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RESEARCH ARTICLE

Prevalence of Musculoskeletal Disorders among Dentists in Casablanca's Dental Center

Yasmina Cheikh [a], Aicha Oubbaih [b], Zoubair Baroud [c], Soufiane Baroud [c], Khadija Kaoun [a], Samira Bellemkhannate [a]

[a] Professor, Department of Removable Prosthodontics, Faculty of Dentistry, University Hassan II of Casablanca, Post code 21100, Morocco.
[b] Prosthodontist, Department of Removable Prosthodontics, Faculty of Dentistry, University Hassan II, Casablanca, Post code 21100, Morocco.
[c] Dentist, Private Practice, Casablanca, Morocco.

ABSTRACT

Background : Musculoskeletal disorders are the most common occupational pathologies among dentists around the world but studies are quite limited. The present study was carried out to investigate the prevalence of MSDs among dentists in Casablanca, Morocco.

Methods : This was a cross-sectional descriptive study conducted among the medical staff (120 dentists) of casablanca's Dental Center, part of the Ibn Rochd University Hospital, Morocco over a period of 3 weeks from July 24, 2017 to August 11, 2017. The study was based on a self administrated questionnaire which comprises two parts : the first part included physical characteristics, academic life, clinical practice, ergonomics and work methods ; and second part consists of the "Standardized Nordic Questionnaire" or Nordic style questionnaire.

Results : The prevalence of musculoskeletal disorders in our sample was 71.67%, predominately affecting the neck, the upper and the lower back.

Conclusion : Prevalence of MSDs was high among moroccan dentists and the prevention of these disorders requires the adoption of a correct posture, good working habits, an ergonomic organization of the workspace, as well as the integration of regular physical activities in order for the dentist to maintain a good quality of life.

KEYWORDS: Musculoskeletal disorders, dentists, Occupational health.

Correspondence: Pr Yasmina Cheikh. Department of Removable Prosthodontics, Faculty of Dentistry, University Hassan II of Casablanca, Post code 21100, Morocco. Email: yasmina.cheikh@etu.univh2c.ma

INTRODUCTION

Musculoskeletal disorders (MSDs) are defined as a group of injuries that affect various regions of the musculoskeletal system, these areas include the muscles, tendons, skeleton, cartilage, joints, ligaments, nerves, and the vertebral column.[1]

These disorders occur after hyper-stress on these structures, most often by repetition of a pathogenic gesture. They are multifactorial, deferred, evolving over the years, and cover all kinds of conditions, from mild disorders and temporary to irreversible injuries and chronic states of incapacity. [2]

They are manifestation of a mismatch between the biomechanical solicitations and the functional capacities of the individual.

MSDs are among the most common professional pathologies in the industrialized world. Dentists have a higher prevalence of MSDs compared with office workers due to the nature of dental work being in a restricted field, sitting for a prolonged time with an awkward body position, and using heavy forces in repetitive movements compounded by a lack of recovery breaks and exercises [3,4,5,6].

The literature reports that there is a close correlation between the psycho-social environment and the onset of

MSDs : stress directly influences the posture, movements and muscle tone of the practitioner, thus leading to these disorders. [7,8]

The objectives of this study were to assess the prevalence of musculoskeletal disorders among the dental professionals of Casablanca's Dental Center, to identify associated factors and determine the different anatomical sites most affected by musculoskeletal disorders.

MATERIALS AND METHODS

We conducted a cross-sectional descriptive study within casablanca's Dental Center, part of the Ibn Rochd University Hospital in Morocco over a period of 3 weeks from July 24, 2017 to August 11, 2017.

Participants and sample size :

A self-administered survey was prepared and distributed to the entire of dental professionals practicing at Ibn Rochd University Dental center of Casablanca (Morocco), namely 148 dentists including, 27 professors, 12 associate professors, 11 assistants professors, 32 dental specialists, 50 residents, and 16 interns. The exclusion criteria included practitioners who have had an accident or surgery on the musculoskeletal system and women who are pregnant or have given birth, during the two years preceding the study.

Data collection procedure : A questionnaire was developed in two parts : the first one relating to the variables : physical characteristics, physical activity practice, academic life (status, service, seniority), clinical practice, ergonomics and work methods.

The second part consists of the Standardized Nordic Questionnaire (SNQ) which is widely used by occupational physicians to screen for musculoskeletal disorders [9].

The data analysis : was done with the Epi Info Software under Windows. We used the Chi2 and Fisher test for the comparison of percentages and the Anova one-factor test for the comparison of averages. The statistical significance level (p) was set at 5%.

Ethical considerations : Dentists were informed of the survey's objectives and their oral consent was obtained prior to the administration of the questionnaire. Anonymity and data confidentiality were maintained Throughout the study.

RESULTS

Of the 148 moroccan dentists practicing in Casablanca's Dental Center who received the questionnaire, 120 dentists responded and completed the survey (response rate of 81.08%). The average age was 33.79 years with a predominance of females 99 (82.5%). In terms of the seniority, the average was 8.81 years. Residents made up the majority of the dentists surveyed (38.3%).

Physical characteristics : Aproximately half of dentists reported having diagnosed MSDs such as arthrosis, herniated discs, sciatic nerve damage, torticollis, scoliosis and tendonitis. Only 6 (5%) of respondents reported having risk factor diseases for the development of musculoskeletal disorders such as diabetes, hyperthyroidism, hypothyroidism and Hashimoto's thyroiditis (Table 1).

Variables related to daily clinical practice :

Practitioners took an average of 6 patients (+/- 4) per day, 80 (66.7%) reported working overtime and 95% took at least one break during the day.

The fatigue, which is one of the main factors correlating with musculoskeletal disorders, was very common among the practitioners surveyed. 88.4% of them reported experiencing some or a lot of physical or mental fatigue at work.

Table 1 : Personnal characteristics and working experience of dentists.

Variables	N	%
Gender		
Male	21	(17,5)
Female	99	(82,5)
Age:		
[23-35]	79	(65.8)
]35-50]	31	(25.9)
>50	10	(8.3)
Get a diagnosis of MSD		
Yes	71	(59,2)
No	49	(40,8)
Disease risk factor for MSDs		
Yes	6	(5)
No	114	(95)
Accident history		
Yes	23	(19,2)
No	97	(80.8)
Hormonal pathologies		
Yes	54	(45)
No	66	(55)
Sport		
Oui	55	(46.2)
Non	64	(53.8)
Speciality		
Prosthodontics	32	(26,7)
Orthodontics	14	(11,7)
Periodontics	15	(12,5)
Restorative and endodontic dentistry	16	(13,3)
Pediatric dentistry	22	(18,4)
Surgery	18	(15)
General practitioner	3	(2,5)
Status		
Interne	14	(11.7)
Resident	46	(38.3)
Spécialiste	24	(20)
Assistant Professor	9	(7.5)
Assiciate Professor	9	(7.5)
Professor of higher education	18	(15)

Variables related to ergonomics and work methods

In this study sample, 21(17.5%) of practitioners reported not paying attention to their posture, and only 10 (8.33%) reported being careful with their work positions. As well 50 (41.7%) of them are working mainly when seated, 11 (9.2%) choose to work standing and 59 (49.1%) alternated the two positions. (Table 2).

Results of the Standardized Nordic Questionnaire (SNQ) :

The results of the Standardized Nordic Questionnaire showed that 86 practitioners in our sample had musculoskeletal disorders with a prevalence of 71.67%. The anatomical areas most affected by pain and discomfort were the neck, upper and lower back. (Figure 1,2 and 3).

The Nordic style Questionnaire is considered positive when at least one upper limb symptom is noted in the previous year or week [10].

The result of crossing the positive SNQ and the different variables is shown in (Table 3 and 4).

Table 2 : Characteristics related to daily clinical practice and population ergonomics.

Variables	N	%
Overtime Hours		
No	40	(33.3)
Mildly	41	(34.2)
Enough	25	(20.8)
Much	14	(11.7)
Breaks during the day		
Yes	114	(95)
No	6	(5)
Physically tiring work		
Mildly	14	(11.7)
Enough	42	(35)
Much	64	(53.3)
Mentally tiring work		
Mildly	14	(11.7)
Enough	47	(39.2)
Much	59	(49.1)
Attention to posture		
Never	21	(17.5)
Moderatly	68	(56.7)
Enough	21	(17.5)
Always	10	(8.3)
Muscle power		
Low	9	(7,5)
Medium	76	(63,3)
Excessive	35	(29,2)
Posture at work		
Sitting	50	(42)
Standing	10	(8.4)
Both	59	(49.6)
Repetitive gestures		
Yes	115	(95,8)
No	5	(4.2)
Lighting		
Sufficient	57	(47.5)
Insufficient	63	(52.5)
Use of optical aid		
Yes	34	(28.3)
No	86	(71.7)
Suitable equipment		
Not at all	17	(14,2)
Mildly	52	(43,3)
Enough	46	(38,3)
Much	5	(4,2)

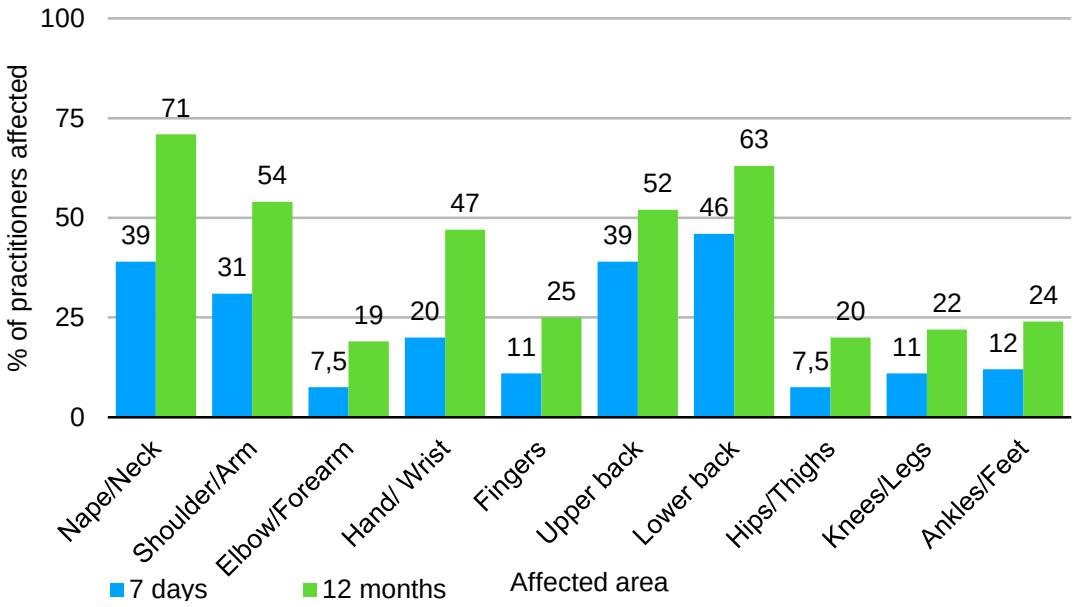

Figure 1 : Pain or discomfort felt during the last 7 days and 12 months depending on anatomical zones.

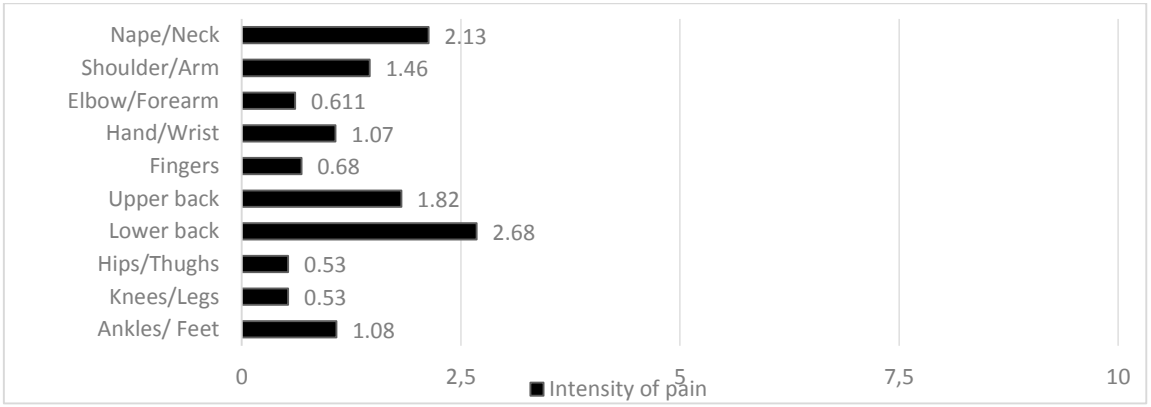

Figure 2 : Average intensity of pain felt when filling out the questionnaire by anatomical region.

Table 3 : Physical characteristics and working experience of practitioners with a positive SNQ

Variables	N	%	P
Gender			
Male (21)	12	(57.1)	0,104
Female (99)	74	(74,7)	
Diseases risk factor MSDs			
Yes (6)	5	(83,3)	0,674
No (114)	81	(71,1)	
Accident history			
Yes (23)	*18*	*(78,3)*	*0,435*
No (97)	68	(70,1)	
Seniority			
[1 - 10]	60	(73,2)	
]10 - 20]	13	(61,9)	0,535
]20- 30]	10	(76,9)	
Sport			
Yes (55)	36	(65,5)	0,124
No (64)	50	(78,1)	
Speciality			
Prosthodontics (32)	22	(68.75)	
Orthodontics (14)	11	(78.6)	
Periodontics (15)	10	(66.7)	0.204
Restorative dentistry (16)	12	(75)	
Pediatric dentistry (22)	20	(90.9)	
Surgery (18)	9	(50)	
General practitioner (3)	2	(66.6)	
Status			
Interne (14)	10	(71.4)	
Resident (46)	33	(71.7)	
Specialist (24)	20	(83.3)	0.414
Assistant Professor (9)	6	(66.7)	
Associate Professor (9)	4	(44.4)	
Professor of higher education (18)	13	(72.2)	

Table 4 : Ergonomics and daily practice of practitioners with a positif SNQ

ErgoVariables	N	%	P
Attention to posture			
Yes (99)	70	(70,7)	0,613
No (21)	16	(76,2)	
Repetitive gestures			
Yes (115)	83	(72,2)	0,621
No (5)	3	(60)	
Mentally tiring work			
A little (14)	8	(9,3)	
Enough (47)	35	(40,7)	0,432
Much (59)	43	(50)	
Physically tiring work			
A little (14)	6	(7)	
Enough (42)	27	(31,4)	**0.05***
Much (64)	53	(61,6)	

DISCUSSION

In this study, a self-administered survey was distributed to dentists practicing in governmental dental sector to investigate the prevalence of MSDs, determine the different anatomical sites most affected by musculoskeletal disorders and identify associated factors. we assessed musculoskeletal symptoms by Standardized Nordic Questionnaire, which is an internationally accepted screening instrument for assessing MSDs [11]. This study is the first on the subject with Moroccan dentists.

Our results showed a higher prevalence of musculoskeletal disorders 71.67% among dentists, this is similar to previously published surveys conducted by El Meisha et al. [4], Al-Ali et al.[12], and Feng et al.[13] (70%, 68%, and 88% respectively). Dentistry is a profession with high risk of developing MSDs, They are the most common cause (29.3%) of early retirement among dentists [11].

Female dentists in our sample were more prone to MSDs than male dentists. This is in agreement with the literature [14,9,15,16] where the difference in prevalence between the two genders was statistically significant [17,18,19]. Some studies attributed this gender difference to low muscle tone and strength, hormonal changes, and a higher incidence of osteoporosis among females [20,21] ; and some others explained the difference by the fact that female practitioners would tend to make greater physical effort for similar performance [22].

In the present survey, we noted that the prevalence of musculoskeletal disorders tended to decrease for the most experienced practitioners (Assistant Professors and

Associate Professors with 10 to 20 years experience) to increase even more for the oldest practitioners (Professors with 20 to 30 years experience) without this being statistically significant. The study by ABDULJABBAR carried out among Saudi dentists states that the prevalence of MSDs tends to decrease with experience, explaining this by the fact that more experienced practitioners adopt healthier and more ergonomic work positions than their less experienced colleagues [23,24,17].

SZYMÀNSKA's study carried out in Poland found a statistically significant relationship between seniority and MSD prevention : practitioners with more than 30 years seniority were more likely to prevent MSDs [25].

In another hand, Alyahya's study findings show that pain in the upper and lower back, hand/wrists, hips, ankles, knees increased with the increased years of practice, and explain that by the fact that the young general dental practitioners often work over 8 hours a day in the earliest years of their practice, which trigger premature occurrence of MSDs within 3 years [26].

The Pedodontics department was the department with the highest prevalence of MSDs at the DCTC with a prevalence of 91% for 20 practitioners. In another study carried out in Saudi Arabia by ALGHADIR, pedodontists were again the most affected with a prevalence equal to ours (91%) for 21 practitioners [16]. This can easily be explained by the additional difficulty associated to the treatment of young patients, who most often, lack cooperation and do not adhere to the treatment, thus requiring increased physical effort, energy and time to carry out care [27]. However, the difference in prevalence does not reach statistical significance.

The prévalence of MSDs among the orthodontists was also high (78.6%), Literature showed that Orthodontists have mostly low back pain caused by repeated head positioning forward and lower back flexion during clinical procedures [28,29], it may also be due to the high precision required by their work, the long duration of the sessions and the rare use of indirect vision.

In our study, we found that the prevalence of MSDs increased with increasing work-related stress and mental fatigue. Similar results were obtained in the different studies that looked at stress as a potential factor influencing the development of MSDs for dentists. However, no statistically significant relationship was found between the two parameters [30, 23].

Statistical analysis of our study results showed a statistically significant relationship between the feeling of fatigue experienced at work and the appearance of musculoskeletal disorders ($p= 0.05$). The literature does not consider the physical fatigue parameter per se, but rather focuses on the time required for the practitioner's physical recovery (need for recovery) after a work day. Indeed, in the study of ALEXOPOULOS et al. conducted in Thessaloniki, pain in the shoulder, neck, wrist and lower back was significantly associated with an accumulated need for physical recovery [31].

In the study of Taraneh, there was a significant reduction in musculoskeletal pain in neck, right shoulder, left shoulder, upper back, and right wrist ($P<0.05$) after implementing educational intervention in terms of good body posture and stretching exercises, Findings obtained from the study indicated a significant statistical relationship between short break in appointments and musculoskeletal disorders ($P<0.05$); in this case, the expanded break time between appointments resulted in less musculoskeletal disorders [32].

The anatomical area most affected by discomfort and pain among dentists in the last 12 months was the neck, with a prevalence of 70.9%. In the literature, the results vary according to the study, without us being able to see any trend. Thus, as in our population, the neck, and more particularly the nape of the neck, is the area most affected by MSDs among American and Saudi practitioners at 51.1% and 67.9% respectively [24,19]. Among Lebanese, Polish, Australian, and Greek dentists, the lumbar region dominates the distribution of MSDs with a prevalence of 85.5% ; 60.1% ; 59% and 46% respectively [30,25,17,31]. However, in Malaysia, practitioners mainly complain of shoulder pain at 92.7% [23].

Among chinese, the highest 12-month prevalence rate of MSDs was in the lower back, knees, shoulders and neck with a prevalence rate of 91.2% [33].

The pain is felt by the dentists during the response to the questionnaire, it testifies to its presence outside of clinical practice and the chronicity of the phenomenon. MSDs have thus, an impact on the quality of life and daily clinical practice of the dentists. Muralidharan et al. found through the survey conducted in India that (40%) of practitionners required sick leave (1–7 days) from their work in the preceding 12 months [28]. Hence the importance of making dentists aware of this risk. Preventive education therefore has a crucial part to play.

CONCLUSION

In conclusion, work-related musculoskeletal disorders are a common problem among practitionners dentists of Casablanca's Dental Center with a high prevalence, this disorders are the result of the convergence of a multitude of factors that cannot be easily isolated. As we have seen in the various studies of dentists around the world, we cannot pinpoint a single factor as the main cause of the development of MSDs. However, improving certain aspects of daily practice and adopting good habits can significantly reduce the risk of developing MSDs in the dentist's office.

It is therefore essential to include ergonomics and healthy working positions early on the basic training of the dental student. So, if these working methods are taught and rigorously controlled during practical work, the future dentist will automatically adopt them during his clinical internship, and thus throughout the rest of his professional career.

Follow-up of dentists by an occupational physician in hospitals should be mandatory in order to facilitate the early diagnosis of musculoskeletal disorders and thus be able to set up adequate care.

AUTHORS' CONTRIBUTIONS

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors. Indeed, all the authors have actively participated in the redaction, the revision of the manuscript and provided approval for this final revised version.

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COMPETING INTERESTS
The authors declare no competing interests.

REFERENCES

[1] Gangopadhyay S, Ghosh T, Das T, Ghoshal G, Das BB. Prevalence of upper limb musculo skeletal disorders among brass metal workers in West Bengal, India. Ind Health. 2007;45(2):365-70. DOI: 10.2486/indhealth.45.365

[2] Aljanakh M, Shaikh S, Siddiqui AA, Al-Mansour M, Hassane SS. Prevalence of musculoskeletal disorders among dentists in the Ha'il Region of Saudi Arabia, Ann Saudi Med. 2015;35(6):456-61. DOI: 10.5144/0256-4947.2015.456

[3] Alexandre PC, da Silva IC, de Souza LM, de Magalhães CV, Palacios M, Meyer A. Musculoskeletal disorders among Brazilian dentists. Arch Environ Occup Health. 2011; 66:231–5. DOI: 10.1080/19338244.2011.564571

[4] Meisha DE, Alsharqawi NS, Samarah AA, Al-Ghamdi MY, Prevalence of work-related musculoskeletal disorders and ergonomic practice among dentists in Jeddah, Saudi Arabia Clinical, Cosmetic and Investigational Dentistry. 2019:11,171-9. DOI: 10.2147/CCIDE.S204433

[5] Cosoroaba MR, Cirin L, Anghel MD, Talpos-Niculescu CI, Argesanu V, Farkas AZ, Negrutiu ML. The use of thermal imaging in evaluating musculoskeletal disorders in dentists. J Med Life. 2019 ;12(3) :247–52. DOI: 10.25122/jml-2019-0017

[6] Zaker Jafari HR, YektaKooshali MH. Work-Related Musculoskeletal Disorders in Iranian Dentists : A Systematic Review and Meta-analysis. Saf Health Work. 2018;9(1):1-9. DOI: 10.1016/j.shaw.2017.06.006

[7] Kompier MAJ., Van der beek AJ. Psychosocial factors at work and musculoskeletal disorders. Scand. J. Work. Environ. Health, 2008, 34 (5), 323-5. DOI: 10.5271/sjweh.1281

[8] Mohd F, Mohd T, Sangwoo B, Myung HY, Mohd S. The effects of physical and psychosocial factors and ergonomic conditions on the prevalence of musculoskeletal disorders among dentists in Malaysia. Work. 2017;57(2) :297-308. DOI: 10.3233/WOR-172559

[9] Kuorinka I, Jonsson B, Kilborn A, Vinterberg H, Biering SF, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics. 1987;18(3):233–37. DOI: 10.1016/0003-6870(87)90010-x

[10] Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Jørgensen K.Appl Ergon.1987;18(3): 233-7. DOI: 10.1016/0003-6870(87)90010-x

[11] Sultana N, Mian MAH, Rubby MG, Banik PC. Musculoskeletal Disorders in Dentists: A Systematic Review. UpDCJ. 2017,7(2):38-42.

[12] Al-Ali K, Hashim R. Occupational health problems of dentists in the United Arab Emirates. Int Dent J.2012; 62(1) : 52–56. DOI: 10.1111/j.1875-595X.2011.00091.x

[13] Feng B, Liang Q, Wang Y, Andersen LL, and Szeto G. Prevalence of work-related musculoskeletal symptoms of the neck and upper extremity among dentists in China, BMJ Open.2014; 4(12): e006451. DOI: 10.1136/bmjopen-2014-006451

[14] Al-Mohrej OA, AlShaalan NS, Al-Bani WM, et al. Prevalence of musculoskeletal pain of the neck, upper extremities and lower back among dental practitioners working in Riyadh, Saudi Arabia : A cross-sectional study, BMJ Open 2016;6:e011100. DOI: 10.1136/bmjopen-2016-011100

[15] Al-Ali K, Hashim R. Occupational health problems of dentists in the United Arab Emirates. Int Dent J. 2012 ;62(1) :52–56. DOI: 10.1111/j.1875-595X.2011.00091.x

[16] Alghadir A, Zafar H, Iqbal ZA. Work-related musculoskeletal disorders among dental professionals in Saudi, Arabia. J. Phys. Ther. Sci. 2015, 27(4), p.1107-12. DOI: 10.1589/jpts.27.1107

[17] Marshall E.D., Duncombe L.M., Robinson R.Q., Kilbreath S.L., Musculoskeletal symptoms in New South Wales dentists. Aust. Dent. J, 1997, 42 (4), p 240-246. DOI: 10.1111/j.1834-7819.1997.tb00128.x

[18] Moen B.E., Bjorvatn K. Musculoskeletal symptoms among dentists in a dental school. Occup Med. 1996 ;46 : 65-8. DOI: 10.1093/occmed/46.1.65

[19] Abduljabbar TA. Musculoskeletal disorders among dentists in Saudi Arabia. Pak. Oral. Dent. J. 2008;28(1): 135-44.

[20] Hodacova L, Sustova Z, Cermakova E, Kapitan M, Smejkalova J. Self-reported risk factors related to the most frequent musculoskeletal complaints among Czech dentists., Ind Health. 2015 ;53(1) : 48–55. DOI: 10.2486/indhealth.2013-0141

[21] Bedi HS, Moon NJ, Bhatia V, Sidhu GK, Khan N. Evaluation of musculoskeletal disorders in dentists and application of DMAIC technique to improve the ergonomics at dental clinics and metaanalysis of literature. J Clin Diagnostic Res. 2015 ;9(6) : ZC01–3. DOI: 10.7860/JCDR/2015/14041.6126

[22] Yi J, Hu X, YAN B, Zheng W, Li Y, Zhao Z. High and specialty-related musculoskeletal early training years. J Appl Oral Sci. 2013 ;21(4):376-82. DOI: 10.1590/1678-775720130165

[23] Taib MFM, Bahn S, Yun MH, and Taib MSM. The effects of physical and psychosocial factors and ergonomic conditions on the prevalence of musculoskeletal disorders among dentists in Malaysia. Work. 2017;57(2):297-308. DOI: 10.3233/WOR-172559

[24] Estrich CG, Caruso TJ, Gruninger SE, Pleva D. Musculoskeletal complaints among dental practitioners. Occup. Environ. Med, 2014, (n°71). DOI : 10.1136/oemed-2014-102362.154

[25] Szymańska J. Disorders of the musculoskeletal system among dentists from the aspect of ergonomics and prophylaxis. Ann Agric Environ Med. 2002;9(2):169-73.

[26] Alyahya F, Algarzaie K, Alsubeh Y, Khounganian R. Awareness of ergonomics & work-related musculoskeletal disorders among dental professionals and students in Riyadh, Saudi Arabia J. Phys. Ther. Sci. 2018, 30 : 770–6. DOI: 10.1589/jpts.30.770

[27] Raha Habib A, Rezvan D, Hashemipour MA. Neck, back, and shoulder pains and ergonomic factors among dental students J Educ Health Promot. 2018 ; 7 : 40. DOI: 10.4103/jehp.jehp_80_16

[28] Muralidharan D, Fareed N, Shanthi M. Musculoskeletal disorders among dental practitioners: Does it affect practice ? Epidemiol Res Int 2013 ; Article ID 716897. DOI : 10.1155/2013/716897

[29] Newell TM, Kumar S. Prevalence of musculoskeletal disorders among orthodontists in Alberta, International Journal of Industrial Ergonomics, 2004 ; 33 (2), 99–107. DOI: 10.1016/j.ergon.2003.06.003

[30] Ghoussoub M, Ghoussoub K., Moucharrafieh L., Khoury A., Sleilaty G., Rifaï K. Troubles musculo-squelettiques chez une population de chirurgiens-dentistes libanais : Fréquence et facteurs de risque. J Med Liban. Jan-Mar 2005;53(1):21-7.

[31] Alexopoulos EC, Stathi IC, Charizani F. Prevalence of musculoskeletal disorders in dentists. BMC. Musculoskel. Disord.2004:5(16);1-8. DOI: 10.1186/1471-2474-5-16

[32] Taraneh F, Rezai M, Vaziri MH, Vaziri F. Investigating the Effect of Educational Intervention on Musculoskeletal Disorders in Dentists. 2018;16(2):307-313. World Family Medicine. DOI: 10.5742/MEWFM.2018.93275

[33] Hongyun D, Qiong Z, Guangzeng L, Tingguo S, Yingzhi X. Prevalence and associated factors of musculoskeletal disorders among Chinese healthcare professionals working in tertiary hospitals : A cross-sectional study. BMC Musculoskeletal Disorders. 2019,20(1):175. DOI : 10.1186/s12891-019-2557-5