

# Evaluation of Right-Handed and Left-Handed Dental Students' Clinical Skills in Restorative Cavity Preparation in Different Positions: A Comparative Pilot Study

Iman Parisay<sup>1</sup>, Lida Bahramian<sup>2</sup>, Morteza Zahedian<sup>3</sup>, Fatemeh Khorakian<sup>1</sup>

<sup>1</sup>Department of Pedodontics, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>2</sup>Pediatric dentist, Mashhad, Iran

<sup>3</sup>Dentist, Mashhad, Iran

*Received 27 March 2022 and Accepted 4 July 2022*

## Abstract

**Introduction:** One of the major factors affecting dentists' manual dexterity is their sitting position while performing dental procedures. The training patterns in dentistry schools are mostly established in accordance to right-handed (RH) students. The present pilot study aimed to compare the RH and left-handed (LH) students in terms of their performance in restorative cavity preparation while operating from both right-side and left-side positions. **Methods:** A total of 24 students, comprising of 12 RH and 12 LH students, were enrolled. The selected students were to prepare a mesio-occlusal cavity on acrylic maxillary, mandibular, right and left first molars. Their performance was rated by three dental specialists based on predetermined indices for ideal Class-II restorative preparation. Parametric statistical tests, including paired-sample t-test and independent t-test, were used to compare the students' performance. **Results:** Based on the results, RH students exhibited significantly better performance on their ideal side. The LH students' performance was better on their ideal side and this difference in performance was significant only while preparing the mandibular molars ( $P < 0.05$ ). The difference in the performance of the LH students on their ideal and non-ideal sides was less than that of the RH ones. A comparison of the mean scores of the RH and LH students in the two right-side and left-side positions showed no statistically significant difference. **Conclusion:** There was no difference between the LH and RH students' skills in restorative preparation in their ideal posture. The LH students showed considerable improvement in their performance when working on their ideal posture.

**Keywords:** Dental cavity preparations, Dental student, Handedness

Parisay I, Bahramian L, Zahedian M, Khorakian F.

Evaluation of Right-Handed and Left-Handed Dental Students' Clinical Skills in Restorative Cavity Preparation in Different Positions: A Comparative Pilot Study. *J Dent Mater Tech* 2022; 11(3): 178-184.

## Introduction

The majority of individuals usually prefer on performing their routine tasks with the same hand and are typically homogenous in terms of personal hand preference patterns (1). The dissimilar function of the brain hemispheres results in one dominating the other, the most important representation of which is the issue of right-handedness and left-handedness (2). Approximately 12% of males and 10% of females around the world are left-handed (LH) (3). Studies have indicated that the overall performance of LH individuals improves from the left side, and the best performance for these individuals is indeed the performance based on their nature (4). LH individuals are always pressured to overcome the existing shortcomings while working in environments that are designed for right-handedness.

In the field of dentistry, the position of the patient and dentist are crucial to a creating a comfortable experience for both. Adopting the best working position, along with an appropriate body posture, reduces physical pressure, fatigue, and the chances of musculoskeletal disorders (5). Additionally, the treatment outcomes are evidently influenced by the dentist's posture and manual dexterity (6). The majority of dental units, training, and practice patterns are suitable for right-handed (RH) students in dentistry schools; therefore, the RH professors might fail

to achieve a proper perception of LH students' performance conditions during dentistry practice, which would afflict the training and performance of such students (7).

A review study showed that left-handedness of oral and maxillofacial surgery residents can result in higher anxiety for the operator and the instructor, and that the surgical instruments are not adapted for LH individuals; therefore, it is necessary to modify the instruments or provide special training courses for LH students (8). The results of another study showed that 85.7% of LH dental students feel extremely uncomfortable while working from the right side (9).

The findings of previously conducted studies reveal a higher prevalence of neck and shoulder pain among LH dental students, compared to RH ones; this was attributed to their inappropriate right-sided position while providing dental care (10, 11). The challenges dental students routinely face were investigated through a questionnaire; 84.5% of the LH students pointed out the lack of facilities, equipment, and training for such students (7). In another study, LH students were not as capable as their RH counterparts in terms of completing subgingival scaling, except for the scaling the facial and mesial surfaces of teeth (12). RH and LH dentists have been previously compared in terms of their performance quality in scaling and root planning and RH dentists were able to demonstrate more satisfactory results. Considering that both groups used the same right-sided dental chairs, consequently the necessity for revising the design of the units used for LH dentists were emphasized (12).

Although a fewer percentage of dental students turn out to be LH, however ameliorating the performance of LH dentists is feasible through implementing only a few simple and low-cost modifications that can significantly enhance these students' ability to learn and provide dental care. In a questionnaire study regarding the challenges and hardships of LH students in dentistry, students reported a greater difficulty in conducting procedures on dental phantom heads from right-side positions, during their pre-clinic courses (13).

Our literature review revealed a lack of published data focusing on comparing RH and LH students' performance in restorative cavity preparation. Therefore, the present study sought to compare LH and RH students in terms of their performance in restorative cavity preparation in both right-side and left-side positions.

## Materials and Methods

This pilot study was conducted on voluntary dental students who were completing their final year of study Mashhad School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran, in 2018. A total of 24 samples were selected using a purposive non-randomized sampling method and divided into two equal groups of RH and LH. The participants were standardized in terms of gender, age, and grade point average. The protocol of this study was approved by the Research and Ethics Committee of Mashhad University of Medical Sciences (IR.mus.sd.REC.1395.922009)

All subjects participated in three sessions of Class-II cavity preparation on acrylic first molars on the arcs embedded in the restorative phantom head. The students performed final cavity preparation on a phantom head that was connected to the dental units. They prepared the mesio-occlusal cavities on the right and left maxillary first molars from 1 and 9 o'clock positions and on the right and left mandibular first molars from 9 and 3 o'clock positions. The cavity preparation time given to the students was 15 min for each tooth, and all students completed the procedure within this time frame. Two restorative specialists and a pedodontist, all of whom were blind regarding the students' handedness and their working position, rated the prepared cavities based on the predetermined principles for Class II cavity preparations. Checklist 1 represents the assessment of the RH and LH students' clinical skills in cavity preparations in the present study.

The collected data were subjected to statistical analysis using SPSS 16 (Inc., Chicago, IL). In this study, Kolmogorov-Smirnov test was used to evaluate data in terms of distribution normality, which indicated a normal distribution for all indices. The students' performance in Class II cavity preparation on the molars was compared using parametric statistical tests, including paired-sample t-test and independent t-test. A P-value of  $< 0.05$  was considered statistically significant.

## Results

The present pilot study was conducted on a total of 24 senior dental students from Mashhad University of Medical Sciences with a mean age of 24 years and 7 months (age range of 24.11 to 23.3 years). These students were divided into two groups of RH and LH, 12 students per group. Each group included 3 females and 9 males. Tables I and II present the mean scores of the RH and LH students sorted based on the prepared tooth and the right and left positions, respectively.

Table I: Comparison of RH students' scores on the right and left side using paired-sample t-test (max score=100)

Tooth	Mean score on right side	Mean score on left side	Comparison
First right upper molar	72.3±6.7	60.7±5.4	P*=0.001
First left upper molar	73.7±8.8	56.8±10	P*=0.001
First right lower molar	79.5±7.4	67.5±7.5	P*<0.0001
First left lower molar	73.8±8.8	63.5±12	P*=0.001

\*Statistically significant at P ≤ 0.05

Table II: Comparison of LH students' scores on the right and left side using paired-sample t-test (max score=100)

Tooth	Mean score on right side	Mean score on left side	Comparison
First right upper molar	60.5±9.6	71±1.8	P=0.19
First left upper molar	65.9±9.9	74.1±8.7	P=0.06
First right lower molar	65.8±8.5	78±6.4	P*=0.004
First left lower molar	62.2±10	71±8.8	P*=0.029

\*Statistically significant at P ≤ 0.05

*Analysis of the total scores in each group*

In the present study, the mean total scores of RH students in the right-side and left-side positions were 74.85 and 62.17, respectively. The highest score among the RH students was obtained for the preparation of the right mandibular first molar from the right side (79.58), while the lowest score was recorded for preparation of the left maxillary first molar from the left side (56.83). The obtained results indicated a significant difference between the total scores obtained for all of the prepared teeth (Table I).

The mean total scores of LH students in cavity preparation from the right side and left side were 63.66 and 73.86, respectively. In the LH group, the highest and lowest scores were obtained for the preparation of the right mandibular first molar from the left side (78.08) and of the right maxillary first molar from the right side (60.58), respectively. The results of this test indicated a statistically significant difference between preparation from the right side and the left side for the mandibular first molars, while the mean scores obtained for the maxillary first molars showed no significant difference (Table II).

The comparison of the total scores of the students in the same positions for preparing different teeth on one jaw (right and left molars) was carried out using paired-sample t-test. The results of this comparison showed that

regarding cavity preparation on the lower jaw from the right side, the RH students exhibited significantly better performance in carving the right-side tooth (P=0.01). On the other hand, in terms of cavity preparation on the lower jaw from the left side, the LH students exhibited better performance in cavity preparation of the right-side tooth (P=0.03).

*Comparison of the two groups in terms of the total scores in ideal and non-ideal positions*

Comparing the RH and LH students' total scores in cavity preparation from ideal sides (left side for LH students and right side for RH students) indicated no statistically significant difference (P=0.58). Likewise, comparing their scores from non-ideal sides showed no statistically significant difference (P=0.588). According to these results, there is no difference between the LH and RH students' skills in restorative cavity preparation from the ideal and non-ideal sides.

*Effect of different restorative cavity preparation principle factors on total scores in each group*

To investigate the effect of the restorative cavity preparation principle factors on the total scores in each group paired-sample t-test was used to compare the indices of the occlusal dovetail and box cavity preparation. The results of these tests in the RH and LH groups are provided in tables III and IV, respectively.

Table III: Effect of different restorative cavity preparation principle factors on total scores in RH students using paired-sample t-test

Tooth	Factor	Mean score on right side	Mean score on left side	Comparison
First right upper molar	Dovetail index	22.1±3.4	19.1±1.4	P*=0.005
	Class II index	43.5±5.1	38.2±2.6	P*=0.006
First left upper molar	Dovetail index	23.3±3.01	20±0.4	P*=0.001
	Class II index	43.7±5.1	34.3±7.4	P*=0.005
First right lower molar	Dovetail index	23.5±2.3	920.8±3.9	P=0.058
	Class II index	46±5.8	4.08±3.9	P*=0.004
First left lower molar	Dovetail index	19.9±4.2	18±4	P=0.036
	Class II index	43.9±5.2	40.5±4.9	P*=0.008

\*Statistically significant at  $P \leq 0.05$

Table IV: Effect of different restorative cavity preparation principle factors on total scores in LH students using paired-sample t-test

Tooth	Factor	Mean score on right side	Mean score on left side	Comparison
First right upper molar	Dovetail index	18±2.6	20.9±2.6	P*=0.006
	Class II index	38.4±5.8	43.4±6.9	P=0.06
First left upper molar	Dovetail index	19.8±3	21.7±2.6	P=0.132
	Class II index	42.7±6.9	45.7±5.6	P=0.1
First right lower molar	Dovetail index	19.8±2.5	23.5±1.6	P*=0.001
	Class II index	41.8±7.2	45.4±4	P=0.2
First left lower molar	Dovetail index	18.3±3.8	19.1±4.5	P=0.6
	Class II index	38±9.4	42.8±5.1	P=0.15

\*Statistically significant at  $P \leq 0.05$

In terms of the damage to the adjacent tooth during cavity preparation, no statistically significant difference was observed between the RH and LH students in ideal and Parisay et al.

non-ideal positions. The relationship between procedure time and the damage to the adjacent tooth was assessed using independent-samples t-test, the results of which

showed that the occurrence of more damage in shorter periods was significant only for the LH students working on the right mandibular molar from the left side ( $P=0.02$ ).

## Discussion

In the present study, it was attempted to investigate an applicable example of the relationship between right-handedness and left-handedness of the individuals and their manual dexterity and coordination of hands for ideal restorative cavity preparation. The highest mean total scores of the students were obtained for RH from the right side, LH from the left side, LH from the right side, and RH from the left side in descending order.

Based on the findings of a study by Kaya et al., RH students demonstrated a better performance than LH ones in scaling and root planning (9). Orbak et al. also realized that the best performance in scaling was shown by LH students working on a left-sided dental chair, followed by RH students with a right-sided chair, LH students with a right-sided chair, and RH students with a left-sided chair (14). Such discrepancy in results could be due to the differences in the type of treatment procedure and study designs. An analysis of the total scores of cavity preparation showed that the highest score was related to the right mandibular first molar from the right side in the RH group and the right mandibular first molar from the left side in the LH group. This could be indicative of the students' dexterity in cavity preparation of the right molars from the ideal position. Moreover, the lowest scores in the RH and LH groups belonged to preparing the left maxillary first molar from the left side and the right maxillary first molar from the right side, respectively. In other words, the students in both groups exhibited lower dexterity in cavity preparation of the contralateral maxillary molars from the non-ideal positions.

The analysis of scores revealed that the students in the RH group obtained significantly higher scores in cavity preparation from the right side or ideal position; however, in the LH group, although the students obtained higher scores in cavity preparation from the left or ideal position in all cases, the difference was significant only for the mandibular teeth. The obtained results emphasized that the LH students had to adapt themselves to the unsuitable conditions due to the circumstances of the dental units and education patterns in dental schools, which forced them to sit on the patient's right side. Such results could also show the higher capability of LH students in terms of spatial perception. Kaya et al. also reported the higher efficacy of LH students in scaling and plaque removal from the left-side position and concluded that providing the conditions for the LH students to work from the left-side position would lead to better treatment

outcomes (9). Orbak et al. found out that the dentists' handedness affected the scaling and root planning results, which was consistent with the results of the present study. They reported less difference in the performance quality of the LH students during scaling from the left and right sides, compared to the RH students (14).

The results of a study by Canakci et al. revealed a direct relationship between spatial perception and manual dexterity, which was significantly higher in LH dentists than in the RH ones (12). Kilshaw et al. reported that right-handedness negatively affected the manual dexterity and spatial perception that was associated with the poor performance of the left hand (15). A comparison of the partial and total scores of the RH and LH students in cavity preparation from the ideal and non-ideal positions showed that there was no difference between the RH and LH students in terms of their performance in the ideal positions.

The results of comparing the cavity preparation indices for each tooth in the RH group showed that the students' scores for these indices were significantly higher for all the teeth on the right side. This finding indicated that RH students had no progress in left-side position performance because of the circumstances of their dental schools in which the dental units were designed for RH students and LH students always operated in the right-side position. In the RH group, the comparison of the students' performance on the right and left sides indicated that the dovetail index in the maxillary and mandibular molars was significantly better in the right-side position than in the left-side. This demonstrated that the LH students had better performance in creating the dovetail for the right molars, compared to the left molars. It should be noted that the obtained scores for the dovetail index were low for all students (either RH or LH ones), which could be due to the lack of sufficient training and practice in the preclinic.

A comparison was carried out to investigate that in the case of a fixed sitting position, students would exhibit a better performance whether on the proximal molar or the distal molar. The results showed that in the case of cavity preparation on the lower jaw, the RH group showed better performance in cavity preparation from the right side when preparing the right mandibular molars; nevertheless, the LH group had better performance in cavity from the left side when carving the right mandibular molars. This could be due to the better view and higher mastery of the students in cavity preparation on the lower jaw from their ideal side and, consequently, the better retraction of the cheeks and tongue in this position. However, no difference was observed for the upper jaw due to using indirect view.

In the present study, the analysis of the damage to the adjacent tooth during cavity preparation from the ideal side among the RH and LH students indicated that these individuals had no difference regarding this index because the number of damaged teeth on the jaw arches was almost equal in the two groups. According to the results of the analysis of the correlation between the two indices of time and damage to the adjacent tooth, the LH students caused more damage to the adjacent tooth in a shorter time only during cavity preparation on the right mandibular molar from the left side. Based on the results of a study by Kishlow et al., LH students showed faster performance in manual skills, compared to the RH students (15).

Regarding the fact that left-handedness is not a rare phenomenon and there is a lack of dental units designed for LH individuals in some dental schools and dental clinic centers, numerous LH dentists are attempting to adapt themselves to the chairs designed for the RH individuals and this will definitely affect treatment outcomes. Therefore, it is reasonable to design suitable units and chairs for such dentists appropriate for their performance. Based on the results of the present study, it is suggested to conduct further studies with larger sample sizes and investigate the subjects' performance in other dental procedures on the units that have been designed for the LH dentists in order to achieve more reliable results.

## Conclusion

In conclusion, the RH dental students had significantly better performance in cavity preparation from the right-side position. Considering the LH dental students, despite their better performance in cavity preparation from the left-side position, the difference was significant only for mandibular teeth. It was also revealed that the LH dentists' performance in the right-side and left-side positions was less different from that of the RH dentists. The comparison of the RH and LH dental students showed no difference in terms of their performance in the ideal position.

## Conflicts of interest

The authors have no conflict of interest to disclose.

## Acknowledgments

The authors wish to thank the Research Committee of Mashhad University of Medical Sciences for financial support and the students of Mashhad School of Dentistry, Mashhad, for their participation.

## Checklist

Evaluation of clinical skills of left- and right-handed students in class II cavity preparation

First name and surname: ...

1. Cavity outline form (90) .....

A) Dovetail index (30):

\* Smooth pulpal floor and occlusal convergence of walls (8) .....

\* Buccolingual width (6).....

\* Pulpal depth (8) .....

\* Form (absence of sharp angles) (3) .....

\* Dovetail shape (5).....

B) Class II cavity index (60):

\* Preservation (Reverse curve) (4).....

\* Non-inclination walls (4) .....

\* Buccolingual wall inclination to adjacent teeth (4).....

\* 90-degree cavosurface margins (8).....

\* Buccolingual box width (8).....

\* Depth of axial wall (16).....

\* Axiopulpal bevel (8).....

\* Axial wall shape (8) .....

2. Damage to adjacent teeth (10)

\* Yes

\* No

3. Time:

\* ≤ 70 minutes (1.25)

\* 80-70 minutes (1)

\* 90-80 minutes (0.75)

\* 100-90 minutes (0.5)

\* 110-100 minutes (0.25)

\* > 110 minutes (0)

## References

1. Annett M. Handedness and brain asymmetry: The right shift theory. 1<sup>st</sup> ed. Psychology Press, 2001.
2. Llaurens V, Raymond M, Faurie C. Why are some people left-handed? An evolutionary perspective. *Philos Trans R Soc Lond B Biol Sci.* 2009;364 (1519):881-894.
3. Papadatou-Pastou M, Martin M, Munafo MR, Jones GV. Sex differences in left-handedness: a meta-analysis of 144 studies. *Psychol Bull.* 2008;134 (5):677-699.
4. Brandler WM, Morris AP, Evans DM, et al. Common variants in left/right asymmetry genes and

- pathways are associated with relative hand skill. *PLoS Genet.* 2013;9 (9).
5. Hilton TJ, Ferracane JL, Broome J. *Summitt's Fundamentals of Operative Dentistry: A Contemporary Approach.* 4th ed. Quintessence Publishing Co Inc., 2013.
  6. Newman MG, Takei H, Klokkevold PR, Carranza FA. *Newman and Carranza's Clinical Periodontology.* 13th, editor: Saunders, 2018.
  7. Al-Johany SS. A survey of left-handed dental students and interns in Saudi Arabia. *J Dent Educ.* 2013;77 (1):105-112.
  8. Tchanchaleishvili V, Myers PO. Left-handedness--a handicap for training in surgery? *J Surg Educ.* 2010;67 (4):233-236.
  9. Kaya M, Orbak R. Performance of left-handed dental students is improved when working from the left side of the patient. *Int J Ind Ergon.* 2004;33 (5):387-393.
  10. Silva E, Cruz I, Costa I, et al. Left-Handed Students and Clinical Practice in Dentistry: Adaptations, Difficulties and Realities Experienced in the Academic Environment. *Open J Prev Med.* 2016;6 (11):247-259.
  11. Tezel A, Kavrut F, Tezel A, Kara C, Demir T, Kavrut R. Musculoskeletal disorders in left- and right-handed Turkish dental students. *Int J Neurosci.* 2005;115 (2):255-266.
  12. Canakci V, Tan U, Orbak R, Tezel A. Right- and left-handed dentists in periodontal therapy. *Int J Neurosci.* 2002;112 (1):1-14.
  13. Silva MA, Souza-Rodrigues RD, Lashowisk K, Oda M, Vieira GF. Left-handed dental students. *Braz Dent Sci.* 2012;15 (4):36-40.
  14. Orbak R, Tezel A, Canakci V, Tan U. Right- and left-handed dentists using right- and left-sided dental chairs in treatment of calculus. *Int J Neurosci.* 2002;112 (1):15-30.
  15. Kilshaw D, Annett M. Right- and left-hand skill I: Effects of age, sex and hand preference showing superior skill in left-handers. *Br J Psychol.* 1983;74 (Pt 2):253-268.

**Corresponding Author**

Fatemeh khorakian

Department of Pedodontics, Faculty of Dentistry, Mashhad University of Medical Sciences, Iran Tell: 09151157653

Email: khorakianf@mums.ac.ir