

Ergonomics in Dentistry: A 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, equipment and working postures that does not fit the required way of working and/or individual characteristics. 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 and kinesiology. This review article includes Musculoskeletal Disorders (MSDs), their types, clinical features, risk factors and steps to prevent MSDs through various applications of ergonomics in dentistry.

Key words: Musculoskeletal Disorders (MSDs), Ergonomics, and dentistry

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INTRODUCTION

"Look after your body Jim Rohn says, "It's the only place where you reside". To save great structure, capacity, and wellbeing, each dental specialist should keep up with ideal stance and shape. Dental work necessitates a high level of physical and mental concentration, and long work hours can lead to poor posture [1]. Dental professionals are susceptible to a variety of occupational diseases and disorders, the most frequent of which being Musculoskeletal Disorders (MSDs), which can cause long-term harm [2]. The most prevalent injuries are to the wrists, elbows, shoulders, neck, and back and spine, according to research [3]. Dental personnel and dentists are increasingly commonly connected to carpal tunnel syndrome, sciatica, tendinitis, and tension neck syndrome [4]. Ergonomics is derived from two Greek words: Ergon, which means "labour," and Nomo's, which means "principles or laws". It is a method of working smarter by providing tools, equipment, and workstations that allow practitioners to operate as efficiently and safely as possible. Ergonomic design improves productivity, reduces injuries, and increases worker happiness. As a result, it is vital for prospective dentists to practise dentistry with

appropriate ergonomic design. Several musculoskeletal ailments are discussed in this article, as well as how they are treated. The dental profession need highly precise and controlled dental preparations. Muscles utilised for this reason are at danger of becoming exhausted, causing the dentist discomfort. Due to limited access and restricted perspective, dentists are believed to be the most sensitive to postural disorders, making them subject to occupational. To stay away from redundant strain wounds, which can prompt long haul inadequacy, effective intuitive design should be prioritised. Ergonomic principles are intended to provide practitioners with a generally safe and healthy working environment, resulting in increased productivity [5,6].

LITERATURE REVIEW

Musculoskeletal Disorders (MSDs)-description and widespread

MSD's are "Work-related musculoskeletal illnesses with a chronic progressive development involving ligaments, spinal discs, muscles, cartilage, nerves, joints and tendons" [7]. They're also known as Repetitive Motion Injuries/RMI or Cumulative Trauma Disorders/CTD. MSD's are the world's second leading cause of disability [8], and they are rapidly becoming a global healthcare issue. Since the beginning of dental therapy is acted in a somewhat restricted employed region in the company of genuinely hardened work position, MSDs are more normal than

different issues. As per an audit of the worldwide dental writing, around 65% of dental specialists experience outer muscle manifestations like agony, uneasiness, practical hindrance, and expanded labour duration [9]. In 1998, Bramson discovered that up to eighty one percent of dental operators suffer from back, neck, shoulder, or arm pain [10]. According to a Bureau of Labour analysis, dental hygienists scored first among all professions in terms of the number of instances of carpal tunnel syndrome per 1,000 employees.

Classification of MSD's

- **Neural diseases:** Ulnar neuropathy, Carpal tunnel syndrome.
- **Diseases of the neck:** Cervical Spondylosis, Tension Neck Syndrome, cervical disc disease, Brachial plexus compression.
- **Diseases of the shoulder:** Trapezius myalgia, Rotator cuff tendonitis, Rotator cuff tears, and adhesive capsulitis.
- **Diseases of the Forearm, Elbow and Wrist:** de Quervains disease, Tendonitis, Tenosynovitis, Epicondylitis.
- **Hand-Arm vibration syndrome:** Reynaud's disease.
- **Diseases of the back:** Low Back Pain (LBP), Upper back pain.

Risk factors for musculoskeletal disorders

The following are some of the risk factors for MSDs among dental workers:

- Long periods of difficult postures: Dentists adopt uncomfortable attitudes in order to gain a good view of the patient's teeth and to keep the dentist and assistant in rhythm. The spinal discs are put under higher tension when the back is bent or twisted. Exercising for long periods of time above shoulder height might also be stressful. Furthermore, when sitting in a forwardly bent and rotated position, disc pressure rises quickly.
- If performed repeatedly and over a lengthy period of time, repetitive actions can cause fatigue and muscle strain? The more drawn out the time of constant work, the more extended the rest stretch is required.
- Poor lighting: Inadequate illumination at the workplace may unintentionally contribute to improper postures.

Aside from the aforementioned risk factors, there are a few more that contribute to MSDs, such as stress, lack of flexibility, inadequate breaks, and poor equipment adjustment [4]. According to 2016 survey, 44 percent of dentists have Repetitive Motion Injury [6].

Carpal Tunnel Syndrome (CTS) is a neural disease induced due to vibration exposure that mostly affects the median nerve of the wrist [7]. Both repeated and strenuous labour has been associated to CTS. CTS have been linked to highly repetitive labour, either alone or in combination with other factors, according to research [4].

Musculoskeletal disorders and its consequences

MSDs can cause early weariness, soreness, and a pessimistic attitude toward work. Poorly constructed workstations have the greatest impact on the neck. Improper eyesight of the patient's mouth cavity could be one of the reasons behind this. The operator has a proclivity for bending into unnatural positions, resulting in a shift away from a balanced stance. Furthermore, a faulty neck posture might radiate to the back, causing backache. It was discovered in a 2018 study of ergonomic postures during typical that none of the operators had the optimal neck position [8]. A large number of dentists have also mentioned lower and upper back ache. Lower back torment can be disturbed by rigidity around the pelvic girdle, just as a relative deficiency of the stomach and gluteal muscles [1]. Consistent flexion and augmentation activities of the hand and wrist with no rest produce mechanical weight on the advanced nerves. MSDs can be avoided by working in an ergonomically designed environment.

Clinical features of musculoskeletal disorders (MSDs)

Signs

- Range of motion is reduced
- Deprived normal sensation
- Abnormal grip strength
- Loss of normal Locomotion
- Deprived co-ordination.

Symptoms

- Hypersensitivity in hands and fingers
- Excessive fatigue in shoulder and neck
- Tingling and burning sensations in hand
- Weak grip, cramping of hands
- Numbness in fingers and hands
- Clumsiness and dropping of objects

Ergonomics objectives

- Decreasing the chances of musculoskeletal problems.
- Increasing worker comfort while improving worker safety.
- Employee fatigue should be maintained to a minimum.
- Upgrade the job of high grade.

Intervention and prevention: "Prevention is preferable to cure." Any sickness can be prevented, which saves time, money, and pain. Musculoskeletal disorders (MSDs) are a common condition (disease) among dentists, and Ergonomics is the solution to the problem. Maintaining a proper posture and symmetry requires a strong connection between the dentist and the intraoral working zone. Ergonomics should be considered while building instruments and planning workspaces, as well as in clinical practise. It is always recommended to leave 35-40 cm between the working field and the dentist's eyes [9]. The following changes can aid in the implementation of ergonomic principles:

Posture: Improper postural alignment exerts pressure on nerves and blood vessels, producing unnecessary muscular strain and wear and tear in the joints [9]. Maintaining an upright posture should be a priority at all times. Use a reclining chair with proper support, as well as a footrest that can be adjusted. The chair's height should be adjusted to a comfortable level. Wrist motions that are excessive should be avoided at all costs. The dental seat ought to be raised sufficiently high for the administrator's thighs to turn uninhibitedly underneath it. The following are characteristics of a balanced posture:

- Respect for body symmetry and a straight back.
- Avoid a forward tilt of the body by placing your arms along your body.
- The operator's feet are symmetrically positioned beneath his or her hands.

Instrument selection: When the working edges are not blunt, the device does the majority of the work, requiring less force. When employing devices with dull or blunt edges, extra force is necessary. Furthermore, instead of manual hand instruments, the adoption of lightweight and durable mechanical hand pieces should be advocated.

Magnification and lighting: Shadow-free illumination is provided by the parallel alignment of the light beam in the observing direction, which improves job quality [10]. Dental loupes and a microscope with multiple magnification levels allow for a more upright posture, reducing back and neck pain.

Dentist micro breaks: Take frequent rests to relax your body parts. Moving the muscular workload from one location to another should be done on a regular basis. A dentist can take a break on the chair side and stretch.

Scheduling: Appointments should be scheduled to allow for adequate recovery time and to avoid muscular fatigue. With buffer intervals in between, alternate easy and challenging situations should be tackled.

Dental personnel training: Every health-care situation requires training. It ensures that personnel are well-informed about workplace hazards and are able to self-volunteer in identifying and minimising potential hazards.

Some aspects of a faulty work station set-up

- The dental specialist's or alternately persistent seat is either excessively high or excessively low.
- There is no proper support in a dentist's chair.
- The equipment table is incorrectly positioned.
- The lighting is inadequate for the work.
- Table/work surface edges are sharp and uncomfortable.
- The workplace is damp and cold.
- Ventilation makes workspace cold.

Ideal dental set-up

Magnification: Magnification allows the physician to operate at a longer distance from the patient, improves neck posture by minimising leaning forward, and increases eyesight. Magnification systems include dental loupes, operational telescopes, and microscopes. Using such technology allows the dentist to concentrate his or her gaze just on the working field. To further develop perceivability, there's no good reason to stretch your head and backbone.

Patient chair: Main objective is provide patients with the best possible access while also ensuring their comfort.

Look for:

- Make use of a chair that has a level surface.
- Consistency.
- Armrests that pivot.
- Neck and headrest support
- Support for the wrist and forearm.

Operator stool: The idea is to increase patient movement and access while also accommodating various body sizes.

Look for:

- A lumbar support that can be adjusted.
- Seat height can be adjusted.
- Footrests that can be adjusted.
- Body support wrapped around
- Upholstery with no seams

Operator stools come in a variety of shapes and sizes.

Saddle stools, Brewer operator stools, Posiflex stools, and Kobo chairs are some of the options. By extending angle of the pelvis of 130 degrees and positioning the sacrum in a neutral position, saddle type stools retain the lower back curvature. It's perfect for cramped operating rooms.

Ergonomics in dentistry: advances and strategies

Four-handed dentistry: It is a method in which the dentist and subordinate work together to execute procedures that are designed with the patient's best interests in mind [11]. A skilled chair side assistant during any dental treatment performed in a dental practise supports the dentist in performing the technical procedure [12]. In a four-handed dentistry arrangement, proper use of a dental auxiliary's extra pair of hands is widely recognised as an optimum manner of providing dental services.

The following requirements must be completed in order to practise proper four-handed dentistry [13].

- All equipment must be developed with ergonomics in mind.
- Surgical team and the patient must be seated in ergonomically designed equipment.
- You ought-to use pre-made trays.

- Based on the state's requirements, the dentist should delegate all legally delegable tasks to certification auxiliary.
- Treatment for the patient should be planned ahead of time and arranged in a logical manner.

Zones of activity: The work area surrounding the patient is divided into 4 "activity-zones" [11]. To detect activity zones, the patient's face is utilised to simulate the face of a clock. The four activity zones are (Figure 1):

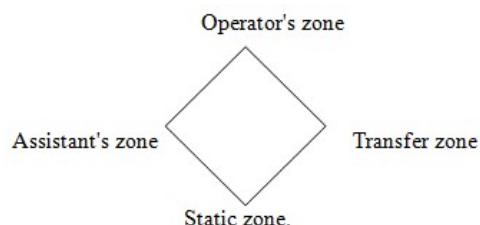


Figure 1: The four activity zones.

Alternate between standing and sitting

- You can ease back pressure by standing. But during some procedures the dental practitioners are required to sit. When one sits their whole body weight is transferred to their girdle area.
- By rotating between the 2 postures, one set of muscles gets a respite while the effort is moved to another. Alternating between sitting and standing might be a good approach to avoid injury.

Proper size and fit of gloves: Gloves that are properly sized, light, and supple are essential. Carpal tunnel syndrome can be worse by gloves that don't fit, this results in hand discomfort, especially a point near the bottom of the pollex.

Proper temperature: To keep dexterity and grip strength from deteriorating, hands and fingers should be kept at a temperature of at least 25°C (77°F). Temperatures, on the other hand, are not regulated.

Stretching and exercises: Exercise, stretching, and relaxation practises (meditation, biofeedback, and yoga) can help you avoid injuries and reduce stress, so improving your quality of life.

Body-strengthening exercises are:

- Maintain the physical wellbeing of the muscles that support the neck and back, as well as those that support the forearm, wrist, and hand, by stretching and strengthening them.
- Stretching throughout the day at regular intervals.
- One of the most significant things in preventing CTS is to rest your hands on a regular basis.
- Take a break from your activities and focus your eyes at a distance for 20 seconds to relieve eyestrain caused by focusing hard on one depth of vision for extended periods of time.
- Gradually lower the head and let the arms and head to fall between the knees; pause for a few seconds

before gently raising the head by contracting the stomach muscles and rolling up, with the head coming up last.

- If you have neck stiffness, rotate your head. Head rotation entails turning the head in a comfortable range of motion from forward and backward, right and left.
- Shoulder rolling can help stretch fatigued shoulder muscles from holding an oral evacuator, tools, or a phone handset.
- Pull the shoulders up to the ears and then roll them in a circle back and forth.

DISUSSION

Dental practitioners are among the most vulnerable to MSD because of their lengthy procedural working hours and awkward postures. Clinicians have been known to develop diseases ranging from a simple sprain to carpal tunnel syndrome. According to a survey conducted by Kanteshwari only 50 % of respondents were aware of ergonomics also Gopinadh found 59.6 percent in another study. These figures highlight how important it is to be cognizant of ergonomics.

Many additional aspects, such as continual vibration in the hand piece, illumination in the workplace, tool shape, and so on, have an impact on the dentist's efficiency. In their study, Akesson colleagues found that practising four-handed dentistry was effective in reducing stress, which Finkbeiner backed up [6].

Ergonomics ensures maximum production, as well as the prevention of illness and injury. On the other side, a failed application can result in work-related MSD. It is vital to seek medical attention as soon as possible if you experience symptoms of occupational stress or notice risk indicators.

CONCLUSION

High productivity, injury prevention, and greater patient satisfaction are all benefits of successful ergonomics in the dental operator. MSDs can be avoided by following some fundamental principles and maintaining a healthy posture. Regular continuing dental education seminars and lectures should be promoted to raise awareness among dental practitioners. Four-handed dentistry should be used on a regular basis to promote efficiency and convenience. Hence, aspire to inspire before your expire.

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