Certain Exercises That Can Be Performed During Short Breaks:**

Longer work periods without breaks can lead to musculoskeletal disorders. 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. Periodic stretching throughout the workday. Resting hands frequently is believed to be one of the most important factors in preventing. 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.

Quick stretch exercises can be performed in and out of operatory and can be incorporated into daily routine that facilitates balanced musculoskeletal health. These exercises can be performed easily while anesthesia is taking effect or while wearing gloves. Some such exercises are as follows.<sup>20</sup>

**A. Neck and shoulder combination -**

With the elbow at shoulder height and at 90°, gently pull the arm across the front of the body with opposite arm. Look over the shoulder being stretched and hold for two to four breathing cycles. Repeat with the other side.

**B. The untwister -**

With the knees wider than the shoulder width, bend to the left side, resting full body weight through the left elbows on the left knee. Stretch the right arm overhead and look towards the ceiling. Hold for two or four breath cycles. Repeat on the other side.

**C. Upper trapezius stretch -**

Anchor the right hand behind the seat of the operator chair, gently bring the left ear towards the left armpit. Hold for a two to four breathing cycles. Repeat on other side.

**D. Downward squeeze -**

Assume a neutral head posture (ears over the shoulders) do not let the head move forward throughout the exercise. Lift the chest upwards, position the arms at sides with fingers pointing upwards and palms facing forwards. Roll the shoulders back and down squeezing the shoulder blades downward and together. Hold for long breathing Cycle. Repeat five times.

**Safety Tips During Stretches:**<sup>20</sup>

To avoid injury, following points must be kept in mind:

1. Avoid stretches in painful range and discontinue stretching if it increases pain.
2. Perform stretches in both directions.
3. Hold the stretches to 2-4 breathing cycles.
4. Slowly release the stretch and return to a neutral zone.
5. Begin the exercises gradually, starting with minimum number of repetitions.

**MSD prevention strategies:**<sup>21</sup>

1. Use Magnification.
2. Exercise.
3. Chair-side body Stretching.

4. Micro breaks.
5. Weight Control.
6. Vary procedures within the same appointment.
7. Alternate tough and easy patients.
8. Shorten patient's recall interval.

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#### Goals of ergonomics in any work place should include:<sup>22</sup>

1. Reducing the risk of cumulative trauma disorders.
2. Increasing productivity.
3. Increasing safety.
4. Improving the quality of work.
5. Decreasing fatigue and errors.

#### CONCLUSION

As an old maxim says "Prevention is better than Cure" MSD problem can be managed by using a multi factorial 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. Also it is important that dentists incorporate these strategies into practice to facilitate musculoskeletal health that will enable longer, healthier careers; increase productivity, provide safer work place and prevent musculoskeletal disorders.

#### Conflict of interest

The authors confirm that this article content has no conflict of interest.

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