

Research Paper: Prevalence of Musculoskeletal Pains and Disability among Dentists in Zahedan



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ABSTRACT

Introduction: dentists are vulnerable to work-related musculoskeletal disorders (WMSDs) of the neck and upper extremities. This study aims to investigate the prevalence of musculoskeletal pains and disability among dentists in Zahedan. The results of this study can be used to take effective preventive measures to improve the quality of life of dentists.

Materials and Methods: this descriptive-analytical study, which has been conducted at the time of the coronavirus (Covid-19) outbreak. 102 dentists participated in the study. An online questionnaire was sent to them through cyberspace. The questionnaire contains demographic information of the dentists (age, gender, work experience, daily working hours, and academic rank) and items associated with pain in the neck, shoulders, back, arms, and forearms. The intensity of pain was measured by the VAS scale. Besides, some items were also asked at the end to measure the disability of the back and neck. Comparing the qualitative data was done using Chi-Square, and quantitative data comparison was done using independent t-test and ANOVA.

Results: 96.1% of dentists reported chronic pain at least in one organ. Neck pain at 77.5% and backache at 72.5% were the most prevalent pains, and forearm pain at 12.7% had the least prevalence. Prevalence of musculoskeletal pain was not significantly different in terms of gender, age, work experience, daily working hours, and academic rank ($p > 0.02$). The disability in the neck was equal to 15.545% and was equal to 12.81% in the back.

Conclusion: the majority of dentists reported pain and disease in different areas, especially the neck, back, shoulders, and wrists. It would be better for the dentists to perform stretching exercises regularly, and to be focused on the empowerment of upper-body muscles.

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Introduction

Musculoskeletal disorders (MSDs) are injuries or pain in the human musculoskeletal system, including the joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck and back (1). Occupational health hazards are common (2). With promotion of industrial life, the prevalence of musculoskeletal disorders have increased markedly during the past decades (3). Musculoskeletal (MSK) pain is a major occupational health concern in dentistry (1). The higher rates of MSK pain among dentists can be attributed to various physiological and ergonomic factors related to the profession (2). Work-related factors include awkward postures and movements, frequent and prolonged use of vibrating tools, and time spent with each patient (3). Additional factors include the dentists body mass index (BMI), lengthy working hours, number of walk-in patients and number of scheduled patients per day (4,5). The frequency of awkward movements performed by dentists such as stooping, slouching, ducking, uncomfortable posture while sitting, and bending forwards and sideways for better manoeuvrability make dentists more prone to MSK pain (2,6). Such prolonged and awkward postures mostly affect the back, neck and upper extremities (2,6). MSK pain affects the quality of life of the dentist and may lead them to change profession to protect their health (7-9). Lower back pain is common among dentists. Its prevalence was reported to be around 37% in a study from Surat, India, which revealed that mental health, gender and exercise play a vital role in the development of MSK pain (10). A study of dentists carried out in New Zealand showed a prevalence of lower back pain of 54%, a prevalence of neck pain of 57% and a prevalence of shoulder pain of 52% (11). A study from Saudi Arabia in 2001 demonstrated that dentists reported reduced visibility of the mouths of their patients and restricted movement due to lack of work space (12). The study also reported that 55% of the sample population had neck pain while 74% had lower back pain that could potentially have been reduced

by exercise. A more recent study in 2015 among dentists in Saudi Arabia showed that 85% have work-related MSK pain (13). The present study aims to investigate the prevalence of musculoskeletal pains and disability among dentists in Zahedan. The results of this study can be used to take effective preventive measures to improve the quality of life of dentists.

Methods and materials :

In this descriptive-analytical work, according to coronavirus outbreak and the order of the National Committee to Combat Corona based on the closure of the Dental College of Zahedan, and the dental clinics in Zahedan in the study period, the applied questionnaires were sent for the dentists in Zahedan in an online mode. 102 dentists (general and specialists) participated in this study. The data collection instrument included Nordic Questionnaire to determine the prevalence of the site of the pain and measurement of the intensity of the pain by Visual Analog Scale (VAS). The questionnaire was made by Kourinka et al. (1987) in the Nordic Institute for Advanced Training in Occupational Health (NIVA) (6). The Oswestry Disability Index (ODI) was used to measure the disability caused by backache, and to measure the prevalence, area, and intensity of pain of the dentists reporting pain in the back. Neck Disability Index (NDI) was presented to measure the disability associated with neck pain in the dentists reporting neck pain.

0-20% (min disability)

The person can take the majority of daily activities and needs no treatment usually except for advice while sitting, standing, and exercising

21-40% (moderate disability)

The person experiences more pain and severity in sitting and standing. Traveling and social life is hard to do, and the person may be unable to work. Personal activities, sexual activity, and sleeping are not significantly affected. The person is usually managed by preservative treatments.

41-60% (severe disability)

Pain is the major problem in this group; although the usual and daily activities are affected too.

The person needs exact clinical examinations.
61-80% (cripple)

Pain in the back and neck affect all aspects of life, and such a person needs positive intervention for treatment.

81-100%

The person is in the bed or the symptoms are being magnified.

The reliability and validity of the said questionnaires are confirmed (7-10). The scoring pattern of ODI and NDI scales was similar (each item was scored in the range 0-5. The first point 1 was equal to 0 and the last point is equal to 5). Finally, the final score was measured based on a percentage of scores and was placed in the relevant group.

Results :

In this study, 102 dentists participated (52.9%

were male and 47.1% (n=48) were female).

71.6% (n=73) of the dentists were general dentists, and 28.4% (n=29) were specialists. The mean age range of dentists was 37.6±8.9 and the mean work experience of the dentists was 11.8±8.8 years. Also, the mean working hours per day for the dentists were 6.06±2.18 hours.

Investigating the frequency of feeling skeletal pain showed that in 86.3% of dentists, pain in at least one organ was reported in recent 7 days, and in 96.1% of them, the pain was reported over the last year (chronic pain). Besides, 59.8% of the dentists reported interruption-causing pain in daily activities over the last year.

3.9% of dentists reported no chronic pain; although 9.8% reported pain in one site, 29.4% in two sites, 25.5% in three sites, 22.5% in four sites, and 8.8% of them reported pain in all sites investigated (five sites).

Table 1: prevalence of pain in studied times based on gender, age, work experience, working hours, and academic degree

		Recent 7 days	Recent 12 months (chronic pain)	Recent 12 months with the disorder
		Percent (number)	Percent (number)	Percent (number)
Gender	Female	93.8 (45)	97.9 (47)	64.6 (31)
	Male	79.6 (43)	94.4 (51)	55.6 (30)
	p-value	0.039	0.367	0.353
Age	24-35	89.6 (45)	97.9 (47)	56.2 (27)
	36-45	86.7 (26)	96.7 (29)	70 (21)
	Above 45	79.2 (19)	91.7 (22)	54.2 (13)
	p-value	0.479	0.428	0.393
Work experience	1-10 years	91.1 (51)	98.2 (55)	58.9 (33)
	11-20 years	82.1 (23)	96.4 (27)	64.3 (18)
	More than 21 years	77.8 (14)	88.9 (16)	55.6 (10)
	p-value	0.274	0.206	0.824
Working hours	1-5hrs	85.7 (42)	98 (48)	59.2 (29)
	6-10hrs	86.3 (44)	94.1 (48)	58.8 (30)
	11-15hrs	100 (2)	100 (2)	100 (2)
	p-value	0.847	0.588	0.503
Degree	General	86.3 (63)	95.9 (70)	63 (46)
	Specialized	86.2 (25)	96.6 (28)	51.7 (15)
	p-value	0.990	0.877	0.294

The results of table 1 show that in the study times, there was no significant difference in the prevalence of pain based on age groups, work experience, working hours, and aca

ademic degree. However, based on gender, the prevalence of pain in females was significantly more than males in the recent 7 years (table 1).

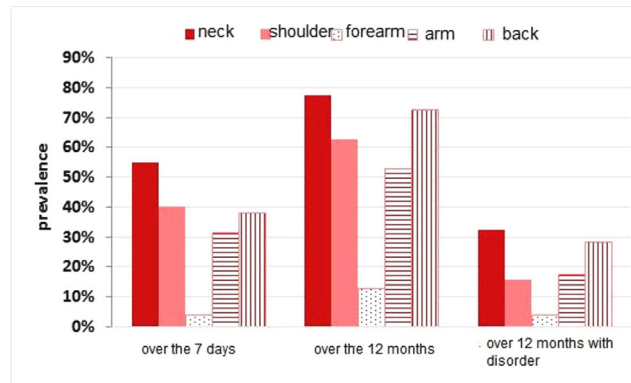


Figure 1: prevalence of pain based on the site of pain in studied times

Within the recent 7 days, the prevalence of pain in the shoulder in females was more than in males ($P < 0.05$). In other sites, the prevalence of pain was the same in males and females.

Over the 12 days, feeling musculoskeletal pain, along with disorder in all sites (neck, shoulder, forearm, arm, and back) was not significantly different between males and females (table 2).

Table 2: prevalence of musculoskeletal pain of dentists based on site of pain and gender

GENDER	Recent 7 days		Recent 12 months		Recent 12 months with disorder		
	Percent (no)	p-value	Percent (no)	p-value	Percent (no)	p-value	
Neck	Female	47.9 (23)	0.181	72.9 (35)	0.302	33.3 (16)	0.893
	Male	61.1 (33)		81.5 (44)		31.5 (17)	
shoulder	Female	58.3 (28)	0.000	72.9 (35)	0.045	16.7 (8)	0.829
	Male	24.1 (13)		53.7 (29)		14.8 (8)	
Forearm	Female	4.2 (2)	0.904	12.5 (6)	0.944	1.2 (1)	0.357
	Male	3.7 (2)		13.0 (7)		5.6 (3)	
Arm	Female	35.4 (17)	0.407	62.5 (30)	0.068	16.7 (8)	0.773
	Male	0 (0)		44.4 (24)		18.5 (10)	
Back	Female	41.7 (20)	0.501	75.0 (36)	0.604	27.1 (13)	0.730
	Male	35.2 (19)		70.4 (38)		29.6 (16)	

Over the recent 7 days and the 12 months, no significant difference was observed among the age groups in neck, shoulder, arm, and back in terms of musculoskeletal pain (table 3). Over the 12 months, musculoskeletal pain, along

with disorder in the neck, shoulder, forearm, arm, and back, and with disruption in personal activities showed no significant difference among the dentists with an age range of 24-35 years old and above 45 years old (table 3).

Table 3: prevalence of musculoskeletal pain of dentists based on sit of pain and age groups

	AGE	Recent 7 days		Recent 12 months		Recent 12 months with disorder	
		Percent (no)	p-value	Percent (no)	p-value	Percent (no)	p-value
Neck	24-35	50.0 (24)	0.639	79.2 (38)	0.917	29.2 (14)	0.766
	36-45	60.0 (18)		76.7 (23)		36.7 (11)	
	Above 45	58.3 (14)		75.0 (18)		33.3 (8)	
Shoulder	24-35	41.7 (20)	0.896	58.3 (28)	0.361	4.2 (2)	0.09
	36-45	36.7 (11)		60.0 (18)		26.7 (8)	
	Above 45	41.7 (10)		75.0 (18)		25.0 (6)	
Forearm	24-35	0 (0)	0.150	4.2 (2)	0.050	0 (0)	0.141
	36-45	6.2 (7)		20.0 (6)		6.7 (2)	
	Above 45	3.8 (2)		20.8 (5)		3.8 (2)	
Arm	24-35	27.1 (13)	0.218	50.0 (24)	0.654	18.8 (19)	0.308
	36-45	26.7 (8)		60.0 (18)		10.0 (3)	
	Above 45	0 (0)		50.0 (12)		25.0 (6)	
Back	24-35	35.4 (17)	0.520	68.8 (33)	0.713	25.0 (12)	0.683
	36-45	46.7 (14)		76.7 (23)		30.0 (9)	
	Above 45	33.3 (8)		75.0 (18)		33.3 (8)	

Over the recent 7 days and 12 months, musculoskeletal pain, and musculoskeletal disorder in recent 12 months showed.

no significant difference among dentists based on work experience (table 4)

Table 4: prevalence of musculoskeletal pain of dentists based on site of pain and work experience

	work experience	Recent 7 days		Recent 12 months		Recent 12 months with disorder	
		Percent (no)	p-value	Percent (no)	p-value	Percent (no)	p-value
Neck	1-10 years	51.8 (29)	0.757	80.4 (45)	0.574	32.1 (18)	0.688
	11-20 years	57.1 (16)		71.4 (20)		32.1 (9)	
	more than 21	61.1 (11)		77.8 (14)		33.3 (6)	
shoulder	1-10 years	42.9 (24)	0.768	58.9 (33)	0.542	5.4 (3)	0.011
	11-20 years	39.3 (11)		67.9 (19)		32.1 (9)	
	more than 21	33.3 (6)		66.7 (12)		22.2 (4)	
forearm	1-10 years	1.8 (1)	0.206	7.1 (4)	0.216	0 (0)	0.002
	11-20 years	3.6 (1)		17.9 (5)		7.1 (2)	
	more than 21	11.1 (2)		22.2 (4)		11.1 (2)	
arm	1-10 years	28.6 (16)	0.710	53.6 (30)	0.760	19.6 (11)	0.586
	11-20 years	32.1 (9)		57.1 (16)		7.1 (2)	
	more than 21	38.9 (7)		44.4 (8)		27.8 (5)	
back	1-10 years	41.1 (23)	0.799	71.4 (40)	0.187	30.4 (17)	0.090
	11-20 years	35.7 (10)		75.0 (21)		17.9 (5)	
	more than 21	33.3 (6)		72.2 (13)		38.9 (7)	

Over the 7 days and 12 months, feeling musculoskeletal pain and MSD over the 12 months showed no significant difference among dentists based on working hours (table 5).

Table 5: prevalence of musculoskeletal pain of dentists based on site of pain and working hours

	work experience	Recent 7 days		Recent 12 months		Recent 12 months with disorder	
		Percent (no)	p-value	Percent (no)	p-value	Percent (no)	p-value
Neck	1-5hrs	49.0 (24)	0.251	77.6 (38)	0.977	34.7 (17)	0.911
	6-10hrs	58.8 (30)		76.5 (39)		29.4 (15)	
	11-15hrs	100.0 (2)		100.0 (2)		50.0 (1)	
shoulder	1-5hrs	42.9 (21)	0.732	65.3 (32)	0.798	20.4 (10)	0.897
	6-10hrs	39.2 (20)		58.8 (30)		11.8 (6)	
	11-15hrs	100.0 (2)		100.0 (2)		100.0 (2)	
forearm	1-5hrs	2.0 (1)	0.233	10.2 (5)	0.056	4.1 (2)	0.001
	6-10hrs	5.9 (3)		13.7 (7)		2.0 (1)	
	11-15hrs	100.0 (2)		50.0 (1)		50.0 (1)	
arm	1-5hrs	28.63 (14)	0.147	57.1 (28)	0.092	10.2 (5)	0.005
	6-10hrs	31.4 (16)		47.1 (24)		23.5 (12)	
	11-15hrs	100.0 (2)		100.0 (2)		50.0 (1)	
back	1-5hrs	36.7 (18)	0.644	77.6 (38)	0.554	22.4 (11)	0.184
	6-10hrs	37.3 (19)		66.7 (34)		31.4 (16)	
	11-15hrs	100.0 (2)		100.0 (2)		100.0 (2)	

Over the 7 days and 12 months, musculoskeletal pain and MSD over the 12 months showed no significant difference among the dentists in terms of academic degree (table 6).

Table 6: prevalence of musculoskeletal pain of dentists based on site of pain and academic degree

	work experience	Recent 7 days		Recent 12 months		Recent 12 months with disorder	
		Percent (no)	p-value	Percent (no)	p-value	Percent (no)	p-value
Neck	general	53.4 (39)	0.634	78.1 (57)	0.809	32.9 (24)	0.944
	specialist	58.6 (17)		75.9 (22)		31.0 (9)	
shoulder	general	38.4 (28)	0.548	60.3 (44)	0.413	15.1 (11)	0.731
	specialist	44.8 (13)		69.0 (20)		17.2 (5)	
forearm	general	2.7 (2)	0.329	11.0 (8)	0.391	2.7 (2)	0.310
	specialist	6.9 (2)		17.2 (5)		6.9 (2)	
arm	general	31.5 (23)	0.963	49.3 (36)	0.244	16.4 (12)	0.557
	specialist	31.0 (9)		62.1 (18)		20.7 (6)	
back	general	43.8 (32)	0.065	78.1 (57)	0.047	35.6 (26)	0.013
	specialist	24.1 (7)		58.6 (17)		10.3 (3)	

The mean value of disability in the neck (15.54±10.80) and back (12.81±9.49) showed no significant difference (Table 7).

Table 7: comparing average disability in dentists suffering from neck and back damage

	number	mean	SD	p-value
neck	79	15.54	10.80	0.099
back	74	12.81	9.49	

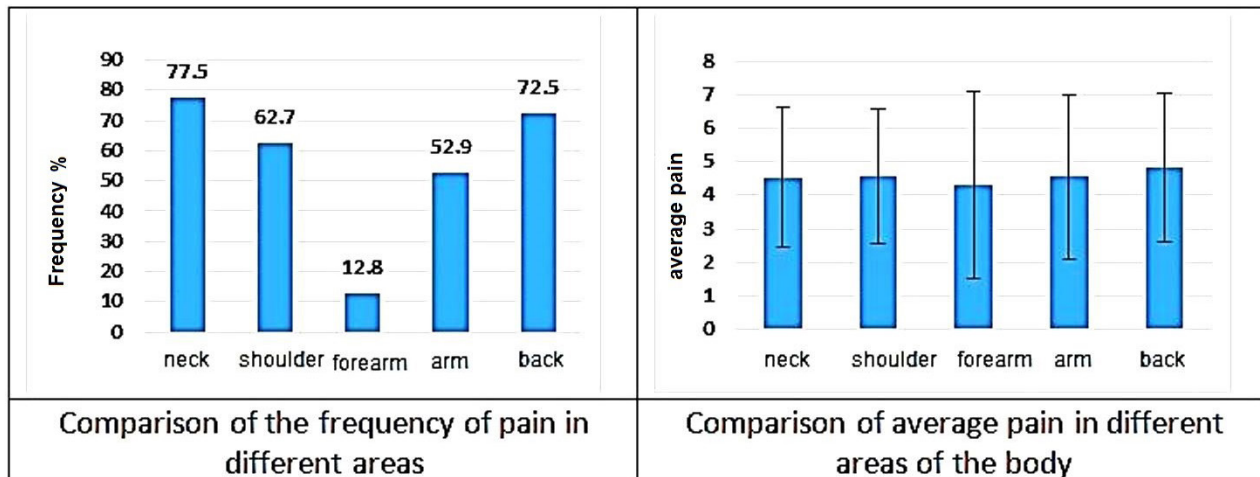


Figure 2 : comparison of the pain frequency and average pain in different areas of the body

Discussion :

There was extensive evidence that musculoskeletal pain is a significant burden in dentistry(14-16). This study has been conducted with the cooperation of dentists during the spring and summer of 2020. This work was completed at the time of the coronavirus outbreak. Based on the order of the National Committee to Combat Corona based on minimizing unnecessary physical contacts, online questionnaires were used and were sent in cyberspace (WhatsApp and Telegram).

The results of this study showed that 96.1% of dentists reported chronic musculoskeletal pain (over the 12 months) at least in one organ. In 59.8% of them, this pain could interrupt the daily activities over the 12 months. Besides, 86.2% of dentists reported musculoskeletal pain at least in one organ over the 7 days. Hayes et al.(17) reported the musculoskeletal disorder (MSD) complaints in dentists equal to 64-93%; Marklund et al (18) report the value at 71.1%, and Freire et al (19) reported the value at 90.4%. Alaqil et al (20) reported MSD after dentistry equal to 68%, which is less than the value in this study. Gandham et al (21) showed that 20.7% of dentists reported no pain over the 6 months; although cases without pain over the 12 months in this study were just 3.9%. However, this can be attributed to the short time of the study (6 months) of Gandham compared to the present study. The rest of the difference can be attributed to working

conditions of dentists such as using ergonomic chairs, elbow support, and good posture of body while working, indirect vision, and good light.

The results of this study showed that chronic pain in the neck at 77.5% had the most prevalence and chronic pain in the back (72.5%) was in second place. Besides, chronic pain in the forearm (12.7%) had the least prevalence among dentists.

The findings of , Gandham et al (21), Pejcic et al (22), Freire et al (19) have respectively reported neck and back as the highest risk factors of MSD. The findings of Bozkurt et al (23), Hayes et al (17), and Al-Mohrej et al (24) showed back and neck pain as the most prevalent items. These results were consistent with the findings of the present study. Alaqil et al (20) have reported backache with the prevalence of 53.9% as the most prevalent and ankle pain with the prevalence of 7.4% as the most non-prevalent musculoskeletal pain. These results are close to the findings of this study; although there are some differences between the two studies. The differences are probably because of differences in using instruments such as dentist loop and other magnification instruments and different daily habits of dentists in both studies such as exercising and food diets.

In this study, the prevalence of chronic musculoskeletal pains in female dentists (97.9%) was more than in males (94.4%); although the difference between them is not significant

statistically. Marklund et al (18), Pejčić et al (22), and Al-Mohrej et al (24) reported that the prevalence of pain in females is more than in males. However, Gandham et al (21) reported that the prevalence of musculoskeletal pain in males is significantly more than in females. Bozkurt et al (23) reported pain in the arm in females significantly more than males. The difference is probably relevant to the larger sample size of these studies (more than 300 individuals) and different measurement instruments.

According to the reports of dentists who participated in this study, 86.2% of them were suffering from chronic pain in more than one area. Marklund et al (18) reported that pain was observed in about 55% of participants in more than one area. Besides, Alaqil et al (20) reported pain in more than one area higher than 17%, which is lower than the value in this study. The reason for such difference can be less working hours of dentists in this study compared to the dentists in the present study and using magnification such as dentistry loop.

In this study, musculoskeletal pain showed no significant difference in different age groups of dentists. However, the findings of Al-Mohrej et al (24) showed that the prevalence of pain in older dentists was significantly higher than others, which can be explained based on the large sample size in these studies. It should be noted that aging may cause disabilities in individuals regardless of the job.

The results of this study on the prevalence of chronic pains showed no significant difference based on the work experience of dentists.

In this study, the daily working hours of dentists left no significant effect on the overall prevalence of musculoskeletal pains, and the findings of Arthisri et al (25) confirmed this result. However, the findings of Gandham et al (21), and Pejčić et al (22) showed that the prevalence of pain in dentists is more than in others. Although the present study confirms this finding, the insignificant nature of the results of the present study can be attributed to more work hours.

In this study, the academic degree could leave no significant effect on the overall prevalence

of musculoskeletal pains. The findings of Gandham et al (21) have also confirmed this finding. Only the prevalence of back pain in general dentists was significantly higher than in other areas. In other areas, no significant difference was observed between specialists and general dentists.

In this study, investigation of the prevalence of musculoskeletal pain based on the intensity of pain showed that average pain in the neck, back, and shoulders, and mild pain in the forearm and arm had the highest prevalence. However, the mean value of VAS in different areas showed no significant difference.

The findings of Ramandi et al (26) showed that there is a significant correlation between back disability and work experience; although the present study didn't confirm this. As the mean back disability in the participants of this study was more than the present study, the difference can be explained. Besides, there was a significant and positive correlation between neck disability and work experience. Hence, with aging and gaining work experience, the disability in the neck could be increased.

Conclusion:

The findings showed that risk of MSDs and their prevalence in the study population was high with significant association. Based on the results, it seems necessary to pay proper attention to factors associated with MSDs to develop ergonomic solutions to reduce or eliminate musculoskeletal injuries. It is recommended to further studies to consider the data collection time and study population and sample size. Besides, further studies should be done to analyze the effectiveness of different educational methods for dentists to get adequate postures of the body, and the effectiveness of improvement methods and reduction of musculoskeletal disease in dentist.

References :

1. Kumaraveloo, K Sakthiaseelan; Lunner Kolstrup, Christina (3 July 2018). "Agriculture and musculoskeletal disorders in low- and middle-income countries". *Journal of Agromedicine*. 23 (3): 227-248. <https://doi.org/10.1080/1059924X.2018.1458671>

2. Hagberg M, Wegman DH. Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups. *Br J Ind Med* 1987;44(9):602-10. <https://doi.org/10.1136/oem.44.9.602>
3. Babar-Craig H, Banfield G, Knight J. Prevalence of back and neck pain amongst ENT consultants: national survey. *J Laryngol Otol* 2003;117(12):979-82. <https://doi.org/10.1258/002221503322683885>
4. Maguire M, O'Connell T. Ill-health retirement of schoolteachers in the Republic of Ireland. *Occup Med (Chic Ill)* 2007;57:191-3. <https://doi.org/10.1093/occmed/kqm001>
5. McNee C, Kieser JK, Antoun JS, et al. Neck and shoulder muscle activity of orthodontists in natural environments. *J Electromyogr Kinesiol* 2013;23:600-7. <https://doi.org/10.1016/j.jelekin.2013.01.011>
6. Ayatollahi J, Ayatollahi F, Ardekani AM, et al. Occupational hazards to dental staff. *Dent Res J (Isfahan)* 2012;9:2-7. <https://doi.org/10.4103/1735-3327.92919>
7. Ayers KMS, Thomson WM, Newton JT, et al. Self-reported occupational health of general dental practitioners. *Occup Med (Lond)* 2009;59:142-8. <https://doi.org/10.1093/occmed/kqp004>
8. Kierklo A, Kobus A, Jaworska M, et al. Work-related musculoskeletal disorders among dentists-a questionnaire survey. *Ann Agric Env Med* 2011;18:79-84.
9. Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a review. *Ind Health* 2007;45:611-21. <https://doi.org/10.2486/indhealth.45.611>
10. Shah S, Dave B. Prevalence of low back pain and its associated risk factors among doctors in Surat. *Int J Heal Sci Res* 2012;2:91-102.
11. Samotoi A, Moffat SM, Thomson WM. Musculoskeletal symptoms in New Zealand dental therapists: prevalence and associated disability. *N Z Dent J* 2008;104:49-53; quiz 65.
12. Al Wazzan KA, Almas K, Al Shethri SE, et al. Back & neck problems among dentists and dental auxiliaries. *J Contemp Dent Pr* 2001;2:17-30. <https://doi.org/10.5005/jcdp-2-3-1>
13. Alghadir A, Zafar H, Iqbal ZA. Work-related musculoskeletal disorders among dental professionals in Saudi Arabia. *J Phys Ther Sci* 2015;27:1107-12. <https://doi.org/10.1589/jpts.27.1107>
14. Ratzon NZ. Musculoskeletal symptoms among dentists in relation to work posture. *Work*. 2000;15:153-158.
15. Lehto TU, Helenius HY, Alaranta HT. Musculoskeletal symptoms of dentists assessed by a multidisciplinary approach. *Community Dent Oral Epidemiol*. 1991;19:38-44. <https://doi.org/10.1111/j.1600-0528.1991.tb00103.x>
16. Milerad E, Ekenvall L. Symptoms of the neck and upper extremities in dentists. *Scand J Work Environ Health*. 1990;16:129-134. <https://doi.org/10.5271/sjweh.1807>
17. Hayes MJ, Cockrell D, Smith DR. A systematic review of musculoskeletal disorders among dental professionals. *International Journal of Dental Hygiene*. 2009;7(3):159-65. <https://doi.org/10.1111/j.1601-5037.2009.00395.x>
18. Marklund S, Mienna CS, Wahlström J, Englund E, Wiesinger B. Workability and productivity among dentists: associations with musculoskeletal pain, stress, and sleep. *International Archives of Occupational and Environmental Health*. 2019;93(2):271-8. <https://doi.org/10.1007/s00420-019-01478-5>
19. Freire ACdGF, Soares GB, Rovida TAS, Garbin CAS, Garbin AJ. Musculoskeletal disorders and disability in Brazilian Dentists in São Paulo. *Revista Dor*. 2017;18(2):97-102. <https://doi.org/10.5935/1806-0013.20170020>
20. Alaql F, Alshouibi E, Almansour L, Alqurashi A. The effect of several patients treated dental loupes usage, stress, and exercise on musculoskeletal pain among dentists in Jeddah. *Journal of International Society of Preventive and Community Dentistry*. 2020;10(3):336. https://doi.org/10.4103/jispcd.JISPCD_2_20
21. Gandham A, Boppana NK, Vinnakota NR, Burri KK, Th UK, Pallepati A. Assessment of musculoskeletal disorders and associated risk factors among dentists in Rajahmundry City: A cross-sectional study. *Journal of Indian Association of Public Health Dentistry*. 2019;17(2):114. https://doi.org/10.4103/jiaphd.jiaphd_9_19
22. Pejčić N, Petrović V, Marković D, Miličić B, Dimitrijević II, Perunović N, et al. Assessment of risk factors and preventive measures and their relations to work-related musculoskeletal pain among dentists. *Work*. 2017;57(4):573-93. <https://doi.org/10.3233/WOR-172588>
23. Bozkurt S, Demirsoy N, Günendi Z. Risk factors associated with work-related musculoskeletal disorders in dentistry. *Clinical and Investigative Medicine*. 2016:S192-S6. <https://doi.org/10.25011/cim.v39i6.27527>
24. Al-Mohrej OA, Al-Shaalan NS, Al-Bani WM, Masuadi EM, Almodaimegh HS. 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(6):e011100. <https://doi.org/10.1136/bmjopen-2016-011100>
25. Arthi Sri AS, Jain AR, Philip JM, Krishnan CJV, Chandran CR. Site Predilection of Occupational Musculoskeletal Complaints among Dental Practitioners in Chennai City. *Biology and Medicine*. 2017;09(01). <https://doi.org/10.4172/0974-8369.1000373>
26. Fasih-Ramandi F, Nadri A, Teimori G, Nadri H. The correlation between low back pain and disability index with lumbar lordosis among dentists. *Russian Open Medical Journal*. 2019;8(2):e0207. <https://doi.org/10.15275/rusomj.2019.0207>