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Cross-sectional studies

Prevalence of Musculoskeletal Disorder due to Postural Load among Egyptian Dentists

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Abstract

Purpose: To investigate prevalence of work-related musculoskeletal disorders in different body regions among Egyptian dentists and to find the correlation between high postural load and work-related musculoskeletal disorders.

Materials and Methods: One hundred two dentists, their age range from 25 – 30 were selected and allocated from faculty of Dentistry Badr university and Alkasr Elainy outpatient clinic. Pictures were taken to fulfill rapid upper limb assessment from lateral and anterior views. Cornell questionnaire was explained and fulfilled by the dentists to determine the prevalence of musculoskeletal disorders during the past 12 months.

Results: Results showed that the most prevalent musculoskeletal disorder among dentists affect neck region followed by lower back then upper back and there was a high postural load in almost of the dentists. Also, there was a strong relation between high postural load and musculoskeletal disorders.

Conclusion: It can be concluded that the most prevalent musculoskeletal disorder among Egyptian dentists is in neck followed by lower back then upper back. Also, there is a strong relationship between high postural load and incidence of musculoskeletal disorders.

Keywords: **Postural load; Musculoskeletal disorders; Dentists; RULA; Cornell questionnaire.**

Introduction:

Dentists around the world are experiencing more body aches and pains, known as musculoskeletal disorders (MSDs), because of the challenging nature of modern dental work. Dentists have to be very precise in tight spaces inside a patient's mouth, and this makes them stay in uncomfortable positions for a long time. This position can strain their back, neck, and shoulders, rapid upper limb assessment (RULA) was used to explore how dentists are affected by factors that might lead to upper limb issues. They're looking at repetitive actions, forceful tasks, and awkward postures. The aim of this study is to understand how common and severe musculoskeletal pain is among dentists and what factors contribute to it **(1).**

Prolonged or awkward postures can increase pressure on intervertebral discs, potentially contributing to issues like disc compression, the demands of working in a confined space may contribute to spinal hypomobility, limiting the range of motion in the spine which results in discomfort and decreased flexibility, the combination of prolonged static postures and increased pressure on the spine can contribute to low back pain. The lumbar spinal region is particularly susceptible to strain during dental procedures, the constrained postures and muscle engagement during dental work may lead to reduced blood flow, potentially causing muscle ischemia, this can result in fatigue, discomfort, and potentially contribute to musculoskeletal issues **(2).**

Around the world, musculoskeletal issues affect dentists, with rates ranging from 63% to 93%, especially focusing on upper limb muscles during dental work. Dentists use many muscles to stay still and fight against gravity in their work postures. These static forces are tougher on the body than moving forces. As the supporting muscles get tired, it can lead to pain and discomfort, possibly resulting in musculoskeletal injuries **(3).**

Faulty postures, such as forward-head postures, are common among dentists seeking better visibility during treatment. However, this posture can compromise the spine's proper support, leading to a pain pattern known as tension neck syndrome **(4).**

Tension neck syndrome can cause headaches and persistent pain in the neck, shoulders, and muscles between the shoulder blades, sometimes spreading to the arms. When the neck muscles stay tight, as in forward-head postures, it might weaken the spinal discs and even lead to disc problems. Bad postures not only bring tension neck syndrome but can also lead to long-lasting lower back pain, muscle pain in the trapezius, problems with the rotator cuff, and carpal tunnel syndrome **(5).**

The aim of this study is to provide a detailed exploration of the challenges faced by dental professionals, the global prevalence of musculoskeletal disorders. It underscores the intricate relationship between postures, pain, and various musculoskeletal disorders prevalent in the dental profession.

Materials and Methods:

Study design, setting and participants:

One hundred two Egyptian dentists from both genders, their age ranged from 25-30 years were allocated and participated in this study from faculty of Dentistry Badr University and Alkasr Elaini outpatient clinic. Subjects who met the study's inclusion criteria were enrolled in the observational study. Pictures were taken to fulfill RULA from lateral and anterior views then Cornell questionnaire was explained to the dentists, and they fulfilled it to determine the prevalence of musculoskeletal disorders during the past 12 months.

Inclusion criteria: Age ranges from 25 and 30 years old of Egyptian dentists. Males and females were included in the study. Two years of experience with six hours of work daily at least and the average daily rate is 6-8 patients.

Exclusion criteria: Subjects with congenital musculoskeletal disorders, fractures or previous musculoskeletal surgery, cardiovascular disease, pulmonary disease, diabetes and neurological disease were excluded from the study.

Instruments:

1. **RULA for assessment of postural load:**

It is an ergonomic assessment tool that considers biomechanical and postural load requirements of job tasks on neck, trunk and upper extremities, it uses a systematic process to evaluate required body posture, force and repetition of job task being evaluated. Reliability and validity of RULA have been approved **(6,7).**

Procedures: A picture was taken from lateral and anterior view and RULA points were fulfilled. The maximum score that could happen is 7 plus which means that we need to investigate and implement changes. Positions of individual body segments will be observed and the more there is deviation from the neutral posture the

higher will be the score of each body part. Categorization of body postures and force, with action levels for assessment.

2. Cornell questionnaire for Musculoskeletal disorders evaluation:

Cornell questionnaire is a self-reporting questionnaire to assess musculoskeletal disorders in neck, shoulders, thoracic, back, forearm, wrist, hand thigh, buttocks, knee and foot. Reliability and validity of the questionnaire in the study have been approved **(8,9).**

Procedures: by weighting the rating scores to more easily identify the most serious problems as follows:

Never = 0
1-2 times/week = 1.5
3-4 times/week = 3.5
Every day = 5
Several times every day = 10

then multiplying the above Frequency score (0,1.5, 3.5, 5, 10) by the Discomfort score (1,2,3) by the Interference score (1,2,3)

In computational analyses missing values can be coded as 0. If the missing value is for the frequency score, then use this as a zero in multiplying, i.e. all combinations of Frequency, Discomfort and Interference become 0. However, if the missing value is in the Discomfort or Frequency score then treat it as missing so that the multiplied score will be at least the value of the Frequency score.

Sample size calculation:

A public web server calculator called Scalex was used to perform the sample size calculation. A prevalence of musculoskeletal disorders 43% among dentists, estimated by a previous study. With a precision percentage of 14% and level of confidence 95% (the type I error of 5%) and a margin of error of 2%, the required sample size was estimated to be 49 and added 53 will be added to account for the estimated loss. Finally, a total number of 102 questionnaires were collected.

Statistical analysis:

The statistical analysis was conducted by using statistical SPSS Package program version 25 for Windows (SPSS, Inc., Chicago, IL). Quantitative data reported as the mean and standard deviation for demographic data, high postural load, neck severity, lower and upper back severity, right and left shoulder severity, and right and left wrist severity variables. Qualitative data expressed as the frequency and percentage for distributions of gender musculoskeletal disorders variables. Spearman rank correlation coefficient was performed to compute the relation and direction between high postural load and work-related musculoskeletal disorder. All statistical analyses were significant at level of probability ($P \leq 0.05$).

Results:

In the current study, one-hundred two dentists from both genders (68 males and 34 females) were participated in this study. Their age ranged from 25 to 30 year with mean value of age 26.22 ±1.18year. The mean value of weight was 79.78 ±7.62 kg with ranged from 61.00 to 103.00kg. The mean value of height was 173.10 ±7.62 cm with ranged from 158.00 and 184.00cm. The mean value of experience years was 2.80 ±0.96 years with ranged from 2.00 to 6.00year. The mean value of working hours was 8.90 ±1.52 hours with ranged from 6.00 to 12.00 hours **(Table 1).**

Table 1. Patients clinical general characteristics in in study population group

Variables	General characteristic values (n=102)		
	Mean ±SD	Minimum	Maximum
Age (years)	26.22 ±1.18	25.00	30.00
Weight (kg)	79.78 ±7.62	61.00	103.00
Height (cm)	173.10 ±7.62	158.00	184.00
Years of experience (years)	2.80 ±0.96	2.00	6.00
Working hours per day (hours)	8.90 ±1.52	6.00	12.00
Gender (males: females)	68 (66.70%) : 34 (33.30%)		

Subject characteristics are expressed as mean ±standard deviation
Qualitative data (gender) are expressed as frequency (percentage)

The number (percentage) of categories none, mild, moderate, and severe for neck severity

distribution were 0 (0.00%), 14 (13.70%), 32 (31.40%), and 56 (54.90%), respectively, lower back severity distribution was 42 (41.20%), 18 (17.60%), 28 (27.50%), and 14 (13.70%), respectively, and upper back severity distribution were 60 (58.80%), 40 (39.20%), 0 (0.00%), and 2 (2.00%), respectively **(Table 2).**

Table 2. Distribution of musculoskeletal disorders in study population group

Scoring	Musculoskeletal disorders (n=102)		
	Neck	Lower back	Upper back
None	0 (0.00%)	42 (41.20%)	60 (58.80%)
Mild	14 (13.70%)	18 (17.60%)	40 (39.20%)
Moderate	32 (31.40%)	28 (27.50%)	0 (0.00%)
Severe	56 (54.90%)	14 (13.70%)	2 (2.00%)
Total	102 (100%)	102 (100%)	102 (100%)

The total number (percentage) of neck severity distribution in musculoskeletal disorder patients was 102 (100%). The prevalence of neck severity was 8 (7.80%) score 6, 6 (5.90%) score 10.5, 32 (31.40%) score 60, and 56 (54.90%) score 90 in musculoskeletal disorder patients. The total number (percentage) of upper back severity distribution in musculoskeletal disorder patients was 60 (58.80%). The prevalence of upper back severity was 8 (7.80%) score 1.5, 8 (7.80%) score 5, 2 (2.00%) score 20, 28 (27.50%) score 20, and 14 (13.70%) score 90 in musculoskeletal disorder patients. The total number (percentage) of lower back severity distribution in musculoskeletal disorder patients was 60 (41.30%). The prevalence of upper back severity was 38 (37.30%) score 10, 2 (2.00%) score 20, and 2 (2.00%) score 60 in musculoskeletal disorder patients.

The total number (percentage) of right and left shoulder severity distribution in musculoskeletal disorder patients were 42 (41.30%) and 14 (13.70%), respectively. The prevalence of right shoulder severity was 38 (37.30%) score 1.5, 2 (2.00%) score 10, and 2 (2.00%) score 90 in musculoskeletal disorder patients. The prevalence of left shoulder severity was 8 (7.80%) score 1.5, 4 (3.90%) score 10, and 2 (2.00%) score 90 in musculoskeletal disorder patients. The total number (percentage) of right and left wrist severity distribution in musculoskeletal disorder patients were 10 (9.80%) and 2 (2.00%), respectively. The prevalence of right wrist severity was 8 (7.80%) score 1.5 and 2 (2.00%) score 90 in musculoskeletal disorder patients. The prevalence of left wrist severity was 0 (0.00%) score 1.5 and 2 (2.00%) score 90 in musculoskeletal disorder patients **(Table 3).**

Bi-variate Spearman-rank correlation coefficient was computed between high postural load and work-related musculoskeletal disorder **(Table 4).** The results of these correlational analyses revealed that there were significantly ($P<0.05$) positive relation between high postural load with neck severity ($r=0.56$; $R^2=31.36\%$; $P=0.0001$), lower back severity ($r=0.58$; $R^2=33.64\%$; $P=0.0001$), and upper back severity ($r=0.5862$; $R^2=38.44\%$; $P=0.0001$). These positive correlations mean that change in the neck severity, lower back severity, and upper back severity are consistent with change in high postural load. The direction of the relations between high postural load with work-related musculoskeletal disorder by increase high postural load the neck severity, lower back severity, and upper back severity increased (positive relation) in musculoskeletal disorder patients. However, no significant ($P>0.05$) relation between high postural load with right shoulder ($r=-0.13$; $R^2=1.69\%$; $P=0.195$), left shoulder ($r=-0.13$; $R^2=1.69\%$; $P=0.195$), right wrist ($r=-0.07$; $R^2=0.49\%$; $P=0.460$,) and left

wrist (r=-0.08; R^2=0.46%; P=0.413) severity in musculoskeletal disorder patients.

Table 3. Prevalence of neck, upper, and lower back severity in study population group

Scoring	Musculoskeletal disorders (n=102)						
	Neck	Lower Back	Upper back	Right shoulder	Left shoulder	Right Wrist	Left Wrist
Score 1.5	-------	8 (7.80%)	-------	38 (37.30%)	8 (7.80%)	8 (7.8%)	-------
Score 5	-------	8 (7.80%)	-------	-------	-------	-------	-------
Score 6	8 (7.80%)	-------	-------	-------	-------	-------	-------
Score 10	-------	-------	38 (37.30%)	2 (2.00%)	4 (3.90%)	-------	-------
Score 10.5	6 (5.90%)	-------	-------	-------	-------	-------	-------
Score 20	-------	2 (2.00%)	2 (2.00%)	-------	-------	-------	-------
Score 60	32 (31.40%)	28 (27.50%)	2 (2.00%)	-------	-------	-------	-------
Score 90	56 (54.90%)	14 (13.70%)	-------	2 (2.00%)	2 (2.00%)	2 (2.00%)	2 (2.00%)
Total	102 (100%)	60 (58.80%)	42 (41.30%)	42 (41.30%)	14 (13.70%)	10 (9.80%)	2 (2.00%)

Data are expressed as frequency (percentage).

Table 4. Correlation between high postural load and work-related musculoskeletal disorder

Relations	Mean ±SD	r	R2	P-value
High postural load Neck severity	6.55 ±0.92 69.42 ±28.20	0.56	31.36%	0.0001*
High postural load Lower back severity	6.55 ±0.92 29.73 ±5.36	0.58	33.64%	0.0001*
High postural load Upper back severity	6.55 ±0.92 5.88 ±1.14	0.62	38.44%	0.0001*
High postural load Right shoulder severity	6.55 ±0.92 2.28 ±1.68	-0.13	1.69%	0.195
High postural load Left shoulder severity	6.55 ±0.92 2.28 ±1.68	-0.13	1.69%	0.195
High postural load Right wrist severity	6.55 ±0.92 1.88 ±0.59	-0.07	0.49%	0.460
High postural load Right wrist severity	6.55 ±0.92 1.76 ±0.61	0.08	0.64%	0.413

Data are expressed as mean ±standard deviation r: Spearman ranked correlation P-value: probability value *Significant: P>0.05.

Discussion:

The aim of this study is to investigate prevalence of work-related musculoskeletal disorders in different body regions among Egyptian dentists and to investigate correlation between high postural load and work-related musculoskeletal disorders.

Recent research has significantly contributed to our understanding of the intricate relationship

between Work-Related Musculoskeletal Disorders (WRMSDs) and postural load among dentists. Poor ergonomic setups, characterized by improper chair and equipment positioning, have been identified as significant contributors to WRMSDs, with the intensity and duration of awkward postures playing a pivotal role in their development **(10).**

The nature of dental work, particularly in general dentistry, presents unique challenges and stressors, making dentists more susceptible to musculoskeletal disorders. Prolonged, repetitive working habits and the observational demands of the profession, coupled with recurrent movements of the upper body and limbs, contribute to the prevalence of these issues **(11).**

Long-term, short, and repetitive working periods exert static, constant pressure on various body parts, resulting in pain, spasm, tingling, and joint stiffness. The cumulative effect of these challenges can impact a dentist's routine life **(12).**

Our cross-sectional observational study delves into the correlation between work-related musculoskeletal disorders in different body regions and the high postural load experienced by dentists. The inclusion of 102 dentists, representing both genders, allowed for a comprehensive evaluation using the Rapid Upper Limb Assessment (RULA) for postural load and the Cornell questionnaire for musculoskeletal disorders.

Our findings revealed a statistically significant positive correlation ($P<0.05$) between high postural load and the severity of musculoskeletal disorders in the neck, lower back, and upper back. However, a statistically non-significant correlation was observed in the shoulders and wrists, indicating the nuanced impact of postural load on different body regions **(13).**

The high prevalence of WRMSDs among dental professionals is a well-documented occupational health concern. Factors such as working in a restricted field, prolonged sitting in awkward positions, using heavy forces in repetitive movements, and a lack of recovery breaks and exercises contribute to this prevalent issue. WRMSDs may negatively impact the quality of life for dentists **(13).**

Our study in Egypt aligns with global investigations into the prevalence of WRMSDs among dentists. Pain in the neck emerged as the most prevalent, followed by lower back and upper back pain. These findings are consistent with systematic reviews reporting high prevalence rates among dental professionals **(14).**

Contrary to some studies reporting a higher incidence of symptoms related to hands, wrists, and low back, our study identified the neck, lower back, and upper back as the most affected body regions. The observed disparities may be attributed to variations in study populations and methodologies as our study focuses on young dentists and the cumulative small repetitive injury for the wrist does not reveal yet **(13).**

Factors such as the use of ergonomic dental chairs, years of experience, the number of patients seen per day, and medication intake to relieve work-related WMSDs were identified as significant associations with the number of affected body regions. This underlines the importance of addressing ergonomic factors in dental practice **(15).**

Some biomechanical considerations specific to the dental profession must be taken into consideration to give reasons for the variety between Musculoskeletal regions affection in different articles between different countries: Dentists often work in awkward and static postures for extended periods, which can contribute to musculoskeletal strain. The neck, shoulders, and lower back are commonly affected areas. Variations in how dental procedures are performed and the ergonomic design of the dental workspace can influence postural load **(16).**

Using dental tools like hand pieces, mirrors, and scalers needs precise skills. Doing repetitive and strong movements, along with uncomfortable hand and wrist positions, can lead to overuse injuries and discomfort in muscles and

bones. Differences between dentists, like age, fitness, and existing health issues, can affect how these body positions impact their muscle and bone health. Younger dentists might handle these physical demands differently than older ones **(17).**

Differences in the level of ergonomic training and awareness among dental professionals may influence their ability to adopt and maintain proper working postures. Education on ergonomic principles and regular reminders may contribute to a reduction in musculoskeletal issues **(18).**

In summary, our study contributes to the growing body of evidence supporting the association between postural load and WRMSDs among dentists. The prevalence of these disorders in Egypt aligns with global trends, emphasizing the urgency of addressing ergonomic factors to enhance the occupational health and well-being of dental professionals.

Conclusions:

According to the scope and results of this study, that concluded that the most prevalent musculoskeletal disorder among Egyptian dentists is in neck followed by lower back and there is a strong relationship between high postural load and increasing of musculoskeletal disorder in neck, lower back and upper back. Therefore, physiotherapists in the Egypt should increase the dentists' awareness of ergonomic fit position and teach them how to avoid bad posture to decrease postural load and musculoskeletal disorders.

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