ASPECTS OF MUSCULOSKELETAL PATHOLOGY RELATED TO DENTISTS' ACTIVITY: A REVIEW

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Abstract: *According to the publications in this field, musculoskeletal disorders are widely spread among dentists and may cause in time severe injuries that can lead to work interruption due to medical causes. They may affect various structures such as: muscles, ligaments, tendons, nerves, joints and intervertebral disks, leading to back pain or thoracic pains, herniated disk, pain in the cervical spine, limitations in neck rotation movements, pain and decreased mobility at the level of scapular-humeral joint, carpal tunnel syndrome, tendinitis etc. The present paper reviews studies concerning musculoskeletal disorders in the dental practice, because a better understanding of the professional risks in this field, the injury mechanisms and the prevention methods may lead to a better health condition of dental practitioners.*

INTRODUCTION

Musculoskeletal problems hold first place in many countries' occupational pathologies.(1) During his activity, the dental practitioner adapts the whole posture to allow maximum visibility and unobstructed access to the work site. The aim is to avoid errors during dental manoeuvres that may lead to undesired tissue damage. In this context, often due to fatigue at the end of the activity or due to the concentration of total attention on labour performed in the mouth, the doctor adopts unbalanced positions that excessively overload some parts of the body, due to the extensive and forced muscle contraction. For these reasons there is a high risk for dental practitioners to develop chronic musculoskeletal disorders. The studies conducted so far have revealed that even from the university, students in dentistry present postural and musculoskeletal impairments (2), as they frequently adopt inappropriate postures or are doing movements causing non-physiological musculoskeletal stress, discomfort and fatigue.

PURPOSE

The purpose of this article is to offer to the dental practitioner a global image about the extent of musculoskeletal pathology in clinical dental practice, to understand the severe health implications that may develop, insisting on the most common mistakes that dentists make from the ergonomically point of view. Also, we intend to present a synthesis of some simple measures that each practitioner can take to avoid such a pathology which sometimes may lead to a premature activity cessation.

MATERIALS AND METHODS

A literature review was conducted which focused on peer-reviewed journals with articles concerning the musculoskeletal disorders in dental practice. English and Romanian language reports were included.

The searches were accomplished using Google Scholar, typing in the subject field a combination of terms like "dentist", "dental practitioner", "musculoskeletal", "disorders", "occupational health", "ergonomic", and "dentistry". Most articles were published after year 2000, but there are some after 1990. We included several extended reviews.

RESULTS AND DISCUSSIONS

Pain in the lower and upper back proved to be a frequent health problem among dentists. For example, a study of dentists in Israel revealed that 55% of these patients had musculoskeletal pain.(3) A survey of dentists in Denmark has revealed that 50% had back pain and 65% reported pain in the neck and/or scapular-humeral region.(4) Also, pain in the lower and upper back and disk herniations are part of the conditions that lead to interruption of professional activity and absence from work. Disk herniation may occur in a milder form, when the disk bulges and puts pressure on the dura mater, resulting in low back pain, or can be a complete herniation that makes direct pressure on nerve roots, causing pain, paresthesias and muscle weakness in the innervated territory. Depending on the case, it is possible that the patient remains with a chronic pain (mechanical pain in the lower back) and difficulty in performing certain tasks such as bending, lifting or driving a car for long distances.(5)

Problems in the cervical region were also commonly reported among dentists as follows: 58% of dentists in Queensland Australia (6), 65% of dentists in Saudi Arabia (7), 65% of dentists in Denmark (4), 72% of dentists in Taiwan (8) and 38% of dentists in Israel.(3) Symptoms include a stinging form, which frequently radiates to the scapular-humeral region, with feelings of stiffness and limitation of head rotation motion. In some severe cases intervertebral disk prolapse can occur, which can then be accompanied by degenerative phenomena (cervical spondylosis).(9) The problems in the neck region have frequently as etiologic factors uncomfortable positions of the body and head, forced supported, adopted in order to allow direct visibility across different regions of interest in the oral cavity of the patient.

The pathology of the scapular-humeral region can be

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linked to cervical pathology or can develop independently thereof. Most often it affected supraspinatus tendon. The most common pathology at this level is tendinitis, but partial or total muscle ruptures or degeneration may also appear Tendinitis generally causes pain and discomfort increased by movement. Muscle ruptures cause lack of muscle strength in abduction, old fractures or degenerative lesions can cause pain in abduction, which decreases if abduction goes below 90^0.(10) Tendinitis may have as etiology a forced movement, high in intensity, like for a difficult extraction or eccentric positions, when the arms are raised above the elbow and the shoulder, and maintained for a long time.(11)

Carpal tunnel syndrome is the compression of the median nerve of the wrist inside the carpal tunnel. Among the determinants, we can mention: manual force working, repetitive movements, using hand and fingers for a long time every day and working with tools that produce vibrations or pursuit in an environment with low temperatures. Rapid movement of the tendons in synovial sheath may cause the inflammation and synovial fluid accumulation. In time even thenar muscle atrophy can occur, tingling in the thumb, index, middle and half of the ring finger, pain at night, sometimes causing violent awakening; and pain in handling specific instruments.(12) The affected area is edematiated and sensitive to the touch, while the pain is caused by certain gripping movements. De Quervain tenosynovitis affects the extensor tendons of the first dorsal compartment of the hand, the short extensor and the long abductor of the thumb, causing painful extension movements and difficulty in handling instruments because it affects rotation movements and lateral bending of the wrist.(13)

In 2014, we conducted a study on 100 Romanian dentists aged between 25 and 78 years old. Most of them accused pain in the lower back (69%), 55% in the cervical region, 48% in the scapular-humeral region, 46% on the wrist or hand, 45% in the upper back, 31% in the knees, 19% in the thigh/hip, 18% in the ankle / foot.(14)

An interesting study was that of Jonker et al. (15) who used a device connected to a computer to perform inclinometry measurements on dentists working during 4 hours. Different sensors were attached directly to the skin, on their head, arm and back. An initial individual calibration was carried out in certain standard positions, so they could get accurate, quantifiable and objective data relating to the position taken by each doctor during the various manoeuvres.

The Spinal mouse (Spinal Mouse® (Idiag, Volkerswill, Switzerland)) is a device that can provide two-dimensional information on the extent of damage to the spine thoracic and sacral, and can be used in the investigation of musculoskeletal problems. It is a noninvasive technique, without irradiation with ionizing radiation (X-rays). It can provide data about the spine alignment (measuring the global and segmental angles in sagittal and frontal plane), data about posture and spinal mobility and about the features and performance of the spine. A device is applied and guided along the spine, in various degrees of flexion. The Spinal Mouse® program analyzes and interprets the results, highlighting hypo or hyper mobile vertebral junctions or deviations from reference values (16). A study published in 2014 wanted to test the test-retest reliability of this possible new tool for investigating musculoskeletal disorders of the spine region. The results obtained showed that this new non-invasive method has good test-retest reliability for measurements in the sagittal plane, to assess the deformations, curvatures and the spine mobility.(17)

The works on dental office ergonomics highlights the importance of adopting a posture in which the physiological curvature of the spine maintains its natural angulation and that is in balance towards the center of gravity. In this situation the spine is supported mainly by bony structures of the vertebral bodies. When the physiological curves are exaggerated or flattened, the role of supporting the spine turns more and more to the muscles and tendons.(11) The curvatures of the spine are interrelated and when one of them changes, it changes the one above and the one underneath. When the dentist sits on the seat without having the back sustained, the lumbar physiological lordosis tends to flatten. In this situation the spine supporting role of the skeletal bones becomes weaker, in favour of the muscles and ligaments of the cervical spine, resulting in charging these structures with the emergence of strains on them, even the occurrence of trigger points. Flattening the lumbar lordosis may promote migration of the intervertebral disk to posterior. In time, the disk wall may weaken and the disk herniation occurs.

Essential is also to keep a correct position on the cervical lordosis. The position with flexed neck and head tilted above is one of the most common mistakes among dental practitioners who adopt this position to optimize visibility. In this position the cervical vertebra are no longer able to support alone the weight of the head and will require the overuse of muscle groups of the upper thoracic and cervical region, which will have to contract steadily. This situation may lead in time to the emergence of a syndrome of neck tension, accompanied by headaches, chronic pain in the neck, shoulder, interscapular region and sometimes pain can radiate along the arms.(11) The constant contraction of neck muscles can favor the weakening, degeneration and herniation of the cervical intervertebral disks.(18)

A too anterior head position can also cause rounded shoulders. A static position with arms raised or abducted more than 30^0 lead to decreased blood flow to the supraspinatus muscle and its tendon.(19) Prolonged arms abduction can lead to the trapezius muscle myalgia, accompanied by chronic pain and the appearance of triggers pain points.(20)

There are certain strategies related to posturology that can reduce the musculoskeletal risk of dental professionals. These include:

- maintaining the lumbar physiological curvature by tilting forward the seatback with 5^0-15^0, which determines hips placement slightly above the knees, a position that allows an over 90^0 angle between thighs and trunk, favoring proximity to the patient without requiring bringing shoulders forward and increasing the thoracic kyphosis. Chairs that are not able to tilt the seatback forward can be adjusted using an ergonomic pillow positioned in the lumbar area;(11)
- feet must be firmly positioned on the ground so they can support part of the weight that is directed towards, due to the highest hips position compared to the knees. Studies have shown that maintaining the physiological curvature reduces the incidence of lumbar pain in the lower back;(21,22)
- using magnifying glasses, enables a better positioning of the doctor, accompanied by decreasing of the cervical and lumbar pain.(23) Magnification systems should allow maintaining flexion of the neck from the vertical under 20^0, over this value being favoured the emergence of pain in this region;(24)
- firstly fix the doctor's seat to enable a correct and comfortable position and according to it adjust the patient's seat. Most practitioners proceed vice versa. Exceptions can be made for elderly patients or for patients with different disabilities. The armrests should be adjusted and used, because they allow elbows and forearms to stand in a

position that decreases the shoulders' tension and fatigue;(11)

- during the work, the physician must avoid adopting a single static positions and to change often the postural position to switch the postural strain between different muscle groups;(4,11,22)
- alternating seated position with upright position, according to some studies, decreases pain in lumbar region;(4)
- the patient must be positioned at an appropriate height, to avoid performing manoeuvres with lift shoulders and arms in abduction. The patient must be positioned differently for jaw and mandible manoeuvres;
- excessive unilateral twisting movements, have to be avoided because, over time, they can lead to lower back pain. Access to instruments should be easy and if a rotation is necessary, it is recommended to be done by a complete turn with the chair, not just a trunk turn.
- a short 30 seconds break used to perform muscle stretching movements between various manoeuvres, reduces the discomfort felt during daily working activities;(25,26)

CONCLUSIONS

To create a favourable environment for health in the workplace, it is particularly important to apply the concepts of ergonomics, with a functional organization of the dental office and a special attention to posture during activity, with the introduction of relaxation breaks to perform exercises for different most commonly overused muscle groups. Such an attitude will help reducing the incidence of musculoskeletal disorders, maintaining a good professional performance for a longer time, also influencing the quality of the medical services provided.

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