

Musculoskeletal pain and ergonomic aspects of dentistry*

Dores osteomusculares e aspectos ergonômicos na prática odontológica

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ABSTRACT

BACKGROUND AND OBJECTIVES: Dentists are considered professionals highly vulnerable to occupational problems and such injuries are sometimes caused by adopted postures and repetitive efforts during their work. This study aimed at checking the prevalence of musculoskeletal pain and to observe whether the work of dentists acting in both public and private sectors was carried out ergonomically.

METHODS: This is a cross-sectional, descriptive and observational study with dentists (n=80). A self-applicable questionnaire was used to check the frequency of musculoskeletal pain and occupational injuries, as well as to record labor activities, practice of physical activity and their frequencies. Professionals were observed while carrying out dental assistance based on recommendations of the document "Adopting a healthy sitting working posture during patient treatment", which is part of the International Standards Organization standardization 106/SC 6 N 411 from 2006.

RESULTS: There has been job-related pain in at least 65.67% of dentists. The number of individuals adopting incorrect and inadequate positions during assistance was high, such as: head rotation (73.13%); spine rotation (47.76%) and legs angle less than 90° (91.04%). Medical leaves related to occupational injuries were found in a greater proportion among public service professionals (64%).

CONCLUSION: There has been high prevalence of musculoskeletal pain related to inadequate postures adopted during clinical assistance and to long working hours without pause.

Keywords: Dentistry, Epidemiology, Human engineering, Musculoskeletal pain, Pain.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O cirurgião-dentista é apontado como um profissional muito vulnerável a problemas ocupacionais e essas lesões às vezes ocorrem devido a posturas adotadas e esforços repetitivos durante seu trabalho. O objetivo deste estudo foi verificar a prevalência de dores osteomusculares e observar se o trabalho dos cirurgiões-dentistas que atuam no setor público e privado foi realizado de forma ergonômica.

MÉTODOS: Trata-se de um estudo com desenho transversal, descritivo e observacional, com cirurgiões-dentistas (n=80). Com um questionário autoaplicável verificou-se a frequência de dores musculoesqueléticas e lesões ocupacionais, bem como o registro das atividades laborais, prática de atividade física e suas frequências. Os profissionais foram observados enquanto realizavam o atendimento odontológico baseado nas recomendações contidas no documento "Adopting a healthy sitting working posture during patient treatment", que é parte da normatização da *International Standards Organization*, 106/SC 6 N 411 de 2006.

RESULTADOS: Houve experiência de dor relacionada ao trabalho em pelo menos 65,67% dos cirurgiões-dentistas. O número de indivíduos que adotam posições incorretas e inadequadas durante os atendimentos foi elevado, tais como: rotação da cabeça (73,13%); rotação da coluna (47,76%) e angulação das pernas menor que 90°(91,04%). Afastamentos relacionados a lesões ocupacionais foram encontrados numa proporção maior entre os profissionais do serviço público (64%).

CONCLUSÃO: Houve alta prevalência de dores osteomusculares relacionadas com as posturas inadequadas adotadas durante os atendimentos clínicos e a longas jornadas de trabalho sem pausas.

Descritores: Dor, Dor musculoesquelética, Engenharia humana, Epidemiologia, Odontologia.

INTRODUCTION

Dentistry working market is becoming increasingly competitive and this is influencing the daily life of dentists, bringing changes to their professional activities and requiring more working hours. These daily difficulties are exposing dentists to increasingly stressing situations¹. It is possible that this whole labor transformation process favors adverse physical and psycho-social conditions, among them the appearance or worsening of pain, thus bringing changes to the quality of life (QL) of such professionals^{2,3}. It may also generate high

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stress levels, contributing to make many workers with 40 to 50 years of age unable to respond to the requirements of tasks proposed to them⁴. Since stress has several causes, it is not possible to establish a single way to prevent it or fight it. Associated to this, a certain working posture, maintained for a long time, may lead to continuous stress of most required muscles and may generate circulatory and metabolic disorders, in addition to causing pain or muscle discomfort⁵. The origin of musculoskeletal injuries is in general related to labor activities requiring excessive strength with hands, inadequate upper limbs (UULL) postures, repetitiveness of a same movement, mechanical compression of UULL structures and neighbor regions (shoulders, arms and hands) and not enough time to carry out a certain job⁶. In this sense, dentists are exposed to stress, anxiety and excessive physical effort^{2,7}.

The prevalence of musculoskeletal disorders is higher than any other occupational disease among dentists and this is due to the fact that such professionals work for long periods in inflexible and prolonged static postures, carrying out delicate and accurate procedures⁸⁻¹⁰. To meet the specifications of the profession, dentists adopt a kyphotic posture, bending and twisting the head to adjust their field of vision, with lumbar rotations and UULL flexion¹¹. In spite of ergonomic recommendations, these professionals end up adopting vicious or wrong positions which, in the future, may impair their health, triggering cervical and lumbar disks degeneration and inflammatory processes in shoulders, elbows, wrists and hands⁸⁻¹¹.

Musculoskeletal disorders are prevented by means of ergonomically organized environments, adequate working postures and intervals between consultations. Dental ergonomics looks at organizing environments to provide professionals with higher productivity allied to QL^{12,13}. The posture of professionals and their working environment are in general organized according to standards proposed by the partnership between the International Standards Organization (ISO) and the Federation Dentaire Internationale (FDI) which aims at optimizing dentists' work, promoting a restructuring to standardize dental office working routine by establishing ergonomic standards and guidelines¹⁴.

ISO, in 1980, has divided the dental office in 12 virtual parts, as the hands of a clock, the center of which is patient's oral cavity¹². Dental equipment is classified according to the disposition of its items, being classified as Type I, that is, the working unit is lateral to the professional; Type II, or posterior disposition; the side table is behind patient's head; Type III, with transthoracic positioning, which allows the dentist to work without assistants, preventing torsions to pick the tools to be used; and Type IV, or to the right side of the assistant.

Lack of physical activity and sedentary lifestyle also contribute to increase the risk of developing or worsening some medical conditions, such as cardiovascular and metabolic disorders and musculoskeletal pain^{15,16}. Some North-American studies show that frequent exercises are associated to lack or

less painful, depressive or anxiety symptoms^{16,17}.

To promote health and minimize negative physical consequences of the profession, it is necessary to know the profile of professionals, their working environment and current health reality of dentists.

This is an epidemiologic study on the prevalence of musculoskeletal pain by ergonomically observing professionals during their clinical activity, both in the public and private sector.

METHODS

This is a transversal, descriptive, inquiry-type and observational study. Population was made up of dentists (n=80) working in the public service (primary and secondary attention) and professionals of the private sector of a Brazilian city with approximately 200 thousand inhabitants. Sixty-seven dentists agreed to participate in the research. Exclusion criteria were individuals with some congenital or acquired physical disability involving upper or lower limbs, joints or spine; pregnant and breastfeeding women. People not agreeing to participate in the research or those not present during data collection days were not included in the study.

Research was carried out in two stages. First, dentists have answered a self-applicable questionnaire and then they were observed during dental assistance. A questionnaire was developed for the first stage to check the frequency of musculoskeletal pain and occupational injuries of dentists, the location of such pains, as well as to record labor activities, the existence or not of pauses or micro-pauses between assistances, the practice of physical activities and their frequency. For the second stage, a different data collection tool was developed based on the document "Adopting a healthy sitting working posture during patient treatment"¹⁸, integral part of ISO standardization 106/SC 6 N 411 of 2006, which describes ergonomic guidelines for dental assistance. As from this document, a list of ergonomic positions to be adopted during dental assistance was developed.

The observational stage was made up of 6 items: dentists position during treatment (7h, 9h, 11h or 12h); equipment (dental chair) and office furniture position; check whether they worked with the help of an assistant; spine, head and legs position. These items were taken into consideration during observation because studies show that inadequate posture, lack of pauses, poorly designed furniture and equipment, repeatability of movements, use of excessive strength, static posture for long periods, are primary causes of musculoskeletal pain and discomfort. When carrying out activities in the sitting position, there are two frequent arm movements: arm displacement to the front (flexion) and to the side (abduction). These movements are noxious when carried out above the shoulder line because they produce torque on rotating cuff equivalent to nine times the upper limb weight¹.

Data were collected during six months. In the first contact

with dentists, guidelines were given about the objectives of the study to get their consent to participate in the research by means of signing the Free and Informed Consent Term (FICT). Data were obtained by means of a questionnaire filled in a private location, in individual sessions, before they started their clinical activities, without impairing their rhythm. After this stage, dentists were observed during a working period to check their position while carrying out clinical procedures (7h, 9h, 11h or 12h); equipment (dental chair) and office furniture position; whether they worked with the help of an assistant; position of head and spine (not binding excessively to the front, laterally and rotations) and legs (maintenance of the angle between the thigh and the leg between 90 and 120 degrees).

After collection, data were analyzed by the programs Epi Info 7 and Bioestat 5.3¹⁹. Chi-square test was used to analyze the relationship between socio-demographic variables and the presence of pain and significance level was 5%, or $p < 0.05$.

This study was approved by the Research Ethics Committee, in accordance to Resolution 466, from December 12, 2012 (Process FOA 373.186).

RESULTS

Total sample was made up of 67 dentists, of whom 25 (37.31%) worked exclusively for the public sector, being most males (73.0%), 35 (52.23%) worked for the private sector and slightly more than half were females (51.0%) and 7 (10.44%) for both sectors; of these, 57.0% were males.

Most dentists worked 8 hours a day (46.0%), being that 64.0% of them have stated having sporadic intervals between consultations. No professional reported doing any type of stretching.

All private sector professionals worked as generalists, although attending specialization courses in orthodontics and implantology. Most of these professionals have working loads above those of the public service, working for approximately 12 daily hours and have stated not having intervals between consultations (70.0%), being that 74.0% seldom stretch themselves. From professionals stating being generalists, 11% worked both for the public and the private sector. Daily working hours of such professionals were 8h (50.0%) and intervals between consultations were few (86.0%); 84.0% have reported stretching arms and legs.

With regard to occupational pain/injury, 65.67% of dentists have reported some type of injury.

To identify specific characteristics of medical leaves of professionals participating in the research, it was observed that public service professionals had a higher number of leaves due to pain/injuries (64%) as compared to dentists working for the private sector (18%).

When relating pain to gender, there has been no statistically significant association, but the prevalence of pain was higher among female dentists (67.86%).

The analysis of variables to identify the origin of pain was carried out by means of incorrect postures adopted during

clinical assistance. With this, it was observed that many professionals would rotate their heads during consultations (73.13%), their spine (47.76%) and that the position of their legs was less than 90° with regard to the floor during work (91.04%).

Table 1 shows the position of equipment with regard to working environment, where most of them were placed in "Position I" with regard to the office (53.73%). Most frequently adopted positions by professionals during work were 9h (35.82%) and 11h (51.23%), positions which favor assisted work, carried out by 79.10% of professionals.

According to information given by dentists, most professionals (55.22%) have reported practicing some physical activity, such as: body building, running/walking, Pilates or fights in general, keeping a frequency of 3 days a week (48.64%) (Table 2).

Table 1. Frequency of dentists working place characteristics, according to professionals working sector. Araçatuba, 2012

Variables			Public		Private		Both	
			n	%	n	%	n	%
Type of equipment	Position I		20	80	30	83.3	6	85.7
	Position II		5	20	6	16.7	1	14.3
	Total		25	100	36	100	7	100
Working position (hours)	9		10	40	12	34.3	2	28.6
	11		14	56	18	51.4	3	42.8
	12		1	4	5	14.3	2	28.6
	Total		25	100	35	100	7	100

Table 2. Socio-demographic variables and factors preventing musculoskeletal diseases according to dentists working place. Araçatuba, 2012

Variables			Public		Private		Both	
			n	%	n	%	n	%
Gender	Male		18	73	17	49	4	57
	Female		7	27	18	51	3	43
	Total		25	100	35	100	7	100
Physical activity	Yes		16	64	18	51.4	3	42.9
	No		9	36	16	45.7	4	57.1
	NR		0	0	1	2.9	0	0
	Total		25	100	34	100	7	100
Type of activity	Body building		10	45.4	10	41.6	2	33.4
	Running		4	18.1	5	20.8	1	16.7
	Pilates		2	9	1	4.1	1	16.7
	Fights		1	4.5	5	20.8	0	0
	Other		5	27.7	3	12.4	2	33.2
	Total		22	100	24	100	6	100
Weekly frequency	Two		5	31.2	3	16.7	2	66.7
	Three		7	43.7	10	55.5	1	33.3
	Four or more		4	25	5	27.8	0	0
	Total		16	100	18	100	3	100

Continue...

Table 2. Socio-demographic variables and factors preventing musculoskeletal diseases according to dentists working place. Araçatuba, 2012 – continuation

Variables		Public		Private		Both	
		n	%	n	%	n	%
Professional orientation	Yes	13	81.2	18	66.7	4	80
	No	3	18.8	9	33.3	1	20
	Total	16	100	27	100	5	100
Type of professional	Physiotherapist	2	13.4	3	15.8	1	25
	Physical educator	13	86.6	16	84.2	3	75
	Total	15	100	19	100	4	100

NR = no reply.

Most dentists practicing some physical activity did it with orientation of a qualified professional (72.91%), such as physical educator (84.21%) or physiotherapist (15.79%).

DISCUSSION

Musculoskeletal injuries are increasingly becoming object of concern, research and discussion worldwide. It is critical for professional and personal QL of dentists to know their causes, manifestations, psychological aspects, how to prevent and treat such injuries²⁰. Carrying out labor activities in static postures, or with few and low amplitude movements leads to the development of musculoskeletal disorders in several professions, and dental practice is a risk factor for the development of such disorders²¹.

In analyzing the presence of pain or occupational injury, 65.67% of dentists have reported having some type of injury. In activities where movements are cyclic, short and repetitive, added to static muscle contraction caused by poor posture, more than ergonomic solutions are needed. Musculoskeletal pain complaint by dentists has been described by several authors^{6,14,21,22}, who state that pain reports are very common among dentists due to the time they spend sitting down or working in a same posture, which most of the time is not ergonomic.

Sometimes, to carry out a task, in a certain working place, people generate mechanical overload in their musculoskeletal structures even unconsciously, especially when they adopt inadequate occupational or functional postures as a function of poorly designed work places¹. Not all studies on musculoskeletal pain in dentists describe specific or standardized criteria to accurately diagnose this and sometimes such criteria are inconsistent from one examiner to the other^{23,24}.

Barbosa et al.²⁵ have stressed that 68.9% of inquired professionals had pain complaints at the end of the working day, similar to what was found in this study where most dentists have stated not frequently pausing between consultations (86%). Sometimes, the pause is limited to lunch time. According to Nunes, Freire & Leles³, this attitude is linked to work market demand both in the public and private sectors, which increases the number of profession-

als with pain. Resting pauses are not a vital body need, however the introduction of this practice in the daily life may decrease mental fatigue, especially for workers like dentists who require a lot from their nervous system, that is, in mental works where fingers agility and sense organs requirements are important^{1,21}. It was also observed that the number of medical leaves caused by musculoskeletal disorders was high, especially among public sector professionals (64%).

The presence of pain/injury related to dentists occupation was high in this study (65.67%) and there has been higher prevalence of musculoskeletal pain among females (67.86%), result also found in most literature studies^{6,21,26,27}. Female dentists and surgery specialists have more injury than males and any other specialty and such factor may be related to high strengths and continuous pressures occurring during such procedures²³. Although there is no evident reason for musculoskeletal pain among females, there is a suggestion in these studies that females are more attentive to their health and wellbeing, go through several monthly hormonal changes or that they might have a lower pain threshold as compared to males, being less resistant to constant pain and daily stresses^{6,21,26,27}.

Dentists participating in this study have reported that long working hours (59.70%) and not maintaining working position (40.30%) are items worsening pain at the end of the day. This fact was also pointed out by other studies with dentists^{6,22}. When working hours go beyond the tolerance of the worker, that is, physical or mental workload, pause becomes a physiological mechanism to compensate and prevent muscle and mental fatigue. Micro-pauses are as important as regular labor exercises or long pauses, because they allow professionals to adopt some postures to decrease muscle stress without interrupting their work or during short intervals, such as drinking water, chatting or going to the restroom, between consultations. These short pauses release lactic acid built up by prolonged postures, improving tissue oxygenation^{1,6}.

Dentistry forces professionals to use UULL and adjacent structures frequently with the same repetitive movement pattern due to their clinical activity. This may induce mechanical compression of structures such as hands and shoulders as a function of inadequate postures or excessive strength used for surgical techniques⁶.

These complaints are primarily related to neck, shoulders and cervical and lumbar spine pain, similar to those found in most studies^{1,21,22,26,28}, stressing that poor posture-related health problems are still afflicting professionals, in spite of technological advances.

To consider professionals correctly positioned on the bench, they should sit symmetrically erect and most possible to the back, allowing the sternum bone to be slightly advanced and raised, abdominal muscles should be smoothly compressed and back should be supported by posterior hip bones^{12,18}.

Primary dentists' difficulty is the accurate visualization of

the surgical field, forgetting the right posture, excessively bending the neck, very often followed by its rotation. This study has observed many incorrect postures, both of spine (47.76%) and neck (73.13%) projecting them a lot to the front, laterally or performing rotations; and legs (91.04%) being unable to maintain the angle between thigh and leg in an interval of 90 and 120 degrees; and association with musculoskeletal pain during and after procedures. Garbin et al.¹² have observed that the reason for a poor posture may be associated to lack of knowledge about the right posture. Other studies associate working hours and excessive number of patients per period as influencing occupational pain^{6,21,22,29}. Musculoskeletal injuries are appearing increasingly earlier during dentists professional life, indicating that they leave graduation courses with noxious postural habits^{27,30}.

So, there is an international consensus that musculoskeletal injuries are causally related to labor activities with the presence of ergonomic stressors, such as: repetitive movements, vigorous efforts, non-neutral postures, vibrations or combinations of such exposures, stressing also that the lack of muscle strengthening and postural education cooperates for the installation of such pains/injuries^{21,24}. Evidences of dentistry as a profession with potential risk for the development of musculoskeletal diseases are questionable, because studies to date have no standardization of methods²³. Although our study has not shown statistically significant association or correlative potential for the variable lack of pain and the practice of physical exercises, it is important to stress that most professionals (55.22%) have reported practicing some physical activity such as body building, running/walking, Pilates or fights in general, keeping a frequency of 3 times a week (48.64%). Even so, there has been a high rate of labor-related pain complaint (65.67%). There is a consensus in the literature that practicing regular physical activity oriented by a qualified professional (physical educator or physiotherapist) may prevent the installation of musculoskeletal pain or the worsening of chronic pain^{27,31,32}.

Notwithstanding most professionals practicing some physical activity, the number of sedentary professionals was high (44.78%). Sedentary life is recognized as an important factor for poor health and early death. So, a physical exercise program may contribute to minimize workload, to better tolerate postural stress and to protect from some manual work hazards in the case of dentists^{1,27,30-32}. Daily exposure to aggressions of different origins and characteristics is a factor that, added to sedentary life, may negatively influence QL of people. So, the practice of physical exercises and pauses between consultations play a protective role for dentists^{1,27}.

Musculoskeletal injuries in dentistry often start with postural fatigue of trunk and shoulders stabilizing muscles. Since there is fatigue of such muscles, dentists tend to adopt a poor posture, preparing their body for injuries. Professionals should carry out specific exercises to strengthen the

trunk and the shoulder girdle to improve spinal health and integrity, maintain a good labor posture, optimizing the function of arms and hands, thus preventing injuries^{27,33}. Our study had some limitations, such as refusal of professionals to participate, especially those working in the public sector, by fear of retaliation by their bosses. Professionals were not comfort being observed during assistance. It is worth mention also that data were collected by means of self-report questionnaires and so answers were subjectively measured. It might be that prospective studies with larger samples are needed to be able to delimit musculoskeletal pain among dentists in the future.

CONCLUSION

Dentists had a high prevalence of musculoskeletal pain which may be related to excessive working hours and to incorrect postures adopted during dental procedures. These factors may be worsened by the low frequency of physical exercises and lack of pauses and micro-pauses between consultations. Further studies on the subject would be interesting to explain the epidemiology of musculoskeletal pain in dentists, including the identification of risk factors and their impact on labor activity and quality of life.

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