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Ergonomics and Operating Posture for Dentists

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ABSTRACT

Dentistry requires ardous high- finesse dental preparations. Accuracy and control are required in executions that require the dentist's complete attention, focus, and patience. The appropriate treatment approach and the success of the practice demands special working circumstances for the dentist and his team in an ergonomic setting. In ergonomics, posture relates to how different portions of the body are placed and so reports are made between them to enable for the execution of a given activity. This article explains dentists' working postures, beginning with the balanced stance and moving to numerous position variants. The ideal posture of a dentist offers him with excellent working conditions (access, vision, and control) as well as physical and psychological convenience throughout clinical actions. Dentists should conduct postural corrective activities and compensating measures based on the risk and perspective of musculoskeletal problems associated with unbalanced postures to limit the harmful consequences of working in a bad posture.

KEYWORDS: *Balanced posture, Musculoskeletal disorders, Ergonomics*

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INTRODUCTION

Ergonomics is derivative of the commixture of "*Ergos*" which means "work" and "*Nomos*" which means "Natural law of systems." Which are two Greek words [1].Ergonomics is defined as, "A 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 to optimize human well-being and overall system performance." by the International Ergonomics Association[2]· ERGONOMICS is a method of working smarter, by designing equipment, work stations, tasks and tools to facilitate the job to the operator, rather than the operative to the job [3].

HISTORICAL BACKGROUND

WojciechJastrzbowski used the term for the first time in an article "The Outline of Ergonomics "whereas the term Ergonomics, is now widely attributed to British psychologist Hywel Murrell, who founded Ergonomics Society in a 1949 meeting at the United Kingdom's Admiralty [4].

Work Stance

The spine in humans has curves which are four in number. Four types being Cervicallordosis, Thoracic kyphosis, Lumbar lordosis, and Sacral Kyphosis. Poor posture causes more wear and tear on the discs, muscles, ligaments, and vertebrae, resulting in pain. When sitting, bent forward, or rotated, pressure on the disc increases, causing the lumbar curve to flatten. Because the spine is only attached to muscles and ligaments rather than bone, bending forward continuously increases the force on the lower back, causing strain which is muscular in nature and trigger points causing pain. When a person sits with thighs being parallel to the floor, pelvis rolls backward, flattening the low back curve. This raises disc pressure and causes muscle strain [5].

It is critical to maintain proper posture. A dentist's ideal posture provides him with working conditions which are optimal in nature which includes access, visibility, and control in the mouth. A "good" posture gives the dentist supplementary working vigor, less anxiety, more comfort, less pain and tension in the muscles , and a minor risk of therapeutic errors. A "bad" posture causes premature exhaustion, discomfort, pressure, and an increased risk of musculoskeletal disorders and poor work quality[6].The balanced or neutral posture explained through "ISO Standard 11226 Ergonomics - Evaluations of static operating postures" is endorsed for dentists.

The features of a balanced posture are summarized below [7].
straight back and proper body symmetry; avoid negotiating the areas related to the back into a "C" shape; -forward trunk proclivity of no more than 20°; A larger forward inclination, side leaning, and rotation of trunk are all prohibited. Inclination of the head of about 20-25° in the forward direction from the trunk; -arms positioned along the body, oriented at an angle of 10°, forearms raised till an angle of 25° from the horizontal line; -angle between the thighs and shanks between 105-110° ,thighs placed apart at 45°, evading inflexible fixing of the hip joint;
The shanks vertical to the floor or somewhat posterior; -the feet on the floor oriented in the plane forward in nature similar to the shanks; posture is balanced when one's feet are evenly positioned underneath the hands of the operator. Symmetry of the posture implies that Entirety of the body's horizontal lines which include the eyes, shoulders, elbows, hips, and knees are parallel and perpendicular to the median line of the body.

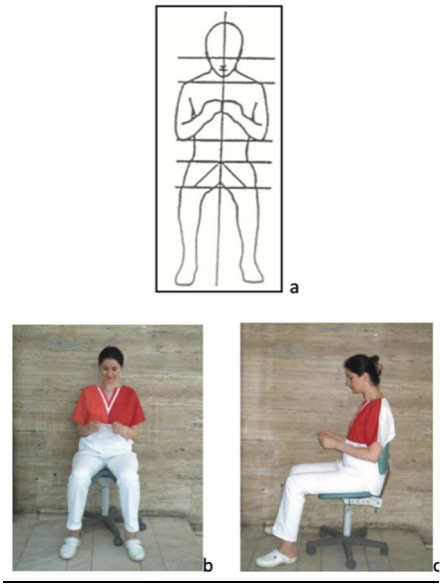

Figure 1: The balanced posture [8]

WHY IS IT REQUIRED?

An appropriate posture is critical for a dental healthcare professional. It not only improves access and visibility while working, but it also prevents repetitive strain injuries and long-term disability. An incorrect or awkward posture, on the other hand, increases an individual's risk of musculoskeletal disorders (MSDs). In ergonomics, posture refers to how dissimilar parts of the body are placed and consequently the reports established in between to allow for a specific task implementation [8].
Ergonomics aims to reduce cognitive and physical stress, prevent occupational diseases associated with dentistry practise, and increase productivity while improving quality and comfort for both the professional and the patient[9].In dentistry, the operator position must be distinguished by the three-dimensional positioning of the dentist's entire body around the patient. This distinction is beneficial in comprehending the operatory conditions. Dentists are particularly vulnerable to musculoskeletal disorders due to the nature of their work. The science of making the work environment adaptable to the operator is the key to preventing work-related musculoskeletal disorders.
To avoid tedious stress related injuries, which can emerge over the course of time and lead to long-term debility, appropriate ergonomic design is required[10].Disorders of the musculoskeletal system (MSDs) are injuries and disorders of musculoskeletal system. MSDs can be caused or exacerbated by one or more risk factors which include repetition, obstinate or static postures, high forces, and contact stress. When such factors coexist, the risk of suffering with an MSD increases significantly.
According to the literature, the prevalence of pain musculoskeletal in nature in dentists, dental hygienists, and dental students lies in the range of 64% to 93%. Most commonly area of concern in relation to pain in dentists were found to be back associated (36.3-60.1%) and neck region (19.8-85 %), the most common being hand and wrist in dental hygienists (60-69.5 %). 6.1.

SIGNS AND SYMPTOMS OF MSDS [11]
Symptoms of MSDs:
1.Extreme fatigue in the areas associated with shoulder and neck

2. Stinging and burning sensations in the arms
3. Poor grip
4. Ineptness and tumbling of objects
5. Numbness in the hands and digits
6. Hypersensitivity in the hands and digits.

Clinical Indications of MSDs:

1. A reduction in the range of motion
2. Absence in the presence of common sensations
3. Loss of power associated with grip
4. A decline in coordination.
5. Loss of regular motion

Dental Consideration related to Ergonomics

Ergonomics related goals in any workplace should include:

- Risk reduction of Cumulative trauma disorder
- Enhancing productivity
- Refining work quality
- lowering exhaustion and mistakes
- Increasing safety

Importance of posture: While performing numerous procedures on the patient, the fundamentals of an inappropriate operatory setup make the dental professional to adopt postures which may cause harm. Such positions exert undue stress on nerves and circulatory vessels, strain musculature, reduce circulation, and increase wear and tear on the joints [12].

POSTURODONTICS [13]

The part of an improper static posture, pressure biochemical in nature, exertive force, repetitive movement, and its importance in ergonomics had remained recognised for many decades. As a result of intense physical and mental strain, as well as long working hours, dental practitioners adopt an improper posture. Ergonomics keeps into account the type of task performed and creates a suitable and sound environment for the operator, increasing work efficiency and preventing work-related MSD. Because the dental operatory is more complicated than other Health related fields.

Ways to achieve a correct posture for the operator:

The supine position of the patient is an effective and desirable position to maintain a neutral posture.

1. Set the dentist stool and the patient's chair to a suitable height.

Avoidance of twisting or bending forward of the torso, the operator should be in a position to freely move his or her legs beneath the patient's head and headrest. Right-handed operators work from 8 o'clock to 12 o'clock position, while left-handed operators work from 12 o'clock to 5 o'clock position

2. Avoid a short operational distance [14]

It is the distance that is between the doctor's eye and the patient's occlusal surface. A longer working distance improves visibility and neck posture. Lower back ache happens when the patient is positioned incorrectly or when the dentist is leaning in an improper posture over the patient. It is recommended to use indirect vision. The operating field and the dentist's eye should be 35-40cm apart.

3. **Adjustable backrest [15]**

The combination of a 120 degrees inclination in the backrest and 5 cm lumbar support reduces pressure on the lower back.

4. Check that the **adjustable light** is in the mid-sagittal plane of the patient. It is placed around the dentist's head so that light beam and viewing direction are parallel to each other with a maximum aberration of about fifteen degrees [16].
5. Alternate between sitting, standing, and working on the patient's side.
6. Maintain a straight posture
7. Reduce excessive wrist movements
8. Adjustable chairs/stools with arm, thoracic, and lumbar support, such as the Saddle stool, Brewer operator stool, Kobo chair, and Posiflex stool, should be used.

Saddle stool: provides optimal seating allowing for proper spine and pelvic positioning .The seat's angle allows for proper core muscle balance and the maintenance of normal curvature without the use of the backseat or any pressure on the spine.

9. Adjustable footrest
10. The patient chair should be pivoting or drop-down armrests.

Recent trends and strategies in ergonomics in dentistry [17]

The clandestine information related to a sound practise through various ergonomically compatible modalities in dentistry is the design of the operatory system based on principles in line with laws of ergonomics in relation to posture, movement of body parts and strength of the musculature .There are various methods that can be incorporated to make the working environment operator friendly . Few of them are discussed below:

•Four handed dentistry

When performing Dentistry in relation to being four handed, the dentist upholds a position around the operating field with partial arm, hand and body movement and should keep his or her gaze focused on the operating area. Dental armamentarium should be centred around the operatory assistant, endorsing over-the-head and above the patient delivery systems which allow for better access while performing various treatment modalities [17].

•Alternation of position between sitting and standing

Standing in between work allows you to relieve back pain. However, there are times when the dentist must take a break. The majority of the weight of the operator is transferred to the scat when sitting. Altering between positions of standing and sitting allows a group of muscle to rest while shifting the workload to the other group. Standing and sitting alternately can be a useful method in averting injuries [18].

- **Dental control unit associated with foot:**

Foot control can be premeditated with a pedal on which operator's foot is entirely or partially set. Placement of the entire foot creates a load causing various problems , resulting in an unequal placement of the right and left foot, causing an irregular, strain on the pelvic area and vertebra. As a result, the heel must be placed on the floor to give support to the foot, while the shoe worn by the operator is placed on the pedal.

•Microbreaks

The oral health professional can take breaks to avoid muscle injury and allow periods of rest to replenish and nurture structures under duress. A thirty-second microbreak may assist the dentist in working more successfully and proficiently.

- **Scheduling**

Scheduling allows for enough recovery period to evade chronic muscular fatigue. Flexible preparation systems, varying treatment modalities within the same appointment, and shortening the recall interval of the patient are all potential strategies.

- **Exercise and habit of stretching**

Regular exercise, stretching, and relaxation methods like meditation, biofeedback, and yoga help to avoid injuries and evade stress, ultimately improving quality of life.

1. Stretching and strengthening of the muscles supporting the back and neck, as well as the ones in the forearm, wrist, and hand, will keep them robust and strong.
2. Stretching at regular intervals all through the day
3. Frequent hand rest is thought to be one of the most pertinent factors in preventing CTS.
4. Strain in the eyes caused by intense focus at single depth of vision for extended periods of time, can be relieved by looking up from the task and focusing one's eyes at a distance for about twenty seconds.
5. Slowly lowering the head and allowing the head and the arms to fall amid the knees and holding that position for some time and slowly rising by contracting the muscles associated with the stomach and rolling up, bringing the head up in the end.
6. For stiffness caused in the neck, trying rotation of the head which entails tilting the head from right to left, as well as back and forth, without pushing the motion outside a comfortable range.
7. Shrugging of shoulders can be used to stretch muscles associated with shoulders that have been strained by holding the oral evacuator, armamentaria , and phone sets. Pulling the shoulders up to your ears, then rolling them back and forth in a circular motion.

Figure 2: Exercises

CONCLUSION

In dentistry, repetitive injuries related to stress are on the upsurge. Various dental professionals and assistants have MSDs, and most of them have experienced musculoskeletal pain associated with shoulders, neck, hands and wrists, lower back. The importance of adhering to appropriate principles related to ergonomics should be recognised in order to avoid these problems by growing awareness related to work stances, reimagining the operatory to promote positions neutral in nature, investigating effect of armamentarium use on pain related to upper extremities, and adhering to operatory practices healthy in nature to decrease the stress of dental procedures associated with Dentists body. Efficiency in work and productivity of dental surgeons can be increased by practicing proper postures, which can lead to a significant difference in financial gains and quality of practice related to dentistry .The effectiveness in applying principles of ergonomics ensures high yield and the evasion of illness and injury. A composed musculoskeletal well-being will allow the dental professional to work for longer duration in healthier circumstances, in safer environments, thereby preventing musculoskeletal disorders. An optimal posture is not extravagance, involving large investments, but rather reimaging and reinventing of one's operatory methods.

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