Musculoskeletal alterations associated factors physical and environmental in dental students

Alteraciones osteomusculares asociadas a factores físicos y ambientales en estudiantes de odontología

Abstract

Objective: To describe the musculoskeletal disorders and association with physical and environmental in students of Dentistry. **Methods:** Cross sectional study. Simple random sampling was conducted obtaining a proportional sample of 182 students per semester. Collecting information from physical and environmental exposures related to different clinical practice and this was assessed by a structured survey questionnaire type. The valuation muscle was performed by visual analysis with Scantest. To assess factors related to working position, the instrument was used RULA. For the analysis of the association were used odds ratios with confidence intervals of 95%. For the multivariate analysis using logistic regression. **Results:** 58.2% of students had pain tenderness in upper trapezius and 45.6% in area cervical. Lateral movements in the cervical found pain in 35.7%, with the bending cervical 35.1% related to all these factors own dental practice and not to other factors external. **Conclusions:** The onset of muscle pain in this population is influenced by multiple variables, most of them, related to dental practice of students to interact with each other can trigger symptoms at neck and back**.**

Keywords: Muscle disorders. Working position. Pain. Dental practice.

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Resumen

Objetivo: Describir las alteraciones osteomusculares y su asociación con factores físicos y ambientales en estudiantes de odontología. **Métodos:** Estudio analítico de corte transversal. Se realizó muestreo aleatorio simple por fijación proporcional de acuerdo al ciclo académico cursado, seleccionado una muestra de 182 estudiantes. La recolección de la información de las exposiciones físicas, ambientales relacionadas con la práctica clínica odontológica y diferentes a estas fueron valoradas mediante un cuestionario validado tipo encuesta estructurada. La valoración muscular se realizó mediante un análisis visual con el Scan-test. Para los factores relacionados con la posición de trabajo, se utilizó el instrumento RULA. Para el análisis bivariable se utilizaron las razones de disparidad con intervalos de confianza del 95%. Para el análisis multivariable se utilizó la regresión logística nominal. **Resultados:** El 58,2% de los estudiantes presentaron dolor a la palpación en trapecio superior y el 45,6% en zona cervical. En los movimientos de lateralidad cervical se encontró dolor en un 35,7%, junto con el de flexión cervical en 35,1%. La prevalencia de dolor estuvo relacionada con factores propios de la práctica clínica odontológica y no hubo relación con otros factores externos. **Conclusiones:** La aparición de dolor muscular en esta población está influida por múltiples variables, la mayoría de éstas, relacionadas con la práctica odontológica de los estudiantes, las cuales al interactuar entre sí pueden desencadenar sintomatología a nivel de espalda y cuello.

Palabras clave: Alteraciones musculares. Posición de trabajo. Dolor. Práctica dental.

Introduction

The health of the osteo-muscular system has been the object of numerous studies which report that these physical disorders are caused by the poor application of comfortable postures in the work area, reducing in this manner work production and leading to the onset of muscular lesions[1-4]. Finkbeiner *et al.*[5] observed pain in the spine, neck, shoulders or arms in 81% of the dentists examined. Likewise, Chaikumarn *et al.*[6] found a positive association between pain and specific inadequate postures: torsion of the torso, shifting the shoulders, elevating the elbows, inadequate lighting in the operative area and working for prolonged periods of time in uncomfortable positions.

Very frequently dentists assume static postures which require more than 50% of the muscles to sustain the body immobile, opposing gravity[7]. Leggat *et al.*[8] reported muscular disorders in 89.1% of Australian dentists, with neck pain and lumbar pain as the most frequent symptoms.

Díaz *et al.*[9] confirmed the presence of inadequate postures in the dental students of the city of Cartagena; exaggerated cervical flexions and torsions were used by the participants to get a better vision of the operative field, although the environmental conditions of the work place, such as physical space, lighting, noise, temperature and humidity, were not evaluated in this study. In this regard, the mouth of the patient becomes an imaginary central circumference like the sphere of a wristwatch, the head of the patient is oriented towards the 12 o´clock position and the feet mark the 6 o´clock position. The dentist is usually located at the 11 or 12 o´clock position to work behind the patient, and at the 9 o´clock position to work sideways. The height of the chair must allow the muscles to be parallel to the floor, which implies in an angulation of 90-100° between the thighs and the legs. However, under conditions of low lighting in the work area, uncomfortable temperatures and non ergonomic dental chairs, inadequate postures are taken in order to

obtain a better vision of the operative field, which in turn could cause disorders in the musculoskeletal system[10]. On the other hand, there are postural factors unrelated to clinical practice, among which we can highlight postures used to sleep, sit or perform daily movements, which can increase the risk of suffering these disorders even more. This is why it is necessary to carry out a multivariate evaluation integrating all these exposures to permit controlling for those additional factors that interact to influence musculoskeletal disorders and obtain a real knowledge of this important occupational event as well as to generate preventive measures in Colombia´s General System of Health Services and the possibility of designing more comfortable dental chairs. In this sense, the aim of this study was to describe musculoskeletal disorders and their association with physical and environmental factors in dental students.

Methods

This is a cross sectional analytical study, with a quantitative approach, carried out in dental students of a public University of the city of Cartagena during the first period of 2011. Participants were selected through simple random sampling, by proportions, in accordance with the academic cycle in course. The sample consisted of 182 subjects, a calculation that was obtained using a confidence interval of 95 %, a type I error of 5% and power of 80%. It also considered the expected frequency of at least one musculoskeletal disorder, based on the lowest prevalence reported in the literature for the two disorders evaluated as dependent variables in this study[8,9] (pain upon palpation and pain during movement).

Prior to the selection of the sample, we considered the registered active students for the first academic period in 2011 and those who accepted to participate in the study by means of a written signed informed consent. Students with congenital musculoskeletal disorders, Temporal Mandibular Disorders (TMJ) and those who had suffered spinal trauma were excluded from the study. This project was approved by the Institutional ethics committee and the research committee of the College of Dentistry (approval number 0253), following the recommendations of the Helsinki declaration, Edinburgh modification year 2000. Likewise, the authors declare complete independence during the execution of this study, confirming no conflict of interest with the institution object of the study and that could, in any way, influence the veracity of the data.

Questionnaire

The collection of information regarding postural and environmental exposures in clinical practice and the unrelated exposures were measured by means of a structured survey type questionnaire. There were 32 dichotomy and polytomic questions, which permitted to classify the students in accordance with the presence or absence of uncomfortable exposures during and outside of their clinical practice, as well as socio-demographic variables. This instrument was evaluated by two experts on the topic, seeking validity of appearance; the unanimous opinion ratified that the instrument was capable of really measuring what it proposed to measure. Also, content validity was evaluated in order to verify if the different items included in the instrument adequately represented the domains or factors of the concept to be measured. Factorial analysis allowed finding out how the different items in the instrument represented the different factors; besides, two items that did not add variability to the measurement of the exposures were eliminated, since more than 95% of the individuals to which the survey was applied to, graded them as being equal. In this same sense, the instrument was tested to evaluate its cultural application, as well as its understanding within the environment where it would be used, obtaining as a result an easily understood instrument by all, with written items in a simple and comfortable language easy to be answered by all the subjects in the study. Also, the grammar

and syntax of each item was evaluated, and reliability-stability, test-retest were applied to a group of volunteer students at two different times, to observe how the results were related at the two moments. The intraclass correlation coefficient resulted in the percentage of variability of the scores which depends only on the variability of the subjects measured (r=0.81).

Musculoskeletal clinical assessment

This exam was done by two expert physical therapists that were standardized in the use of the Scan-test[8,] both at the intra and inter examiner level, with a concordance index between 0.75 and 0.80 with the Kappa Cohen test. They only evaluated the anterior-posterior position of the cervical, dorsal and lumbar curvatures by clinical observation, for the following items: (1=increased 2=normal; 3=reduced). Muscular palpation was done in the following areas (1=cervical; 2=upper trapezius; 3=middle trapezius; 4=wide dorsal; 5=lumbar) in order to detect the presence of pain, using the pain Visual Analog Scale (VAS); ranges between 0 and 10, with 0=no pain perceived and 10=maximum pain perceived). Pain was also evaluated during movement of the trunk and neck, with the following items (0=presence; 1=absence) and in the following positions (1=flexion; 2=extension; 3=rotation; 4=laterality). For purposes of the nominal bivariate analysis, the VAS´ findings were dichotomized in the presence of perception of pain and absence of perception of pain as dependent variables of the exposures, while the anterior-posterior curvature of the spine was taken as the intervening variable, because these changes could possibly be present before the exposures, due to hereditary causes.

Observation of work posture

The RULA instrument[10] was used to systematically register the uncomfortable postures of each participant during clinical practice (standing, sitting, or mixed); through direct observation by the two examiners, during a period of one continuous week and in the two shifts that took place at the institution (morning;7:am-10:00pm and afternoon; 12:00m a 3:00 pm). To this end, the body was divided in two groups of limbs, group A: upper limbs (arms, forearms and wrists) and group B: legs, trunk and neck. The global measurements were modified according to the muscular activity developed and the force applied during the execution of the activity, reducing or increasing one point, depending on the case. Lastly, the final measurement was obtained parting from said modified global values and the scale of intervention levels; level 1, acceptable evaluated posture; level 2, could require changes in the activity; level 3, requires the redesign of the activity; and level 4, indicates the urgent need for changes in the activity. The final value obtained by RULA is proportional to the risk implied during the execution of the activity; therefore, higher values indicate a higher risk for musculoskeletal lesions. For the nominal bivariate analysis, the variable was dichotomized according to its magnitude (code1=level 1 and level 2; code 2= level 3 and level 4).

Statistical analysis

The data of the study were stored, organized and refined in a Microsoft Excel® 2007 database; they were then transported and analyzed using the STATA® version para Windows® 10.0 program (Stata Corp. LP, College Station, TX, USA). Prevalence was used in order to estimate the occurrence of disorders, while the ratio (OR;CI 95 percent) was used as association estimators, applying the χ^2 statistical test to evaluate significance. Nominal logistic regression was used for the multiple analysis, considering value probability for models ($p < 0.05$).

Results

Postural and environmental exposures during clinical practice

Table 1 shows that the most frequent

Table 1 - *Postural and environmental exposures during clinical dental practice.*
Tabla 1 - *Exposiciones posturales y ambientales durante la práctica clínica odontológica.*

	Number n=182	Percentage (%)	CI 95%
Exposure to clinical practice			
Yes	109	59.9	52.7-67.1
No	73	40.1	32.9-47.3
Time in clinical practice (months)			
>16	27	14.8	9.6-20.0
12 a 16	28	15.4	10.1-20.7
8 a 11	19	10.4	5.9-14.9
4 a 7	16	8.8	4.6-12.9
0 a 3	19	10.4	6.0-14.9
Hours of daily practice			
>4	32	17.6	12.0-23.2
4	20	10.9	6.4-15.6
3	51	28	21.4-34.6
2	6	3,3	0.6-5.9
Continuous practice time (min)			
>50	52	28.6	21.9-36.2
40 a 50	20	11	6.4-15.6
30 a 40	20	11	6.4-15.6
20 a 30	11	6	2.5-9.5
10 a 20	6	3.3	0.6-5.9
Posture during practice			
Standing	1	0.6	-0.05-1.6
Sitting	55	30.2	23.5-36.9
Mixed	53	29.1	22.5-35.8
Changes posture			
One time	4	2.2	0.05-4.3
Two times	35	19.2	13.5-25.0
Three times	30	16.5	11.0-21.9
Four times	7	3.9	1.0-6.7
More than four times	13	7.1	2.9-10.2
Vision of the field			
Direct	13	7.1	3.4-10.9
Indirect	41	22.5	16.4-28.7
Both	55	30.2	23.5-37.0
Adequate lighting			
Yes	94	51.6	44.3-59.0
No	15	8.2	4.2-12.3
Adequate temperature			
Yes	85	46.7	39.1-52.6
No	24	13.2	6.5-20.0
Do you stretch			
Yes	26	14.3	9.2-19.4
No	83	45.6	38.3-52.9

postural exposure ranged between 12 to 16 months, with a work period of three hours a day. The most frequently used position by participants during their clinical practice, was sitting down on a stool. Regarding environmental exposure, most of the students used both types of vision of the operative field (direct and indirect) and a high percentage of them reported adequate lighting and temperature in the work environment, but almost half of them reported not stretching after their clinical practice.

Postural exposures and physical activity unrelated to clinical practice

The most frequently described position used to sleep was mixed (backwards and in front of the mattress). The semi-orthopedic is the most used type of mattress, while the most commonly used pillow is soft and placed under the head. Also, a large number of participants use the computer more than four times a week, mostly in bed. Regarding physical activity, most of the surveyed participants reported no activity at all (table 2).

Physical assessment of the musculoskeletal system

Table 3 shows the reduction or increase of the anterior-posterior curvature of the spine, and important occurrences were observed only in the lumbar zone. Also, pain to palpation was found in the upper trapezius with VAS codes between 1 and 4 in about half of the participants, and pain during cervical lateral and flexion movements was seen with VAS codes between 1 and 3 in a lower proportion. Regarding the intensity of the pain according to the VAS scale, since most of the participants perceived slight levels of pain during palpation and movement, we decided to dichotomize the values to the following indicators in order to carry out the nominal bivariate analysis; no pain perceived (category 1) and pain perceived between 1 and 4 (category 2).

Posture during clinical work with the RULA visual method

When analyzing work posture during the student´s clinical practice, it was observed to be deficient in 43.1 percent (CI; 33-52) (final value 7), which indicates need for an urgent change in the work area. While 34.8 percent (CI; 25-43) require a rapid change in posture, (final value 5-6).

Bivariate and multivariate analysis for pain to palpation

Table 4 shows the bivariate findings obtained when the academic cycle and age estimators were adjusted, resulting in 10 exposures with statistical significance. For the multivariate analysis, the best model showed a statistically significant relation for four exposures (p=0.000; χ^2=30.7); the levels of pain to palpation increased in the participants of the higher semesters and in those with clinical practice for a period of time longer than 8 months. Besides, the students that do not stretch after clinical practice and those who practice in one position during three continuous hours are more likely to develop pain (table 4).

Bivariate and multivariate analysis for pain to movement

Table 5 shows the bivariate results for the adjusted estimators by age and academic cycle, observing 9 exposures with statistical significance. For the multivariate analysis, the best model showed a statistically significant relation with 3 exposures (p=0.000; χ^2=35.36), as pain levels increased in the students with clinical practice. Also, it is 1.2 times more likely for students who practice more than two hours a day in the dental unit and for those that do not take a break between patients, to experience pain.

Discussion

The importance of evaluating different exposures to explore their association with

Table 2 - *Postural exposures and physical activity than dental practice.*
Tabla 2 - *Exposiciones posturales y actividad física diferente a la práctica.*

	Number n=182	Percentage (%)	CI 95%
Posture during sleep			
Mouth upwards (spine against the mattress)	17	9.3	3-13
Mouth downwards (face against the mattress)	46	25.3	16-30
Lateral (both sides towards the mattress)	48	26.4	18-34
Mixed (spine and face against the mattress)	71	39	31-46
Type of mattress used			
Foam	27	14.8	8.5-20
Semi-orthopedic	123	67.6	60-76
Orthopedic	32	17.6	10-23
Type of pillow used			
hard and high	5	2.8	0.02-4
Hard and low	13	7.1	3-13
Soft and high	68	37.4	31-48
Soft and low	89	48.9	36-54
Does not use pillow	7	3.9	0.03-8
Number of pillows when sleeping			
Three	13	7.1	3-12
Two	66	36.3	27-44
One	96	52.8	42-60
Does not use pillow	7	3.9	0.03-8
Location of the pillow when sleeping			
Under the head	122	67	60.1-73.9
Over the head	57	31.3	24.5-38.1
Between legs	34	18.7	12.9-24.4
Between feet	8	4.4	1.3-7.4
Use of the computer during the week			
>4 times	132	72.5	66-79.1
3 and 4 times	30	16.5	9.5-20.2
1 and 2 times	20	11	6.3-21.0
Location of the computer			
Over the bed	74	40.7	33.5-47.9
Auxiliary table	17	9.3	5.1-13.6
Dining room	8	4.4	1.4-7.4
Computer table	77	42.3	35.1-50.0
Do you perform any physical activity			
Yes	46	25.3	18.9-31.6
No	136	74.7	68.4-81.1
Use of bags or briefcases			
Yes	72	39.6	32.4-46.7
No	110	60.4	53.3-67.6

Table 3 - Physical assessment of musculoskeletal system.
Tabla 3 - *Valoración física del sistema osteo-muscular.*

Curvature zones of the anterior posterior spine	Number n=182	Percentage (%)	CI 95%
Cervical			
Reduced	27	14.8	7-22
Increased	7	3.9	2-5.1
Normal	148	81.3	76-88
Dorsal			
Reduced	26	14.3	9.1-19
Increased	15	8.2	4.2-12
Normal	141	77.5	71-83
Lumbar			
Reduced	58	31.9	25-38
Increased	1	0.55	0.0-0.1
Normal	123	67.6	60-74
Areas with pain to palpation			
Cervical	83	45.6	38-52
Upper trapezius	106	58.2	51-65
Middle trapezius	77	42.3	35-49
Wide dorsal	57	31.3	24-38
Lumbar	58	41.8	34.5-49
Areas with pain to movement			
Cervical flexion	64	35.1	28-42
Dorsal flexion	18	9.9	5.5-14
Lumbar flexion	33	18.1	12.0-23
Cervical extension	32	17.5	11.0-23
Dorsal extension	18	9.9	5.0-14
Lumbar extension	41	22.5	16.0-28
Cervical rotation	24	13.1	8.0-18
Dorsal rotation	14	7.7	3-11
Lumbar rotation	15	8.2	4-12
Cervical lateral movement	65	35.7	28-42
Dorsal lateral movement	13	7.1	3-10
Lumbar lateral movement	19	10.4	5-14

musculoskeletal disorders was based on the need to obtain a risk model for occupational diseases and test it in future longitudinal studies. These results are useful in the decision making process at the time of presenting preventive strategies to avoid uncomfortable positions during clinical practice, both for the students as well as for the dentist, and at the same time propose modifications to the design of dental chairs and initiate discussions regarding the labor demands for dentists, related with the time spent in clinical practice, continuous work and lack of rest.

The results of this study indicate that a high percentage of students going through their clinical practice presented neck and back pain related to factors of the dental practice and a few to external factors such as daily habits and postures unrelated to clinical practice. Also, studies done by Westgarrd *et al.*[11] and Lehto *et al.*[12] report that the presence of these disorders may be related to multiple clinical factors such as: static postures, poor lighting, poor work posture, time in practice and not enough resting time.

The physical therapy evaluation in this

Table 4 - *Bivariate analysis and logistic regression for the presence of muscle palpation pain and factors related to clinical dental practice.*
Tabla 4 - *Análisis bivariado y regresión logística para la presencia de dolor a la palpación y factores relacionados.*

	Bivariate						Multivariate	
	OR¶	CI 95%	OR¶¶	CI 95%	OR‡‡	CI 95%	OR††	CI 95%
Exposed to clinical practice (ref.)	6.93*	3.5-13.9	7.13*	3.4-15.1	5.87*	2.8-12.3	6.0*	3.2-12.5
Time in practice > 8 months (ref.)	4.41*	2.1-9.3	4.01**	1.2-1.5	3.05‡	1.4-6.8	2.7	0.7-10
Daily practice > than 2 hours (ref.)	6.17*	3.1-12.3	5.42*	2.6-11.5	6.01*	2.8-12.8	-	-
Continuous work > than 30 min (ref.)	2.76†	1.4-5.5	2.30	1.1-4.9	3.88**	1.8-8.4	-	-
Work posture only standing or sitting (ref.)	3.32‡	1.5-7.4	2.89	1.2-6.9	4.96*	2.0-12.1	3.4	0.8-14.4
Does not take a break (ref.)	6.69*	2.7-16.7	6.47*	2.4-17.6	5.9*	2.2-16.1	-	-
Does not stretch (ref.)	6.87*	3.2-14.8	6.54*	2.8-15.0	7.03*	3.0-16.5	3.8**	2.1-14.2
Computer use weekly > than 3 times (ref.)	0.63	0.3-1.5	0.61	0.2-1.5	0.86	0.3-2.3	-	-
Position to study lying on bed or sitting (ref.)	1.54	0.8-2.9	1.46	0.7-2.9	1.50	0.7-3.1	-	-
Study more than three hours/day (ref.)	1.34	0.7-2.5	1.21	0.6-2.4	1.66	0.8-3.4	-	-
Unfavorable work posture RULA (ref.)	7.34*	3.4-15.9	5.82*	2.5-13.5	7.11*	3.0-16.9	-	-
Changes in dorsal curvature of the spine (ref.)	4.33¤	1.6-11.7	2.97	1.0-8.7	6.43**	2.1-19.6	-	-
Changes in lumbar curvature of the spine (ref.)	1.79	0.9-3.6	1.73	0.8-3.7	2.39**	1.1-5.4	-	-

(ref.) = categoría tomada como referencia en el análisis; valores de probabilidad con significancia estadística; *p = 0.000; †p = 0.007; ‡p = 0.003; ¤p = 0.004 **p = 0.001; ¶estimador sin ajustar; ¶¶estimador ajustado por edad; ‡‡estimador ajustado por semestre; ††estimador ajustado por regresión (chi: 30,7; p = 0000).
*(ref.)=category taken as reference in the analysis; probability values with statistical significance; *p=0.000; †p=0.007; ‡p=0.003; ¤p=0.004 **p=0.001; ¶ estimator not adjusted; ¶¶estimator adjusted by age; ‡‡ estimator adjusted by semester; †† estimator adjusted by regression (χ^2: 30.7; p=0000).*

study analyzed the presence or absence of pain to palpation, being the most affected zones the areas of the upper trapezius and lower trapezius, while pain to movement was most frequent during cervical lateral movements and cervical flexion. Similar findings were reported by Hayes *et al.*[13] in a systematic review, evidencing a high prevalence of muscular pain which varied between 64 and 93 percent, with the spine and the neck as the most affected regions. On the other hand, Dajpratham *et al.*[14] found that this frequency is higher in neck and shoulders in postgraduate students; this could be related with the older age of the individuals and longer time of exposure.

The evaluation of factors related with posture during clinical practice, using the RULA visual method, revealed that deficient posture was the most frequent, which indicates need for an urgent change in the site of clinical practice by participants. A study carried out by Malker *et al.*[15], 2007, indicated that there are serious consequences for the musculoskeletal system if the same posture is maintained for prolonged periods of time. This was observed in a large number of dentists, who had bad postures during work, and who need to change in order to avoid future musculoskeletal lesions.

According to the present study, the levels of pain to palpation increased in the participants in the higher semesters, however, in the first clinical academic cycle (seventh semester or fourth year) all the students examined presented pain, and

Table 5 - Bivariate analysis and logistic regression for the presence of muscle movement pain and factors related to clinical dental practice.

Tabla 5 - *Análisis bivariado y regresión logística para la presencia de dolor al movimiento y factores relacionados.*

	Bivariate						Multivariate	
	OR¶	CI 95%	OR¶¶	CI 95%	OR‡‡	CI 95%	OR††	CI 95%
Exposed to clinical practice (ref.)	7.90*	4.0-15.5	5.99*	2.9-12.3	7.86*	3.7-16.5	4.5*	2.9-6.1
Time in practice > 8 months (ref.)	3.89*	2.0-7.5	3.10*	1.5-6.2	3.91*	1.8-8.4	-	-
Daily practice > than 2 hours (ref.)	3.89*	2.0-7.5	3.10*	1.2-1.4	3.91*	1.8-8.4	1.2	0.32-2.88
Continuous work > than 30 min (ref.)	3.23*	1.7-6.2	2.22‡	1.4-3.7	5.78*	2.7-12.5	-	-
Working posture only standing or sitting (ref.)	2.4†	1.2-4.8	1.53	0.7-3.1	5.01*	2.1-11.7	-	-
Does not take a break (ref.)	5.43*	2.6-11.4	3.78*	1.7-8.3	5.99*	2.4-15.3	1.2	0.25-2.09
Does not stretch (ref.)	4.97*	2.6-9.5	4.03*	2.0-8.0	6.42*	2.9-14.0	-	-
Computer use weekly > than 3 times (ref.)	0.61	0.3-1.4	1.2	0.6-2.4	1.60	1.11-2.58	-	-
Position to study lying on bed or sitting (ref.)	1.7	0.8-3.3	1.6	0.9-2.8	1.50	1.15-2.20	-	-
Study more than 3 hours per day (ref.)	1.3	0.6-2.5	1.2	0.7-2.0	1.50	1.11-2.12	-	-
Unfavorable working posture RULA (ref.)	3.91*	2.1-7.4	2.64¤	1.3-5.2	5.0*	2.4-10.6	-	-
Changes in dorsal curvature of the spine (ref.)	1.2	0..5-2.7	1.05	0.5-2	1.20	0.80-1.84	-	-
Changes in cervical curvature of the spine (ref.)	1.9	0.7-5.1	1.3	0.6-2.1	2.40†	1.36-4.51	-	-

(ref.)=categoría tomada como referencia en el análisis; valores de probabilidad con significancia estadística; *p = 0.000; †p = 0.01; ‡p = 0.002; ¤p = 0.005; ¶estimador sin ajustar; ¶¶estimador ajustado por edad; ‡‡estimador ajustado por semestre; ††estimador ajustado por regresión (chi: 35,36); p = 0000).

*(ref.)=category taken as reference in the analysis; probability values with statistical significance; *p=0.000; †p=0.01; ‡p=0.002; ¤p=0.005; ¶ estimator not adjusted; ¶¶estimator adjusted by age; ‡‡ estimator adjusted by semester; †† estimator adjusted by regression (χ^2: 35,36); p=0000).*

also, in this group of students, there was more exposure unrelated to clinical dental practice in comparison to the total sample (p=0.000). Similar results were obtained by Harutunian *et al.*[16] in 2010, who reported the presence of musculoskeletal symptoms in third year students (p <0.001), associated more with environmental factors than with clinical factors. On the other hand, in this study, the students that did not stretch after clinical practice were 3.8 times more likely to present pain to palpation (p=0.000) and to movement in the spine and neck (p=0.000). Hayes *et al.*[13] demonstrated that dentists who do not stretch after clinical practice are 4.8 times more likely to present pain in the lumbar area. Besides, in relation to hours of study, those who study more than 16 continuous hours are more prone to develop neck pain, although, this variable was not significant in the present study.

Regarding the multivariate analysis for pain to muscular palpation and to movement, there was an increase in the association and statistical significance with the variables of clinical dental practice. These results are similar to the ones reported by Hayes *et al.*[17], 2009 who evaluated a group of students and concluded that working in the dental unit for more than 6 hours is related to the presence of pain in the upper spine.

On the other hand, the multiple analysis for pain to movement shows that students are 1.2 times more likely to present pain to movement if they practice more than two hours per day in their dental unit and do

not take a break between patients. Similar results were obtained by Alexopoulos *et al*.[18] who found a direct relationship for the presence of pain in the neck and lower spine in students that do not take a break after providing dental service.

In accordance with the results of this study, it can be concluded that some practices and inadequate postures related with dental practice are directly related with the musculoskeletal disorders of the participants. This allows to identify the possible disorders that can be developed by dental students and dentists in general, and contribute to reduce the negative impact that can be caused by dental practice in two manners: in the first place, epidemiological surveillance programs could be developed by the personnel in charge of occupational health to promote the use of preventive protocols to acquire comfortable postures. On the other hand, the problem is even more complex when seen from the occupational perspective, by involving the demands led by the international labor organization which has manifested the importance of discussing labor legislation in those countries where workers do not have benefits regarding the time of daily practice, and are subject to continuous working hours and no breaks. In this sense, it would be important for dental personnel to generate discussions to permit modifications in the stools used in their clinical practice, making them even more comfortable, and also, to reduce the continuous time of clinical practice, the hours of practice during the day and the increase of time for breaks in order to permit stretching and a new musculoskeletal and mental organization. This would be reflected in better quality of life for dentists and less musculoskeletal symptoms in the future.

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