

An Insight to Ergonomics in Dental Practice

Abstract

Three out of four dental professionals experience chronic neck and shoulder pain that can affect quality of life, productivity, or career longevity. Proper movement in the neck and shoulder is essential to the delivery of dental care and in performing everyday activities. The aim of our review is to summarize and ascertain dental practice-related disorders influencing the physical and psychological health of practitioner. Also we would like to highlight the most vulnerable systems of the dental professional and to survey the best methods to overcome these ailments. There is growing body of evidence that suggests surprisingly high vulnerability within the dental profession to certain disorders and afflictions that can be categorized as practice-related. In different countries dentists reported having poor general health and suffer from various health-related problems. To enjoy and be satisfied with their professional and personal lives, dentists must be aware of the importance to maintain good physical and mental health.

Key Words

Dentist's general health; physical disorders; dental ergonomics

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INTRODUCTION

Dental work includes a wide range of physical hazards. Musculoskeletal disorders are one obvious hazard. They may be caused by exposure to high precision work with long-lasting static loads in the cervical and shoulder regions.^[1] Moreover, dentistry is an occupation with high psychological demands and with other ergonomics risk factors, which require effective ergonomics interventions to solve those problems.^[1,2] According to Pollack the key aim of ergonomics for dentists is to allow them to achieve optimum access, visibility, comfort and control in clinical work.^[3] The concept of ergonomics was introduced into dentistry in order to improve the dental profession's working conditions; the work concepts included sit-down and four-handed dentistry.^[4]

What is ergonomics?

Ergonomics is a science concerned with the 'fit' between people and their work. It puts people first, taking account of their capabilities and limitations. Ergonomics aims to make sure that tasks, equipment, information and the environment suit

each worker. To assess the fit between a person and their work, ergonomists have to consider many aspects. These include:

- The job being done and the demands on the worker;
- The equipment used (its size, shape, and how appropriate it is for the task);
- The information used (how it is presented, accessed, and changed);
- The physical environment (temperature, humidity, lighting, noise, vibration); and
- The social environment (such as teamwork and supportive management).

Ergonomists consider all the physical aspects of a person, such as:

- Body size and shape;
- Fitness and strength;
- Posture;
- The senses, especially vision, hearing and touch;
- The stresses and strains on muscles, joints, nerves.

Ergonomists also consider the psychological aspects of a person, such as:

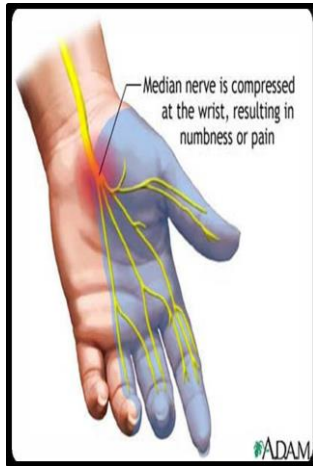


Fig. 1

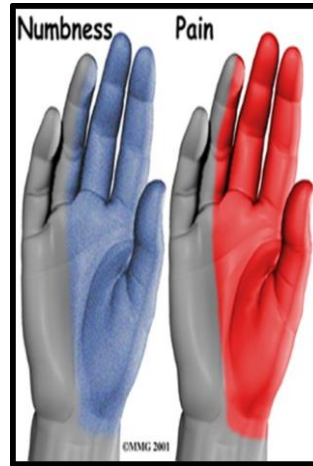


Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6



Fig. 7



Fig. 8



Fig. 9

- Mental abilities; personality; knowledge; and experience.

By assessing these aspects of people, their jobs, equipment, and working environment and the interaction between them, ergonomists are able to design safe, effective and productive work systems.

Why is ergonomics important?

Industries increasingly require higher production rates and advances in technology to remain competitive and stay in business. As a result, jobs today can involve:

- Frequent lifting, carrying, and pushing or pulling loads without help from other workers or devices;

- Increasing specialization that requires the worker to perform only one function or movement for a long period of time or day after day;
- Working more than 8 hours a day;
- Working at a quicker pace of work, such as faster assembly line speeds; and
- Having tighter grips when using tools.

These factors especially if coupled with poor machine design, tool, and workplace design or the use of improper tools create physical stress on workers' bodies, which can lead to injury. A dramatic increase in MSDs began in the 1970s when these disorders increasingly appeared on companies' injury and illness logs. OSHA cited companies for hazardous workplace conditions that caused problems such as tendinitis, carpal tunnel syndrome, and back injuries. The Bureau of Labor Statistics, an agency of the U.S. Department of Labor, recognizes MSDs as a serious workplace health hazard. These injuries now account for more than one third of all lost-workday case.^[5] If work tasks and equipment do not include ergonomic principles in their design, workers may have exposure to undue physical stress, strain, and overexertion, including vibration, awkward postures, forceful exertions, repetitive motion, and heavy lifting. Recognizing ergonomic risk factors in the workplace is an essential first step in correcting hazards and improving worker protection. Ergonomists, industrial engineers, occupational safety and health professionals, and other trained individuals believe that reducing physical stress in the workplace could eliminate up to half of the serious injuries each year. Employers can learn to anticipate what might go wrong and alter tools and the work environment to make tasks safer for their workers.



Fig. 10

What causes work-related MSDs?

Work-related MSDs occur when the physical capabilities of the worker do not match the physical requirements of the job. Prolonged exposure to ergonomic risk factors can cause damage a worker's body and lead to MSDs. Conditions that are likely to cause MSD problems include the following:

- Exerting excessive force;
- Excessive repetition of movements that can irritate tendons and increase pressure on nerves;
- Awkward postures, or unsupported positions that stretch physical limits, can compress nerves and irritate tendons;
- Static postures, or positions that a worker must hold for long periods of time, can restrict blood flow and damage muscles;
- Motion, such as increased speed or acceleration when bending and twisting, can increase the amount of force exerted on the body;
- Compression, from grasping sharp edges like tool handles, can concentrate force on small areas of the body, reduce blood flow and nerve transmission, and damage tendons and tendon sheaths;
- Inadequate recovery time due to overtime, lack of breaks, and failure to vary tasks can leave insufficient time for tissue repair;
- Excessive vibration, usually from vibrating tools, can decrease blood flow, damage nerves, and contribute to muscle fatigue.
- Whole-body vibration, from driving trucks or operating subways, can affect skeletal muscles and cause low-back pain; and
- Working in cold temperatures can adversely affect a worker's coordination and manual dexterity and cause a worker to use more force than necessary to perform a task.
- These risk factors, either alone or in combination, can subject workers' shoulders, arms, hands, wrists, backs, and legs to thousands of repetitive twisting, forceful, or flexing motions during a typical workday.
- To contribute to MSDs, however, these risk factors must be present for a sufficient duration, frequency, or magnitude.

What types of work are most likely to pose ergonomic hazards?

MSDs affect workers in almost every occupation and industry in the nation and in workplaces of all sizes. The disorders occur most frequently in jobs that involve: Manual handling, Manufacturing and production, Heavy lifting, Twisting movements, and

production, Heavy lifting, Twisting movements, and Long hours of working in awkward positions.

How do I know if I have an MSD?

You could have a work-related MSD if you experience any of the following (Fig.1 to Fig. 5):

- Numbness in your fingers,
- Numbness in your thighs,
- Difficulty moving your finger,
- Stiff joints, or
- Back pain.

How can ergonomics help my workplace?

Providing a workplace free of ergonomic hazards can do the following:

- Lower injury rates as MSD incidences go down;
- Increase productivity by making jobs easier and more comfortable for workers;
- Improve product quality because fewer errors will be made when using automated processes that demand less physical effort;
- Reduce absences because workers will be less likely to take time off to recover from
- Muscle soreness, fatigue, and MSD-related problems;
- Reduce turnover as new hires are more likely to find an ergonomically designed job within their physical capacity;
- Lower costs as workers' compensation and other payments for illness and replacement workers go down; Improve worker safety; Increase worker comfort; Reduce worker fatigue; and Improve worker morale.

How can ergonomics principles adopted in dental practice..

Ergonomics in dental practice:

1: PATIENT CHAIR:

Goal: promote patient comfort, maximize patient access; Looks for: stability, pivoting or drop-down arm rests (for patient ingress/egress); Supplemental wrist/forearm support (for operator) (Fig. 6).

2: TOOL/INSTRUMENT DESIGN

Goal: reduce force exertion; maintain hand/wrist in neutral posture; Considerations: overall size/shape, handle size/shape, weight, balance, maneuverability, ease of operation, ease of maintenance.

3: MAGNIFICATION INSTRUMENTS

Goal: improve neck posture, provide clearer vision; Considerations: work distance, depth of field, declination angle, convergence angle, magnification factor, lighting needs (Fig. 7).

4: WORKSTATION NEEDS

Ensure: instruments, materials, medications etc, are accessible while seated; Hoses are positioned away from the body; Set up can be adopted by different operators (Fig. 8 & Fig. 9).

5: OPERATOR CHAIR

Goal: promote mobility and patient access, accommodated different body sizes; Looks for: stability (5 legged base), lumbar support, hands free seat adjustment, adjustable foot rests, adjustable wrap-around body support, seamless upholstery.

6: HAND INSTRUMENTS

Look for: hollow and resin handles, round, knurled or compressible handles, carbon steel construction (for instruments with sharp edges).

7: POSTURE AND POSITION

Goal: avoid static and/or awkward posture; Potential strategies a) Position patient so that operators elbows are elevated no more than 30 degrees, b) Adjust patient chair when assessing different quadrants; Alternate between standing and sitting (Fig. 10).

DISCUSSION

Good working ergonomics is essential so that work capability, efficiency and high clinical level of treatment can be maintained throughout the working life of dental professionals.

"Learning by experience often is painful-and the more it hurts, the more you learn."- Ralph Banks

The neck and shoulder are intimately connected and profoundly influenced by each other via the musculoskeletal and neuromuscular systems. Proper movement in the neck and shoulder is essential to the delivery of dental care and in performing everyday activities. For dental professionals, maintaining optimal neck and shoulder musculoskeletal health means understanding the unique muscle imbalances to which you are prone and how various working postures, positions, adjustment of ergonomic equipment and exercise can positively or negatively affect your musculoskeletal health. Studies indicate that strategies to prevent the multifactorial problem of dental operators developing musculoskeletal disorders exist. These strategies address deficiencies in operator position, posture, flexibility, strength and ergonomics.^[6,7] A study in Poland showed that dentists work in conditions which generally produce disorders of the musculoskeletal system. The long working time in the course of a day is used irrationally from the point of view of ergonomics, and over the years consequently increases the

number of disorders of the musculoskeletal system.^[8] The study in England exhibited high overall burnout in 10.6 percent of examined dentists. Emotional exhaustion was found in 25.53 percent, depersonalization - 8.88 percent and reduced personal accomplishment in 34.42 percent of dentists.^[9] When the Spanish dentists were questioned, high values were detected in emotional exhaustion - 54.3 percent, depersonalization - 55.6 percent; personal achievements - 6.9 percent. Gender differences in burnout among dentists do exist. Male dentists reported a higher score of depersonalization than did female dentists.^[10,11] However, results indicate that underlying factors, such as working hours, have a profound effect on these differences.^[10] Men work more hours and work part time less frequently.^[12] Dentists are not unique experiencing high overall burnout. Very similar data is presented among all primary care practitioners: 19% of respondents had a high score for emotional exhaustion, 22% had a high score for depersonalization or cynicism and 16% had a low score for professional accomplishment, 32% had a moderate degree and 4% had high degree of burnout.^[13] A high degree of burnout is associated with the male sex, practicing in a rural area, and excessive perceived stress due to global workload, patient's expectations, and difficulties to balance professional and private life, economic constraints in relation to the practice, medical care uncertainty and difficult relations with non-medical staff at the practice.^[13] Recent findings suggest that burnout has features of maladaptive coping in the short term but is, paradoxically, protective in the longer term.^[14] There is a relationship between emotional load and volume of patients treated. Depersonalization levels decrease with age and it could be due to a number of factors - socialization skills increasing with age, a slowing of pace of work which allows more personal contact, or the establishment of personal relationships with patients over time.^[15] Nervous psychological state, tension, depression and others signs of psychological impairment also has to be taken into account when talking about job related stress in dental practice. A huge study in England shows amazing results: sixty percent of general dental practitioners feel nervous, tense or depressed, 58.3 percent reported headache, 60 percent reported difficulty in sleeping at night and 48.2 percent reported feeling tired for no apparent reason. Levels of minor psychiatric symptoms were high, with 32.0 percent of cases identified.^[16] A study of Sweden

general practice dentists revealed that females constitute one-quarter of all dentists. These female dentists suffer from many problems relating to their psychosocial working conditions. There are wide discrepancies between their perception of the ideal job situation and reality.^[17] Physicians, who report high levels of work stress, also report lower levels of marital satisfaction and a higher prevalence of psychiatric symptoms.^[18] Dentists are much like physicians in their reports of overall work stress, and the similarities and differences regarding specific stressors suggest these professions are very alike in reporting the stresses of professional practice.^[18] As mentioned above studies indicated the occupational health knowledge gained from school is erratic. The curriculum reform should be developed. The practitioner is recommended to be actively concerned about problems. Numbers of percutaneous injury show that dental practices should have a comprehensive written program for preventing needle stick injuries that describes procedures for identifying, screening and, when appropriate, adopting safety devices; mechanisms for reporting and providing medical follow-up for percutaneous injuries; and a system for training staff members safe work practices and the proper use of safety devices.^[19] In order to avoid part of musculoskeletal disorders among dentists altering position between sitting and standing is recommended.^[20] A thorough understanding and controlling of the underlying physiological mechanisms leading to them is necessary to develop and implement a comprehensive approach to minimize the risks of a work-related injury. Dentists must be highly aware of the importance of maintaining good physical and mental health to enjoy and be satisfied with their professional and personal lives.

CONCLUSION

In different countries dentists reported having poor general health and suffer from various healths' related problems. The dentistry has always been known as uneasy occupation therefore one must take into account serious difficulties before attending course. First of all, students must be aware of the health risks in dentist's job. Talking about musculoskeletal disorders it might be assumed that knowledge in ergonomics may be of some use. Secondly, all sorts of protection must be used during treatment in order to prevent infectious diseases and other injuries. Furthermore, dentists must be taught about coping with stress patterns.

There are some points in preventing psychological discrepancies. To enjoy and be satisfied with their professional and personal lives, dentists must be aware of the importance to maintain good physical and mental health. It is important to enjoy their lives, exercise physically, have a hobby, create a harmonious family, communicate with colleagues and keep learning all their lives. Keys to success in preventing neck and shoulder injuries and pain include maintaining a neutral head posture, maintaining a neutral shoulder posture with the patient positioned at an appropriate height, using chairs with armrests, developing muscle endurance for specific neck and shoulder muscles, using indirect vision, using loupes or procedural microscopes, as well as taking frequent breaks and stretches.

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