INTRODUCTION

Health is wealth. In these fast paced busy lifestyles, we are losing health in a voracious attempt to gain wealth. There is an alarming increase in the work related stress in every field globally. However due to the nature of work in dental practice, there are specific demands in this profession too. Every profession has an occupational environment which has certain risks and hazards associated with it. Dental health care personnel are also exposed to numerous occupational hazards which if disregarded can result in some serious long-term occupational illnesses. Recent advances in techniques and material science have allowed to manage several problems. The developed nations have formulated governing bodies who design definite regulations and systematic protocol to tackle these hazards. Conversely, in a developing nation like ours, where day-to-day practice has its own challenges, dental professionals are yet to reckon the potentially harmful effects.

It has been elucidated in studies that dentists report worse health problems frequently than other high risk medical professionals. An array of occupational hazards are encountered by dental professionals, including but not limited to risk of infections, percutaneous exposure incidents, allergic reactions to toxins in chemicals used, physical injury from noise induced hearing loss, eye problems, peripheral neuropathy due to vibrations, psychological stress, social, financial and legal hazards etc. These potential hazards have a definite negative bearing on the psychological wellbeing of dental professionals. Ergonomics related risk of musculoskeletal disorders (MSDs), MSDs

Dental professionals are constantly exposed to certain occupational hazards owing to their work environment. This wide range of occupational hazards includes the musculoskeletal disorders which markedly affect the long term efficiency and health of the dental health care workers. The effects on overall health and wellbeing are governed the nature of work demands of a dentist. These physical demands when exceed the normal capacity of function, lead to symptoms of muscle fatigue, pain and deformity. These potential problems if left ignored could severely affect the functionality of a clinician. This article briefly discusses the need to review the ergonomic principles to prevent jeopardizing the health of dentists and in turn improve their quality of practice.

Key words: Biocentric, ergonomics, musculoskeletal disorders, occupational hazards, static postures.

MSDs

MSDs are significant physical occupational hazards which include injuries and disorders adversely affecting the musculoskeletal system. It comprises acute as well as chronic injuries affecting the muscles, tendons, nerves joints, spinal discs, and ligaments particularly affecting wrist, fingers, elbow, shoulder, neck and back. The prevalence of musculoskeletal complications in dentists is well-documented. There is a high prevalence of MSDs in India, but it is not well-documented. A survey in Karnataka revealed that at least one-third of the participant admitted to MSDs affecting their routine practice.

The conditions can be mild initially but if adequate measures are not taken timely it may get severe to debilitating. The long term effects of these circumstances can be described as cumulative trauma disorders. The cause of these stress injuries can be attributed to:

- Repetitive movements
- Awkward or static postures for long durations
- Prolonged static postures
- Working in a confined space
- Limitations with the tools and equipment used
- Vibrations.
Repetitive Movements
When same part of the body is used repeatedly, without rest periods, it may cause muscle fatigue, discomfort and pain. Repetitive motions are well evident in every day practice, particularly performing scaling, root planning, during root canal instrumentation. At the same time, the effect will depend upon how frequently is the same repeated, with or without breaks in between and what is the time duration of one particular type of movement.

Vibrations
Mechanical vibration exposure occurs when one must hold vibratory equipment/tools like dental hand pieces or mechanical scalers for prolonged periods of time. These Vibrations transmitted may lead to cumulative traumas. These microtraumas add up over time and cause “wear and tear” on the muscles, tendons, nerve tissue and associated structures. Fatigue develops in muscles of the hand due to over stimulation by vibrations of hand instruments. This requires the operator hold the instrument harder with more pressure to counter these vibrations during use. The wide use of hand tools in dentistry work can cause a chronic extrinsic compression of the nerves present in the hand, and therefore may cause an entrapment of digital nerves. Neurological symptoms are of consequence in professions where tactility and manual dexterity are relevant.

Awkward Postures
Mostly a “neutral” posture implies that the joints are not used at the extreme limits of their range of motion and muscles holding them are not overstrained. As the joint deviates farther toward extremes of its range of motion, the posture becomes awkward imbalanced, leading to more strain on muscles and their associated structures. A distinct reduction in strength is seen, as illustrated in Figure 1, where the different positions of the wrist can be seen.

Prolonged Static Postures
Static postures imply the positions where the operator does not change positions for considerably long time. When any stationary continuous posture without intermission is assumed for a long duration, the blood supply to tissues slows down. This causes a reduction in the nutrients and oxygen supply resulting in lactic acid accumulation and other metabolites, which can cause pain. Studies have indicated that in as much as 37.7% of work time, the dentist’s posture is strained, which induce stress injury on the musculoskeletal system. Prolonged static postures can lead to pain and muscle imbalances, nerve compression, spinal degeneration. To counteract the increased stress on one group of muscles, other groups of muscles become functional and substitute the same.

Several studies have illustrated that dental health care workers show symptoms of MSDs affecting back, neck shoulders and wrists related to sustained work positions. Low back pain is the most prevalent musculoskeletal complaint. Neck and shoulder complaints were less prevalent than back pain. Hand/wrist complaints among dentists and especially dental hygienists are highly prevalent.

One can reduce the risk of developing MSDs by incorporating simple Ergonomic principles in clinical practice. “International Ergonomics Association” defines ergonomics as “the 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 in order to optimize human well-being and overall system performance.”

Ergonomics is the relationship of the worker with their occupational environment. Ergonomics is a way to work smarter with greater efficiency. Suitable ergonomic design is essential to avoid repetitive strain injuries, which overlap with time and progressively cause a long-term disability. The design of workplace, position of dentist, position of patient, type of equipment, techniques of using equipments and tools are among the several factors that have an impact on the health of dentist. They can be modified to optimize the productivity of the practitioner. The goals of applied ergonomics in dentistry can be summarized as follows:

- Decrease work-related pain and injuries
- Increase efficiency
- Better musculoskeletal health
- Increase comfort
- Decrease work related stress
- Enhance quality of life
- Improve career span

Figure 1: Wrist strength and posture
Source: Agr Ability Project 2002 What to look for when selecting or modifying hand tools to provide a better fit with the user. Available online: http://uwadmweb.uwyo.edu/agrability/Fact_Sheets/What_to_Look_for_in_Hand_Tools.pdf
CLINICAL GUIDELINES

Dentist’s Seat

A dentist’s seat should have a rigid base must to prevent tipping. The base should be rigid yet compact enough to allow proper functioning such as to allow free access to foot controls of dental chair, non-interfering with chair’s base and do not hinder the freedom of movements of operator’s feet. With the adoption of digitized control panels on chair and base – free dental chairs, the foot interference is less of a problem. The seat height should also be modifiable. With feet properly supported on the ground, the angle between back and thighs should be 90-110°.[17] Flat footwears should be chosen for workplace. Researchers recommend height adjustment according to clinician’s short and tall stature. The clinician’s seat should be in a range where their thighs are nearly parallel to the ground and feet are fully supported.[17] If the arm rest for elbow support is incorporated in the doctor’s stool, it should be such that the elevation of shoulders should not occur while using these elbow rests.[18] At the same time, the rests should not interfere with the access to the patient. Maintain an erect posture and adjust seating to minimize forward or lateral bending. In a seated posture, bending and twisting motions of the spine significantly increase the pressure in the lumbar discs when compared with standing.

Dental Chair

Optimum position of the oral cavity of a patient seated in the dental chair is considered to be at the level of the seated clinician’s heart. Adjustments can be made to facilitate functionality according to maxillary or mandibular arch as the area of working. Any position at higher or lower level causes strain and fatigue of shoulders. It will unnecessarily force the dentist to assume awkward bending or leaning forward. The body should be in a relaxed, natural position. Arms should not be elevated and tensed. The elbows and upper arms should stay close to operator’s body. The elbow and forearm should be at right angle to each other. Operator should be able to move freely with legs beneath the chair’s headrest to prevent from undesirable forward leaning toward patient. The base-free dental chairs these days offer a better leg room. There should be sufficient room for the stool to move around in different O’clock positions. The use of retractable overhead variety of attachments is however controversial. The added weight of cords and resistance offered can often influence the muscle fatigue experienced by a clinician.

Instrument Design and Selection

Material science has progressed in leaps and bounds. There is a large influx of manufacturers with a huge variety of instruments available in the market. The clinician must carefully select the instruments based on its specific utility design and handling characteristics. Dong et al. in 2006 had pointed that the diameter of most dental instruments could range between 5.6 and 11.5 mm. Large diameters (up to 10 mm) of handles diminish the muscle load, however no advantage is added beyond 10 mm size. Similarly, they stated that instruments with lighter weight (up to 15 g) also reduce the load on muscles during pinch grasp.[20] “No. 4” handle lessens pinch gripping and can be used for most instruments.[18] Round handles with patterns, grooved or textured surface offer a good grip without compromising on tactile sensation. Using a pen grasp and modified pen grasp with three digit support offers optimum balance and workability. It takes more effort to work with dull instruments and hence their sharpness should be maintained on a regular basis. Sharp edged instruments manufactured from carbon steel make could be more efficient. Tungsten Carbide cutting edges are preferred. Burs and files should be discarded timely before they are overused. Lightweight, cordless hand pieces with built-in light sources should be preferred. Angled or straight shank variety should be chosen according to use. Properly fitted gloves, preferably right and left handed designs should be used for better performance.

Equipment Placement

Equipment layout should be such that minimum adjustment and effort is needed to access it. The size of the dental chair’s instrument tray should allow free movement of hands to access instruments or material. The accessory instrument trolleys on the operator’s working side offer a good solution to it. Fixed cabinets on non-working side can be used to keep armamentarium seldom required by dentist himself. The necessary items of regular use should be kept in a “comfortable distance” (22-26 inches for most people) and between the shoulder height and waist height so that extending upwards or bending downwards is minimized. Frequently used items should be kept at horizontal arm’s distance. Items used less frequently required can be placed within the maximal horizontal reach. The Figure 2 illustrates the normal and maximum work field region demonstrated by fully extended arms.

Figure 2: Preferred working area of the hands

Visibility Accessibility and Illumination
Good quality mouth mirrors, when used appropriately, can help maintain a neutral working posture. Indirect vision using mouth mirrors can significantly prevent awkward body positioning. In addition, they can be used to reflect light, as well as retract tongue or cheek. However, handles should be avoided to use for retraction as they can be hurtful. Proper retraction methods should be employed. Using dulled, or scratched mirror surfaces cause undue strain on the eyes while obscuring the correct details as well. Operator has a variety of anti-fogging, double sided, scratch resistant and disposable ones to select from. Using compressed air improves the clarity of the operating field as well as it enhances the ability to appreciate color and differentiate textures of tooth surfaces, restorations and mucosal surfaces. Dentists are often compelled to bend closer to the oral cavity for better visual acuity during intricate procedures. Surgical magnification can be instrumental in reducing compromised undesirable working postures. There are stationary, or fixed microscopes mounted on wall or ceiling used for high magnification. Surgical Loupes with lower magnification levels attachable to a head band or mountable on operator’s glasses can dramatically augment their visual competence thereby improving the working posture. Proper lighting is of paramount importance during any clinical procedure. Ideally it should create an uniform, shadow-free, color-corrected illumination of the operating filed. Normally the light source should be placed directly above and slightly behind the patient’s oral cavity. To minimize shadows, the trajectory of the light beam should be as close along as the line of vision of the operator. Use of two light sources has also been suggested.

Work Techniques
Varying one’s positions facilitates better visual focus in the operating area. It shifts the workloads to different muscle groups. This muscle substitution by continually changing positions is very effective in preventing muscle fatigue, transient ischemia and pain. While moving around the patient’s head, optimum working range is from 7 to 9 O’clock. Nevertheless, this often necessitates lifting of elbow as well as twisting of neck and torso. Adopting a conservative range from 10 O’clock to approximately 12:30 can be helpful. Majority of the techniques incorporate the use of similar repeated patterns of muscle activity. It increases the rate of muscle fatigue and risk of development of an MSD. Researchers like Meador (1997) have suggested a shift toward “biocentric technique.” This technique tries to maintain joint neutrality by allowing workload to transfer from one group of muscles to the other, essentially from smaller hand muscles to larger upper arm and shoulder muscle group. Thus, force gets distributed. This technique permits a neutral position of upper extremity to be maintained where shoulders are level, upper arm stays vertical, and forearm is horizontal to be maintained.

Take Home Tips
If musculoskeletal symptoms appear, seek professional consultation from a physician. Intelligent and meticulous patient management can be helpful. Modifying the work schedule to include short “stretch break” periods between patients will prevent muscle fatigue. It increases blood flow to muscles, replenishes the nutrient supply and allows the stressed parts to recompose. Incorporate appropriate finger rests where required. One should change posture as frequently as one can to prevent muscle ischemia associated with static postures. Schedule the appointments such that easy and difficult, lengthy procedures are alternately placed. Give more treatment time for more difficult patients. One can reserve the dominant hand for precise operative procedures while try to utilize the other hand for accessory tasks like lifting objects, etc.

CONCLUSION
An ounce of prevention is better than a pound of cure. Considering the impact of ergonomically designed and chosen equipment on the efficiency one must modify the workplace to reduce the possibility of injuries. Paying attention to body symptoms does pay in the long run. Among the various occupational hazards, MSDs are very much at the disposal of the clinician himself. Adopting newer techniques, armamentarium and work strategies can definitely prevent detrimental changes in the future.

REFERENCES


