



Dental Ergonomics.... The Key to a Healthy Dental Career

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Abstract

Dentists are at high risk for musculoskeletal disorders due to the nature of their work. The key to preventing work-related musculoskeletal disorders is ergonomics — the science of fitting the work environment to the worker. In dentistry, ergonomics involves the design, selection, adjustment, and modification of operatory layouts, delivery systems, and most importantly dentist, assistant and patient positioning with regards to safety measures. Literature has shown more than 65 % of the dentist suffer from musculoskeletal complaints varying in severity but accompanied with pain, discomfort, hindrance in functioning and loss of working time.

This article will provide a brief review about ergonomically safe working environment for dentists, that will help to improve productivity, enhance quality of dental procedures and prevent work related repetitive stress disorders.

Keywords: Ergonomics; Posture; Pain

Dentistry is a profession characterized by performing small controlled movements in a confined area within the mouth and within the limited space of a small operatory. Ergonomic knowledge among dental professionals remains low. Awkward and prolonged static postures during dental procedures lead to cumulative trauma injuries and repetitive motion disorders. Many dentists are not adequately educated about ergonomics because it does not form part of the curriculum in most dental schools. Dentistry is a profession where every joint and muscle of our body gets used. That is the reason it is imp for us to understand the biomechanics of our own body and thus study dental ergonomics. Literature has shown more than 65 % of the dentist suffer from musculoskeletal complaints varying in severity but accompanied with pain, discomfort, hindrance in functioning and loss of working time [1]. This article will provide a brief review about ergonomically safe working environment for dentists, that will help to improve productivity, enhance quality of dental procedures and prevent work related repetitive stress disorders.

What is dental ergonomics

Dental Ergonomics involves the design, adjustment and modification of operator layouts, counters, delivery systems, stools,

instruments, and patient chairs to minimize excessive reaching, twisting, leaning, gripping, and repetitive motions. In addition to workplace modification, dental operators should be educated on proper body mechanics and preventive exercise to safeguard against injuries.

The human body

If we look at the organization of the body, the cell is the functional unit of our body. Cells form tissues and different types of tissues further form organs. Various organs come together to form organ systems. There are 11 such organ systems in the body thus forming an organism. A human being is an organism. All these organs, systems, tissues and cells are highly interdependent. Incorrect postures will lead to changes in tissues and affect normal cell functioning. For example, a prolonged static posture will affect the blood supply to that joint leading to cellular changes in the ligaments, joint cartilage and muscles surrounding the joint. This further leads to pain and early degenerative changes. Inability to work our joints and muscles due to pain will slowly start affecting other systems in the body. Our ancestors have been traditionally hunters and gatherers and our body is not designed to sit in one place. But due to automation and sedentary lifestyle our muscular

skeletal system and other systems of the body are progressively degenerating faster. Thus diseases like obesity, diabetes, cardiovascular disease, arthritis of joints, cancer are on the rise. So factors such as incorrect posture, sedentary lifestyle, stress are significantly impacting our quality of life.

The neuromusculoskeletal system

We always hear about the musculoskeletal system which consists of muscles, bones, joints and ligaments. The muscles work dynamically and help us in maintaining postures and do movement. The joints act as a fulcrum for the movement and ligaments provide static stability to the joint. One system that is neglected is our nervous system. Our nervous system is the command centre for all other systems in the body. Lack of knowledge and awareness about correct postures and spinal alignment will lead to incorrect postures. Ergonomics as a subject is not taught in detail in dental school. So, our nervous system is never trained to maintaining right postures during work. Proprioception i.e. the awareness of our joints in space is perceived by small sensory organs and nerves present in our joints and ligaments. Habitual wrong postures will significantly alter our proprioception. That is the reason why when you try to follow the principles of ideal ergonomic dentistry you might find it difficult as the patterns in our brains are programmed incorrectly. Prolonged and habitual incorrect postures also bring about changes in the length and tension relationships between muscles, ligaments and joints. So even if your brain tries to direct your body to maintain the right posture one will find it difficult to sustain it due to changes in musculoskeletal system.

So just knowledge about correct postures is not enough. One needs to work with the help of exercises to normalise the length and tension relationships.

The neutral zone

The neutral zone (NZ) is a region of intervertebral motion around the neutral posture where little resistance is offered by the passive spinal column. The NZ appears to be a clinically important measure of spinal stability function. Sustained incorrect postures take our ligaments, muscles and capsules into the plastic zone where there is disruption of molecular bonds and sometimes permanent disruption of the normal architecture. Good posture will help us to stay in the neutral or elastic zone without causing any tissue damage. Maintaining ideal posture will significantly reduce muscle activity, thus maintaining the length tension relationship. Neck pain is very common in teenagers and youngsters. The main reason for this is the text neck syndrome. This is due to continuous and prolonged mobile use with neck in a flexed posture. When you are looking down all the time, your posterior neck muscles i.e. the neck extensors have to work very hard to hold your neck against gravity. This tightens these muscles leading to neck pain. This would not happen if the neck is kept in its neutral position i.e. looking straight ahead. In dentistry, work similarly affects the spine. So being in the neutral zone, will help to prevent repetitive stress injuries.

Posture and pain

Pain related to prolonged abnormal posture may be variable among dentists. A posture may appear to be very faulty, yet the individual may be flexible and the position of the body may change readily to avoid posture related pain. Alternatively, a posture may appear to be good, but inherent joint stiffness or muscle tightness may also limit mobility that the position of the body may not change readily causing pain and discomfort. The onset and severity of posture related pain may be acute and develop into chronically painful symptoms which can be avoided by early intervention, relative rest (avoiding painful positions) and following the principles of ergonomics highlighted in the following article. Knowledge of ergonomics along with regular exercise will ensure prevention of dentistry related repetitive stress disorders. (RSD's)

Risk factors leading to the development of RSD'S

- Prolonged static posture
- Awkward posture
- Improper positioning
- Repetitive motion
- Weak postural muscles
- Mental stress
- Poor equipment or adjustment
- Poor flexibility
- Force
- Inadequate lighting

Dentists use arotors and micromotor handpieces very frequently for excavation of caries, root canal treatments, esthetic restorations and various other procedures. Along with sustained gripping of the instruments the dentists have to apply considerable force while performing the above mentioned procedures. This leads to a constant isometric contraction in the muscles leading to cumulative stress injuries. Recurring movements of the hand and fingers during use of hand files and broaches for root canal procedures lead to a repetitive stress. Use of instruments without proper stabilization (finger rest) may lead to excessive muscle hand activity and reduction in thumb pinch strength [2]. Every dentist has a different body type with a unique anthropometry of the hand and fingers. Imported/Local equipments may not be designed according to the anthropometric measurements of Indians, so caution has to be taken before purchasing the instruments. The diameter (size and shape), handle weight, handle surface contour and texture of the equipment should vary to accommodate the unique characteristics of the dentist. The instruments having a large diameter and light weight will require the least amount of muscle load and pinch force [2]. Thus, hollow handled instruments are preferred. An instrument that is chosen should be standardised and instrument balanced. Human-centered design depends upon proprioceptive feedback to reveal human standards for intraoral procedures, placement and design of equipment, and the configuration, size, weight, and surface texture of instruments. The ergonomic functions of hand instruments and handpieces

are related to the operator's ability to see, sense resistance and textures, and position to gain access for finger contacts that support unstrained joint positions of the entire body as cumulative and repetitive stress not only affects the hands and fingers, but also affects the wrist joint, elbow joint, shoulder joint and the entire spine [3]. Many combined risk factors, rather than a single event or practice, lead to RSD's [4].

Factors affecting working postures

The posture of the dentist may also vary according to the dental condition of each patient related (Intrinsic) and environmental (Extrinsic) factors. Certain constraints a dentist may be exposed are as follows [5]:

Patient Related: (intrinsic)

1. Poorly positioned teeth
2. Limited Mouth Opening
3. Heavy Salivation
4. Bleeding
5. Macroglossia
6. Medical restrictions regarding the position of the patients and level of co-operation.

Environment Related: (extrinsic)

1. Incorrect lighting
2. Faulty design of Equipment
3. Malfunctioning Chair/Equipment
4. Limited working space
5. Room Temperature
6. Stress – Work load, Time pressure, Financial Constraints.

Repetitive stress disorders (RSDs)/Musculoskeletal disorders (MSDs)

RSDs are caused due to prolonged incorrect static and dynamic postures. As discussed during the introduction, incorrect postures will lead to molecular and cellular changes in our musculoskeletal system. Prolonged static postures will lead to ischemia of tissues of ligaments, muscles and joints. Ischemia will further lead to lack of recovery and poor healing of the stressed tissues. Three out of four dentists suffer from RSD's. Further they may suffer from multiple pains with more than two or more painful areas in the body. A survey done on 981 female dental health workers revealed 81% suffered from upper extremity musculoskeletal disorders [6]. Musculoskeletal complaints increase significantly in several body parts with increasing age [7]. Thus various such studies have reported high incidence of musculoskeletal pain associated with work amongst dentist. This validates the need to understand and follow the correct ergonomics and take steps to prevent work related RSD's.

Signs and symptoms of RSD

Signs

- Decreased range of motion
- Deformity
- Decreased grip strength
- Loss of muscle function

Symptoms

- Pain
- Numbness
- Tingling
- Burning
- Cramping
- Stiffness

Types of MSDs

Neck and Shoulder disorders

- Myofascial Pain Disorder
- Cervical Spondylolysis
- Thoracic Outlet Syndrome
- Rotator Cuff Tendinitis/Tears

Back disorders

- Herniated Spinal Disc
- Lower Back Pain
- Sciatica

Hand and Wrist disorders

- DeQuervain's Disease
- Trigger Finger
- Carpal Tunnel Syndrome
- Guyon's Syndrome
- Cubital Tunnel Syndrome
- Hand-Arm Vibration Syndrome
- Raynaud's Phenomenon

Benefits of dental ergonomics

- Reduce fatigue.
- Prevention of work-related injuries
- Increased energy levels & productivity
- Decreased job stress
- Decreased number of sick days and a safer work place.
- Improved quality of life and job satisfaction
- Increased career longevity.

Conclusion

- Ergonomic practices and procedures are simple to adopt.
- It is inexpensive and helps to improve productivity with less body fatigue.
- Apply principles of ergonomic dentistry
- Make changes in your workplace
- Practice six /eight-handed dentistry whenever possible
- Do not take symptoms of RSD lightly
- Take frequent breaks during work and perform stretches .
- Overall fitness will lengthen your career and keep you away from lifestyle disorders.

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