ORIGINAL ARTICLE

A comparison of mount of preparation and finish lines used by dental students in Damascus University and Al Baath University using (CAD/CAM) scanner

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Abstract *Introduction:* Fixed prosthodontics is considered one of the most vital dental treatments that patients receive. Sometimes, however, complication is encountered along with limited information regarding the quality and precision of preparation. Which that led to the conception of this study in order to highlight the shortcomings and obstacles in an attempt to avoid them. This study aims to evaluate the quality of preparation by students of the faculty of dentistry in Damascus University and Al-Baath University by assessing the finish lines.

Materials and methods: The specimen of this study consists of 244 prepared abutments divided into two groups: the first group consists of 122 clinically prepared abutments conducted by fifth year students in Damascus University. The second group consists of 122 clinically prepared abutments conducted by fifth year students in Al-Baath University. The specimen also consists of gypsum casts containing replicas of the clinically prepared teeth in addition to the primary casts. All casts – primary casts and post preparation casts – were collected and 3D scans were conducted to each abutment – before and after preparation – and a 3D image was acquired. Statistical analysis was conducted using SPSS v.26 (IBM, USA) with a P-Value of 0.05.

Results: The preparation with a simple finishing line at Al-Baath University was 103% greater than it with a statistically significant difference at 56% at Damascus University, by 38%, and the percentage of preparation with a semi-shoulder finish line at Al-Baath University was 5% and at Damascus University was 3% without there being a statistically significant difference Between the two universities, the percentage of preparation with a shoulder finish line in Al-Baath University

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14% was lower by a statistically significant difference than in Damascus University 63% by 40% (P < 0.001).

Conclusion: The percentage of preparation with a simple finishing line at Al-Baath University was 103% greater than it with a statistically significant difference at 56% at Damascus University, by 38%, and the percentage of preparation with a semi-shoulder finish line at Al-Baath University was 5% and at Damascus University was 3%.

1. Introduction

Teeth preparation in universities must be academic in accordance with the approved principles of preparation, and therefore an ideal preparation that will provide stability and permanence for the prostheses.

Where fixed prostheses are considered one of the most important works carried out within the dental treatments provided to patients in the clinics of the Faculty of Dentistry at Damascus University and Al-Baath University.

The most important criterion for the success of the prosthesis is its durability in the patient's mouth, and the fact that this durability is related to one of the most important factors, which is the doctor's commitment to the ideal standards of preparation (Abdulla et al., 2018).

And that is through studying the type of finish lines, preparing the axial walls, reducing the grinding surface and its conformity with the academic principles in order to shed light on the errors and pitfalls that exist to improve the reality of work, and all of this directs the compass towards the ultimate goal of the dental profession, which is to serve the patient.

Fixed prostheses, including crowns and bridges, are considered among the most dental treatments offered to patients (Shillingburg, 2015), especially those who review dental faculties in universities, but the limited information provided about the quality of research completion and sometimes the presence of some of the following complications of these treatments created a problem and we try in this research to stand on the most prominent obstacles and limitations that can occur and lead to these problems.

1.1. Research hypothesis

There is no difference in the quality of dental preparation prepared to receive fixed compensations between students of the two universities, knowing that the theoretical foundations and criteria presented to students are identical.

2. Materials and methods

This study type is one of the studies with a cross-sectional design, where we examined and evaluated the mount of preparation and finish lines type for a randomized sample taken from the University of Damascus and another randomized sample taken at Al-Baath University, and both samples were from the fifth year students in the Faculty of Dentistry in both universities.

Sample description: The research sample consisted of 244 prepared supports divided into two groups:

The first group: consisted of 122 stents prepared clinically by fifth year students at Damascus University in the academic year 2021.

The second group: consisted of 122 stents prepared clinically by fifth year students at Al-Baath University in the academic year 2021.

The research sample was gypsum examples containing clinically prepared dental dies.

The size of samples determined using G-Power software version (3.1.9.4).

2.1. Exclusion criteria

- Crooked teeth
- Crowded teeth
- Abutments tilted more than 20 degrees
- Miss more than a tooth
- Missed adjacent teeth

2.2. Research materials

Additional Silicone.
Alginate.
Dental gypsum.
Clinical examination tools.

2.3. Research devices

Up3D CAD/CAM Scanner.
A computer connected to a cad/cam device (Fig. 1).

2.4. Working method

The students in both of universities made the final impressions using additional silicone and the gypsum casts made by dental gypsum type 4.

Gypsum casts were collected before preparation (study casts) and work casts and after preparation by fifth year students in the Faculty of Dentistry at Damascus University and fifth year students in the Faculty of Dentistry at Al-Baath University.

The casts was chosen randomly without prejudice to any specific factor related to the students, and this was done without knowing their names, nor their academic average, and it was keen that the casts be homogeneous on all categories of fifth year students in both universities.

Fig. 1 Cad/Cam Scanner.

The information of each case was recorded, the name of the student who completed the work, the case number and the name of the patient.

After collecting the gypsum casts before preparation and after preparation by the researcher from the fifth year students in the Faculty of Dentistry, Damascus University and the fifth year students in the Faculty of Dentistry, Al-Baath University, It was taken to a dental laboratory to scan them and make measurements using the cad/cam scanner located in the city of Damascus.

This device contains two digital smart optic cameras that are at the top that work on imaging the casts with 3D technology, where the gypsum casts were placed on the ready-made base that is at the bottom and the device performs a three-dimensional rotational movement to take pictures by the camera installed at the top of the device and is processed by the program attached to it, When imaging begins, the base moves axial movement in the three directions, so that the fixed camera can 3D imaging of the tooth (Figs. 2 and 3).

This digital camera is connected to a computer belonging to the CAD-CAM device, where the digital program of the scanner device processes the data, and issues a file with a suffix (. STL); i.e. It combines the resulting kinematic images into a single three-dimensional image representing the placed twin of the tooth.

Two points (largest and smallest) were adopted in each of the buccal and lingual walls after preparation to measure the amount of preparation, as the arithmetic mean was calculated for each two points in each wall (Fig. 4).

3. Results

3.1. Finish lines

The percentage of preparation with a feather edge at Al-Baath University was 103% greater than it with a statistically significant difference at the University of Damascus 56% by 38%, and the percentage of preparation with a chamfer finish line at Al-Baath University was 5% and at Damascus University was 3% without there being a statistically significant difference between The percentage of preparation with a shoulder finish line in Al-Baath University 14% was lower by a statistically significant difference than in Damascus University 63% by 40% (P < 0.001) as showed in Table 1 and chart 1.

3.2. Mount of preparation

3.2.1. Thickening of the buccal and lingual preparation

The minimum thickness of preparation for the buccal wall of the molars at Al-Baath University ranged between 0.2 and

Fig. 2 Gypsum casts including abutment before and after preparation for Damascus and Albaath Universities student.

Fig. 3   Gypsum cast including prepared teeth.

1.8 mm, with an arithmetic average of 0.8 mm, while it ranged in Damascus University between 0 and 1.7 mm, with a mean of 0.6 mm, and the lowest thickness of preparation for the buccal wall of the molars at Al-Baath University was a statistically significant difference. In Damascus University by 0.2 mm (P = 0.004). The largest thickness of preparation for the buccal wall of the molars at Al-Baath University ranged between 0.3 and 2.2 mm with an arithmetic average of 1.3 mm, while in Damascus University it ranged between 0.3 and 2.1 mm with an average of 0.9 mm, and the largest thickness of preparation for the buccal wall of the molars at Al-Baath University was statistically greater than that in Damascus University by 0.3 mm (P = 0.001).

The minimum thickness of preparation of the lingual molar wall at Al-Baath University ranged between 0.2 and 2 mm with an average of 0.8 mm, while it ranged in Damascus University between 0.2 and 1.7 mm with an average of 0.7 mm without there being a statistically significant difference between the two universities (P = 0.071). The largest thickness of preparation for the lingual wall of the molars at Al-Baath University ranged between 0.2 and 3.6 mm with an arithmetic average of 1.4 mm, while in Damascus University it ranged between 0.4 and 2.3 mm with a mean of 1.2 mm, and the largest thickness of preparation for the lingual wall of the molars at Al-Baath University was statistically significant in Damascus University by 0.2 mm (P = 0.034).

The minimum thickness of the preparation of the buccal wall for premolars at Al-Baath University ranged between 0.4 and 4.5 mm, with an arithmetic average of 1 mm, while in Damascus University it ranged between 0 and 1.7 mm, with an average of 0.6 mm. in Damascus University by 0.4 mm (P < 0.001). The largest thickness of preparation of the buccal wall for premolars at Al-Baath University ranged between 0.7 and 6.4 mm, with an arithmetic average of 1.5 mm, while in Damascus University it ranged between 0.4 and 2.2 mm, with a mean of 1.2 mm. in Damascus University by 0.3 mm (P = 0.032).

The lowest thickness of preparation for the lingual wall of premolars at Al-Baath University ranged between 0.1 and 1.8 mm, with an arithmetic average of 0.9 mm, while it ranged in Damascus University between 0 and 1.5 mm, with an average of 0.6 mm, and the lowest thickness of preparation for the

lingual wall of premolars at Al-Baath University was greater by a statistically significant difference of them in Damascus University by 0.3 mm (P < 0.001). The largest thickness of preparation for the vestibular wall of premolars at Al-Baath University ranged between 0.7 and 2.6 mm with an arithmetic average of 1.5 mm, while in Damascus University it ranged between 0.2 and 2 mm with an arithmetic average of 1.1 mm. in Damascus University by 0.4 mm (P < 0.001) (Table 2).

4. Discussion

Fixed prostheses are one of the most important works performed within the dental treatments provided to patients (Parker et al., 1991).

The most important criterion for the success of prostheses is their durability and conservative as much as possible on dental tissues and not exaggerating the preparation of teeth to ensure the success of this prostheses as dental students in the fifth year and during their initial school stages have been given information Sufficient and adequate theory and process in preparing the ideal teeth in accordance with the rules and principles followed and from this point of view this precise scientific research was conducted to find out the extent to which students adhere to these basic rules and what are the obstacles to adherence to these instructions, which is the doctor's commitment to the ideal standards for preparation From here came the idea of this research to shed light on Clinical reality of the work performed (Ayad et al., 1997).

The research sample consisted of 244 gypsum casts divided into two groups. The first group included 122 gypsum casts of posterior teeth prepared to receive ceramic–metal fixed prostheses for fifth-year students in the Faculty of Dentistry at Damascus University. The second group included 122 gypsum casts of posterior teeth prepared to receive ceramic–metal fixed prostheses for students Fifth year in the Faculty of Dentistry at Al-Baath University.

4.1. Discussion of the methods of measuring angle of convergence

There are a number of methods for measuring the angle of convergence.

One of the common methods in the old days is photography and manual measurement: in this way, an enlarged image or a printed image of the support is used, then two lines are created on two opposite axial walls, after that the angle between these two lines is measured, thus obtaining the measure of the convergence angle for the prepared support. (Ohm and Silness, 1978).

There is also a method of projection and measurement manually using a protractor: this method consumes effort and time that can be dispensed with by the faster and more accurate modern methods.

Digital measurement method with a CAM-CAD scanner: This method is more accurate, reliable and easy than manual methods for measuring convergence angle (Seo et al., 2014).

In this way, a digital scan of the prepared tooth is performed, we obtain a three-dimensional image corresponding to the prepared tooth, and then the convergence angle is measured by a digital program supporting the previous device.
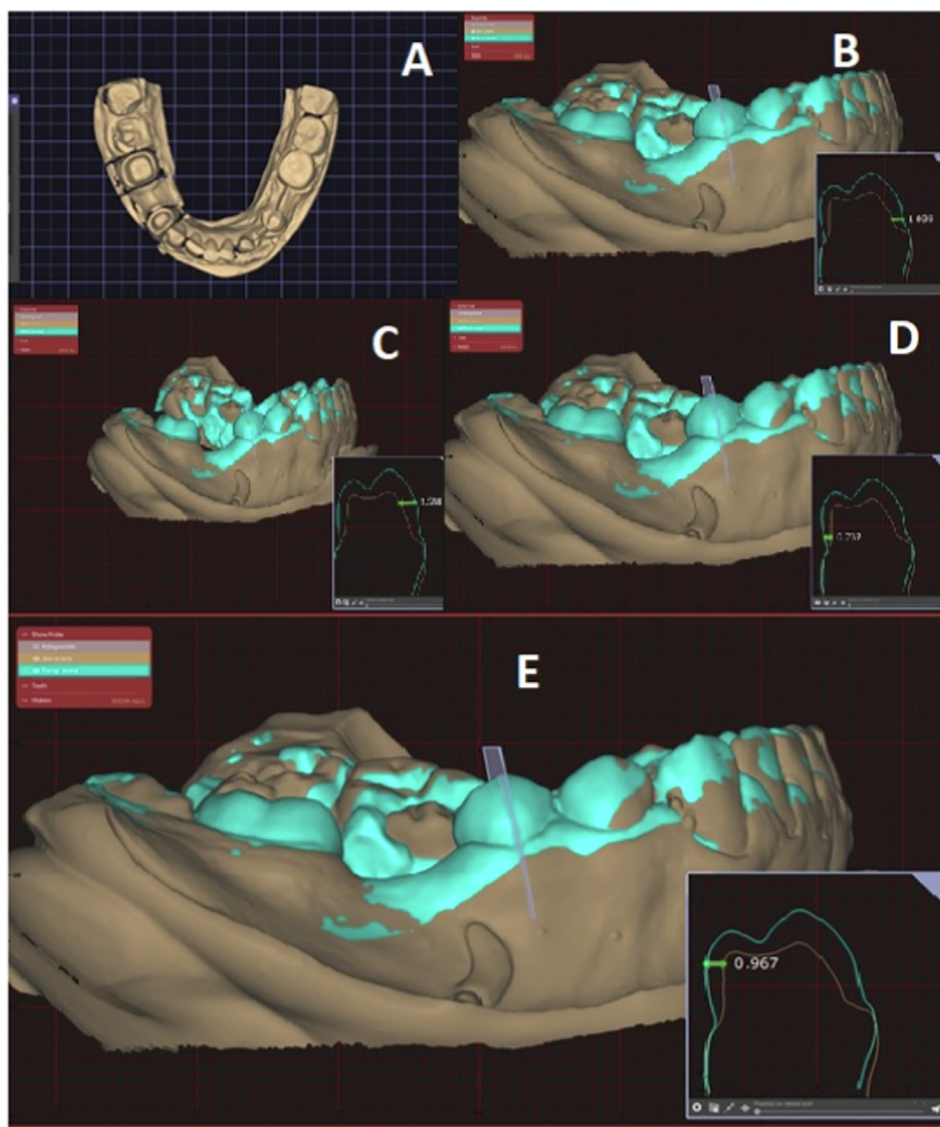
Fig. 4 (A) 3D image of the gypsum model scanned by program after preparation. (B) Three-dimensional image from the program of the scanner of the gypsum example before and after preparation in the smallest point of the buccal wall. (C) Three-dimensional image from the program of the scanner of the gypsum example before and after preparation in the largest point of the buccal wall. (D) Three-dimensional image from the program of the scanner of the gypsum example before and after preparation in the smallest point of the lingual wall. (E) Three-dimensional image from the program of the scanner of the gypsum example before and after preparation in the largest point of the lingual wall.

Table 1 The percentage of preparations.

Finish Line	Al-Baath University		Damascus University		P
	Repetition	%	Repetition	%	
Feather edge	50a	103%	29b	56%	0.000
Chamfer	3a	5%	2b	3%	
Shoulder	14a	14%	30b	63%	

4.2. Discussion of finish lines

In this study, three types of finish lines were prepared:

Simple finish line.

Shoulder finish line.
Chamfer finish line.

Where Pardo mentioned in 1982 that there are five acceptable designs for finish lines when preparing teeth to receive full

Table 2 Descriptive statistics of the thickness of the least and greater preparation of the buccal and lingual walls of the molars and premolars in the universities of Al-Baath and Damascus.

Abutment	Wall	Thickness of preparation	University	Average	Standard deviation	Lowest	Biggest
Molars	Buccal	Lowest	Albaath	0.8	0.4	0.2	1.8
			Damascus	0.6	0.4	0.0	1.7
		Biggest	Albaath	1.3	0.5	0.3	2.2
			Damascus	0.9	0.4	0.3	2.1
	Lingual	Lowest	Albaath	0.8	0.3	0.2	2.0
			Damascus	0.7	0.4	0.2	1.7
		Biggest	Albaath	1.4	0.6	0.2	3.6
			Damascus	1.2	0.5	0.4	2.3
Premolars	Buccal	Lowest	Albaath	1.0	0.6	0.4	4.5
			Damascus	0.6	0.3	0.0	1.7
		Biggest	Albaath	1.5	0.8	0.7	6.4
			Damascus	1.2	0.5	0.4	2.2
	Lingual	Lowest	Albaath	0.9	0.4	0.1	1.8
			Damascus	0.6	0.3	0.0	1.5
		Biggest	Albaath	1.5	0.4	0.7	2.6
			Damascus	1.1	0.4	0.2	2.0

crowns, which were (shoulder, chamfered shoulder, chamfer, semi-chamfered shoulder, simple finish line) (Pardo, 1982).

The percentage of preparation with a simple finish line at Al-Baath University was 84% greater than it with a statistically significant difference in Damascus University 46% by 38%. We agreed with the opinions of el-Ebrashi, M. K., Craig, R. G., & Peyton, F. A. 1969 who found that the shape of the finish line With a simple or chamfer finish line well in order to distribute tension and pressure compared to the shoulder line (el-Ebrashi et al., 1969a,b).

The percentage of preparation with a chamfer finish line at Al-Baath University was 4% and at Damascus University was 2% without there being a statistically significant difference between the two universities.

With these results, our study differed with the study of Shilinberg in 1973 that the finish lines for ceramic–metal compensation should be in the form of a chamfer in order to ensure a good and proper border fit between the edges of the preparation and the finishing line of the restoration.

4.3. Discussing the thickness of the buccal and lingual preparation of the molars and premolars

The upper limit of the preparation of the buccal wall of the molars in Al-Baath University was 0.6 mm, the minimum in Damascus University was 0.5 mm, and the upper limit was 1.1 mm.

As for the preparation of the lingual wall of the molars, the arithmetic mean value of the lower bound at Al-Baath University was 0.5 mm and the upper bound value was 1.6 mm, while at Damascus University the values ranged between 0.8 mm for the lower bound, and the upper bound was 1.3 mm.

As for the premolars, the minimum for the buccal preparation at Al-Baath University was 0.8, the upper limit was 1.7 mm, while the average at Damascus University was 0.5 mm for the minimum and 1.3 for the upper limit.

As for the preparation of the lingual wall of the premolars, the average value of the lower bound for Al-Baath University was 0.7 mm, the upper bound was 0.6 mm, while the average values for Damascus University were the lower bound

0.5 mm and the upper bound 1.2 mm. By discussing the previous output values, we note that the amount of preparation in both universities for the lingual wall is greater than the amount of preparation for the buccal wall. Previous values for the preparation of the buccal and lingual walls within the range of acceptable clinical values according to a study conducted by Rosenstien and his colleagues in 2016 (Rosenstiel and Land, 2015) The values ranged from 0.5 mm to 1.5 mm for each of the vestibular and lingual walls, and the recommended amount of preparation was 1 mm for the vestibular and lingual walls.

5. Conclusion

The following was concluded:

The most used finish line in both universities was the featheredge, the percentage of using the chamfer finish line was more used in Al-Baath University than in Damascus University, the percentage of using the shoulder finish line was more in Damascus University than in Al-Baath University, the thickness of the preparation of the lingual wall of the molars was significantly greater in Al-Baath University than in Damascus University, the thickness of the preparation of the buccal wall of the premolars was significantly greater by a statistically significant difference in Al-Baath University than in Damascus University and the thickness of the preparation of the lingual wall of the premolars is statistically significantly greater in Al-Baath University than in Damascus University.

Ethical statement

All patients of this study were known about the procedure and we took the approval.

All copyright follow for Damascus University Faculty of Dentistry.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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