

POSTURE AND VERTEBRAL PATHOLOGY ISSUES IN DENTAL PRACTICE

Cristina Iordache¹, Codrina Ancuța², Eugen Ancuța³, Oana Țănculescu⁴, Zenaida Surlari⁴

¹Ergonomic Department, University of Medicine and Pharmacy "Gr. T. Popa" - Iasi, Romania

²Rheumatology Department, University of Medicine and Pharmacy "Gr. T. Popa" - Iasi, Romania

³Research Department, Cuza-Voda Hospital, Iasi, Romania

⁴Fixed Prosthodontic Department, University of Medicine and Pharmacy "Gr. T. Popa" - Iasi, Romania

ABSTRACT

Both posture and professional movement in a dental office are shaping the behaviour of the musculoskeletal system, particularly the spine. Two different postural methods are commonly used by dental practitioners, including sitting and standing postures. While sitting is considered as ergonomic, the standing position is considered non-ergonomic, with significant consequences on vertebral structures. Objectives: to realize a complex analysis of the disco-vertebral and muscular pathology in relation with either orthostatic or sitting posture in the real life dental practice. Materials and methods: prospective observational trial on 142 dentists classified into groups based on the predominant position during medical activity, either orthostatic or sitting on ergonomic chair. Results: there is no ideal working posture for the dentist; both orthostatic and sitting position with three subtypes (ischiatric, ischio-femoral, ischio-sacral support) result in significant spine morbidity, meaning an increased number of degenerative disco-vertebral pathology identified clinically (local or irradiated pain, restriction of mobility, impaired tolerance for standing position) and imagistic (X-rays, computed tomography, magnetic resonance imaging). Conclusion: It is widely promoted the recurrent alternation of posture in dental practice and an ergonomic attitude at the workplace. An individualized, strictly monitored kinetic activity is mandatory for both prevention and management of static and dynamic spine abnormalities due to repetitive postural stress in dental practice.

Keywords: ergonomics, dental working posture, spine

INTRODUCTION

Since the entire spine, known as the flexible but robust axis of the trunk, is permanently engaged in dental working, ergonomic research is actually dedicated not only to the complex knowledge of vertebral biomechanics, but also to prevention of spine morbidity. On the other hand, it is widely recognized that mechanical conditions of the spine such as disk pathology and osteoarthritis frequently present with substantial and persistent clinical features with subsequent impairment of work

effectiveness, discomfort and depression; moreover, certain complications related on nerves paralysis can easily and significantly interfere with current dental activities.

Ergonomics in dental medicine aims to establish efficient measures in order to remove trigger or risk factors for musculoskeletal pathology, to increase physical and mental wellbeing of the practitioner and to increase the work efficiency by modeling with ability the activity environment.

Within the ergonomic system, the best

relationship between the practitioner and the patient is currently advanced, to obtain a maximal medical quality.

One of the major determinants of the professional performance is directly linked to the fatigue and the wear generated by the postures adopted by dentist during the professional work. Therefore, the specificity of dental work should combine harmoniously with both axial and peripheral joints posture.

Two essential ways to conduct professional activity are currently recognized in dentistry, including the orthostatic and the sitting position, with three different subsets based on the preferred support (ischiodic, ischio-femoral, ischio-sacral).

Recent concerns of ergonomics have brought into attention the attitude of spine during the professional act and the potential relation with musculoskeletal, particularly vertebral, pathology.

Aim

The primary end point of our study was to realize a complex analysis of the disco-vertebral and muscular pathology in relation with either orthostatic or sitting posture in the real life dental practice.

MATERIAL AND METHODS

We have performed a prospective observational study on 142 dentists aged between 25 and 57 years old classified in two main groups based on the posture adopted during current professional practice, comprising either predominant orthostatic position (68 cases, group I) or sitting position (with support ischiatic, ischio-femoral, ischio-sacral) on a ergonomic chair (74 cases, group II).

All subjects were evaluated according to a standard protocol including different clinical parameters related to potential spine involvement (pain, functional limitation, muscle spasm and tolerance of standing position) and imaging parameters (classical

X-rays and modern imaging techniques such as CT scan and MRI scan); the design of the current study has followed the preliminary study performed on 90 cases whose results have already been presented [5].

The following clinical parameters were recorded:

1. *low back pain*, assessing the following items: type (mechanical, inflammatory), irradiation (radiculopathy) and intensity of pain on a 10-cm Visual Analogue Scale (VAS), "0" meaning no pain and "10" the worst pain;
2. *attitude of the spine*, assessing both sagittal and frontal deviations, namely hyperlordosis, kyphosis, scoliosis, kyphoscoliosis;
3. *segmental spine mobility*, especially for the lumbar segment, assessing both flexion (Schober's test) and extension (extension Schober's test), side laterality (index-knee test) and side rotation (right / left);
4. *paravertebral muscle spasm*;
5. *orthostatic tolerance*, classified as maintained (pain present at 2 hours after initiation activity), impaired (pain present 1 hour of activity) and lost (less than half an hour).

Subjects with history of vertebral surgery, rheumatic conditions involving lower limb, sequelae of fracture of the lower limbs and venous pathology were excluded from the study.

Statistical analysis was done in SAS 4.3 software.

RESULTS

Age and sex distribution among groups was comparable: 15 subjects aged between 25 and 30, 19 subjects aged between 30 and 40 years, 14 subjects aged between 40 and 50 and 20 subjects aged over 50 years old have been enrolled in group I, while group II has been made of 20 subjects aged between 25-30 years, 20 subjects aged between 30 and 40, 17

subjects between 40 and 50 years and 17 aged over 50 years.

The clinical analysis was mainly based on physical and functional examination of the spine, the general exam of the musculoskeletal system focusing on the attitude and walking was also performed in all subjects.

Pain

According to a 10-cm pain scale, three main categories have been defined giving a relevant image on posture as the trigger factor for vertebral pain: mild (score of 2 or 3), moderate (score of 5 or 6) and severe pain (score of 9 or 10).

Therefore, regardless of the posture adopted by the dentist during professional activity, a small percentage of participants in this study had a high intensity painful vertebral syndrome (11.76% in group I and 8.1% in group II), while more than one third of the doctors enrolled in group I (35.29%) and about half (47.29%) of those belonging to group II showed moderate score for axial pain. Moreover, a comparable distribution of moderate and mild pain scores (47.29% and 44.61%) in doctors who preferred to carry out the activity in a seated position has also been reported (Fig. 1).

Up to 84% of cases in group I (57 cases) and about half (51.35%, 38 cases) of those from group II have reported mechanical low back pain.

Mono-radicular pain distribution, either L3 and L4 radiculopathy or L5 and S1

radiculopathy, has been identified in one out of 4 physicians who preferred to work in a standing position (25%, 17 cases) and in about one third (31.08%, 23 cases) of those who worked in a seated position. However, distal paresthesia has been reported in up to 10% in both groups (8.82% in group I and 9.45% in group II, respectively).

Attitude of the spine

The abnormal attitude of the spine has been reported in both groups. Thus, comparable data has been demonstrated (t, p<0.05) as follows: upper dorsal kyphosis with small range of curvature in 33.82% cases belonging to the first group and 33.78% of doctors in the second group; scoliosis, the lateral deviation of the spine, in 27.94% cases in group I and 20.27% subjects in group II; kyphoscoliosis, a complex deviation, in 10.29% of doctors working in orthostatic position and 6.75% of those practicing in a seated position; loss of normal lumbar lordosis in 5.88% cases in group I and 9.45% cases in group II, while hyperlordosis has been encountered in only 2.94% and 1.35%, respectively, of physicians enrolled in group I and group II.

Hence, regardless of the position adopted in daily medical activity, orthostatic or sitting, the most requested vertebral segment is the dorsal spine (upper back kyphosis), whereas the lumbar segment is minimally affected in order to strengthen its physiological curvature (Fig. 2).

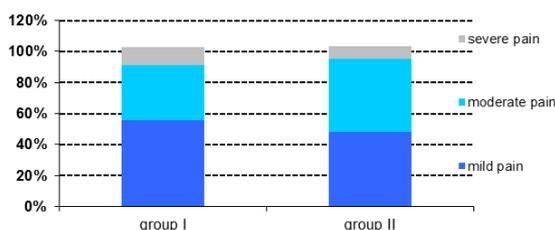


Fig. 1. The distribution of vertebral pain among groups

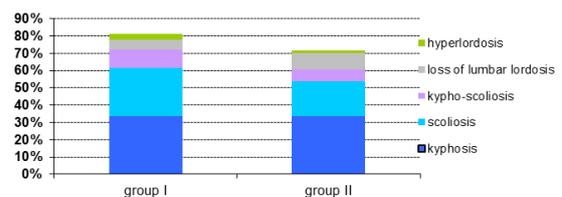


Fig. 2. The changes of the vertebral curves among groups

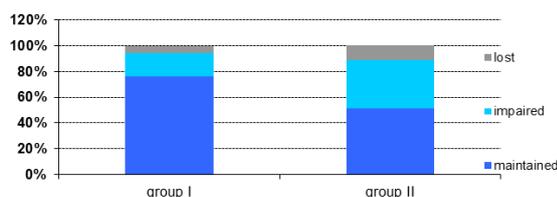


Fig. 3. The orthostatic tolerance based on working position among groups

Segmental spine mobility

Testing the spine mobility has demonstrated the influence of different working postures, especially for the lumbar segment; Schober's test showed moderate restriction (2 to 3 cm) in 35.29% cases practicing in orthostatic position and 39.18% cases in sitting position, while side and rotational movements were minimal intercepted, regardless of study groups.

Paravertebral muscle spasm, either uni- or bilateral, has been demonstrated in up to 17.64% of physicians in group I and 24.32% in group II.

Orthostatic tolerance

Classified as maintained, impaired and lost, the pattern of orthostatic tolerance has been evaluated in all cases as follows: 76.48% maintained, 17.64% impaired and 5.88% lost for standing activity (group I) and 51.35% good, 37.83% impaired and 10.82% lost, respectively for professional activity predominantly performed in a seated position (group II) (Fig. 3).

Several distinct clinical entities have been recognized as a consequence of a complex clinical and imaging study including: chronic low back in 42.64% dentists from group I and 33.78% in group II, respectively, L3 and L4 radiculopathy in 2.94% cases in group I and 8.1% cases in group II, L5 and S1 radiculopathy in 1.47% cases in group I and 4.05% in group II. Myofascial pain syndromes were found in 7.35% of cases in group I and 11.35% in group II B, the data are

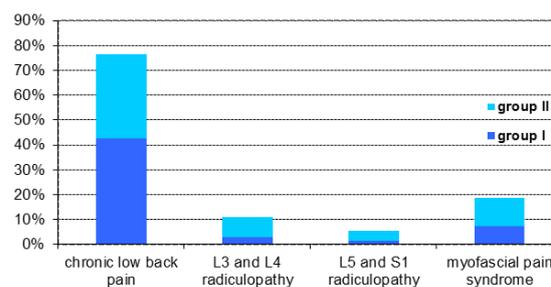


Fig. 4. Clinical entities diagnosed among groups

systematized in figure 4.

On the other hand, conventional radiological assessment revealed the multifactorial etiology of the above mentioned clinical entities, based on degenerative lesions in up to 48.52% of cases working in standing position and 56.75% in cases working predominantly in sitting posture; disco-vertebral pathology such as narrowing of the inter-vertebral space, bone spurs, marginal sclerosis, transitional vertebrae and spina bifida have been commonly reported in our study.

Modern imaging techniques such as CT and MRI have been advocated in persistent clinically significant vertebral syndrome (severe pain and dysfunctional syndrome), validating the disco-radicular conflict in more than half of patients in both groups (52.94%).

DISCUSSION

It is now widely accepted that the neutral attitude of the spine is the position that involves the maintenance of physiological curves regardless the static or dynamic condition, promoting the balance between the flexors and extensors muscle of the spine and subsequently balanced forces on the ligaments, musculoskeletal and articular structures.

Moreover, a properly performed orthostatic position, meaning slightly distant legs and flat abdomen (by abdominal muscle contraction) promote not only the balance between flexors and extensors of the spine,

but also the normal alignment of the spine. Conversely, the sitting position with its three subsets based on the main support (ischiatric, ischio-femoral and ischio-sacral) is generally more challenging for the spine, generating a 150% loading at L3 disk level, higher than those occurring in standing posture (100% load).

On the other hand, vicious postures usually result in distinct vertebral signs and symptoms as the main clinical expression of vertebral pathology, low back pain being actually recognized as the most common musculo-skeletal issue in the professional activity and a leading cause of work-related disability.

Since both static and dynamic postures during daily activities have significant interferences with the axial segment, behavioral principles are essential for dental practice.

The current study based on potential influences of the posture adopted during the dental working on spine has allowed the identification of certain conditions with particular relevance for the current practice. Thus, we have defined a high percentage of cases with vertebral pathology among dentists. Besides, three main clinical entities have been identified among our groups including low back pain, L3 and L4 radiculopathy, L5 and S1 radiculopathy and myofascial pain syndromes.

Regardless of the position adopted in current practice (standing or sitting), significant abnormalities static and dynamic vertebral abnormalities have been subsequently reported. Upper dorsal kyphosis and mixed, both frontal and sagittal deformities were commonly reported in both study groups. Furthermore, vertebral mobility

was globally affected attesting the presence of different pathological conditions of the spine; data were comparable for both analyzed postures. As well, muscle spasm reflecting a pathological spine, was equally identified in any evaluated posture.

The assessment of orthostatic tolerance, a parameter with major connotation on three main aspects of work (performance, effectiveness and productivity) has retained high percentages in both groups, especially in dentists working in sitting posture. Besides, the sitting position with ischiatic support was preferred if impaired orthostatic tolerance, minimizing the negative influence on spine.

Hence, an emerging theory of cyclical employment of both standing and sitting posture during dental practice is currently promoted, based on the complex interrelation posture-vertebral pathology.

CONCLUSIONS

There is no ideal working posture for the dentist, both orthostatic and sitting position (with its three variants of support) being equally challenging for the spine. However, the optimal working posture is the position causing a minimum mechanical stress at axial level and, consequently, minimum fatigue. It is widely promoted the recurrent alternation of posture in dental practice, at intervals not exceeding one hour; moreover, organization of a correct posture program is giving rise to the premises of ergonomic attitude at the workplace.

An individualized, strictly monitored postural training is mandatory for both prevention and management of static and dynamic spine abnormalities due to repetitive postural stress in dental practice.

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