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Clinical Findings Related to Musculoskeletal Disorders (MSDs) in a Group of Orthodontists

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ABSTRACT

Aim: Orthodontists may be exposed to a variety of occupational hazards and may be affected by conditions such as musculoskeletal disorders (MSDs). Prevention strategies are required to identify risk factors at different levels. Through an objective clinical evaluation, this study aimed to identify the factors related to the presence of MSDs in a group of orthodontists from Medellín (Colombia).

Methods: A cross-sectional study was conducted. A clinical evaluation, focusing on the occupational aspects related to orthodontics, was carried out by an occupational health physician, which was standardized for research purposes. Sociodemographic and clinical variables were collected. Descriptive and bivariate analyses were conducted on the prevalence of MSDs according to the study variables and Chi-square tests were carried out to observe statistically significant differences. Ethical approval was obtained.

Results: The prevalence of MSDs was 58.7% (95%CI 44.3- 71.7). The frequency of upper body MSDs was 45.7% (women: 51.4%), and in the Spine area was 23.9% (men: 45.5%). The prevalence of MSDs was higher in men those people ≤ 44 years, single/separate, from middle socioeconomic status, and with other medical previous conditions. Labor conditions were related to the presence of MSDs. The agreed percentage for self-perceived symptoms of MSDs and those found for clinical evaluation was for upper body MSDs and clinical Spine area MSDs considering positive cases was 50% and 29.2% respectively.

Conclusions: The orthodontists participating in the study manifested various MSDs and other pathologies related to their professional practice. Sociodemographic and clinical factors were related to the presence of MSDs. Epidemiological surveillance systems in occupational health and strategies in health and safety at work are requested.

Key words: Occupational Health, Musculoskeletal Diseases, Risk Factors; Orthodontists.

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Introduction

Dentists face numerous risk factors, including ergonomics.[1] When these risks are not controlled, musculoskeletal disorders (MSDs) can appear in dental professionals, including orthodontists.[1] MSDs are defined by the United States Center for Disease Control and Prevention as "*injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs and are considered a public health problem because it is one of the main causes of absenteeism*".[2,3] MSDs prevalence varies between 30-80%,[4-7] with clinical manifestations in the lumbar region, shoulders, and neck.[4,5]

MSDs are associated with risk factors like individual, physical, and workplace-related conditions such as non-ergonomic positions, long working hours, absence of active breaks, inadequate workplace design, and psychosocial characteristics.[8] We can mention other aspects such as general health conditions, body mass index (BMI), and previous history of pain or genetic predisposition.[5,6,9] Regarding the association of MSDs and individual factors, the evidence is not conclusive yet. While some authors have found that the presence of chronic diseases (such as cardiovascular disease, diabetes, varicose veins), obesity, and increased BMI, are correlated with a higher prevalence of MSDs[4,9], others have reported minimal evidence.[8,10,11] Therefore, it is necessary to elucidate which health factors are specifically related to MSDs, through clinical evaluations that allow an objective assessment and find possible associations.

There exists a large number of studies that have been conducted worldwide reporting the high prevalence of MSDs in general and specialist dentists. These results have been based on self-reported surveys.[4-7,12,13] This situation in many cases, can generate the feeling that people who have suffered some symptomatology are more willing and interested to participate in this type of study and, in addition, only the complaints and individual perceptions of the participants are collected, but not supported in medical diagnoses.[6] This could indicate that there is a difference between self-perception and objective findings after a medical evaluation and diagnosis.

Accordingly, this study aimed to identify the factors related to the presence of MSDs in a group of orthodontists from Medellín (Colombia), through a clinical medical evaluation.

Material and Methods

This manuscript is part of a multi-step project that uses different methodological approaches. In a first part, a cross-sectional survey was applied in 100 orthodontists who graduated between 1993 and 2018 from the Faculty of Dentistry at the University of Antioquia (Medellín, Colombia). Data were provided by the Association of Orthodontists of the University of Antioquia, Asociación de Ortodoncistas de la Universidad de Antioquia in Spanish (https://ortodoncistasudea.com). For more details of the study, please check the publication referenced here.[4] Subsequently, a clinical examination was provided in volunteers that participated in the survey.

Design and setting

A cross-sectional study was conducted on orthodontists that voluntarily agreed to participate in a clinical examination. A clinical record was carried out in a specialized clinic and was in charge by a medical practitioner focused on occupational medicine. The final sample was 46 (response rate: 46%), considering secondary participation in this step of the research. According to the study design, our work hypothesis is that there exist several factors that influence the presence or the absence of MSDs and there are differences between the prevalence of MSDs when the subjective perception and the clinical diagnosis are considered.

Clinical examination

The participants were called to the clinical evaluation by personal invitation, and they make the appointment according to their time of preference. At the appointment, an expert medical practitioner in occupational health, previously calibrated theoretically with one of the researchers (DMRO), proceeded to make the medical evaluation that contained: Patient identification data, history, evaluation by systems and physical evaluation focused on the musculoskeletal system. The participant was given a summary result of their evaluation (occupational certificate), while the research team was provided with the result of the complete examination.

Variables

According to the clinical records supplied, the following variables were considered: 1) sex (male/female); 2) Body mass index (BMI): defined as a person's weight in kilograms divided by the square of his/her height in meters (kg/m2), and with this information and according to the parameters of the WHO,[14] the following characteristics were determined: a) underweight: BMI ≤ 18.50; b) normal weight: BMI between 18.50 and 24.99; c) overweight obesity: BMI ≥ 25.00; 3) practice of sports; 4) Medical previous conditions.

The research team reviewed all the clinical records and according to the findings, classified the information that proceed from the diagnosis and grouped in several categories: 1) Upper body MSD; 2) Spine Area MSD; 3) Lower body MSD; 4) Cephalea/Migraine; 5) Visual disturbances; 6) Other pathologies; 7) We grouped the variables 1, 2 and 3 in a new variable named presence of MSDs.

Additional variables were collected from the database obtained from the previous study:[4] 1) Experience as an orthodontist (years); 2) Labor activity; 3) Written contract; 4) Working hours per week; 5) Monthly income (Colombian peso and US dollars); 6) Labor satisfaction; 7) Stressful job; 8) Affiliation to the System of Labor Risks in Colombia. We used other health variables such as: Self-perceived Upper body MSDs and Self-Perceived Spine Area MSDs (previously collected).

Data analyses

First, the prevalence of clinical diagnosis was calculated by sex. Secondly, bivariate analyses were conducted for the prevalence of presence of MSDs (and the 95% confidence interval 95%CI) according to the study variables, and Chi squared test were calculated to observe statistically significant differences. Finally, we measure the agreed percentage (and the 95% confidence interval 95%CI) between the MSDs (clinical examination) and the self-perceived MSDs (self-administrated questionnaire) and we also calculated Chi square tests. SPSS version 22.0 was used to conduct these analyses.

Ethics

The Ethical Committee of the Faculty of Dentistry at the University of Antioquia approved the study (Act 07/2019). All the participants gave informed consent to participate, and confidentiality was guaranteed following Colombian regulations (Resolution number 008430/1993 by the Ministry of Health and Social Protection).

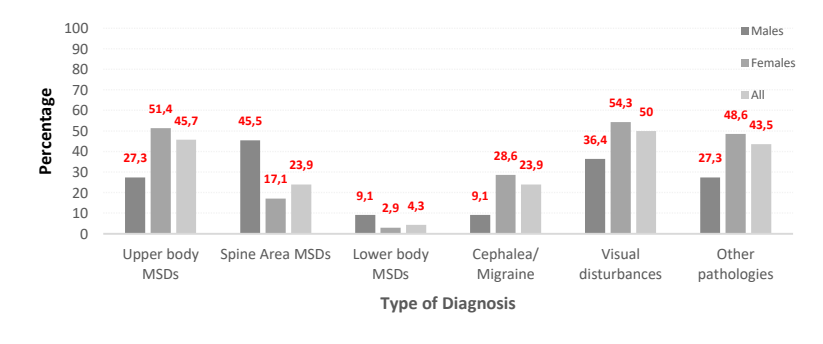

Figure 1. Prevalence of clinical pathologies in orthodontists according to sex (n= 46)

Table 1. Intragroup comparison of plaque index from baseline to 90 days.

Variables	Sample		Prevalence MSDs	
	n	%	%	95% CI
Sociodemographic				
Sex				
Men	11	23.9	63.6	35.4- 84.8
Women	35	76.1	57.1	40.9- 72.0
Age				
≤ 44	25	54.3	64.0	44.5- 79.8
≥ 45	21	45.7	52.4	32.4- 71.7
Marital status				
Single/Separate	19	41.3	73.7	51.1- 88.2
Married /Cohabitated	27	58.7	48.2	30.7- 66.1
Socioeconomic status*				
Middle	15	33.3	73.3	48.1- 89.1
High	30	66.7	53.3	36.1- 69.8
Body Mass Index (BMI)				
Normal	35	76.1	62.9	46.3- 76.8
Overweight/Obesity	11	23.9	45.5	21.3- 72.0
Practice of Sports				
Yes	29	63.0	51.7	34.4- 68.6
No	17	37.0	70.6	46.9- 86.7
Medical previous conditions				
Musculoskeletal history				
Yes	30	65.2	76.7**	59.7- 88.2
No	16	34.8	25.0**	10.2- 49.5
Other pathologies history				
Yes	37	80.4	62.2	46.1- 75.9
No	9	19.6	44.4	18.9- 73.3
Labor conditions				
Experience as an orthodontist(years)				
≤ 10	22	47.8	63.6	43.0- 80.3
≥ 11	24	52.2	54.2	35.1- 72.1
Labor activity (Yes)				
Teaching/research	13	28.3	46.2	23.2- 70.9
Clinical assistance	46	100.0	58.7	44.3- 71.7
Administrative	7	15.2	71.4	35.9- 91.8
Written contract				
Yes	34	73.9	58.8	42.2- 73.6
No	12	26.1	58.3	32.0- 80.7
Presence of several contracts				
Yes	24	52.2	50.0	31.4- 68.6
No	22	47.8	68.2	47.3- 83.6
Working hours per week				
≤ 40	34	72.3	52.9	36.7- 68.6
≥ 41	12	26.1	75.0	46.8- 91.1
Monthly income (Colombian peso)				
≤6,999,999 (U$1,843)	15	32.6	53.3	30.1- 75.2
≥7.000.000 (U$ 1,844)	31	67.4	61.3	43.8- 76.3
Labor satisfaction				
Satisfied	39	84.8	56.4	41.0- 70.7
Unsatisfied	7	15.2	71.4	35.9- 91.8
Stressful job				
Yes	35	76.1	60.0	43.6- 74.5
No	11	23.9	54.6	28.0- 78.7
Affiliation to the System of Labor Risks				
Yes	31	67.4	64.5	47.0- 78.9
No	15	32.6	46.7	24.8- 69.9
All	**46**	**100.0**	**58.7**	**44.3- 71.7**

* Missing values for socioeconomic status (n=1) **p-value <0.01

Table 2. Intragroup comparison of Gingival index from baseline to 90 days.

Variables		Clinical upper body MSDs	
		Yes	No
Self-perceived upper body MSDs	Yes	**18**	18
	No	3	**7**
Agreement percentage (positive & negative cases): 54.3 (95%CI 40.2- 67.9)			
Agreement percentage (positive cases): 50.0% (95%CI 34.7- 65.5)			
Agreement percentage (negative cases): 70.0% (95%CI 39.7- 89.2)			
p-value= 0.2613			
Variables		**Clinical spine Area MSDs**	
		Yes	**No**
Self-perceived spine Area MSDs	**Yes**	**7**	17
	No	4	**18**
Agreement percentage (positive & negative cases): 54.3 (95%CI 40.2- 67.9)			
Agreement percentage (positive cases): 29.2% (95%CI 14.9- 49.2)			
Agreement percentage (negative cases): 81.2% (95%CI 61.5- 92.7)			
p-value= 0.3829			

Results

Figure 1 shows the main diagnosis as provided for the medical records according to sex. When the MSDs are considered, a higher frequency of upper body MSDs was observed (especially in women). 45% of men suffered of MSD in the spine area. In the case of other pathologies, half of the participants were diagnosed with visual disturbances.

Table 1 indicates the prevalence of MSDs in a general way according to different variables. The general prevalence of MSDs (considering all areas) is 58.7% (95%CI 44.3%- 71.7%). The higher frequencies of MSDs were found for men, orthodontists ≤ 44 years old, those single or separated, with middle socioeconomic status. Regarding medical previous conditions, participants, with a musculoskeletal history had a higher prevalence of MSDs ($p<0.01$), the same situation was observed for a medical history in other pathologies. Orthodontists that do not practice sports had a higher prevalence of MSDs. Considering the labor conditions, higher frequencies of MSDs were observed in orthodontists with working experience ≤ 10 years, working in administrative tasks, with monthly incomes ≥7.000.000 (U$ 1,844), unsatisfied and stressed at work. In addition, participants with Affiliation to the System of Labor Risks reported higher frequencies of MSDs.

Table 2 refers to the agreed percentage between the self-perceived symptoms of MSDs according to a previous survey and the diagnosis as provided for the medical records. Considering positive cases (participants suffering MSD symptoms), 50% agreement was observed for upper body MSDs. In case of spine area MSDs, 81.2% agreement was found in negative cases (participants are not reporting MSD symptoms).

Discussion

This study aimed to identify different factors related to MSD in orthodontists and diagnose the presence of MDSs, beyond the symptoms perceived by the participants. A prevalence of MSDs of 58.7% was found. As the first relevant aspect, since a decrease in prevalence is observed compared to other studies;[4, 15] where the evaluation was made through self-completed surveys, this research showed that the diagnosis of MSDs can vary when the evaluation by a specialized clinician is considered.

Regarding sociodemographic factors such as sex, no significant differences were found between men and women. This situation agrees with a previous study by Ramírez *et al.*[4], where no positive correlation was found between sex and the presence of MSDs, and similar findings were observed in other studies.[8,16] However, in the present study, despite no significant differences, men had a higher prevalence of MSDs. This result is comparable to that found by Sankar *et al.*[17] where men had ten times higher prevalence than women, with statistically significant differences. This could be explained because men may have higher workloads than women. On the other hand, these results differ from those found by Meisha *et al.* in general dentists in Saudi Arabia[2] and by Kerouso *et al.*[15] in orthodontists from Canada, where it was observed that women experienced more symptoms of MSDs than men and a possible explanation was given by less muscle mass and tone, hormonal changes and osteoporosis. In this sense, more studies with more significant samples are necessary, which allow greater reliability in the results, given the heterogeneity found in the literature.

Relation to age, another factor that has been related to MDSs in orthodontists, some authors have found a significant positive correlation, thus, older orthodontists are more likely to develop musculoskeletal symptoms.[18] In the same way, Sankar et al. associated the greater older work experience and higher prevalence of MSDs.[17] However, other authors have not found any relationship.[5,8,15] In the present study, on the contrary, a higher prevalence was found in the youngest orthodontists (<44 years). This can be explained by the little work experience, where there is no good postural hygiene, in addition to working more frequently, due to longer periods of time and in more work sites.[4]

General health conditions have been considered a risk factor related to the presence of MSDs.[8] Maintaining good health conditions is correlated with a lower report of musculoskeletal symptoms[18] and many authors, within their recommendations, suggest the activity physics as a mechanism to prevent MSDs.[6,16] In this study, previous medical conditions were evaluated and it was found that those with a greater history of musculoskeletal and other pathologies had a higher prevalence of MDSs. This may be because these pathologies accumulated over time can increase the presence of musculoskeletal symptoms.

Two factors closely related to general health conditions were physical activity and BMI. The practice of physical activity has proven to be a protective factor for the development of MSDs since dentists who practice sports and take active breaks have less musculoskeletal pain.[5,6,8,19] This situation was found in the Colombian study, where, despite not having significant differences, the percentage of orthodontists with musculoskeletal diagnoses and who did not practice physical activity was much higher. In this regard, it is important to call for attention, since studies show that the percentage of general dentists and orthodontists who perform physical activity on a regular basis is very low.[5,17] Regarding BMI, the literature is still not conclusive, authors such as Rafie *et al.*[10], found no relationship between BMI and high frequencies of MSDs, Sakzewski *et al.*[8] reported that there was minimal evidence that this factor was related to MDSs and Ramírez *et al.*[4] found a positive correlation between an increased BMI and high frequencies of MSDs. The present study did not find a positive correlation. However, those participants with a normal BMI had a higher prevalence of MSD. In this regard, more studies are needed to clarify how this factor is related to musculoskeletal symptoms.

Marital and socioeconomic status were also evaluated, it was found that those single or separated orthodontists had a higher prevalence of MSDs, possibly associated with a higher workload due to a lower possibility of distribution of expenses and household tasks. On the other hand, in relation to the socioeconomic aspect, those with a medium status had a higher prevalence, it can be related to a greater workload and economic commitments. No studies were found evaluating these factors, therefore, no comparisons were possible.

Regarding working conditions, it was found that orthodontists who have over less than ten years of experience reported a higher prevalence of MSDs. This agrees with a review carried out by Leggat *et al.*[20] who indicates that musculoskeletal symptoms decrease with age and duration of practice, as did an investigation carried out in dentists in Australia[21] which also revealed that younger and less experienced dentists reported greater discomfort at the musculoskeletal system. This is probably due to the fact that younger orthodontists they work in more places and see more patients per day. However, it is also likely that more experienced orthodontists have already adapted to work positions that avoid the presence of MSDs.[4] One study carried out in Germany[22] found that the years of work showed to increase the percentage of MSDs. This situation could be related with a greater workload because patients seek to be treated by a more experienced professional.

The number of working hours per week and the workload are highly predictive factors of the appearance of disorders of the musculoskeletal system in orthodontists,[18] and in this study a high correlation was found between the presence of MSDs and a higher monthly salary (or equal to U$ 1,844) and more than 40 working hours per week. In studies conducted in general dentists, Pope-Ford and Pope-Ozimba also indicated an increased risk of MSDs related to long hours of work.[23] Al-Gunaid *et al.*[24] found positive correlations between the working hours, the number of patients per day and the presence of MSDs in different parts of the body. Kumar *et al.*[5] refers that with more than 5 patients the risk is increased.

Isolation due to the SARS-CoV-2 pandemic forced people to change their habits and orthodontists were not the exception. To a great extent, the use of computers to perform administrative tasks increased. In this study a relationship was found between the presence of MSDs and deskwork. However, Kumar *et al.*[5] reported that even though people used the computers for 2 or 4 hours a day there was no significant increase in the development of MSDs.

Psychosocial factors within the work environment have been linked to the appearance of MSDs. Sakzewski *et al.*[8] have divided these factors into three categories, those associated with the internal work environment, those associated with the external environment, and the individual characteristics of the employee; and their interaction can generate a stress process that can also affect individual health and job performance. Considering the above, the results of this study coincide with this hypothesis since the participants who classified their work as stressful have a higher prevalence of MSDs. This situation was found in a German study where the stress level was a very important factor related with the presence of MSDs.[22]

In this study, other variables that showed a positive correlation with the presence of MSDs were considered, such as the absence of several contracts and dissatisfaction with the job. However, due to the little literature and the type of study that was carried out, it was not possible to make accurate comparisons. It seems important to reflect on aspects related to the quality of life, and its relationship with health indicators, employment and work conditions, work-life balance and job satisfaction, as has been expressed in studies on the subject.[25-27]

To the best of our knowledge, this is the first study carried out in Latin America that identifies the health factors related to MSDs in orthodontists by using clinical examinations and complements the information obtained from a previous study.[4] Caution should be considered with the findings since these data were collected during the SARS-CoV-2 pandemic, which limited the response of the study population for fear of contagion at the site where the medical examinations were performed. It is suggested to carry out a job evaluation to verify the influence of its design on the presence and development of MSDs.

Conclusions

The orthodontists participating in the study manifested various MSDs and other pathologies that were related to their professional practice and that were diagnosed through a clinical examination performed by an occupational health professional. Some sociodemographic and clinical factors were related to the presence of MSDs, and some discrepancies were found between what orthodontists perceive as symptoms of MSDs and the actual diagnosis of MSDs. Studies of greater scope and depth are required that lead to epidemiological surveillance systems in occupational health and strategies in health and safety at work. The entities whose purpose is to promote the health of the working population are fundamental in these strategies.

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Conflicts of Interest Statement

The authors have no actual or potential conflicts of interest.

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Ethical Approval

11-2019, Ethics Committee, Faculty of Dentistry, University of Antioquia, Medellin, Colombia.

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