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Difficulties of dental practice among left-handed Tunisian students: a cross-sectional survey

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Abstract: In dentistry, most equipment is designed for right-handed (RH) individuals. Thus, left-handed (LH) individuals are often forced to adapt to demanding RH working conditions, and therefore, experience difficulties in their practice. The objective of this study was to determine the prevalence of left handedness among dental students at the Dental Clinic of Monastir, Tunisia, and to investigate the difficulties for LH individuals during clinical practice. A cross-sectional study was conducted among dental students during the academic year from September 2019 to March 2020. An adaptation of the Grad-Corllet Diagram and a specific questionnaire on clinical practices were administered to 221 participants. Data were analyzed using SPSS 24.0 statistical software for descriptive statistics and the chi-square test was performed (with a 5% significance level). The study revealed that 18.1% of dental students were LH. Among which, 82.5% of LH students had difficulties using instruments designed for RH dentists, 47.5% of LH students preferred the 3 o'clock working position, and 77.5% of LH students preferred to work in a sitting position. Most LH students (70%) reported that endodontic treatment was the most difficult procedure to perform. All students, whether RH or LH, presented a higher percentage of pain in the lumbar and neck/cervical regions; however, LH students presented higher values (77.5%) with statistically significant differences being reported for lower back pain ($p = 0.026$) and neck pain ($p = 0.012$). This study highlights the difficulties that LH dental students face in performing dental work. Dental Schools should provide LH students with appropriate equipment and a proper learning environment.

Keywords: Functional Laterality; Musculoskeletal Pain; Surveys and Questionnaires; Education, Dental.

Introduction

Dentistry is a profession that not only requires a theoretical basis but also a high degree of manual dexterity and mental imaging to perform specific clinical procedures. This demanding profession requires practitioners to develop fine motor skills, and a high level of concentration and precision.[1,2] In recent years, technological progress has led to remarkable improvements in dental equipment, which has become increasingly sophisticated and efficient in increasing the safety of dental practices. Unfortunately, in a field

where the work depends on dexterity and the optimal use of equipment and instruments, the manufacturers of the latter primarily target right-handed (RH) users.[3] In a British study of undergraduate dental students and orthodontic specialists, left-handed (LH) individuals commonly felt inconvenienced, which affected their skills development.[4]

They had to develop more manual dexterity to execute different dental procedures like positioning in relation to patients. Improper position, discomfort while handling instruments and the lack of a thorough visibility of the operative site were the major difficulties perceived by these LH dental students.

Left-handedness or right-handedness is a typical example of cerebral laterality, which refers to a domination of one cerebral hemisphere to execute the highest developmental actions.[5] Cerebral laterality expresses body awareness, allowing the completion of activities with greater strength, precision, preference, speed, and coordination, which are key aspects of learning.[6] Both hemispheres of the brain act equally at birth, but with neurological maturity, one hemisphere will begin to dominate. After 5 to 6 years, the person will present a well-defined laterality, although the biological basis for which remains unknown.[7]

According to the study of Alibeik and Angaji, 8%–15% of the global population are LH, with a higher proportion of men than women.[8] Birth difficulties, prenatal ultrasound, maternal smoking during pregnancy, low birth weight, diffuse brain damage, and testosterone levels during early development are environmental factors that can promote left lateralitis.[9]

Despite social and technological developments, the frequency of left handedness tends to decrease with age, which is probably due to social pressure and adaptation.[10] The reduced frequency of left-handers in old age is due to changing patterns of social norms.

The prevalence of left handedness among dental students is 8.6%, which is slightly higher than that observed in the general population (7.2%).[4] However, in dentistry, as in many other professions, equipment and instruments are manufactured for RH users, forcing LH individuals to adapt. This may make performing dental procedures more challenging, therefore, negatively affecting performance and increasing discomfort among LH dentists.[11]

The working position of dentists differs according to their comfort. Indeed, some dentists prefer to work in a sitting position, while others prefer a standing position. However, working on the right or left side of the dental chair is not a choice because most chairs are designed for practitioners to work on the right side.

Among practitioners, some regard left-handedness as a simple inconvenience that can be overcome by practice, while others feel that they are a minority whose specificity of gesture is poorly understood and not taken into account. The difficulty and struggle encountered by LH students when performing the various dental procedures has led them to develop low self-esteem. [12]

Working on a chair designed for RH students was reported to be uncomfortable by 85.7% of LH students.[13] Additionally, in a Turkish study of 24 LH and 97 RH dental students, LH students reported having experienced more musculoskeletal disorders (MSD) than RH students.[1] Compared to RH students, LH students have higher rates of neck and shoulder pain.[2]

Unfortunately, in many dental schools — including ours — there are no chairs designed for LH students. LH students must therefore adapt to instruments and equipment designed for RH individuals, which can affect their dental training and cause discomfort.

Furthermore, to our knowledge, no study has evaluated the difficulties encountered by LH students in Tunisia. Thus, the present study aimed to assess the prevalence of left-handedness among students, interns, and postgraduate students at the only Dental Clinic at the University of Monastir, to identify the main obstacles to achieving a comfortable learning and practice environment for LH dentists, and to propose solutions to overcome this disadvantage.

Methodology

Study design and ethical clearance

This was a cross-sectional descriptive study conducted at the Dental Clinic of Monastir, Tunisia. The study received approval from the Ethics Committee of the Dental Medicine University (Nº 2019/FMDM/22).

Participants, eligibility, and setting

The database of the Clinic of Dental Medicine showed that the number of dental practitioners at the clinic in 2019 / 2020 was 908, including 489 students, 269 interns, and 150 postgraduate students. Only 274 students had an email registered in the database. The survey and an informational letter of the study's objective were sent to all students practicing at the Dental Clinic, and no exclusion criteria were applied. A free prior informed consent form was signed by individuals who agreed to participate in the study. The sample set was non-probabilistic.

Survey instrument

The electronic questionnaire was sent by email to participants from September 01, 2019 to March 31, 2020. The questionnaire consisted of 20 questions that assessed the following: demographic information, difficulties in dental practice arising from being left-handed, preferred hand for performing various dental procedures, and musculoskeletal complications. To assess the intensity of musculoskeletal pain, we used the diagram of Grad-Corllet.[7] Each participant was asked to mark on the diagram the aching part of their body and to indicate the severity of the pain using a score of 1 to 5. The questionnaire was then pilot-tested with four LH dental students and interns to ensure clarity and validity, and was then finalized.

Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences (version 20.0 for Windows, IBM, Corp, Armonk, USA). Descriptive statistics were used to generate means and percentages. Chi-square analyses were used to test for associations between categorical variables. A p-value < 0.05 was accepted as significant.

Results

Two hundred and twenty-one students responded to the questionnaire (80.6%). Regarding laterality, only 18.09% were LH students with a mean age of 24.8 (±1.23) years. Of the 40 LH respondents, females were most prevalent (65%). Regarding educational level, 30% of participants were externs, 50% were interns, and 20% were postgraduate students (Table 1). Table 2 describes the clinical practice and the difficulties encountered by LH individuals during their professional practice. The working positions preferred by LH students when attending patients were 3 o'clock (47.5%) followed by 12 o'clock (42.5%). A total of 77.5% of LH participants preferred working in a sitting position.

Regarding the difficulties encountered by LH students during clinical sessions, 82.5% of LH participants reported having difficulties using instruments and equipment designed for RH individuals. No LH students indicated that specific LH equipment was present in their Dental Clinic. LH practitioners reported that endodontic treatments were the most difficult procedures to perform (70%).

The study also showed that being a LH dentist affected the dental assistant's work and ability to assist the dentist during operative procedures (50%). Among LH students, the execution of any dental procedure was mainly performed by the left hand (80.5%). The adjustment of the dental chair (67.5%) and the maintenance of the mirror for the retraction of the cheek were generally performed by the right hand (75%) (Figure).

Concerning MSD due to the use of RH instruments and equipment by LH practitioners, lower back pain (77.5%) and neck pain (57.5%) were higher in LH individuals than RH individuals (p = 0.012 and p = 0.026, respectively) (Table 3).

Both RH and LH students reported having a history of musculoskeletal pain before enrolling in clinical sessions (31.5% and 32.5%, respectively). No

Table 1. Demographic data of study participants.

Variables	LH		RH		Total	
	n	%	n	%	n	%
Laterality	40	18.1	181	81.9	221	
Gender						
Male	14	20.9	53	79.1	67	30.0
Female	26	16.9	128	83.1	154	69.7
Educational level						
External	12	10.5	102	89.5	114	51.6
Interns	20	24.7	61	75.3	81	36.7
Postgraduate students	8	30.8	18	69.2	26	11.8

LH: Left-handed; RH: Right-handed

Table 2. Analysis of clinical practices and the difficulties encountered by left-handed practitioners during clinical sessions.

Variables	n	%
Commonly used positions		
09 o'clock	16	40
10 o'clock	15	37.5
11 o'clock	9	22.5
12 o'clock	17	42.5
03 o'clock	19	47.5
Sitting position	31	77.5
Standing position	9	22.5
Difficulties during clinical sessions		
Yes	33	82.5
No	7	17.5
Equipment layout for LH practitioner		
Yes	0	0
No	40	100
Most difficult act to perform		
Caries care	11	27.5
Endodontic treatment	28	70
Oral Surgery	12	30
Periodontal care	7	17.5
Prosthodontics	12	30
Complaint expressed by patients treated by a left-handed doctor		
When working on the left side		
Yes	0	0
Some times	10	25
No	30	75
When working with the left hand		
Yes	0	0
Some times	4	10
No	36	90
Perception of the quality of care by working on the right side		
Yes	32	80
No	8	20
Effect on the ability of the dental assistant		
Yes	20	50

correlation was found between musculoskeletal pain and laterality (p = 0.322). Regarding the intensity of pain, 44.75% of RH and 62.5% of LH (62.5%) students reported moderate pain with a significantly higher number of LH practitioners reporting moderate pain than RH practitioners (p = 0.011). Additionally, LH students expressed significant pain in the following regions: neck (p = 0.032); shoulder (p = 0.05); and back (p = 0.026). Regarding the period when pain was felt, 52.5% of LH students reported pain when working, while 57.3% of the RH students experienced pain following dental procedures.

Discussion

This survey-based study was performed to investigate the prevalence of left-handedness among dental students, and to identify the main difficulties they encounter in the only Dental Clinic at the University of Monastir in Tunisia. There is a paucity of information in the literature regarding LH dentistry and there is a lack of studies assessing the prevalence of left-handedness or the major challenges faced by LH dentists in Tunisia. The results of this study revealed that 18.09% of participants were LH, which was more than the percentage of LH dental students reported by Brown and by Henderson et al. (8% and 8.6%, respectively).[4-14]

Demographic analyses also revealed that there were fewer male LH dentists (35%) than female LH dentists (65%). The unequal distribution is also consistent with the findings of Shivam Kapoor et al.[15] and Pratibha Sultane et al.,[16] and is explained by the predominance of women in our faculty. However, a study by Al-Johany[2] reported a higher prevalence LH males (57%) than LH females (43%) among dentists.

This current study also found that LH practitioners preferred the 3 o'clock and 12 o'clock working positions, as well as working in a seated position. Those findings are also consistent the findings reported in the literature. In a Brazilian study, 46% of LH dental students preferred the 12 o'clock position, while 30% preferred the 3 o'clock position.[6] In such positions, LH individuals can maximally observe the dental surfaces while maintaining an ergonomic position. The International Standards Organization and the Federation Dentaire Internationale (ISO-FDI) indicate that the 3 o'clock and 1 o'clock positions are the most suitable for LH dentists.[7]

The preference of LH practitioners for a seated working position is explained by the fact that it provides a comfortable posture with less harm to the musculoskeletal system.[7] This working position makes it possible to perform surgical procedures and obtain impressions; however, working in the

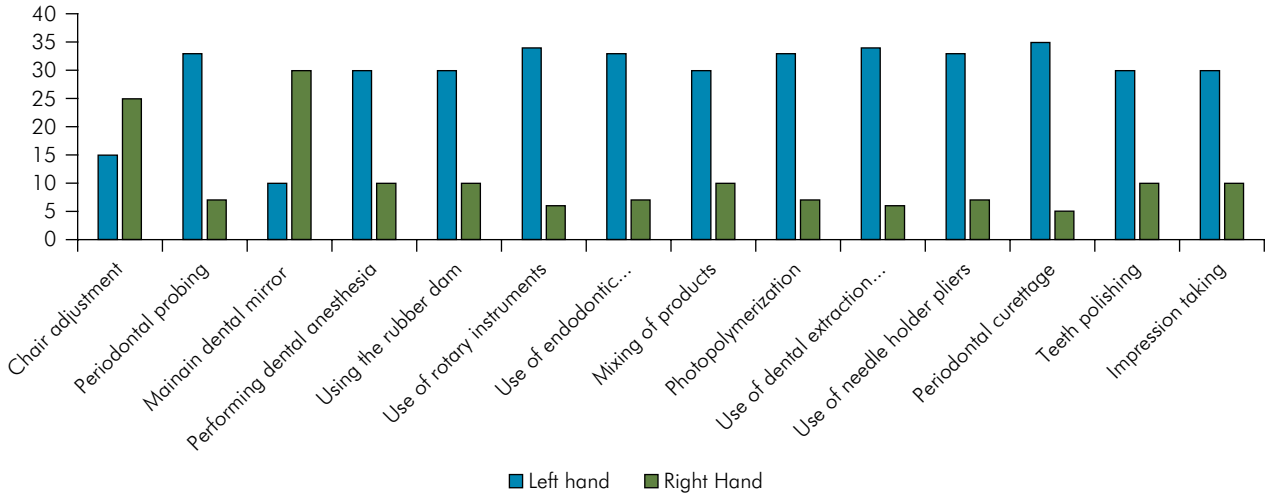

Figure 1. Percentage of left-handed participants' responses regarding the hand they used in performing dental procedure.

Table 3. Distribution of pain and the symptoms reported by right- and left-handed students.

Variables	Right handed		Left handed		p-value
	n	%	n	%	
Symptoms					
Headache	78	43	9	22.5	0.61
Numbness	27	13.4	4	10	0.418
Tendonitis	33	18	9	22.5	0.534
Low back pain	106	58.5	31	77.5	0.012*
Neck pain	84	46	23	57.5	0.026*
Antly	23	12.5	3	7.5	0.355
Presence of musculoskeletal pain before enrolling in the dentistry course					
Yes	57	31.5	13	32.5	0.322
No	124	68.5	27	67.5	
Intensity of pain					
Some discomfort pain	77	42.54	5	12.5	0.327
Moderate pain	81	44.75	25	62.5	0.011*
Severe pain	22	12.15	10	25	0.63
Intolerable pain	1	0.55	0	0	
Period in which pain manifests with higher intensity					
Before clinical sessions	0	0	1	2.5	0.022*
During clinical sessions	71	39.22	21	52.5	0.325
After clinical sessions	95	52.48	17	42.5	0.233
Distribution of pain according to body regions					
Hand	41	22.65	12	30	0.325
Should	57	31.49	22	55	0.05
Neck	93	51.38	24	60	0.032
Back	129	71.27	32	80	0.026
Leg	21	11.6	1	02.5	0.082
Foot	19	10.49	3	07.5	0.562

*$p < 0.05$, based on the chi-square test.

3 o'clock position using a dental chair designed for RH individuals presents some constraints. The location of the dental spittoon next to the practitioner is inconvenient, limiting the practitioner's field of work. The plate comprising the equipment and the unit comprising the rotary instruments are placed on the opposite side of the chair and are inaccessible, thus, forcing practitioners to lean to obtain an instrument.[16]

It must be noted that LH dentists work in an environment dominated by instruments designed for use by RH individuals, and therefore, as students, they must make additional efforts to develop their abilities to use such equipment and prepare for a job market—especially in the public sector—that predominantly provides RH equipment.[7] Thus, such factors explain the high percentage of LH students (82.5%) that reported having difficulties throughout dentistry clinical practices. The main difficulties reported by the students were the awkwardness of their position, difficulties while accessing instruments and the lack of full visibility of operative site.

Endodontic treatment was reported as the most difficult procedure for LH practitioners. In fact, it is a treatment that requires a great deal of precision and its success requires favorable ergonomic conditions. Our results are similar to those of a study conducted in Australia that showed that 73% of LH students experienced difficulties performing endodontic and conservative treatments, 40% experienced difficulties performing periodontal care, and 20%

experienced difficulties performing pediatric dental procedures.[8] Thus, the quality of care provided to patients can be impaired due to the occurrence of pain in the dental professionals.[17] Another study showed that even during dental therapy (scaling and root planning), RH dentists achieved higher levels of success than LH dentists, since both types of professionals used dental chairs designed for RH individuals.[18]

Given the challenges that LH students face when using equipment designed for RH individuals, they have to make an extra effort to adapt to working in the available work environment. Although LH dentists can learn to work on a dental chair designed for RH dentists, it will take time. However, instead of wasting time learning to operate in an awkward position, LH dentists may spend their time improving their abilities in a more comfortable position. The lack of adaptations to the working conditions for LH practitioners may favor the appearance of MSD, even if our study did not show any statistical significance.

Henderson et al.[4] found that RH chairs caused musculoskeletal irritation in LH individuals. Indeed, LH practitioners suffer from MSD more than RH practitioners, and are more vulnerable to neck pain and lower back pain. In fact, during performing different dental procedures, the significant muscular effort and the repetitiveness of the movements give rise to pain, particularly in the neck, shoulders, and back. This may explain the prevalence of pain in LH individuals who are more vulnerable to postural constraints. Thus, ergonomic working principles should be taught to students and dental faculties should provide comfortable working environments.[20]

MSD are occupational disorders and cause disability. MSD is especially common among dentists. A Czech study[21] found that dentists and dental students exhibited a higher prevalence of MSD in the neck, shoulder and back area than the general population.[21] A longitudinal prospective evaluation also showed a significant increase in the occurrence of MSDs among dental students during their training. That latest study suggests that the onset of this occupational burden begins early in the careers of dentists.[20]

We propose some recommendations to prevent MSDs among dental students. First, it is highly recommended that dental students plan their treatment sessions according to a level of difficulty that the procedures may pose. Regarding posture, students should adopt a feet-on-the-floor posture, work with their elbows close to their body, bend their arms about 45°, and work in the 11:00 and 12:00 o'clock positions. To cope with the deleterious effects that may arise from working in a static posture, dental students should perform stretching exercises that oppose the postures adopted during the day. Health authorities should strive to improve the training conditions of LH dental students by introducing dental stools with lumbar supports and mobile elbow rests that support the weight of the arms and share the weight of the upper body. School of dentistry should provide at least a few dental chairs equipped with necessary instruments and equipment designed for left – handed dental students. Dental students should also be provided breaks between care sessions to relax the muscles and allow their blood to circulate.

A limitation of the present study was that it was based off a self-reported questionnaire that could have been subject to recall bias. We also note other limitations to this study, including the small number of participants and the non-probabilistic sample set.

Conclusion

This study revealed that 18.1% of dental students were LH and experienced difficulties during their training and clinical practice. Such difficulties may affect their quality of work and promote the onset of MSD when working on RH dental chairs. This study should encourage dental schools to provide adequate working conditions for LH practitioners.

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