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Left-Handed Students and Clinical Practice in Dentistry: Adaptations, Difficulties and Realities Experienced in the Academic Environment

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Abstract

Objectives: To verify the existence of difficulties throughout the course of dentistry clinical practices, identify musculoskeletal pain, and evaluate frequency and intensity of pain/discomfort (if existent) in different regions of the body, experienced by left-handed students in comparison to right-handed students of the odontology courses of the state of Rio Grande do Norte (Northeast Brazil). **Methods:** A general questionnaire was applied to identify left-handed students in a population of 750 students, enrolled in clinical courses. An adaptation of the Grad-Corllet Diagram and a specific questionnaire on clinical practices were applied to the selected students. Descriptive statistics was utilized to analyze data of the specific questionnaire, and Mann-Whitney statistics, chi-square or Fisher's Exact tests (with a 5% significance level) were utilized for the Grad-Corllet Diagram, searching for an association between discomfort/pain in different body regions and manual laterality. **Results:** All students presented higher percentage of pain in the lumbar and neck/cervical regions. However, left-handed students presented higher values, with statistical significance levels of $p = 0.041$ for lower back, $p = 0.002$ for neck and $p = 0.003$ for cervical region. **Conclusions:** The majority of left-handed students classified "moderate" the difficulty of working with equipment designed for right-handers. There was high frequency of musculoskeletal pain/discomfort, with relevant statistical results for left-handed students regarding intensity. It is suggested that the participating institutions evaluate the adoption of inclusion politics, re-adapt the infrastructure to include

equipment designed for left-handers, and finally provide adequate work conditions for all students.

Keywords

Left-Hander, Odontology, Undergraduate, Academic Orientation, Musculoskeletal Pain

1. Introduction

The asymmetry in the functions of the human brain hemispheres is expressed by laterality [1]. At birth, both hemispheres act equally, but one hemisphere will start to dominate as neurological maturity progresses. This process can last between five and six years and, at the end of this period, the person presents a defined laterality [2], although the biological basis of this laterality remains unknown [3]. The reason why 90% of the population present right-side dominance and only 10% - 12% are left-handed is not known, but several theories have been proposed, for example genetic factors and pre- and post-natal conditions [4].

Regarding differences, social inclusion is directly related to the formation of a democratic society and is based on the guarantee of opportunities for all, independently of peculiar characteristics of an individual and/or social group [5]. Similarly, the preference for the use of the right or left hand is a typical example of laterality and cannot be considered as an exception or bad habit, as it is a natural manifestation of dominance of a particular brain hemisphere. The lack of general equipment adapted to the dominant brain condition [6] of left-handers exposes the fact that usually these characteristics of left-handed people are "forgotten".

In the context of an "inclusive education", the adoption of "inclusion" politics is necessary to offer structural and work conditions to the teachers as well as knowledge on the different pedagogical strategies that can be used for educational work with students, satisfying and responding to their needs [7].

In the implementation process of an inclusive society, the right of work is also essential [8], but if accessibility requirements are not taken into consideration, the quality of professional practice and the health of the worker can be affected. Therefore, any morbid manifestation that appears as a consequence of an individual's occupational activity is considered as a professional disease [9].

Odontology, as in other professions, presents operational risks that can lead to disease, impairment, or even death. Studies on Repetitive Strain Injury/Work-Related Musculoskeletal Disorders (RSI/WRMD) in dentists have been carried out since the 1950's and currently locate these professionals in the first place regarding leaves of absence due to temporary or permanent incapacities [10].

WRMD are a result of the combination of the excessive use of muscular groups in repetitive motions, with or without local strain, associated with the permanence of body

segments in a specific position during a long period of time and insufficient time for the recovery of these segments [11].

However, almost the totality of odontology education, including practical classes in dentistry schools and dentistry chairs, is designed for right-handed students only. Left-handed students can present difficulties throughout the execution of clinical activities, negatively affecting odontology practice and representing a risk factor for professional disease [12].

When associating left-side dominance with professional disease risk, the literature exposes that left-handed dentists could exhibit evidences of disadvantages, resulting in difficulties in the work environment, and that stationary chairs designed for right-handed professionals can generate discomfort for left-handed professionals [13].

Another study, however, observed the prevalence of neuropathic symptoms co-existent with musculoskeletal pain among right- and left-handed odontology students, related to weakness (42% and 40%, respectively), painful sensation equivalent to perforation with pins and needles (35% and 22%, respectively), and dormancy (23% and 19%, respectively). Left-handed students presented a significantly higher prevalence of musculoskeletal symptoms than right-handed students [14].

In this sense, although it is possible that a left-handed student learns to work with a dentistry chair designed for right-handed professionals, this process can be long and accelerate towards a stage of joint strain/wear and painful symptomatology [12]. If the left-handed student already practiced with a chair that was adequate to his/hers dominance particularity, this period of adaptation could be applied to improve practical abilities in a work position that is appropriate to the specific lateral dominance [1]. These studies indicate the necessity of odontology teaching institutions to provide equipment and learning conditions that are adequate to these left-handed students.

This work associates the subjects of left-handed odontology students and clinical practices, considering these left-handers as a group exposed to the risk of developing occupational diseases more precociously. This work aims at verifying whether difficulties exist in the development of clinical practices by left-handers, so that the information obtained builds the basis for universities to adapt the infrastructure of dentistry clinics and provide appropriate work conditions for these students.

2. Methodology

This research is characterized as exploratory-descriptive. The universe comprehended the students of three Odontology courses in the state of Rio Grande do Norte (Northeast Brazil): Federal University of Rio Grande do Norte (UFRN), State University of Rio Grande do Norte (UERN), and Potiguar University (UnP) and the survey was conducted in the 1st semester of 2014 in their universities. The project was submitted to the Research Ethics Committee of the Federal University of Rio Grande do Norte, with approval number 618.427/14 in accordance with the precepts of Resolution 466/12 of the National Health Council of the Brazilian Health Ministry.

The invitation to participate was done in person at each university where the

research objectives were explained and, after acceptance, approval and approval by each of the universities in the person of its director, met students per class and at that time one general questionnaire was applied to the identification of left-handed students in each educational institution.

The study population consisted of 750 students who were studying clinical disciplines in the 6th, 7th, 8th and 9th periods of dentistry in the three universities. It was found that from the 6th period the curriculum structures of the three educational institutions are similar and include the main clinical specialties of the course: Dentistry, Periodontics, Oral and Maxillofacial Surgery and Endodontics. The sample was in turn constituted by all left-handed students identified that 750 of the universe.

After having identified the left-handed students (30)-Group 1, the total universe of 750 and for comparison purposes was made a pair with 30 right-handed students-Group 2 which had similar characteristics with regard to age, during course and the same Institution of Education. This pairing was intended to verify that the difficulties were the same between the two groups of students. Then he obtained the signature of the Consent and Informed (IC) of the selected students in both groups. At that moment it was applied a questionnaire to two groups of students (Group 1 left-handers and right-handers Group 2) that addressed issues regarding the working position, the existence of difficulties in carrying out the procedures, in addition to available before and after exercise clinical practice as well as the absence or presence of pain related.

The inclusion criteria for the group of left-handers were being left-handed, be studying clinical disciplines in the last periods of the course (6, 7, 8 and 9 semesters) and belong to one of three dental educational institutions at the time of data collection. For group handed the criteria were similar to those of left-handed as the current period, to belonging to one of the chosen institutions have similar age and characteristics each other.

The questionnaire when intended for left-handed students presented 03 additional and specific questions regarding their handedness (questions 1, 2 and 3). The remaining questions were the same for both groups. After answered/completed was also applied Grad-Corllet diagram modified to the two groups of students in order to identify the existence of pain and, if present, which the intensity and location of pain/discomfort, enabling a comparative analysis between the two groups.

Data obtained from the questionnaires were analyzed by descriptive statistics, and the information obtained from the adapted Grad-Corllet Diagram was analyzed by Mann-Whitney statistics, chi-square or Fisher's Exact tests (adopting a 5% significance level for all statistical tests). The objective was to verify whether an association existed between laterality and discomfort/pain in different regions of the body.

3. Results

Considering the odontology students from the institutions involved in the study, 23.3% were in the sixth semester, 53.3% were in the seventh semester, 10.0% were in the eight semester, and 13.3% were enrolled in the ninth semester. The variables age and gender

were also analyzed, presenting a mean age of 23.18 (±5.62) years, with the female gender representing the highest percentage (58.3%) of these students. Regarding laterality, a total of 30 left-handed students were identified in the three universities. Considering the utilized methodology, the same amount of right-handed students was selected to complete the research sample and verify whether any symptomatology presented was common to both groups or exclusive to left-handers.

Figure 1 presents the frequency of symptoms in different anatomic regions of the musculoskeletal system of right- (R) and left- (L) handed students.

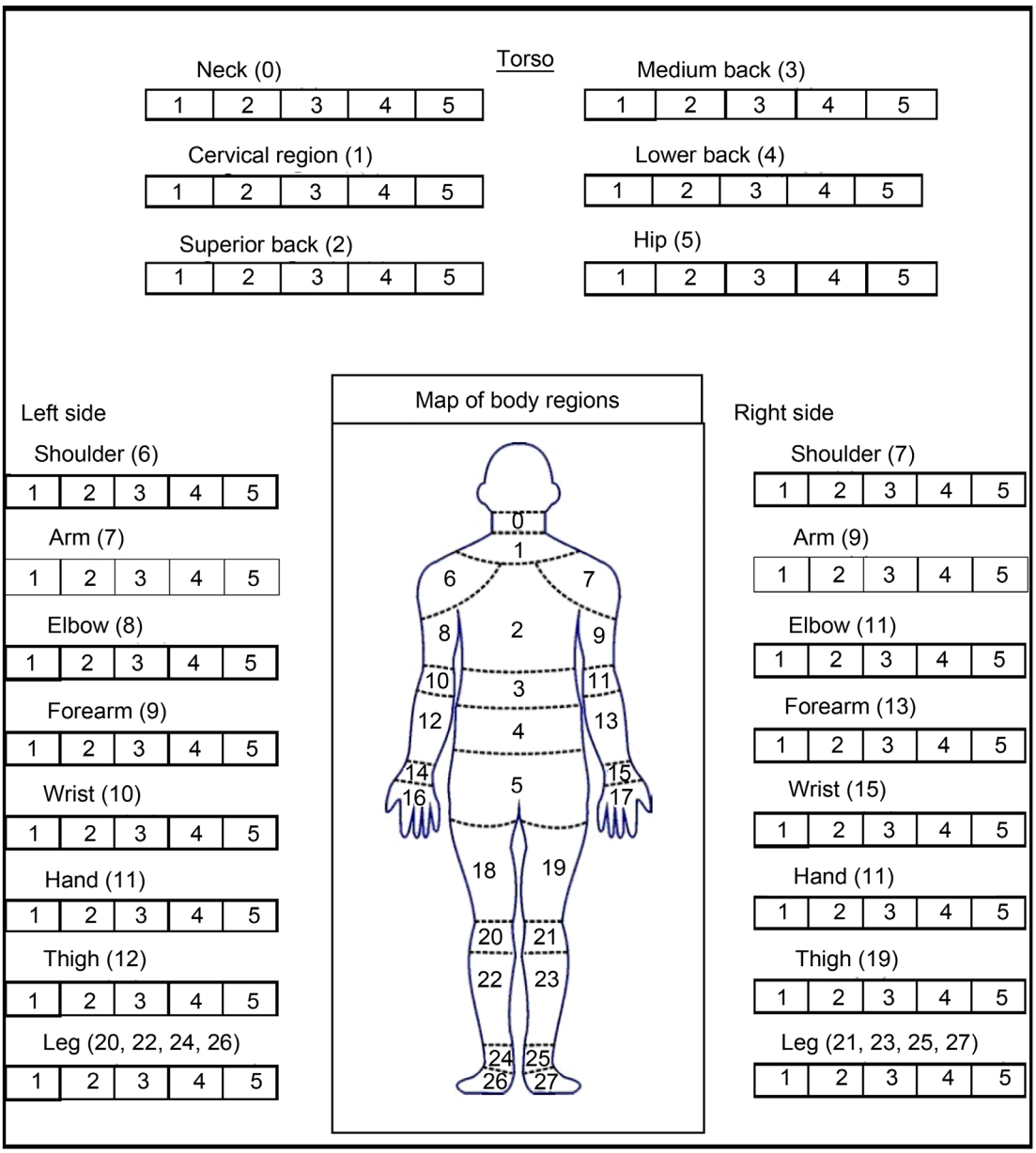

Figure 1. Result of the data analysis for the adapted Grad-Corllet diagram along with the frequency of musculoskeletal symptoms in right- and left-handed students, represented by the letters "R" and "L", respectively, of the Odontology courses of the state of Rio Grande do Norte. Natal/RN, Brazil, 2014.

The criteria used in the construction of the progressive scale of pain intensity, called "bodily discomfort Assessment Scale" are part of a collection instrument, the Grad-Corllet diagram, adapted for this study (Figure 1). Was asked each participant to score in the diagram used the area where he felt discomfort and/or pain, based on this scale with the following scores: intensity of Grade 1—No discomfort/pain intensity Grade 2—Some discomfort/pain, intensity of grade 3—Moderate discomfort/pain, degree of intensity 4—Very discomfort/pain and degree of 5—Intolerable discomfort intensity/pain. It was clarified that, even in cases that had not had problems in any part of the body, the intensity score 1 (no discomfort/pain).

Figure 2 shows the p-values (statistical significance levels) of the left- and right-handed students in different regions of the body represented by the adapted Grad-Corllet Diagram.

Corroborating the results of the Grad-Corllet diagram, Figure 2 shows that the

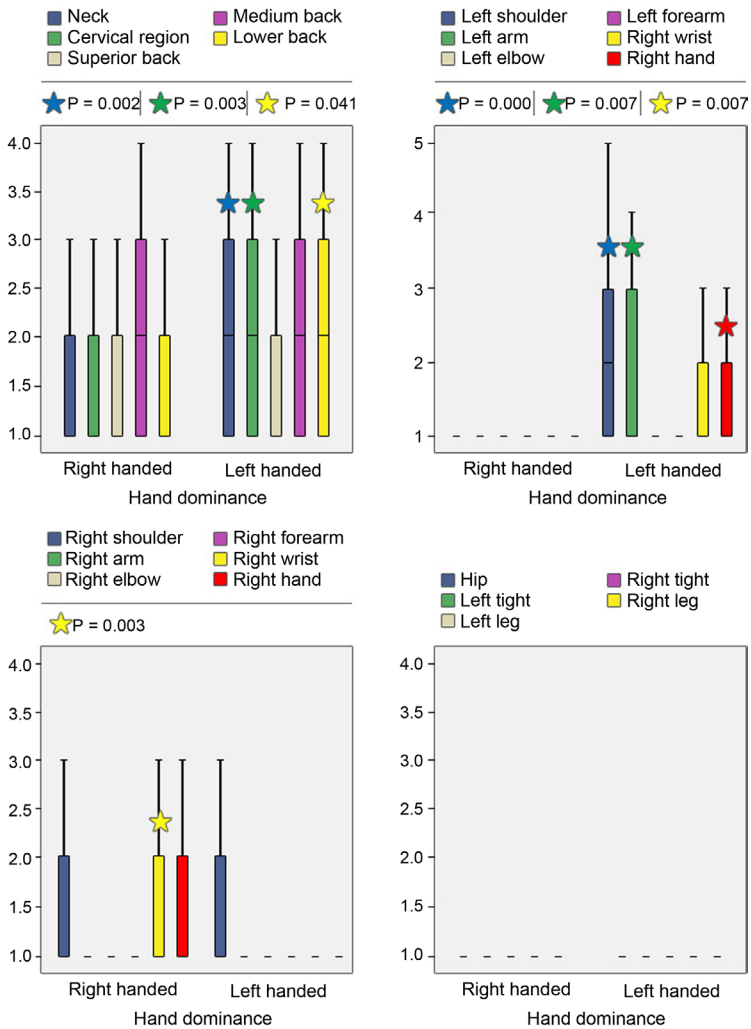

Figure 2. p-value graphs for different regions of the body-represented in the adap ted Grad-Corllet Diagram, comparing right- and left- handed students of Odontology courses in the state of Rio Grande do Norte. Natal/RN, Brazil, 2014.

left-handed students had pain with statistical significance in the following regions: neck (p = 0.002); neck (p = 0.003); in-ferior back (p = 0.041); left shoulder (p = 0.000); left arm (p = 0.007) and left hand (p = 0.007), while the right-handed showed a significant p value just to the right wrist (p = 0.003).

Table 1 presents the absolute and relative frequencies of the results of questionnaire

Table 1. Analysis of clinical practices and characterization of pain in right- and left-handed students of Odontology courses in Rio Grande do Norte. Natal/RN, Brazil, 2014.

	RIGHT-HANDERS		LEFT-HANDERS	
	(n)	(%)	(n)	(%)
ERGONOMIC POSITION IN WHICH THE STUDENTS PREFER TO ATTEND PATIENTS				
09 o'clock	21	70.0	7	23.3
12 o'clock	9	30.0	14	46.6
03 o'clock	0	0.0	9	30.0
Total	30	100	30	100
CLASSIFICATION OF THE DIFFICULTY ENCOUNTERED				
Little	3	100.0	3	13.0
Moderate	0	0.0	14	60.8
Severe	0	0.0	6	26.0
Total	3	100	23	100
HOW THE WORKDAY BEGINS				
Good disposition	25	83.3	26	86.6
Not much disposition	5	16.6	3	10.0
No disposition	0	0.0	1	3.3
Total	30	100	30	100
HOW THE WORKDAY ENDS				
Good disposition	3	10.0	3	10.0
Not much disposition	17	56.6	17	56.6
No disposition	7	23.3	6	20.0
Same as in the beginning	3	10.0	4	13.3
Total	30	100	30	100
INTENSITY OF PAIN				
Grade 2—Some discomfort/pain	6	37.5	4	21.0
Grade 3—Moderate discomfort/pain	9	56.2	14	73.6
Grade 5—Intolerable discomfort/pain	1	6.2	1	5.2
Total	16	100	19	100
PERIOD IN WHICH PAIN MANIFESTS WITH HIGHER INTENSITY				
Before office hours	0	0.0	1	5.2
During office hours	6	37.5	2	10.5
After office hours	10	62.5	16	84.2
Total	16	100	19	100

analysis applied to right- and left-handers regarding the performance of clinical practices in universities and characterization of pain.

Table 1 shows that the positions preferred by right- and left-handed students when attending patients are, respectively, 09 o'clock (70%) and 12 o'clock (46.6%). Regarding the difficulties encountered when utilizing dentistry equipment designed for right-handers, all right-handers classified this difficulty as "none", in opposition to the majority (60.8%) of left-handers, who presented "moderate" difficulties. Some of the difficulties reported by the left-handed students were: "positioning", "discomfort", "ergonomics", "difficulty in reaching curettes on the table", "having to adapt to carry out procedures from a different side", "tight space on the left side for attending, distance from equipment table", "the drill cables are short and sometimes do not reach an adequate distance", "difficulty in handling the auxiliary table and equipment", "difficulty in reaching the instruments in the tray", "difficulty in analyzing the oral cavity and utilizing instruments", "the equipment table".

The majority of right- (83.3%) and left-handed students (86.6%) affirmed to start the workday in good disposition, and ending the work shift with low disposition levels (56.6% for both). Regarding the period when the pain manifests itself with higher frequency, 62.5% of the right-handed students and 84.2% of the left-handed students reported pain after working hours. It must be highlighted that only left-handed students (5.2%) reported pain before the workday even began. Regarding the intensity of pain, the majority of right-handers (56.2%) and left-handers (73.6%) reported discomfort.

Table 2 represents the percentage results of the questionnaire analysis applied to right- and left-handed students, regarding clinical practices and the existence of musculoskeletal pain.

Table 2 demonstrates that the majority of left-handed students (76.6%) encountered difficulties while working with Odontology equipment designed for right-handers during clinical practices at the university, while only 10% of right-handers reported the issue. Both groups of students (left- and right-handers) faced a higher degree of difficulty in the courses of Periodontology and Dentistry. Sixteen right-handed students (53.3%) and 19 left-handers (63.3%) declared musculoskeletal pain, of which most (73.3% right-handers and 78.9% left-handers) did not experience musculoskeletal pain before enrolling in Odontology.

Table 3 presents the relative frequencies for the analysis of results of the specific questionnaire applied to left-handers.

From Table 3 it can be observed that most left-handed students (73.3%) was never supervised by a left-handed professor during clinical practices in the university although this supervision would considered to be more comfortable (53.3%), when applicable. These data point towards the necessity of a greater sensitization in the diagnosis of the difficulties faced by these students, which should not originate only from people in the same situation. These difficulties must be considered real, and should not be neglected. It must be mentioned that no equipment adapted to left-handers was found in any of the three institutions researched.

Table 2. Analysis of the difficulties encountered in clinical practices and painful symptomatology reported by students. Natal/RN, Brazil, 2014.

		RIGHT-HANDERS	LEFT-HANDERS
		(%)	(%)
Faced any difficulties when working with dentistry equipment designed for right-handers during clinical practices in the university	YES	10	76.66
	NO	90	23.33
Which course presented highest difficulty at the time of performing clinical practices at the university	DENTÍSTRY	23.33	30
	PERIODONTOLOGY	30	43.33
	ORAL AND MAXILLOFACIAL SURGERY I	6.66	3.33
	ENDODONTOLOGY	20	6.66
	OTHER	6.66	0
	NONE	13.33	16.66
Presence of musculoskeletal pain	YES	53.33	63.33
	NO	46.66	36.66
Presence of musculoskeletal pain before enrolling in the Odontology undergraduate course	YES	26.66	21.05
	NO	73.33	78.94

Table 3. Academic supervision and existence of specific equipment for left-handers in odontology courses of Rio Grande do Norte. Natal/RN, Brazil, 2014.

SPECIFIC QUESTIONS FOR LEFT-HANDERS	YES	NO	INDIFFERENT
	(%)	(%)	(%)
Have you been supervised by a left-handed professor during clinical practices?	26.66	73.33	-
Did you find it more comfortable when you were supervised by a left-handed professor?	53.33	0	46.66
Is there dentistry equipment destined to left-handed students in your institution?	0	100	-

4. Discussion

Analysis of the pain from the scores marked by students in Figure 1 was then performed using the statistical Mann-Whitney, chi-square test or Fisher exact (adopting a 5% significance level for all statistical tests) where we sought the association between discomfort/pain in different body regions with the handedness (right-handed and left-handed).

The analysis results of the Grad-Corllet diagram in this study are consistent with a study [15], which shows the dentistry as one of the professions more risk to occu-

pational diseases, since it works with inadequate and prolonged postures, repetitive movements, vibration and cumulative, excessive compression of the wrist and hand, as well as sequential and repetitive clinical treatments performed in the same type of procedure [16].

Other studies [17] [18] have similarly observed that Odontology students (right- and left-handers) presented a higher percentage of painful symptomatology in the lumbar and neck/cervical region. A lower percentage of pain was registered in lower limbs in comparison with the remaining body regions of the students (right- and left-handers), which was also observed in other studies [19] [20].

However, left-handed students presented higher percentage of pain in comparison to right-handed students, besides presenting p-values with statistically significant levels. These data can be related to the absence of dentistry equipment adapted to the left-side laterality of this group of students and is a result, consequently, of an inadequate work posture. Similarly, a study [21] affirms that almost the entire undergraduate Odontology course as well as clinical practices are designed for right-handers only.

In this sense, the existence of a reduced number or even complete absence of dentistry chairs designed for left-handers in the participating institutions can affect work quality. The quality of the service provided to the patient can be compromised, in function of the prevalence of pain reported by the professionals [22]. A study [23] showed that even during dental therapy (scaling and root planning) right-handed dentists achieved more success than left-handed dentists, since both types of professionals utilized dentistry chairs destined to right-handers. Nevertheless, another study [12] observed a better performance of left-handed Odontology students during the removal of biofilm and calculus when working with dentistry chairs specifically designed for left-handers.

The absence of adaptations for left-handers exposes a lack of ergonomic guidelines when planning the work environment and dentistry equipment, facilitating the occurrence of musculoskeletal system disorders [24]. Similarly, it was observed herein that the majority of students (right- and left-handed) starts the workday with high levels of disposition, but presents low levels of disposition at the end of office hours, presenting discomforts that are manifested with higher intensity after the workday ends. Most of these students did not experience musculoskeletal pains before enrolling in odontology. Another author [25] remarks that a new model of health and safety is currently emerging in routine work activities in different professional categories that involve a wide ergonomic framework, requiring a new repositioning of professionals or workers in general, especially in universities (as institutions responsible for academic formation).

In this context, a suggestion to control the advance of such diseases is the significant increase in available time for the learning of ergonomics in odontology courses, aiming at prevention since early stages [26]. It is necessary to establish, supervise and apply adequate habits and work postures, and establish pause and stretching intervals between clinical appointments [27]. In the period of professional formation it is indispensable to advise on and supervise the employment of this knowledge in clinical practices,

considering that ergonomic health disorders can already start in the academic period [28].

Data obtained on the preferred position to attend patients can also be an indicative of the work difficulties experienced by left-handers when utilizing dentistry equipment destined to right-handers. The majority of left-handed students prefers the 12 o'clock position to attend patients, while the International Standards Organization and the Federation Dentaire Internacionale (ISO-FDI) consider that the positions of 3 and 1 o'clock are most adequate for the work of left-handers. The results encountered can be associated with the necessity of adaptation of these students throughout their academic life, mainly due to the inexistence of equipment designed for their left-side laterality, as was observed in the three researched institutions.

It must be highlighted that left-handed students have to make an extra effort to develop their abilities while utilizing equipment designed for right-handers and prepare for the work market, which in its almost totality, only offers equipment for right-handers, especially in the public service. Therefore, it is suggested that industry develops totally-reversible dentistry equipment, as currently the options available are stationary and must be specified before installation.

In the context of academic environment, inclusion politics must be put into force effectively, to create a satisfactory environment from an occupational point of view, combating the invisibility of the necessities of the minority while also respecting diversities. Since bureaucracy is very present in the public service, and decisions have to pass by several instances and levels to become real, it is interesting to report that at the end of this study, the only private participating university has indicated the possibility of installing dentistry equipment designed for left-handed students in the next academic year.

Still regarding inclusion in the educational environment, the majority of left-handed participants in a study [29] reported that they preferred an educational model that took into consideration the lateral dominance of students and it would be more functional if at least the equipment was mobile/reversible. Some students described reduced clinical performance due to back pain and inadequate work posture.

5. Conclusions

Given the results obtained, it can be concluded that left-handed students presented difficulties during clinical practices although musculoskeletal pain was experienced by all students of the three participating institutions. Despite the fact that both groups of students reported painful symptomatology, there was a high frequency of musculoskeletal pain/discomfort, with statistically significant results, for left-handers regarding difficulties in clinical practices. These facts can be directly related to the absence of dentistry chairs specifically designed for left-handers.

Considering that the university is a plural environment, where all should enjoy equal opportunities, it is suggested that the three institutions assessed re-evaluate the adoption of inclusion politics and associate these directly to the teaching methodology,

contributing to better satisfy the necessities of minority groups. Following these actions, the institutions can provide better assistance and orientation to these students, and re-adapt the equipment infrastructure so that work conditions are ideal for all students, right- or left-handers. In this way, occupational diseases that nowadays appear precociously will be prevented, while differences are respected and individual potentials are appraised.

6. Study Limitations

A restriction on that point could be the sample size. At the same time there is no way to predict and even calculate the sample because born with dominance of the left side (left-handed) is a low prevalence event, and although we know that at birth the two hemispheres operate in equivalent manner, only with neurological maturity one will be dominant and the biological basis for this dominance laterality still unknown.

Despite the low prevalence, this issue requires further studies considering the university as plural and diverse space, it must be inclusive and provide learning opportunities similar to all its students.

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