

Ergonomics Everytime Keeps Dental Practice Healthy, Wealthy and Fine

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ABSTRACT

ERGONOMICS is a way to work smarter - not harder by designing tools, equipment, workstations and tasks to fit the job to the worker-NOT the worker to the job.

In the dental profession, dentists spend their work days in an awkward static position performing extremely precise procedures in a 2"×2 ½" workspace-the patient's mouth. Therefore, they are at a greater risk of work-related musculoskeletal disorders than is the general population. These disorders can result in pain and dysfunction of neck, back and hands and fingers. This article is aimed at providing some interventions that can be considered by the dentists in light of their own experience and needs. It also discusses the important issues of posture and offers different exercises to work with comfort, efficiency and ease.

A broad research of published literature was performed using the keyword ergonomics, MSD's and stretches from 1983- 2016 in google scholar, internet and text books.

KEYWORDS: Ergonomics, Musculoskeletal disorders, Static postures, Work efficiency, Workplace.

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J Oral Health Comm Dent 2016;10(2)59-64

INTRODUCTION

Ergonomics is an applied science concerned with designing products and procedures for maximum efficiency and safety. Recently, "Ergonomics" has become a popular term. The term has been used with most professions but increasingly in the dental profession. This includes many different concepts such as, how dentists position themselves and their patients, how they utilize equipment, how work areas are designed and how all of this impact the health of dentists (Russel, 1973).(1)

A review of the dental literature pertaining to ergonomics was undertaken. Details appearing in the literature from 1983-2016 were reviewed in a comprehensive manner. Electronic searches of the literature were performed in MEDLINE using key words — ergonomics, musculoskeletal disorders,

stretches, work efficiency— in various combinations to obtain potential references for review.

ROLE OF ERGONOMICS IN DENTISTRY

In dental practice, musculoskeletal disorders have become increasingly common worldwide during the past decades. Several studies have indicated that back, neck and shoulder pain are a major problem among dentists. According to various studies the musculoskeletal pain experienced by dentists is as follows: Shugars et al(1987)-60%,Runderantz et al(1990)-72%,Auguston and Morken (1996)-81%, Finsen et al(1997)-65% and chowanadisai et al(2000)-78%.Prevalence of general musculoskeletal pain ranges from 64-93%.(2) D.J. Veeresh et al conducted a study and found that the prevalence of atleast one musculoskeletal pain among the dentists was

found to be 34.71%, and they reported higher frequency of pain in the neck region(71%).(3)In a study conducted by Mohamed Faisal and Lawrence Mathias , prosthodontists were having a higher ratio of musculoskeletal symptoms at lower back region.(4)

A study conducted by Gopinadh A showed that prevalence of pain according to different specialities showed that general dental practitioners are more affected followed by prosthodontics, oral surgeons, endodontics and periodontology.(5)

The United States Bureau of Labor Statistics has reported that the most prevalent and fastest growing occupational injuries are repetitive stress injuries (RSI), which occur when stress and fatigue overpower the body's natural ability to heal itself. Much has been written about repetitive stress injuries experienced by computer operators, such as carpal tunnel. Also, repetitive stress injuries should be acknowledged for prosthodontists and the technicians; especially as dental laboratory procedures move towards CAD/CAM technology. This technology requires utilization of a computer mouse for extended periods of time.

The tasks performed at the fixed prosthodontic bench also require working with fine tools for waxing a tooth, trimming dies, spruing, fitting, finishing and polishing a crown. This requires sitting for an extended period of time and require gripping small diameter instruments.(6)

In a study, the Nebraskan dentists reported that crown and bridge work was most likely to evoke altered sensations in their upper limbs.(7) B. Valachi and Keith Valachi stated that effective and efficient needs can be met by the design of the workplace. Huge variety of equipment is available to ensure correct posture and good wrist position, wrist and forearm supports, splints and braces, work surfaces, chairs, and other

innovative devices. Werner RA and Armstrong TJ stated that it is imperative to take care to adjust equipment to avoid stress from awkward body positioning and wrist angles. (8)

The overstrained and awkward postures are responsible for back pain, repetitiveness for neck and shoulder disorders psychosocial stressors for back, neck and shoulder complaints. These problems can be avoided by increasing awareness of the postures used during work, redesigning the workstation to promote neutral positions, examining the impact of instrument use on upper extremity pain, and following healthy work practices to reduce the stress of dental work on the practitioner's body (Jabbar, 2008).(1)

The Ergonomic Standard mandated by the Occupational Safety and Health Administration (OSHA) recommended that the most efficient and effective way to remedy "ergonomic hazards" causing musculoskeletal strain should be through engineering improvements in the workstation . (9)

High ergonomic efficiency can be detailed in the following fields:(10)

- Instrument Design
- Operator's Position
- Instrument Layout
- Patient's Position

INSTRUMENT DESIGN Handpieces

In Prosthodontics constant prolonged static position during tooth preparation using an airtor handpiece can predispose to Carpel Tunnel Syndrome.

Therefore use automatic handpieces that have following features:

- Lightweight, balanced models (cordless preferred)
- Sufficient power
- Built-in light sources
- Pliable, lightweight hoses (extra-lengths add weights)
- Angled vs straight shanks

- Swivel mechanisms
- Easy activation

Hand Instruments

Various features of dental instruments may have effect on ergonomic issues. These include:

- Size and shape of the entire instrument
- Diameter of the instrument handle
- Surface configuration where the instrument contacts the fingers
- Weight of the instrument including attachments
- Balance and alignment of the instrument
- Manoeuvrability of the instrument in space
- How well the moving parts can be manipulated
- Maintenance of the cutting edge (11)

Mouth Mirror

Good mirrors coupled with proper use can significantly increase one's opportunity to maintain a neutral working posture.(12)

Operator Chair

- Height adjustable backrest
- Armrest Height-Articulation and Angle Adjustment
- Seat tilt tension control
- Armrest width adjuster
- Seat tilt Adjuster(Optimal angle is b/w 5 degrees & 15 degrees)
- Seat Height Adjuster(Depth of dental stool ranges from 14 inches -18 inches

Dental Chairs

It should include the following features:

- Sitting with an angle of 110° or a little higher between lower and upper legs.
- The seat is divided in 2 parts:
 - ◆ A horizontal part at the rear for supporting the buttocks with a minimal length of 15 cm
 - ◆ An oblique front part declining 20° for an equal support of the

thighs

- ◆ Movable front part, an angle of more than 110° between lower and upper legs
- The maximum depth of the seat shall be 40 cm and the width 40 with a maximum of 43 cm.
- A lumbar or pelvic support of 10 to 12 cm high that is adjustable vertically from 17-22 cm and for very tall dentists to 24 cm.
- The pelvic support can rotate around a horizontal axis with an angle of 25° upwards and downwards.
- The upholstery of the seat has to be sufficiently hard with a roughened surface. It has to be firm, depressing only slightly.
- Support has to be given up to a point just before the elbow to maintain the agility of the underarm and hands.
- 8) Width of 10-12 cm and it being not too long.

OPERATOR'S POSITION

The following changes occur when the head is bent forward(14)

- The weight of the head (approximately 9% of the body's weight) is pulled downward
- The rotation point of the head is the first cervical vertebra
- The muscles of the neck and upper back are contracted to keep the weight of the head from falling down
- After certain amount of time, this constant pressure on the neck muscles to hold up the weight of the head can lead to pain.

Alkesson et al, in 1997 evaluated the posture of dentists when working and stated that back muscles of the dentist are under high tension and head is in a flexed position for long periods of time.(15)

In a neutral-seated position, the torso is leaning back slightly between 100° and 110° (90° is vertical), the buttocks, thighs, and legs are supported and the back of the knee is free. The operative

field (the patient's mouth) to be placed at the same height as the practitioner's elbows is held close to the body. This shows that the arms are at 0° from the horizontal axis or 90° to the shoulder.

INSTRUMENT LAYOUT

Dental equipment should be located in a manner which allows you to maintain a neutral working posture. It should require minimum adjustment and effort to access so as to reduce postural deviation while working. Frequently used items should be kept within a "comfortable distance" (22-26 inches for most people) and not above shoulder height or below waist height.

For dental assistant

- The instruments for suction and other instruments with tubing must be positioned as far as possible toward the front of the upper body of the dental assistant.
- Minimum working height of 78 cm and a maximum working height of 116.2 = 116 cm, for use in a sitting and standing position.
- When these instruments are also used by the dentist the reach must fulfill the requirement of being at a distance of 30-40 cm

For the dentist

- Tray for hand instruments to be at a distance of 20 to maximally 25 cm of the body of the dentist
- Minimum working height of 78 cm and a maximum working height of 107 cm for the sitting dentist.
- The distance from the underside of the instrument console to the tray has to be about 9-10 cm.
- The tray holder attached to the unit via firstly, a horizontal arm with a swivel coupling that is placed directly below the console.

PATIENT POSITIONING

Supine positioning of the patient in the chair is usually the most effective way to help to maintain neutral posture. The chair should be raised so the operator's thighs can freely turn

beneath the patient's chair. Clearance around the patient's head should at least allow unimpeded operator access from the 7 to 12:30 o'clock position, for right-handed operators. For most intraoral access sites,

- The maxillary plane should be extended 7° beyond the vertical.
- For treating the maxillary second and third molars, the maxillary plane should be 25° beyond the vertical.
- For the mandibular anterior teeth, bring the patients chin down so the maxillary plane is 8° ahead of the vertical.

Lighting and Magnification

The goal of overhead lighting is to produce even, shadowfree, color-corrected illumination that is concentrated on the operating field. In general, the intensity ratio between task lighting (the dental operating light) and ambient room lighting should be no greater than 3 to 1.6. Furthermore, the light source should be in the patient's mid-sagittal plane; directly above and slightly behind the patient's oral cavity, and 5° toward the head of the operator in the 12 o'clock position. Once the patient and operator are properly positioned, the light source can be left far above the heads of both the operator and assistant because the correct position will require no adjustment during the procedure.(16)

Reduce Eye Strain

Relax the eyes by rubbing the palms together briskly, then placing the warm palms gently over the eyes for 30 seconds.(17)

The Use of Extreme Magnification in Fixed Prosthodontics

The preparation phase of fixed prosthodontic care is technically demanding. Many factors determine the final design of the preparation, including the required reduction of tooth structure, detection of marginal caries, fractures, furcations, and the need for the margins of the restoration to be placed on

solid tooth structure

The dental operating microscope can be used for the entire preparation of a tooth, but some dentists will use loupes for gross reduction of tooth structure before using the microscope to finish the preparation. Alternatively, the lower range of magnification of the microscope (2.5x to 4x) can be used

for delivery of anesthesia and rubber dam placement. An entire quadrant of teeth can generally be seen at this level of magnification. Gross reduction of tooth structure is accomplished using medium magnification (6.4x to 10x), and margins are completed using 16x magnification. After finishing the margins, the preparation is examined at a lower magnification to ensure that no

undercuts have been created.

Clinically, the use of higher magnification for preparation of margins appears to reduce the degree of taper of the preparations. Close attention must be given to the line of draw and parallelism when preparing multiple abutments for a fixed bridge. Otherwise, it is easy to



Figure 1: Quick stretches between appointments

create tooth preparations with divergent tapers, which can affect the path of insertion. The transition from low magnification (for gross tooth reduction) to high magnification (for final placement of the margin), and then back to low magnification (for the final evaluation), ensures that the clinician does not become so focused on the placement of the margin that unwanted undercuts are created.(18)

GLOVES

Gloves are commonly worn due to universal precautions. Gloves must be of proper size, lightweight, and pliable. Poor fitting gloves can cause pain in the hands, particularly at the base of the thumb. This is often due to com-

pression of the tissues when gloves are either too small or too loose as “bunching” occurs. When used for extended periods of time, gloves must be pulled into a working position, which may compress the back of the hand, strain muscles at the base of the thumb, and reduce blood flow to the hand.

BODY STRENGTHENING EXERCISES (VALACHI & VALACHI, 2003)

- 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 CTS

- 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.
- Move the head down slowly and allow the arms and head to fall between the knees; hold for a few seconds; raise slowly by contracting the stomach muscles and rolling up, bringing the head up last.
- Try head rotation for neck stiffness. Head rotation involves tilting the head from right to left, as well as forward and backwards without forcing the motion beyond a range of comfort.



Figure 2 : Various hand and wrist exercises

- Shoulder shrugging can be used to stretch the shoulder muscles that may be stressed from holding oral evacuator, instruments and telephone handset. Pull the shoulders up toward the ears, roll them backward and then forward in a circular motion (Fig.1 & 2).

ASSISTIVE DEVICES

Assistive devices like working splints may provide reprieve for your specific body part stabilizing and preventing movement. The splints are placed after hand washing and prior to glove placement. (19)

POSTURE

Avoid poor posture as this can lead to low back, upper back and neck pain.

CONCLUSION

A thorough understanding of the ergonomics is essential to know about the musculoskeletal problems that could arise because of improper ergonomics in dentistry. This would enable the clinicians to work in a comfortable posture, to lead a healthy life and render appropriate care for the patients in need.

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