

**ERGONOMICS IN DENTISTRY: POSITIONING FOR SUCCESS: A REVIEW**Sukirat Kaur<sup>1</sup>, Amit Tirth<sup>2</sup>, Vaibhav Tandon<sup>3</sup>, Ramneek Kaur<sup>4</sup>, Shyamalima Bhattacharyya<sup>5</sup>*Post Graduate Student<sup>1,4,5</sup>, Reader<sup>2</sup>, Senior Lecturer<sup>3</sup>**1-5-Department of Public Health Dentistry, Kothiwal Dental College & Research Centre, Moradabad***Abstract**

An ounce of prevention is worth a pound of cure this is what dental health professionals spend their day telling their patients but this is also applied to their working environment that can lead to discomfort and pain in their body parts like: neck, shoulders, back, wrist etc. There are certain activities that results in sudden injuries, rather it is an acquisition of harmful working positions over months and years in dental clinics, so often repeated and cause irrecoverable injuries. This article includes musculoskeletal disorders (and injuries) and signs, symptoms and risk factors of these types of injuries, so that the dental professional can be made aware of the developing injuries and can change his/her approach to alter the workstation setup to prevent further damage.

**Keywords:** Disorders, Ergonomics, Risk Factors.

**Introduction**

Dentistry is a social relationship between dental practitioner and patient in their limited job setting and with personal characteristics. A dentist should be healthy to perform a successful practice and family life too.

Dentist can also suffer from illness and problems that can spoil his/her practice. Yet, there are growing evidences that suggest increased vulnerability within profession to certain disorders and afflictions that can only be categorized as practice related.<sup>1</sup> The postural positions and techniques a dentist learns during the early days of clinical practice while he is a student are likely to get continued for the rest of his career. Hence it is important to ensure that the students are learning the correct techniques and postures and are implementing them during their practice.<sup>2</sup>

The word ergonomics has been used widely in many professions but more and more in the dental profession. Ergonomics is a Greek word where "Ergo" means work and "Nomos" means natural laws or systems<sup>3</sup>. Now a day's most of the equipments in market are labeled as with ergonomic design! What is Ergonomics? And why dentist should be concern about it<sup>4</sup>?

Ergonomics is an applied science associated with the study of the relationship between the efficiency and safety. Good ergonomics is essential in both armamentarium and work habits to prevent repetitive injuries eventually leading to long term and permanent disabilities.<sup>5</sup> The word Ergonomics was coined by Hywel Murrell (British psychologist) at the United Kingdom's admiralty in 1949 that leads to foundation of the ergonomic society.<sup>4</sup>

**Musculoskeletal Disorders**

Musculoskeletal disorders (MSD) are defined as painful injuries to the muscles of human support system caused due to traumatic events which negatively impact the quality of life.<sup>6</sup> MSD can range from pain in the upper limbs, such as the forearm and wrist, to postural muscles such as the upper and lower back, neck and shoulders as well as lower extremities such as hips, thighs, knees and ankles. Left untreated, MSD can evolve into more severe degenerative and inflammatory conditions.<sup>6</sup>

of all work related complaints, MSD may be the most ubiquitous symptom in the modern workforce. A study in 2011 revealed that MSDs were the most frequent health complaint by European, United States and Asian Pacific workers.<sup>7</sup> MSD is common in occupations that involve repetitive movements and prolonged, static postures such as sitting or standing, both of which are prerequisites to dental clinicians.<sup>8,9,10,11</sup> Prolonged static postures (PSP) are inherent in dentistry work.

**Types of MSDs****According to the Site Specific**

Primary types of MSDs that dentist has to face are:

**Back Problems****Lower Back Pain (LBP)**

Majority of the patients with LBP will have repeated episodes of pain and some of them will have recurrent pain after first episode of pain. The cause of LBP is often combined motions of lumbar flexion with rotation which increases the risk to the lumbar disk. This will further worsen by rigidity around the hips and pelvis as well as relative weakness of the stabilizers of the lumbar spine, including the abdominal and gluteal muscles. Furthermore, back pain can exist due to abnormal postures, relative weakness and decreased endurance, and then aggravate by a specific injury.

**Upper Back Pain**

It is not as common as LBP, but some practitioners' complaints excessive pain in mid and upper back. The thoracic spine is designed for support in standing and for caging the vital organs and is quite strong.

**Hand and Wrist Problems**

The main cause of pain in wrist and fingers is constant flexion and extension motions.<sup>12</sup>

**The International Ergonomic Association categorizes ergonomics into three specific domains of physical ergonomics, cognitive ergonomics and organizational ergonomics (IEA 2014)**

- Physical ergonomics that in respect to dental professionals consists of: ◦ interventions aimed at operator factors (e.g. adopting right work posture, appropriate use of patient and dentist chair or correct method of instrumentation and tool handling); ◦ interventions aimed at office design factors (e.g. workstation layout or set-up of spaces for positioning of operators, patients, machines, delivery systems and their interrelationships); ◦ interventions aimed at dental equipment design factors (e.g. ergonomically designed operator and patient chairs, instruments, and visual aids).
- Cognitive ergonomics, that consists of interventions aimed at interactions among humans and other elements of a system (e.g. mental workload or skilled performance).
- Organizational ergonomics that optimizes organizational structures, policies and processes (e.g. organization of workflow or appointment scheduling).<sup>13</sup>

**Symptoms of Musculoskeletal Disorders (MSDs)<sup>1</sup>**

1. Muscle fatigue in the shoulders and neck
2. Tingling, burning sensation in arms
3. Pain in the arm
4. Weak grip with clumsiness and dropping of objects
5. Cramping of hands
6. Numbness in fingers and hands

**Signs of MSDs**

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

**Mechanism Leading to Musculoskeletal Disorders (MSDs) in Dentistry.**

- **Prolonged Static Postures (PSPs):** Dentists undertake static postures, which involve almost 50 percent of the body's muscles to contract and to hold the motions of body while resisting gravity. When the human body is subjected repeatedly to PSPs, it may result in pain, injury or a career-ending MSD.
- **Muscle imbalances:** During treatment, operators should strive to maintain a neutral, balanced posture. Even with best ergonomic postures can find themselves in sustained awkward posture.
- **Muscle ischemia and necrosis:** with the best working postures, dental operators still maintain static contractions of the trunk muscles. Any

deviation from neutral position, the muscles contract harder to maintain a working posture. As muscles become fatigued, this prolonged contraction can cause muscle ischemia.

- **Hypomobile joints:** During periods of PSPs or when joints are restricted due to muscle contractions, synovial fluid production is reduced dramatically and joint hypo mobility may result.<sup>14</sup>

**Dental Risk Factors<sup>15</sup>**

- Awkward Postures
- Forceful Exertions
- Repetitive Motions
- Duration
- Contact Stresses
- Vibration
- Psychosocial Factors

**Ergonomic Requirements for Dental Equipment.**

**The requirements for dental equipment are important for:**

1. Designers and producers of equipment, to be able to meet the standards for working Without damaging the health of the users, according to EU legislation and in relation to the CE mark;
2. Dentists for judging and selecting dental equipment;
3. .ISO and CEN in the framework of developing new standards; European Society of Dental Ergonomics to promote the use of the "Requirements" and to discuss the many topics that still have to be fully developed;
4. Team practices, institutions, dental schools, policymakers etc. as a guideline for selection of dental equipments.
5. Dentists should be supported by dental associations and insurance companies.
6. Creating a basis for training dental students and dentists to work without damaging their health.
7. Dental depots when providing information for dentists.<sup>13</sup>

**Vital steps to Improve Musculoskeletal Health**

The dental professional should be aware of prevention strategies that are required to diagnose and prevent musculoskeletal injuries.<sup>16</sup>

The Keys to Wellness are discussed briefly which will help a dental professional to work more efficiently with less muscle fatigue:

**'Ergonomize' your operatory:** It is very common to observe dental professionals spending money on special therapy, expensive gadgets or exercise routines, only to return to the operatory environment that likely caused the pain problem in the first place. It is no surprise that the pain syndrome usually returns, and round and round it goes...So,

first and foremost, you need to correct the ergonomic problems in your operatory.

**Operator position:** Dental practitioner's working position is described taking clock as a reference, with the head of the patient is positioned at 12 o'clock. The right handed dental practitioners preferably works from 7 to 12 o'clock (or 8 to 2) and left handed dental practitioner work from 12 to 5 o'clock.<sup>17</sup>

**Height of positioning patients:** Positioning patient too high or too low is a common mistake among dental practitioners. This causes elevation or depression of the shoulders and abduction of the arms, leading to prolonged tension in muscles of neck and shoulder.

**Avoid twisting:** Design of the operating system plays a crucial role on how often dentist performs deleterious twisting movements, performing dental operations. Rear delivery systems allow extensive twisting of the trunk and vision movements and side delivery systems require moderate twisting to recover instruments.<sup>18</sup>

**Alternate between standing and sitting:** Standing posture is performed by different set of muscles as compared to sitting posture; so there should be switching between the two positions let one group of muscles rest, while the workload is changed to another group of muscles.<sup>19</sup>

**Reposition the feet:** Conscientious changes in the position of lower body especially foot position can shift the workload from one group of muscles to another, helping the overused muscles to be replenished with nutrients.

**Trigger points:** To relieve stress on trigger points, dentists can use a physical therapist trained in trigger point therapy, contract and relax method, or muscle energy technique, or use self-administering trigger point therapy using a small ball between the back and a wall or using a trigger point self-massage tool.

**Dental workstation:** Dental workstation includes: the dentist's stool, the patient lying in the dental chair, the components of the dental unit (the dentist's cart, the lamp, the vacuum system and the control pedal), the fixed elements around the working area including the fixed furniture and all the tools and equipment placed on it.<sup>20</sup>

**Patient scheduling:** Ideally, dental practitioners should schedule patients according to the needs of the patient (longer sessions or several shorter sessions) and the tolerances of the practitioner depending on the patients dental health (high calculus).<sup>23</sup>

**Handle design:** Handle design should be selected depending upon the hand size of the dental practitioners or the dental operation being performed. Comparatively smaller instruments (small diameter handles with 1/4 or less) require greater operating force.<sup>21</sup>

**Strengthening exercises:** As the muscles get weak with time, the practitioners tends to adjust him in poor posture which ultimately advances to injuries. Dentist should perform specific exercises that can strengthen his/her muscles, especially muscles of spinal column.

**Aerobic exercise:** Aerobic exercise must be performed 3-4 times a week for at least 20 minutes because they increases

blood flow to all tissues and improves their ability to use oxygen. This will ultimately strengthen our muscles.<sup>23</sup>

**Physical therapist (PT):** physical therapists perform differential tests and evaluations to determine the origin of pain syndromes. They work to regain normal movement and function of the body through use of various modalities, hands-on techniques and exercises.

**Certified neuromuscular therapist (CNMT):** Neuromuscular therapy utilizes specific soft tissue manipulation techniques, flexibility stretching, joint mobilization, neuromuscular reeducation, client education and home care to eliminate the causes of most neuro musculoskeletal pain patterns.

**Resolve trigger points:** Before the initiation of any muscle strengthening exercises the trigger points should be resolved, especially the major ones. Dental operators can face painful trigger points due to several risk factors, including body asymmetry, poor postures, poor body mechanics, repetitive movement, lack of movement, sustained muscle contraction and mental stress.

**Develop Good Flexibility:** Chair side stretching and stretching at home will help you regain full range of motion and prepare you for strengthening.

**Strengthen Specific Stabilizing Muscles:** Consider waiting till the area is pain-free to begin strengthening. Because of their vulnerability to muscle imbalances, all strengthening exercise is not necessarily good exercise for dental professionals.

**Be patient:** Allow several weeks to a month to see improvement: Your condition took a long time to get this way, so don't expect instant results.<sup>22</sup>

## Conclusion

Dental practitioners are more inclined to muscle injuries due to the poor ergonomics practices. They require performing some special exercises to maintain their complete health. Today the word „Ergonomics“ have reached a big way in dental profession. Therefore, there is need of interdisciplinary effort to find out preventive strategies towards the deteriorating effects of poor ergonomic practice.

Practicing correct postures enhances the working capacity and the productivity of the operations being performed by

the dental professionals. Making this a habit will allow a dental professional to work in a healthy environment. Here are some keys to wellness to help a dentist to work more comfortably, with less fatigue and extend their career.

First of all, dental operatory should be corrected ergonomically.

- Physical therapists, neuromuscular therapist should be consulted for musculoskeletal disorders.
- Major trigger points should be resolved before any strengthening exercise is attempted. Strengthen specific stabilizing muscles

- Be patient, but most of all commit to a regular regimen of prevention strategies.
- Chairside stretching is an important strategy to perform throughout the workday to prevent microtrauma and muscle imbalances. Proper ergonomics along with regular exercises, medication, biofeedback, yoga practices and proper nutrition helps dental professional battle stress, thus increases productivity. Hence, it will improve the quality of life, ultimately leads to long and successful careers.

## References

1. Priyanka Airen Sarkar, Anand L Shigli. Ergonomics in General Dental Practice. People's Journal of Scientific Research 2012; 5(1):56-60.
2. Saravana kumar, Sosa George. The Extend of Awareness Among Dental Students on the Musculoskeletal Occupational Hazards associated with their Profession- A Questionnaire Survey. Indian Journal of Dental Advancements 2015; 7(2): 116-120.
3. Russell JG: Ergonomics in Dental Surgery, Occupational Medicine 1973; 23(4): 128-131.
4. Yogita Khalekar, Amit Zope, Lalit Chaudhari, Ujawala Brahmkar et al. Prevention is Better Than Cure : Ergonomics in Dentistry. Journal of Applied Dental and Medical Sciences 2016; 2(1): 209-216.
5. Harsh Rajvanshi, Hima Batra , Saumya Singh, Hafsa Effendi, Ilham Zaidi. Ergonomics in Dentistry: The Absolute Dent-Ergonomics Workout. IJSS Case Reports & Reviews 2015; 2(4): 35-39.
6. A. Gupta et al. Ergonomics in dentistry. Int. J. Clin. Pediatr. Dent. 2014; 7: 32-34.
7. Hauke, A.; Flintrop, J.; Brun, E.; Rugulies, R. The impact of work-related psychosocial stressors on the onset of musculoskeletal disorders in specific body regions: A review and meta-analysis of 54 longitudinal studies. Work Stress 2011; 25: 243–256.
8. Fish, D.; Morris-Allen, D. Musculoskeletal disorders in dentists. N. Y. State Dent. J. 1998; 64: 44–48.
9. Kumar, D.K.; Rathan, N.; Mohan, S.; Begum, M.; Prasad, B.; Prasad, E.R.V. Exercise prescriptions to prevent musculoskeletal disorders in dentists. J. Clin. Diagn. Res. 2014; 8: ZE13–ZE16.
10. Lindfors, P.; von Thiele, U.; Lundberg, U. Work characteristics and upper extremity disorders in female dental health workers. J. Occup. Health 2006; 48: 192–197.
11. Nordander, C, Ohlsson, K, Åkesson, I, Arvidsson, I, Balogh, I, Hansson, G.-Å., Strömberg, U, Rittner, R, Skerfving, S. Risk of musculoskeletal disorders among females and males in repetitive/constrained work. Ergonomics 2009; 52: 1226–1239.
12. Dougherty M. Feel-based design: A reason to endorse ergonomic standards. J Colo Dent Assoc 1999 Autumn; 78(4): 22-25.
13. Prof O. (Oene) Hokwerda, J. A. J. (Joseph) Wouters, R. A. G. (Rolf) de Ruijter, S (Sandra) Zijlstra-Shaw. Ergonomic requirements for dental equipment. 2006.
14. www.optergo.com/images/Ergonomic\_req\_april2007.pdf
15. Anshul gupta, Manohar bhat, Tahir .M, Nikita bansal, Gaurav gupta. Ergonomics in dentistry. Int J Clin pediatr Dent 2014; 7(1): 30-34
16. Jodalli PS, Kurana S, Shameema MR, Khed J, Prabhu V. Posturedontics: How does dentistry fit you? Journal of Pharmacy & Bioallied Sciences. 2015; 7(2): 393.
17. Rafeemanesh E, Jafari Z, Kashani FO, Rahimpour F. A study on job postures and musculoskeletal illnesses in dentists. International Journal of Occupational Medicine and Environmental Health. 2013; 26(4): 615–20.
18. Zoidaki A, Riza E, Kastania A, Papadimitriou E, Linos A. Musculoskeletal disorders among dentists in the Greater Athens area, Greece: risk factors and correlations. Journal of Public Health. 2013; 21(2):163-73.
19. Szymanska J. Disorders of the musculoskeletal system among dentists from the aspect of ergonomics and prophylaxis. Annals of Agricultural and Environmental Medicine. 2002; 9(2):169-73
20. Pîrvu C, Pătraşcu I, Pîrvu D, Ionescu C. The dentist's operating posture—ergonomic aspects. Journal of Medicine and Life. 2013; 7(2): 177.
21. Mahboobeh Abdolalizadeh, Fatemeh Jahanmoghadam. Musculoskeletal Disorders in Dental Practitioners and Ergonomic Strategies ASJ. 2015; 12(4):161-166.
22. Bethany valachi. The 6 keys to wellness in dentistry; essential steps to improve your musculoskeletal health. Indian J Dent Adv 2015; 7(2): 116-20.

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