Original Article

Handedness of Malaysian Undergraduate Dental Students and Its Impact on Perceived Difficulty in Clinical Training in Dentistry

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Abstract

Objectives: To assess the prevalence of handedness and its impact on the perceived difficulty in clinical training amongst undergraduate dental students in Malaysia.

Materials and Methods: A cross-sectional survey using a self-administered questionnaire was conducted in 5 dental schools around the Klang Valley. Samples consisted of year 4 and year 5 clinical undergraduate dental students. Information on the socio-demographic data, the determination of handedness and assesment of perceived difficulty in carrying out certain clinical procedures were collected.

Results: A total sample of 347 participants of which 76.9% were females was obtained. The distribution of year 4 and year 5 students in the sample were equal**.** Eighty five percent of the samples were right-handed, 9.5% were ambidextrous and 5.5% were left-handed. Statistically significant difference was found between handedness groups for the combined clinical procedures variable: F (2.100), P<0.050; Wilks' Lambda 0.823; partial-eta squared=0.093. When the procedures were considered separately, usage of hand-piece(s) during cavity preparation, caries removal using hand instrument, placing of restorative material, carving and polishing restorative material, and extraction of lower right quadrant were perceived as significantly more difficult by the lefthanders.

Conclusion: Handedness significantly impacts on perceived difficulty of clinical training in areas of restorative procedure and tooth extraction.

Keywords: Dental students, handedness, left-handedness, clinical training

Introduction

Human beings are born with structurally symmetrical pairs of organs which function symmetrically.(1) However, when it comes to handedness, there is a preference in which side they would prefer in their daily activities. Handedness can be defined as the natural or biological preference for using one hand more than the other in performing special tasks depending on which hemisphere is dominant for the task (2). This preference or tendency, for using one hand or one side of the body more than the other in performing certain tasks is known as lateralization.(2) This preference or affinity categorises people as being right-handed, left-handed or in some instances ambidextrous (the ability to use both hands). Reports from social and psychological literature shows that handedness may be either genetically determined or psychologically perceived.(3) However, the exact cause of handedness remains debatable.(1)

Damore et al.(4) found 60% of left-handed physicians felt that their handedness affected their learning process, and nearly half of them used their non-dominant hand or both hands

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to perform procedures. Clinical training is an important segment of dental education, and one of the issues in its realisation is handedness.(5) The discipline of dentistry demands a high degree of manual dexterity as well as mental imagery.(6) A successful treatment of any dental problem is based on a variety of factors including the anatomy and location of teeth, selection of a well-adapted instrument, proper angulations of the patient and last but not least the skill and manual dexterity of the dentist.(7) As such handedness plays a big impact in clinical training. Unfortunately, almost all dental surgeries and dental schools are designed only for the right-handed students.

While some studies show that left handed students are able to adapt to the configuration of working places in dental surgeries designed for right-handed, problems in the left- handed dental students education still exist.(5) Left-handed dentist would take time to adapt to the dental chair designed for right-handed dentist. As expected, it has been reported that fixed right-sided chairs designed for right handed may generate some discomfort for left-handed dentists. This may pose as a disadvantage for left-handed dental students as compared to their right handed counterparts.

Perceived difficulty can be defined as an interpretation of an individual towards the state or condition of being difficult. Perceiving difficulty in performing physical tasks is associated with dissatisfaction towards physical function where evidence suggested low level of satisfaction towards physical function is associated with greater physical impairment, greater disabilities in valued activities and depressive symptoms. (8) Hence, perceived difficulty in clinical training, either together with reduced quality in clinical outcome or not, still impacts on clinical training and the individual.

The objective of this research is to assess the prevalence of handedness and its impact on the perceived difficulty in clinical training amongst undergraduate dental students.

Methods and materials

This study has adopted the cross-sectional study design. This study was carried out amongst clinical dental students from 5 dental schools in Klang Valley including Universiti Teknologi MARA (UiTM), University of Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Islam Malaysia (USIM) and MAHSA University College (MAHSA). These 5 schools were chosen out of the 13 available dental schools in Malaysia based on geographical proximity.

Ethical approval was obtained from the Research Ethics Committee, Faculty of Dentistry, UiTM. The schools were contacted in advance for permission in distributing the questionnaires amongst their students. An invitation letter with an information sheet explaining that participation was voluntary and the purpose of the survey was distributed to the participants. A self-administered questionnaire consisting of 3 parts was distributed. Part-1 included information on their socio-demographic data. Part-2 included determination of handedness adopted from Oldfield (9) and part-3 included assessment of perceived difficulty in carrying out certain clinical procedures.

Determination of handedness in this study was done using a specialized inventory. Handedness may be assessed through self-reported questionnaires (Appendix I) such as the Edinburgh Handedness Inventory (EHI),(9) Annett's hand preference questionnaire,(10) or the Waterloo Handedness questionnaire.(11) Handedness may also be assessed based on performance (or proficiency) using measures designed to assess hand skill, such as the Purdue Pegboard task,(12) Annett's Peg-Placing task,(13) Tapley-Bryden's dot-filling task,(14) and the Wathand Box.(15) One criticism of handedness inventories is that individuals may avoid an extreme response to inventory items thus confounding the.(16) Interestingly, until present, there are no direct comparisons between these inventories.

The EHI, which is the inventory used in this study is perhaps the most popular brief measure of hand preference used and allows for the classification of handedness as both a continuous or categorical variable based on the strength to which the individual uses one hand more than the other. Briefly, the inventory is composed of 10 items representing daily activities such as drawing, writing, using a spoon, and throwing objects. By reflecting on the way these tasks are performed, the participant is encouraged to check his/her preference in using his/her left or right hand. The inventory includes the possibility that the preference is so strong that the participant would never use the other hand unless absolutely forced to, a situation where the participant may place two checks, resulting in different scoring. The final derived score is the Laterality Quotient (LQ), which ranges from +100, demonstrating that the right hand is preferred for all 10 items, to –100, demonstrating that the left hand is preferred for all 10 items (Appendix II). This numerical grading system allows for the expression of the magnitude and direction of laterality biases and also makes it possible to compare the LQ with other quantitative scores.

The third part of the questionnaire consisted of 16 questions designed to investigate the perceived difficulty of carrying out certain clinical procedures. The questions included perceived difficulty of usage of hand-piece(s) during cavity preparation, caries removal using hand instruments, placing of restorative materials, placement of matrix band, placement of rubber dam, carving and polishing of restorative materials, impression taking, scaling using ultrasonic scaler, root planning using hand instruments, giving local anesthetic injections for the right quadrant, giving local anesthetic injections for the left quadrant, extraction of upper right quadrant, extraction of upper left quadrant, extraction of lower right quadrant, extraction of lower left quadrant and intraoral suturing. Respondents were asked to indicate their level of perceived difficulty in doing each stated task on a 5 point Likert scale.

Data analysis was done using the Statistical Package for Social Sciences (SPSS 20) software. Data were coded and anonymised by assigning a participant number to each participant to replace names. Data entry was followed by checking for errors, outliers and missing data.

The first step of data analysis included a description of the sample by conducting a frequency distribution for all variables in order to assess the characteristics of the sample. The second step of the data analysis included a one-way between-groups multivariate analysis of variance to investigate handedness differences in perceived difficulty of performing 16 clinical procedures. In this study the Bonferroni correction has been applied. The Bonferroni correction is based on the idea that when testing n dependent or independent hypotheses in a set of data, the one way of maintaining the Type 1 error below 5% is to test each individual hypothesis at a statistical significance level of 1/n times, which is what it would be if only one hypothesis were tested. This was done by calculating a level of significance by dividing the chosen significance level (0.05) by the number of domains (0.05/16) so that the cumulative Type I error remains below 5%.

Results

Socio-demographic Characteristics: The response rate for this study was 92.5%, with a total of 388 students participating. However only 89.4% (347) were included in this study. The remaining participants were excluded due to incomplete data. The majority of the students who took part in this survey were females, at 267 when compared to 80 male correspondences. Among the respondents, 62.2% were Malay, 33.7% were Chinese, 10% were Indian and 4% were from other races. The age ranged between 21 to 28 years-old with a mean age of 23.37 years. The respondents were among year 4 and year 5 clinical students with 48.1% from year four and 51.9% from year five (Table 1).

From the total respondents, 312 indicated that they preferred to treat patients using their right hand whereas another 15 preferred to use their left hand, while another 20 indicated that they were ambidextrous

University	Frequency (n)	%
UiTM	58	16.7
UM	128	36.9
UKM	79	22.8
USIM	49	14.1
MAHSA	33	9.5
Total	347	100.0

Table 1: Distribution of participant according to universities

However, when tested using the EHI inventory in the second part of the questionnaire, it was found that only 295 were actually right handed, 19 were in fact left handed and 33 were actually ambidextrous. (Table 2).

Females were found to have higher incidence of left-handedness and ambidextrousness compared to males (Table 3). However, when comparing within the gender group, males have a higher percentage of left handed and ambidextrous incidence.

A one-way between-groups multivariate analysis of variance was performed to investigate the handedness difference in perceived difficulty of carrying out certain clinical procedures. 16 dependent variables were used: usage of handpiece(s) during cavity preparation, caries removal using hand instruments, placing of restorative materials, placement of matrix band, placement of rubber dam, carving and polishing of restorative materials, impression taking, scaling using ultrasonic scaler, root planning using hand instruments, giving local anesthetic injections for the right quadrant, giving local anesthetic injections for the left quadrant, extraction of upper right quadrant, extraction of upper left quadrant, extraction of lower right quadrant, extraction of lower left quadrant and intraoral suturing. The independent variable was handedness. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted. There was a statistically significant difference between handedness groups and the combined clinical procedures: F (2.10), p<0.000; Wilks' Lambda=0.823; partial eta squared=0.93 (Table 4).

When the clinical procedures were considered separately, the only difference to reach statistical significance, using a Bonferroni adjusted alpha level of .003, were caries removal using hand instrument, placing of restorative material, carving and polishing restorative material.

Handedness	Frequency,n (%)	
	Perceived	Actual
Right	312 (89.9)	295 (85)
Left	15 (4.3)	19 (5.5)
Ambidextrous	20 (5.8)	33 (9.5)
Total	347 (100)	347 (100)

Table 2: Assessment of handedness

		Actual Handedness,n (%)			Total
		Right	Left	Ambidextrous	
Gender	Male	62 (77.5)	6 (7.5)	12 (15)	80
	Female	233 (87.3)	13 (4.9)	21 (7.9)	267
Total		295 (85)	19 (5.5)	33 (9.5)	347

Table 3: Distribution of handedness by gender

Clinical Procedures	F	P value*	Partial Eta Squared
1.Usage of hand-piece(s) during cavity preparation	3.465	0.032	0.020
2.Caries removal using hand instruments e.g.: excavator, marginal trimmer, hatchet, chisel etc	9.849	0.000*	0.054
3. Placing of restorative materials e.g.: amalgam carrier, plastic instruments etc.	6.864	0.001*	0.038
4.Placement of matrix band	0.782	0.458	0.005
5.Placement of rubber dam	0.335	0.715	0.002
6.Carving and polishing of restorative materials	6.791	0.001*	0.038
7.Impression taking	0.053	0.948	0.000
8.Scaling using ultrasonic scaler	0.858	0.425	0.005
9.Root planning using hand instruments	2.383	0.094	0.014
10.Giving local anesthetic injections for the right quadrant	1.383	0.252	0.008
11.Giving local anesthetic injections for the left quadrant	2.279	0.104	0.013
12.Extraction of upper right quadrant	2.845	0.060	0.016
13.Extraction of upper left quadrant	1.826	0.163	0.011
14.Extraction of lower right quadrant	4.128	0.017	0.023
15.Extraction of lower left quadrant	0.655	0.520	0.004
16.Intraoral suturing	2.293	0.102	0.013

Table 4: Clinical procedures affecting perceived difficulty

Discussion

The results of this study should be interpreted in relation to the methodological strengths and limitations of this study. The high response rate reduces non-response bias which is strength of this study however the implementation of the self-reported questionnaire in a lecture setting may have introduced some reporting bias as students may have felt pressured into reporting low perceived difficulty in clinical training to avoid embarrassment among peers. Ideally the questionnaire should have been administered in a more private environment. One criticism of using a handedness inventory is also that individuals may avoid an extreme response to inventory items thus confounding the measurement.(16) Critics of the EHI have found several items which are either superfluous, or not valid for indicating one preferred hand, two tasks in

particular; the hand held uppermost on a broom and the hand used to lift the lid of a box were not indicative of general handedness. Although the EHI had a number of tasks that were not highly reliable, or valid indicators of uni-lateral preferences, its Laterality Quotient was shown to have moderate to good reliability and validity as a tool to be used to determine handedness.

Repeat measures of the EHI may have revealed a more reliable result of handedness for the participants, furthermore, in this present study, the handedness of the participants could have been assessed by observing the usage of hands in performing a set number of tasks and comparing these with the EHI results. However, time constraints did not allow this to be done on a person-by person basis.

Inferring the results of this study to the whole population of dental students in Malaysia must also be done with caution as this study only included five dental schools in the Klang Valley area. However, seeing as these schools enroll students from throughout Malaysia it is fair to assume that there are no significant differences between the student bodies in these schools and the ones not sampled thus the findings from these schools can be expected to be similar to findings from schools not sampled. Another consideration is the issue of assessment of perceived difficulty which is a subjective measure, where what is perceived as difficult to one person may not be the same as perceived by another person. However, it is important to realize each person's perceived reality is significant as it is each person's perceived reality that may affects his psychological wellbeing and as such the subjective measure of perceived difficulty is appropriate in exploring the impact of handedness on clinical training. However, clinical studies related to handedness and its association towards clinical performance could be done for further improvements in dental education.

In this survey, 5.5% of the participants were found to be left-handed. This figure is slightly lower compared to findings from previous studies.(17, 18) This may be due to our small sample size and also the fact that this study was carried out in dental schools where the distribution of gender is unequal and predominantly female. This may have lead to the underestimation of prevalence of handedness as the prevalence of left handedness is generally higher in males.(9)

In this study, 17(5.4%) of participants who perceived they were right handed were actually either ambidextrous or left handed. This difference between percieved handedness and actual handedness is maybe due to the fact that some of the participants are not aware of their true handedness and their true handedness potential. This may be the case as they have been forced to adapt to a right handed world.

Perceived difficulty in caries removal using hand instruments, placing of restorative material, carving and polishing restorative material were the only three clinical procedures found to be significantly associated with handedness where left handed students perceived greater difficulty in performing these procedures as compared to right handed students and those who were ambidextrous. This may be due to the fact that these three procedures are procedures that most requires a refined skill, manual dexterity and attention to achieve good clinical outcome out of the 16 clinical procedures listed. Most of the dental schools in Malaysia train dental students using their right hand thus it will indirectly affect the left handed dental students to manipulate the instruments in above mentioned procedures.

If the Bonferroni correction is not applied in this study,(as recommended for hypothesis generating studies as it may close off potentially fruitful observations prematurely)(19) then extraction at the upper right and lower right quadrant and usage of hand piece would also be significantly associated with handedness.

While some studies have shown that left handed people are able to adapt to a right handed world it is important to investigate not only the physical, but also the psycho-social impact of having to adapt to a right handed world. Even if the quality of clinical work of a left handed dentist working in a right handed environment may be at par or supersedes that of a right handed dentist it is still important to investigate the psychosocial impact of this adaptation. A higher reporting of perceived difficulty in carrying out clinical procedures may lead to increased

stress and a less satisfactory education environment. While the current attitude towards left handed students have been that they are expected to adapt, it is worth exploring the actual impact of this adaptation towards the student in terms of psychosocial impact and clinical quality.

Conclusions

Handedness significantly impacts perceived difficulty in clinical training in especially in areas that require fine motor skills. Addressing the issue of handedness in Malaysian Dental Schools may improve the learning environment and improve the wellbeing of students. Left-handed students should be given an equal opportunity to practice based on their handedness preference through availability of left handed adapted equipment and clinical settings.

References

1. Bishop DV. Individual differences in handedness and specific speech and language impairment: evidence against a genetic link. Behavior genetics. 2001;31 (4):339-51.
2. Rice, P. F. Human development (3rd ed.) (1998). New Jersey: Prentice Hall
3. Adeoye E, Dada M. Causes Of And Problems Associated With Left-Handedness As Perceived By Medical And Non-Medical Students At The University Of Ilorin. Ilorin Journal Of Education. 2004:1-13.
4. Damore D, Rutledge J, Pan S, Knotek N, Ramundo M. Handedness effects on procedural training in pediatrics. Clinical pediatrics. 2009;48(2):156-60.
5. Grga Đ, V. Miletić. Dental education of left-handed students. . Stomatoloski Glasnik Srbije. 2006;53(2):138-43.
6. Flatt AE. Is being left-handed a handicap? The short and useless answer is “yes and no.”. Proceedings (Baylor University Medical Center). 2008;21(3):304-7.
7. Kaya MD, Orbak R. Performance of left-handed dental students is improved when working from the left side of the patient. International Journal of Industrial Ergonomics. 2004;33(5):387-93.
8. Katula JA, Rejeski WJ, Wickley KL, Berry MJ. Perceived difficulty, importance, and satisfaction with physical function in COPD patients. Health and Quality of Life Outcomes. 2004;2:18-.
9. Oldfield RC. The assessment and analysis of handedness: the Edinburgh inventory. Neuropsychologia. 1971;9(1):97-113.
10. Dragovic M, Hammond G. A classification of handedness using the Annett Hand Preference Questionnaire. British journal of psychology (London, England : 1953). 2007;98(Pt 3):375-87.
11. Steenhuis RE, Bryden MP. Different dimensions of hand preference that relate to skilled and unskilled activities. Cortex; a journal devoted to the study of the nervous system and behavior. 1989;25 (2):289-304.
12. Tiffin J, Asher EJ. The Purdue pegboard; norms and studies of reliability and validity. The Journal of applied psychology. 1948;32(3):234-47.
13. Annett M. A classification of hand preference by association analysis. British journal of psychology (London, England : 1953). 1970;61(3):303-21.
14. Tapley SM, Bryden MP. A group test for the assessment of performance between the hands. Neuropsychologia. 1985;23 (2):215-21.
15. Bryden PJ, Pryde KM, Roy EA. A developmental analysis of the relationship between hand preference and performance: II. A performance-based method of measuring hand preference in children. Brain and cognition. 2000;43(1-3):60-4.
16. Beaton AA, Moseley LG. Anxiety and the measurement of handedness. British journal of psychology (London, England : 1953). 1984;75 (Pt 2):275-8.
17. Henderson NJ, Stephens CD, Gale D. [Left-handedness in dental undergraduates and orthodontic specialists]. Nederlands tijdschrift voor tandheelkunde. 1997;104(6):223-5.
18. Bagramian RA, McNamara JA, Jr. A prospective survey of percutaneous injuries

in orthodontists. American journal of orthodontics and dentofacial orthopedics : official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics. 1998;114(6):654-8.

19. Streiner DL, Norman GR. Correction for multiple testing: is there a resolution? Chest. 2011;140(1):16-8.