Musculoskeletal Disorders among Brazilian Dentists in São Paulo

Gabriella Barreto Soares[a], Carlos Eduardo Siqueira[b], Lorena Estrada-Martínez[b], Cléa Adas Saliba Garbin[a], Artênio José Ísper Garbin[a]

[a] Araçatuba School of Dentistry – Paulista State University / Unesp, Araçatuba, Brazil
[b] College of Public and Community Service, University of Massachusetts Boston, Boston, USA

ABSTRACT

OBJECTIVE: This study aimed at investigating the relationships between health and work-related musculoskeletal disorders (WMSDs) in dentists, and the relationship with socio-demographic, work and health variables.

METHODS: We conducted a cross-sectional study of 204 dentists who work in public clinics in the state of São Paulo, Brazil. We used a self-administered survey that included questions on socio-demographic and health aspects, work-related factors, and the Nordic questionnaire.

RESULTS: WMSDs were often reported in the neck, shoulder, lower back, and hand/wrists. Logistic regression analysis revealed that there was a correlation between reports of WMSD in the neck and age (OR = 9.48) and health problems (OR = 6.71). Moreover, strong associations were found between MSDs in the shoulders, gender (OR = 5.88) and breaks between appointments (OR = 4.17).

CONCLUSION: We concluded that the health problems diagnosed, work-related activities and gender contributed to musculoskeletal disorders in dentists in this clinic.

Keywords: ergonomics; musculoskeletal disorders; occupational health; dentistry.

Desordens Musculoesqueléticas em cirurgiões-dentistas em São Paulo

RESUMO

OBJETIVO: Este estudo teve como objetivo investigar as relações entre a saúde e as desordens musculoesqueléticas relacionados ao trabalho em cirurgiões-dentistas e a relação com variáveis sociodemográficas, de trabalho e de saúde.

METODOLOGIA: Foi realizado um estudo transversal com 204 cirurgiões-dentistas que trabalham em clínicas no Sistema Único de Saúde (SUS) no estado de São Paulo, Brasil. Foi utilizado um questionário auto-aplicável que incluiu questões sobre aspectos sociodemográficos e de saúde, fatores relacionados ao trabalho e o questionário nórdico.

RESULTADOS: Desordens musculoesqueléticas foram frequentemente relatados no pescoço, ombro, parte inferior das costas e mãos/pulsos. A análise de regressão logística revelou que houve correlação entre relatos das desordens musculoesqueléticas no pescoço e idade (OR = 9,48) e problemas de saúde (OR = 6,71). Além disso, associações fortes foram encontradas entre desordens musculoesqueléticas nos ombros e gênero (OR = 5,88) e intervalos entre os atendimentos (OR = 4,17).

CONCLUSÃO: Conclui-se que os problemas de saúde diagnosticados, as atividades relacionadas ao trabalho e o gênero contribuíram para desordens musculoesqueléticas em cirurgiões-dentistas no SUS.

Palavras-chave: ergonomia; desordens musculoesqueléticas; saúde ocupacional; odontologia.

Correspondence:
Gabriella Barreto Soares
gabriella.barreto@yahoo.com.br

INTRODUCTION

Oral health-related problems affect much of the population in Brazil and abroad, and dentists are often exposed to a greater number of patients in clinics and consequently, an intense workload. In addition, the dental market has become very competitive and has influenced the daily life of these professionals, with changes in their professional exercise requiring great physical effort and increased work days [1,2].

In Brazil, most dentists that previously were dedicated to work only in the public service or just in private practice today exert exhaustive working hours in both types of services. It is also observed that these professionals often work in stressful conditions, spending hours in non-ergonomic awkward postures and performing accurate and repetitive movements [3].

These conditions lead this category of professionals to develop health problems resulting from the exercise of the profession, particularly musculoskeletal disorders. Such diseases are characterized by the presence of discomfort, disability or persistent pain in the joints, muscles, tendons and other parts caused or aggravated by repetitive movements and inadequate prolonged postures or bodily forces [4].

Various case definitions for musculoskeletal disorders are cited in the literature. Some rely on the subject's reported frequency, duration or intensity of pain [5] while others define cases as any report of pain in the specified time period. Physical examination findings have also been included in the definition, however, many MSDs have no detectable physical findings.

The high prevalence of musculoskeletal disorders is also observed in other studies, more frequently affecting the neck, lower back and shoulders [4,6-11]. Some studies have found that musculoskeletal disorders in dental professionals significantly contribute to reduced productivity, departure because of health problems and abandonment of the profession [9].

According to the International Dental Federation (IDF), Brazil has the largest number of dental professionals in the world; in absolute numbers, there were almost 220,000 registered professionals by the year 2009. However, few studies have been performed in Brazil to assess musculoskeletal disorders in dentists [2,7,12] and the questionnaire of perception of work-related factors was not applied earlier in this group of professionals, but only in dental students [13] and dental hygiene technicians [14].

The objective of this study was to investigate the prevalence of musculoskeletal disorders in dentists who work in clinics of the National Health System in the state of São Paulo and describe the relationships between work related risk factors and the prevalence WMSDs.

METHODS

Ethical aspects

The study was approved by the Ethics Committee for Research on Humans of the Araçatuba School of Dentistry, Paulista State University and performed with the understanding and written consent from each participant.

An exploratory cross-sectional study was conducted in public health services of the National Health System that provide dental care in the northwest health region of São Paulo. São Paulo is a state located in southeastern Brazil, with the highest concentration of dentists in Brazil (33.0%). The northwest health region covers 40 municipalities in the region, with about 346 dentists working in the dental offices of Family Health Units, Emergency Care Units and specialized dental clinics in this health region.

The sample consisted of 204 dentists who were active in the municipalities in that period and were working 20 or 40 hours per week in the public health service, and the survey response rate was 69,4%. The sample excluded patients with congenital or acquired physical disabilities involving the upper or lower limbs, joint or spine, pregnant and lactating women.

Data collection

Data collection was performed for four months in 2016. The data relating to socio-demographic variables, work and health of dentists were obtained through a structured questionnaire designed specifically for this study. Socio-demographic variables include age, gender and marital status. The work-related are: work location, working hours, breaks between calls and clinical time. In relation to health, there was the body mass index (BMI), physical activity, diagnosis of any disease in the last 12 months and use of pain medication.

To evaluate musculoskeletal symptoms, the Nordic Questionnaire developed by Kuorinka et al. [15] was used with the aim of standardizing the measurement of reporting musculoskeletal symptoms. The Brazilian version of the Nordic questionnaire was validated and adapted by Barros and Alexandre in 2003 [16]. This instrument consists of the rear view of a human figure, divided into nine anatomical regions: neck, shoulders, upper and lower back, elbows, wrists / hands, hips / thighs, knees and ankles / feet. It includes questions about the presence of musculoskeletal pain in any of the nine anatomical areas impediment to perform normal activities and need for consultation by a healthcare professional. The period of 12 months prior to the study was considered as the occurrence time for musculoskeletal symptoms.

The questionnaire on risk factors at work that can contribute to musculoskeletal disorders (work-related) was also applied to identify how much work activities contribute to the development of musculoskeletal disorders. This tool was originally developed by Rosecrance et al. [17] in the US. It was adapted and validated in 2009 for the Brazilian culture by Colucci and Alexandre [18]. It consists of 15 questions that seek to assess the perceptions of individuals related to different risk factors at work and their contribution to work-related musculoskeletal disorders. The subjects were asked to indicate on a scale from 0 to 10 (0 = none and 10 = a lot)

how much each variable contributed to the development of pain and injury related to their current tasks at work. Responses were classified in scale with three categories that indicate the severity of symptoms in ascending order: the first 0-1 indicates the absence of symptoms, the second 2-7 indicates minimal to moderate symptoms and the last 8-10 indicates more severe symptoms.

Data analysis

Descriptive analyzes were performed for socio-demographic characterization of the population through measures of central tendency (single, mean and median frequencies) and dispersion (standard deviation). Statistical chi-square tests, Fisher and the maximum likelihood ratio for bivariate analysis to evaluate statistical associations between the dependent and independent variables were performed. The independent variables are the five body regions with higher prevalence of reported musculoskeletal symptoms in the last 12 months: neck, shoulders, upper and lower back and wrist / hand, and the socio-demographic, work-related and health as dependent variables, in addition to the work factors associated with musculoskeletal disorders (work-related).

The multivariate logistic regression model included all variables that were associated to the level of $p < 0.01$. After adjusting the multiple logistic regression model with a 95% confidence interval, the p values were estimated. All statistical analyzes were performed using the SPSS version 21.0.

RESULTS

More than half of the study participants were women (62.3%) with mean age of 43 years (SD 9.51) and with a stable relationship (71.9%). Most worked in clinics for an average of 21 years (SD 9.48). Much of the sample worked in public and private services (63.7%), with a workload of more than 8 hours per day (41.4%). In addition 38.4% said they did not take breaks between daily appointments, and among those who did, they had only 1 or 2 (45.9%) daily breaks.

As seen in **Table 1**, most had normal BMI (53.0%), but there is a considerable portion being overweight (35.9%). The majority (66.7%) practiced physical activity for more than 1 year (69.4%) and three times a week (41.9%). Twenty six percent of respondents had some health problem diagnosed in the last year and 62.3% of these were related to musculoskeletal disorders. Most respondents (60.1%) made use of analgesics (22.0%), anti-inflammatory drugs (33.3%) or a combination of both (30.1%).

Table 2 shows that 81.4% of the sample reported pain in the last 12 months. More than half of dentists had pain in the neck (55.4%), shoulders (52.0%) and upper back (50.5%), while 46.1% had sore hands and wrists and 48.8% at the lower back. Musculoskeletal pain in the lower regions (hips, thighs, knees, ankles and feet) were observed in less than 30% of respondents.

Table 1. Health Characteristics of Dentists. São Paulo, Brazil, in 2016.

Variables	n	%
BMI		
Underweight	2	1.0
Normal weight	105	53.0
Overweight	71	35.9
Obesity	20	10.1
Practice physical activity		
Yes	136	66.7
No	68	33.3
Kind of physical activity		
Resistence	28	20.7
Aerobic	61	45.2
Both	46	34.1
Time practice physical activity		
12 months or less	34	30.6
12 months or more	77	69.4
Frequence during the week		
One or Twice	47	34.6
3 times	57	41.9
4 or more	32	23.5
Health problems diagnosed last year		
Yes	53	26.0
No	151	74.0
Kind of problem		
Musculoskeletal disorders	33	62.3
Others	20	37.7
Take Pain Medicine		
Yes	122	60.1
No	81	39.9
Kind of medicine		
Analgesic	27	22.0
Anti inflammatory	41	33.3
Combination	37	30.1
Others	18	14.6

Regarding the impediment to perform their normal activities, it can be seen in **Table 2** that 40.2% of dentists reported that pain interfered with such performance in the last 12 months. Just over half (50.5%) of dentists sought care with a health professional because of musculoskeletal disorders. Forty one point seven percent reported pain in some body area in the last 7 days.

Regarding the problems related to risk factors at work that can contribute to musculoskeletal symptoms, most participants reported moderate or minor problems (77.9%). The issues that had higher scores (average above 6) were "Bending or twisting the back uncomfortably," "Keep working when they are in pain or injury", "Working in the same position for long periods" and "Working in inadequate positions / tight spaces. "

Table 2. Distribution of musculoskeletal symptoms (12 months and 7 days), disability and demand for professional healthcare among dentists. São Paulo, Brazil, in 2016.

Body Area	Symptoms in the last 12 months		Impediment to perform normal activities bacause of this problem over the past year		Consultation with a professional in the área of health because of this condition in the past 12 months		Symptoms in the last 7 days	
	n	%	n	%	n	%	n	%
Neck	113	55.4	32	15.7	53	26.0	37	18.1
Shoulder	106	52.0	26	12.7	45	22.1	40	19.6
Upper Back	103	50.5	28	13.7	35	17.2	35	17.2
Elbow	32	15.7	10	4.9	17	8.3	10	4.9
Wrist/hand	94	46.1	15	7.4	28	13.7	17	8.3
Lower back	99	48.5	32	15.7	47	23.0	42	20.6
Hip/haunch	31	15.2	10	4.9	14	6.9	9	4.4
Knee	45	22.1	12	5.9	20	9.8	10	4.9
Ankle/feet	32	15.7	11	5.4	18	8.8	7	3.4

Table 3. Bivariate Analysis of Pain scores in the Nordic Questionnaire Body Regions, according to Sociodemographic variables, Health and Risk Factors Relating to Work. São Paulo, 2016.

Independent variables	Neck pain		Shoulder pain		Lower Back pain		Upper Back pain		Wrist/Hand pain	
	N(%)	P valor	N(%)	P valor	N(%)	P valor	N(%)	P valor	N(%)	P valor
Gender		0,056		0.004		0.486		0.088		0.300
Female	78(69.0)		77(72.6)		65(65.7)		71(68.9)		63(67.0)	
Male	35(31.0)		29(27.4)		34(34.3)		32(31.1)		31(33.0)	
Marital status		0,179		0.880		0.880		0.736		0.849
Married	77(68.1)		76(72.4)		70(71.4)		73(70.9)		67(71.3)	
Single	36(31.9)		29(27.6)		28(28.6)		30(29.1)		27(28.7)	
Age		**0.006**		0.248		0.216		0.067		0.529
< 43 years	63(56.6)		54(50.9)		51(51.5)		55(53.4)		42(44.6)	
≥ 43 years	50(44.2)		52(49.0)		48(48.5)		48(46.6)		52(55.3)	
Years that clinic		0.001		0.107		0.225		0.006		0.544
< 21 years	69(61.6)		59(56.7)		54(55.7)		62(60.8)		45(48.9)	
≥ 21 years	43(38.4)		45(43.3)		43(44.3)		40(39.2)		47(51.1)	
Kind of service		0,767		0.652		0.234		0.491		0.254
Public	42(37.5)		40(38.1)		40(40.8)		35(34.3)		38(40.9)	
Public and Private	71(62.5)		66(61.9)		59(59.2)		68(65.07)		56(59.1)	
Workload		0,591		0.772		0.540		0.545		0.791
Less than 6 hours	25(22.1)		11(10.4)		26(24.5)		22(30.3)		22(21.7)	
8 hours	44(38.9)		38(35.8)		39(39.8)		38(36.9)		28(30.1)	
More than 8 hours	44(38.9)		42(39.6)		37(37.8)		43(41.7)		40(43.0)	
Breaks		0,325		0.024		**0.015**		0.451		0.258
Yes	73(65.2)		64(61.0)		58(59.8)		67(65.7)		59(64.1)	
No	40(34.8)		42(39.0)		40(40.2)		36(34.3)		34(35.9)	
BMI		0,657		0.959		0.828		0.612		0.195
Normal weight	62(56.4)		56(54.4)		53(55.8)		55(54.5)		43(47.3)	
Overweight	37(33.6)		37(35.9)		33(34.7)		34(33.7)		36(39.6)	
Obesity	11(10.0)		10(9.7)		9(9.5)		12(11.9)		12(13.2)	
Practice physical activity		0,842		0.921		0.373		0.276		0.619
Yes	76(67.3)		71(67.0)		69(69.7)		65(63.1)		61(64.9)	
No	37(32.7)		35(33.0)		30(30.3)		38(36.9)		33(35.1)	
Health problems		0,014		0.269		0.583		0.301		0.252
Yes	37(32.7)		31(29.2)		24(24.2)		30(29.1)		28(29.8)	
No	76(67.3)		75(70.8)		75(75.8)		73(70.9)		66(70.2)	
Medicine pain		0,004		0.036		0.885		0.020		0.031
Yes	78(69.0)		71(67.0)		60(60.6)		70(68.0)		64(68.1)	
No	35(31.0)		35(33.0)		39(39.4)		33(32.0)		30(31.9)	
Work Related factors		0,003		0.236		0.050		0.050		0.041
No problem	6(5.3)		9(8.5)		10(10.1)		7(6.8)		9(9.6)	
Moderate problem	92(81.4)		84(79.2)		77(77.8)		83(80.6)		70(74.5)	
Severe problem	15(13.3)		13(12.3)		12(12.1)		13(12.6		15(16.0)	

Table 4. Multivariate Analysis of the relationship of the Regions Neck, Shoulders, Upper and Lower back and Wrist/Hand scores second Sociodemographic variables, Health, and Factors related to work. São Paulo, 2016.

Independent variables	Neck OR (95% IC)	Shoulder OR (95% IC)	Lower Back OR (95% IC)	Upper Back OR (95% IC)	Wrist/Hand OR (95% IC)
Age	**9.48(1.02–1.09)***	1.07(0.98-1.05)	1.45(0.99-1.05)	3.07(1.02-1.06)	0.01(0.97-1.03)
Female	2.81(0.26–0.98)	**5.88(1.20-1.73)***	0.01(0.50-1.78)	2.80(0.28-0.98)	0.56(0.40-1.40)
Married	0.01(0.55–1.97)	0.54(0.41-1.40)	0.06(0.49-1.67)	0.31(0.44-1.49)	0.43(0.69-2.32)
More than 21 years clinic	1.18(0.83-1.03)	0.13(0.92-1.13)	0.90(0.84-1.04)	1.43(0.82-1.03)	0.14(0.91-1.14)
Public service	0.03(0.52–2.25)	0.05(0.54-2.23)	1.09(0.31-1.28)	0.64(0.70-2.80)	0.06(0.45-1.79)
More than 8 hours per day	0.19(0.59–2.43)	0.22(0.41-1.61)	0.01(0.53-2.01)	0.07(0.52-2.02)	1.33(0.31-1.22)
No breaks	1.13(0.80–2.70)	**4.17(1.15-3.70)***	**6.87(1.41-4.48)***	0.40(0.70-2.21)	0.35(0.69-2.16)
Moderate perception	0.59(0.78-1.98)	0.25(0.70-1.93)	0.02(0.63-1.54)	0.05(0.68-1.67)	0.28(0.73-1.80)
Severe perception	0.59(0.50–1.28)	0.91(0.34-1.32)	0.02(0.64-1.57)	0.05(0.59-1-47)	0.28(0.55-1.35)
BMI	0.07(0.94–1.08)	0.16(0.94-1.09)	0.06(0.93-1.07)	0.00(0.93-1.07)	1.56(0.88-1.01)
Health problems	**6.71 (1.47-5.61)***	1.42(0.84-2.90)	0.01(0.54-1.79)	0.74(0.75-2.52)	0.37(0.68-2.27)
Use medicine pain	2.24(0.34-1.05)	1.58(0.86-2.87)	0.04(0.62-1.82)	2.87(0.33-0.98)	2.38(0.35-1.03)

* x2 test, p < 0.05; OR = prevalence ratio; 95% CI = 95% confidence interval.

The bivariate analysis of the Nordic Questionnaire variables (**Table 3**) shows the following statistically significant associations (p<0.05): a) neck pain in the last 12 months were associated with age, years of work, health-related problems, the use of pain medication and problems related to risk factors related to work b) shoulder pain was associated with gender, breaks between daily care and use of pain medication c) lower-back pain was associated with breaks in between daily care and medication use. e) pain in the upper back was associated with years of work, use of medication for pain and problems related to risk factors related to work f) pain in the wrists and hands were associated with drug use and problems related to risk factors related to work.

The multiple logistic regression model shows that being older (OR = 9:48) and related health problems (OR = 6.71) increased the risk of developing neck pain; and individuals from the female gender (OR = 5.88) that did not take breaks between sessions (OR = 4.17) had a higher risk of having shoulder problems (**Table 4**). In addition, individuals who did not take breaks between sessions (OR = 6.87) also had a higher risk of musculoskeletal symptoms in the lower back.

DISCUSSION

Studies on musculoskeletal disorders in dentists have been performed for over 40 years and have generated important proposals for changes in the working process of these professionals, even with the change of standing work position for seated [16]. Their knowledge is still incipient in Brazil, although there are many studies on the prevalence of musculoskeletal complaints in other countries.

Some of these studies show a high prevalence of pain in the regions of the neck, shoulders and back, as found in this study. For example, in the study of 268 Polish dentists, 60.1% reported lower back pain, and neck pain (56.3%), lower extremities (47.8%) and wrists / hands (44.0%) [8]. In a similar study with dental professionals in Denmark, lower back pain was also the most reported problem prevalent in two-thirds of the study sample [6].

The most affected area reported by Brazilian dentists in our study was the neck (55.4%), as conducted by Alexandre et al. [12] with 298 Brazilian dentists. This author found that dentists had higher risk of developing musculoskeletal disorders, particularly back pain, tendinitis and arthritis than the general population and other health professionals such as doctors. Barbosa et al. [11] also found that dentists in the state of Minas Gerais were 1.5 times more likely to report musculoskeletal problems than other health professionals.

Occhionero et al. [19] conducted a systematic review of musculoskeletal disorders in health workers and showed that for dentists, the neck is the most affected area of the body in all the analyzed studies, with prevalence from 26% to 73%, and greater than 50% in 7 of the 12 reviewed studies. This high incidence of neck pain can be explained by the fact that dental professionals work most of the time with the neck flexed at 30 degrees [20], and that many dentists do not use indirect vision with a clinical mirror to work in the jaw region of the patient [21]. The use of a clinical mirror facilitates and eases movements to examine the oral cavity, as verified in the study by Santos and Barreto [7], in which indirect vision was associated with lower frequencies in neck pain.

The high prevalence of musculoskeletal disorders found among dental professionals can also be explained by exposure to awkward postures during the visits, the management of vibrating tools, excessive working hours, often without breaks, and the precise movements performed [7, 9, 22-24]. Our study found similar results, probably because the dentists who participated worked in both the public and private service, with work days of over 8 hours, without breaks between sessions.

The realization of pauses between sessions is essential to alternate the muscle groups and keep work productive. Detailed analyses on rest breaks in the dental practice were made by some authors, which found that more than 30%

of dentists work without breaks [8,25]. In our study, it was observed that the lack of breaks increased the likelihood of these professionals to present shoulder and lower back pain. The guidelines of the American Association of Industrial Hygienists (AAIH) recommends at least 6 minutes rest every hour for professionals who perform repetitive movements [26].

Wazzan et al. [27] found that only 37% of oral health professionals who suffer from neck and lower back pain sought medical attention, and concluded that these symptoms among dental professionals were not severe enough to require medication. In our study, more than half of dentists routinely used drugs for pain, and only 50.5% sought medical care because of musculoskeletal symptoms.

The reason for the difference in musculoskeletal symptoms between men and women is unclear, although researchers claim that women can pay more attention to their health and well-being, and that they may have a lower pain threshold or have less resistance to muscular stress [10]. On the other hand, according to these authors, women experience a double workday in their day-to-day, especially those living with a partner and children. They are burdened by household chores with less time for leisure activities and necessary rest, and therefore suffer the effects caused by occupational tasks more than men [28].

According to the published literature in scientific journals, the activities related to work that most commonly cause problems for health professionals are lifting heavy equipment, working in the same position for a long time and repetitive movements [29]. The variables that were perceived as greater risk factors for muscular-skeleton disorder symptoms in our study were related to the working position – bending the back uncomfortably, working in the same position for long periods and in inadequate positions, corroborating with previous studies on the subject.

There are no previous studies in the literature that have evaluated the perception of dentists regarding the association between risk factors and symptoms of musculoskeletal disorders. Garcia et al. [13] found that there was a strong association with the neck region in dental students. In addition, Anton et al. [14] applied the same instrument used in our study to oral hygiene technicians, and found that the main problems reported were related to the working posture and repetitive movements.

A few years ago, newly trained dentists worked intensely, more than 8 hours a day in the early years of their careers. But what can be observed in our study is that even with the average of 21 years of clinical practice professionals have two employment relationships and exert an intense workload. The organization of work in dentistry has changed along with the exchanges in the labor market in Brazil, causing increased workdays, shift work, and the number of employment relationships. Moreover, the absence of breaks and costs of productivity becomes routine in the life of these professionals, which together may influence their health [30].

The results of our study demonstrate the need to develop ergonomic practices for the improvement of working conditions of Brazilian dentists. The practice of ergonomics becomes essential to determine the best way to achieve success in the profession without abandoning the clinical practice because of health problems or even leaving the profession.

CONCLUSION

Given the cross-sectional design of the study, it is not possible to establish a cause and effect relationship for the associations found between the symptoms of musculoskeletal disorders and other variables. Research based on questionnaires completed by respondents themselves allow for the occurrence of self-report bias. In addition, the non-probability and non- randomized sample compromises the legitimacy of the answers by dentists, making it difficult to generalize the results for the rest of these professionals throughout Brazil.

REFERENCES

1. Kumar DK, Rathan N, Mohan S, Begum M, Prasad B, Prasad ERV. Exercise Prescriptions to Prevent Musculoskeletal Disorders in Dentists. J Clin Diagn Res 2014;8(7):13-16.

2. Carmo IC, Soares EA, Virtuoso Júnior JS, Guerra RO. Fatores associados à sintomatologia dolorosa e qualidade de vida em odontólogos da cidade de Teresina – PI. Rev Bras Epidemiol 2011;14(1):141-50. https://doi.org/10.1590/S1415-790X2011000100013

3. Pozos Radillo BE, Lopez TMT, Aguilera Velasco ML, Fernandez MA, Perez GJ. Stress-associated factors in Mexican dentists. Braz Oral Res 2008;22:223-228. https://doi.org/10.1590/S1806-83242008000300006

4. Rundcrantz BL, Johnsson B, Moritz U. Cervical pain and discomfort among dentists: Epidemiological, clinical and therapeutic aspects. Part 1: A survey of pain and discomfort. Swed Dent J 1990;14:71-80.

5. Knibbe JJ, Friele RD. Prevalence of back pain and characteristics of the physical workload of community nurses. Ergonomics 1996;39:186-198. https://doi.org/10.1080/00140139608964450

6. Finsen L, Christensen H, Bakk M. Musculoskeletal disorders among dentists and variation in dental work. Appl Ergon 1998;29:119-125. https://doi.org/10.1016/S0003-6870(97)00017-3

7. Santos FS, Barreto S. Atividade ocupacional e prevalência de dor osteomuscular em cirurgiõesdentistas de Belo Horizonte, Minas Gerais, Brasil: contribuição ao debate sobre os distúrbios osteomusculares relacionados ao trabalho. Cad Saúde Pública 2001;17(1):181-93. https://doi.org/10.1590/S0102-311X2001000100019

8. Szymanska J. Disorders of the musculoskeletal system among dentists from the aspect of ergonomics and prophylaxis. Ann Agric Environ Med. 2002;9:169-173.

9. Leggat PA, Smith DR. Musculoskeletal disorders self-reported by dentists in Queensland, Australia. Aust Dent J 2006;51:324-7. https://doi.org/10.1111/j.1834-7819.2006.tb00451.x

10. Puriene A, Aleksejuniene J, Petrauskiene J, Balciuniene I, Janulyte V. Self reported occupational health issues among Lithuanian dentists. Ind Health 2008;46(4):369-374. https://doi.org/10.2486/indhealth.46.369

11. Barbosa REC, Assunçao AA, Araújo TM. Distúrbios musculoesqueleticos em trabalhadores do setor de saúde de Belo Horizonte, Minas Gerais. Bras. Cad. Saúde Pública 2012;28:1569-1580. https://doi.org/10.1590/S0102-311X2012000800015

12. Alexandre P, Silva I, de Souza L, Camara V, Palacios M, Meyer A. Musculoskeletal disorders among Brazilian dentists. Arch Environ Occup Health 2011;66:231-235. https://doi.org/10.1080/19338244.2011.564571

13. Garcia PPNS, Presoto CD, Campos JADB. Perception of Risk of Musculoskeletal Disorders Among Brazilian Dental Students. Journal of Dental Education 2013;77(11):1543-1548.

14. Anton D, Rosecrance J, Merlino L, Cook T. Prevalence of musculoskeletal symptoms and carpal tunnel syndrome among dental hygienists. Am J Ind Med 2002;42:248–257. https://doi.org/10.1002/ajim.10110

15. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson G. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon 1987;18:233-7. https://doi.org/10.1016/0003-6870(87)90010-X

16. Barros ENC, Alexandre NMC. Cros-cultural adaptation of the Nordic musculoskeletal questionnaire. Int Nurs Rev 2003;50:101-108. https://doi.org/10.1046/j.1466-7657.2003.00188.x

17. Rosecrance JC, Cook TM, Zimmermann CL. Work-related musculoskeletal disorders among construction workers in the pipe trades. Work 1996;7:13-20. https://doi.org/10.1016/1051-9815(96)00183-0

18. Coluci MZO, Alexandre NMC. Cross-cultural adaptation of an instrument to measure work-related activities that may contribute to osteomuscular symptoms. Acta Paul Enferm 2009;22(2):149-54. https://doi.org/10.1590/S0103-21002009000200006

19. Occhionero V, Korpinen L, Gobba F. Upper limb musculoskeletal disorders in healthcare personnel. Ergonomics 2014;57(8):1166-91. https://doi.org/10.1080/00140139.2014.917205

20. Marklin RW, Cherney K. Working postures of dentists and dental hygienists. J Can Dent Assoc 2005;33:133-136.

21. Rundcrantz BL, Johnsson B, Moritz U. Pain and discomfort in the musculoskeletal system among dentists. A prospective study. Swed Dent Journal 1991;15:219-228.

22. Carvalho MVD, Soriano EP, Caldas Jr AF, Campello RIC, Miranda HF, Cavalcanti FI. Work-related musculoskeletal disorders among Brazilian dental students. J Dent Educ 2009;73:624-30.

23. Garbin A, Garbin C, Moimaz S, Baldan R, Zina L.Dental practice and musculoskeletal disorders association: a look at the evidence. Arch Environ Occup Health 2011;66:26-33. https://doi.org/10.1080/19338244.2010.506493

24. Dantas FFO, Lima KC. The relationship between physical load and musculoskeletal complaints among Brazilian dentists. Applied Ergonomics 2015;47:93-98. https://doi.org/10.1016/j.apergo.2014.09.003

25. Kierko A, Kobus A, Jaworska M, Botulinski B. Work-related musculoskeletal disorders among dentists – A questionnaires survey. Ann Agric Environ Med 2011;18(1):79-84.

26. Ratzon NZ, Yaros T, Mizlik A, Kanner T. Musculoskeletal symptoms among dentists in relation to work posture. Work 2000;15:153-158.

27. Wazzan KA, Almas K, Al Shethri SE, Al-Qahtani MQ. Back and neck problems among dentists and dental auxillaries. J Contemp Dent Pract 2001;2(3):17-30.

28. Strazdins L, Bammer G. Women, work and musculoskeletal health. Soc Sci Med. 2004.;58:997-1005. https://doi.org/10.1016/S0277-9536(03)00260-0

29. Jelcic A, Culjak M, Horvacic B. Low back pain in health personnel. Reumatizam 1993;40(2):13-20.

30. Ulbricht, C. Considerações ergonômicas sobre a atividade de trabalho de um cirurgião-dentista; um enfoque sobre as LER/DORT. [Dissertação de Mestrado]. Florianópolis, Santa Catarina: Universidade Federal de Santa Catarina, 2003.