

# A Study of Evaluation of Finish Line of Die in Fixed Prosthodontic Laboratory

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## ABSTRACT:

**Background:** The purpose of a fixed prosthodontic treatment may vary from the restoration of a single tooth to the complete rehabilitation of full occlusion. Finish line design is important in any tooth preparation, as the finish line ensures the success of the future prosthesis. Finish line affects not only retention but also stability of fixed prosthesis. The finish line must be distinct, uniform, and smooth. Finish line is important during tooth preparation for acceptable marginal adaptation. The finish line must be easy to prepare, it must be easy to duplicate in impression, conservative, and provide sufficient strength to restore material. Finish line design helps in measuring the surface detail recording ability of an impression material. Various tooth preparation designs have distinct finish lines. **Objectives:** To evaluate the finish line of the die in a fixed prosthodontic laboratory. **Materials and Methods:** This laboratory-based descriptive, cross-sectional, observational study has been conducted in the department of prosthodontics, BSMMU, with a sample size of 125 working casts die having different finish lines. The purpose of this study was to observe the finish line of the die of the working cast by using a dental magnifying loop. Data was collected on the basis of type, location, and quality of the finish line and recorded on a predesign data collection sheet. Collected data were analyzed by using the chi-square test. A P-value <0.05 is considered statistically significant. **Result:** Among 125 dies, according to location of finish line, the maximum number of dies, 110 (88%), showed sub subgingival finish line, but according to types of finish line, 112 (88.40%) dies showed a chamfer finish line, and according to quality of finish line, 105 (84%) dies showed a detectable finish line. **Conclusion:** According to the results of the study, it can be concluded that the tooth preparation for single crowns that have been done in the department of prosthodontics, BSMMU, most of their finish line is subgingival, chamfer, and detectable.

**KEYWORDS:** Finish Line, Subgingival, Supragingival, Equigingival, Chamfer, Shoulder, Knife-edge, Quality of finish line, Detectable finish line.

## INTRODUCTION

Fixed Prosthodontics is the branch of Prosthodontics that deals with the restoration of teeth using crowns, bridges, onlays, inlays, and veneers. All of the above-mentioned restorations are made in the dental laboratory on an impression of the mouth made by the Prosthodontist. The purpose of fixed prosthodontic therapy may vary from the restoration of a single tooth to the rehabilitation of the complete occlusion. Fixed Prosthodontics can transform an unhealthy, unattractive dentition with poor function into a comfortable, healthy occlusion capable of giving years of further service while greatly enhancing esthetics. Fixed prosthodontic treatment can offer exceptional satisfaction for both the patient and the dentist.

Tooth preparation is defined as the mechanical treatment of dental diseases or injury to hard tissues that restore a tooth to the original form. Tooth preparation is the cutting or instrumentation procedure that carries on the tooth during the crown construction procedure. A prepared tooth is a tooth's final form or shape after the preparation procedure. The tooth is prepared so the crown restoration can slide into place and be able to withstand the forces of occlusion. Tooth preparation should have specific geometrical characteristics to provide necessary retention and resistance to the vertical and lateral forces acting on the restoration. The most important element of retention is the presence of two opposing vertical surfaces. The main objectives of tooth preparation are reduction of a tooth in miniature to provide retainer support, preservation of a healthy tooth to secure resistance form, preservation of periodontium, and maintaining marginal integrity.<sup>2</sup>

In any tooth preparation, the finish line design is critical because it

affects not only the sealing difference but also the appearance of the tooth, disparity in seating, aesthetics, periodontal fitness, and biological width. The clinicians build a finish line on the tooth on which the prosthetic reconstruction lies while preparing dental abutments for FDP. This can be found supragingival or subgingival. One of the factors that influences crown marginal adaptation is the type of finish line.<sup>19</sup>

The finish line is the line that separates between the prepared and the unprepared tooth portion. It represents the end margin of our preparation; it should be smoothly continuous from one surface to the other otherwise it will interfere with the seating of the crown if it's poorly done. The finish line, by definition, is the apical limit of the abutment tooth model and the margin of the reconstruction must end on it, i.e., it represents the point of transition between the biological and artificial parts. Finish line design helps in measuring the surface detail recording ability of an impression material. Various preparation designs have distinct finish lines. However, the length of the finish line could have an effect on the marginal recurrent caries which subsequently affect the success of the prosthesis.<sup>10</sup>

Finish line preparation of tooth for a full veneer crown is always invasive and leads to permanent loss of tooth tissue. So many procedures have been done in prosthetic dentistry to establish the best method of finish line preparation that would confirm optimum marginal fitness, emerging profile, highest preservation of natural tooth tissue, small loss of tooth hard tissues, good marginal seal, and integrity.<sup>17</sup>

Ideally, all finish lines should be placed supragingivally. Due to aesthetic and carious considerations, however, subgingival placement of the finish line is preferred. No one type of finish line can be used for all crown preparations. In lower anterior teeth or periodontally treated teeth, the knife-edge finish line appears to be the treatment of choice.<sup>21</sup> Types of finish lines are Chamfer finish line, Heavy chamfer finish line, Shoulder finish line, shoulder with bevel, radial shoulder, knife Edge finish line, and feather edge finish line.<sup>7</sup>

In general, a marginal discrepancy is explained in terms of marginal discrepancy or gap, which can be defined as the vertical distance from the finish line of the prepared tooth to the cervical margin of the restorations. Poor marginal discrepancy creates high plaque accumulation and exposes the cemented region to an oral environment, which increases micro-leakage and leads to periodontal diseases. Finally, restoration loses its mechanical stability and failures occur.<sup>5</sup>

Despite strict clinical guidelines set for tooth preparation, laboratory technicians are still facing challenges in this respect. Error in tooth preparation was set as a second laboratory challenge directly after inadequate impression. The continuation of the tooth preparation problems over a long time is astonishing, and the repetition of the same defects in spite of the records is questionable.<sup>16</sup>

So, the study was designed to evaluate the finish line on the die in the fixed prosthesis laboratory.

## METHODS

It was a laboratory-based descriptive cross-section observational study. This study was carried out in Fixed Prosthodontics Laboratory in the Department of Prosthodontics, Faculty of Dentistry, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh. Die of Fixed Prosthodontic cast prepared in laboratory of the Prosthodontics Department of BSMMU used as a sample of the

study. In this study, 125 die of single crown with different finish lines were collected from the Prosthodontics laboratory of BSMMU. A consecutive sampling technique was used to select the sample for this study.

The collected working cast with the die was evaluated for-

- Location of finish line.
- Type of finish line.
- Quality of finish line.

Impressions having endodontically treated single-unit teeth were selected by thorough dental procedure in the department of Prosthodontics, BSMMU and as per inclusion and exclusion criteria set for this study.

### Evaluation of finish lines

The aim of this study was to evaluate the various types of finish line configuration given on different teeth for patients undergoing fixed dental prosthesis treatment. The finish line, by definition, is the apical limit of the abutment tooth model and the margin of the reconstruction must end on it, i.e., it represents the point of transition between the biologic and artificial parts. Being able to identify the zone that is apical to the finish line in absolute precision is fundamentally important for two reasons: It allows defining the preparation limit with certainty and being intact, it maintains the anatomic characteristics of that tooth. Objectives of tooth preparation are reduction of the tooth in miniature to provide retention, preservation of healthy tooth structure to secure resistance form, provision for acceptable finish line, performing pragmatic axial tooth reduction to encourage favorable tissue response from artificial crown contour. Functions of the finish line, the correct marginal adaptation of wax trial depends on the finish line on the cast.

Different finish lines have different effects on the escape of cement during the cementation process; studies recommended that finish line design influence the marginal discrepancy. The main objective of the study was to find the most frequently used finish line quality and the association between the finish line on various tooth surfaces. The finish line should be chosen based on clinical situation, location and material used. The data is then arranged and checked for the frequency of different finish lines used and the type of finish line configuration used in different regions.

A well-structured data collection sheet was developed for the study to evaluate the finish line of die. It was pretested and tested on five respondents for improvement and finalization before conducting the actual study.

Data were collected on a pre-designed structured data collection sheet on the basis of location of finish line, types of finish line and quality of finish line.

The collected data were processed by editing, checking, and rechecking. The edited data were classified and presented in different tables, graphs, and figures in the result section. Edited data were put in the computer and compiled in a master sheet according to the variables. Later the data were placed in the M.S. Office Excel worksheet for statistical analysis. Data were analyzed with the help of S.P.S.S. (Statistical Package for Social Sciences). All data were qualitative data. Data were expressed as frequency and percentages and expressed in tables and graphs.

**Quality assurance strategy**

Maximum quality was assured by using disposable and sterilized instruments. Here exclusion and inclusion criteria were strictly followed. Investigator was sufficiently trained. There was direct supervision from the guide. Investigator himself was present in all the steps of the study, datasheet filling up and maintenance of all records, data checking, data entry, data analysis, and report writing. The sound quality was maintained by a periodic discussion with professional assistance and a supervisor. About 10% of the data were checked randomly by the guide. It was an unbiased study. All data were checked for inadequacy, irrelevancy, and inconsistency. Irrelevant and inconsistent data were discarded.

**Utilization of study results**

This study result may help to evaluate the merits and demerits regarding the clinical performances between most frequently used finish lines. Clinicians will be able to provide more satisfactory finish line to the patient with good retention of fixed prosthesis and less economic burden. And also, the results will generate data for further research in the related field.

**RESULTS**

The present study was carried out to evaluate the finish line of the Die in the fixed prosthodontic laboratory. The study included total 125 samples of Die of posterior tooth. The finish lines were evaluated in terms of type of finish line, location of finish line, and quality of finish line with the help microscopic dental loupes 3.5X-R magnification. The findings obtained from the study were presented in figures and tables.

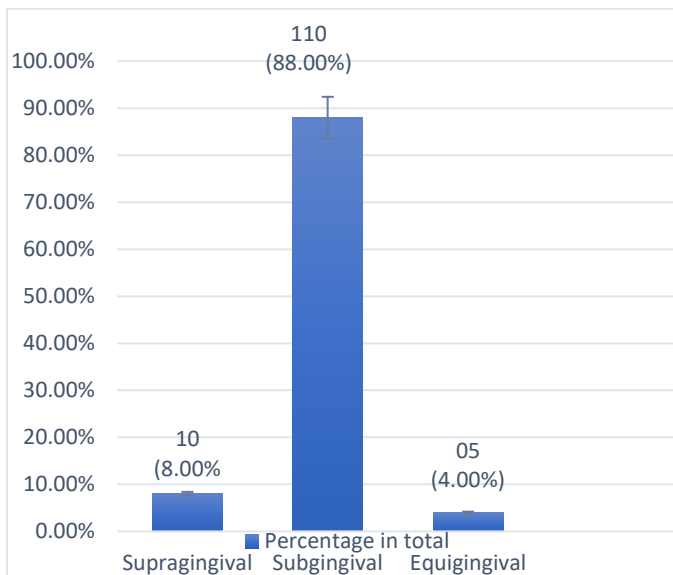


Figure 1: The diagram represents location of finish lines in Die. N=125 The X - axis represents the type of finish line and the Y – axis represents the number & percentage of the Dies. Among total sample 125 Dies, 10 (8.00%) of the finish lines were Supragingival, 110 (88.00%) were Subgingival finish line, 05 (4.00%) were Equigingival finish line.

**Table 1: Distribution of location of finish line among the sample (N=125)**

Location of Finish Line	Number of Die	Percentage (%)	P- value
Supragingival	10	8.00	0.001
Subgingival	110	88.00	
Equigingival	5	4.00	
<b>Total</b>	<b>125</b>	<b>100%</b>	

Data were analyzed by using Chi-Square test.

Table 1: Shows majority of die 110 (88.00%) were subgingival finish line followed by 10 (8.00%) were supragingival finish line and only 05 (4.00%) were equigingival finish line. The difference was statistically significant (P<0.05)

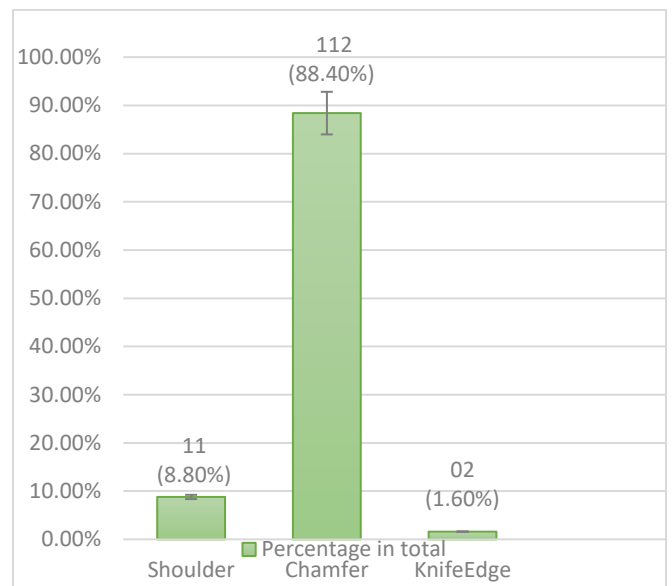


Figure 2: The diagram represents types of finish lines

In Die. N=125. The X - axis represents the type of finish line and the Y- axis represent the number & percentage of the dies among the total sample size of 125 Dies, 112 (88.40%) of the finish lines were Chamfer finish line, 11 (8.80%) were Shoulder finish line, and 02 (1.60%) was Knife Edge finish line.

**Table 2: Distribution of type of finish line among the sample (n=125)**

Type of finish line	Number of die	Percentage (%)	P- value
Shoulder	11	8.8	0.001
Chamfer	112	88.40	
Knife Edge	2	1.6	
<b>Total</b>	<b>125</b>	<b>100</b>	

Data were analyzed by using Chi-Square test.

Table 2: Shows majority 112 (88.40%) were chamfer finish line followed by 11 (8.80%) were shoulder finish line and only 02 (1.60%) were knife Edge finish line. The difference was statistically significant (P<0.05).

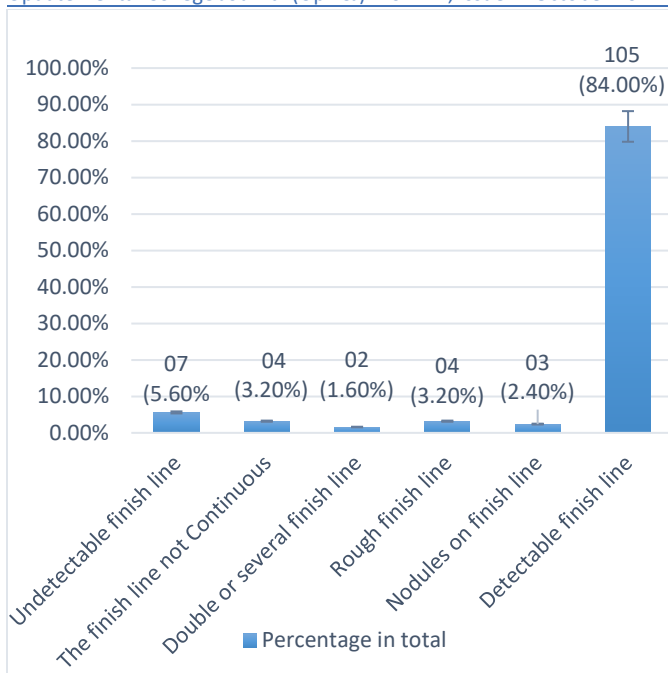


Figure 3: The diagram represents Quality of finish lines in tooth preparation. N=125.

The X - axis represents the quality of finish line and the Y - axis represents the number & percentage of the Dies. Among the total sample size of 125 Dies 07 (5.60%) of the finish lines were Undetectable, 04 (3.20%) of the finish lines were Not Continuous, 02 (1.60%) of the finish lines were Double, 04 (3.20%) of the finish lines were Rough, 03 (2.40%) of the finish lines were Nodules on finish line and 105 (84.00%) of the finish lines were Detectable finish line.

Table 3: Distribution of quality of finish line among the sample (N=125)

Quality of Finish Line	Number of Die	Percentage (%)	P-value
Undetectable or light finish line	7	5.6	0.001
The finish line not continuous	4	3.2	
Double or several finish line	2	1.6	
Rough finish line	4	3.2	
Nodules on finish line	3	2.4	
Detectable finish line	105	84%	
<b>Total</b>	<b>125</b>	<b>100%</b>	

Data were analyzed by using Chi-Square test

Table 3 : Shows majority 105 (84%) were detectable finish line Followed by 07 (5.6%) were undetectable or light finish line, 04 (3.2%) were finish line not continuous, 04 (3.2%) were rough finish line, 03 (2.4%) were nodules on finish line and 02 (1.6%) were double or several finish line. The difference was statistically significant ( $P < 0.05$ ).

## DISCUSSION

This in vitro study was conducted to evaluate the finish line of die in the fixed prosthodontics laboratory. This study aimed at accessing the preference of dental professionals about when finish line configuration do they prefer the most in their daily clinical practice. Finish line configuration is one of the main factors that influence the longevity of a restoration. The present study was conducted with 125 dies of prepared tooth evaluated many aspects of finish line.

Table 1 showed the location of finish lines of tooth preparation among 125 dies, 10 (8%) of the finish lines were Supragingival, 110 (88%) were Subgingival finish line, 5 (4%) were Equigingival finish line. Finish lines should be positioned supragingivally whenever the esthetic and resistance form requirements permit such a location. The periodontal benefits of supragingival finish lines have been well documented. However, subgingival finish lines often are used for appropriate reasons that include the need to achieve adequate dimension for retention and resistance form. Subgingival finish lines are also used to produce a cervical crown ferrule on endodontically treated teeth and to improve the esthetic result achieved on discolored teeth and with certain types of restorations.

In the study of George, Ajrish, and Dhanraj Ganapathy et al 2021, based on the position of finish line to level of gingiva the students mostly preferred equi-gingival finish line (40%) and least preferred sub-gingival finish line (11%). Table 2 showed the types of finish lines of tooth preparation among 125 dies, 112 (88.40%) of the finish lines were Chamfer finish line, 11 (8.8%) were Shoulder finish line, and 2 (1.6%) were Knife Edge finish line.

From this study, it is evident that most of the post students preferred to use chamfer finish line configuration for their maximum cases. In postgraduate students, only few finish lines have been used, among chamfer the highest frequency followed by shoulder and knife edge. The result does not coincide with the previous studies because of the choice of finish line in tooth preparation of post graduate students, mostly depending on the clinical condition of the patients, sometimes the choice of fixed restoration by the patient. It is recommended that chamfer finish lines be used for all- metal crowns. For metal ceramic crowns, chamfer, shoulder, or beveled finish lines can be used. The finish line should be chosen based on clinical situation, location and material used.

In the study of George, Ajrish, and Dhanraj Ganapathy et al 2021, based on the type of the finish line shoulder finish line configuration was the most preferred 35% and sloping shoulder was least preferred of 1%.

In the study of Tantray, M.A. et al 2018, the finish line thickness at the shoulder, shoulder with bevel and chamfer finish lines are 0.134mm, 0.089mm and 0.094mm with standard deviation of 0.0176, 0.089 and 0.0179. The measurements of the thickness of the finish line was done during cast crowns preparation upon the dies, when subjected to one way analysis ANOVA showed p-value of 0.00001 that is statistically significant at p-value of 0.05.

In the study retrospective study of Reddy, M.S.T., Maiti, S and Shashank, K., et al 2021, it shows that the highest percentage of finish line configuration used is shoulder with a percent of 76.8%, followed by chamfer with a percent of 19.4%, radial shoulder with a percent of 2.93%, Least Percent was reported by knife edge and feather edge with a percent of 0.7% and 0.14% respectively. Association between the type of finish line and the location of the teeth in which the finish line is given was done using Chi square test (Chi-Square Value=25.258, Phi value=.188 and p-value=.956 and found to be statistically not significant.

In The study of Ravichandran, V. et al, 2020 had found that the study by Rosenstiel, SF, et al, 2006 had similar findings regarding the types of finish line. The study By HT Shillingburg, et al 1997, had similar findings regarding the type of finish line. In the present study, we concluded that the Shoulder finish line was the most preferred type

of finish line done in tooth preparations.

Previously in the study of Assessment and study of types of finish lines in tooth Preparation -An observational study by Ravichandran,V and Chaudhary,M., et, al 2020, among the sample size of 867 tooth preparations, The most preferred type of finish line was Shoulder finish line 77 %. Chamfer finish line was preferred in 13 %, Radial shoulder in 3 %, Heavy chamfer finish line in 3 %, Feather edge & Knife edge finish lines in less than 1 % of tooth preparations. There was a statistically significant difference between the finish lines placed in fixed partial denture treatment, with shoulder finish line being the predominant one receiving treatment (Chi Square test;  $P < 0.05$ ). Table 3 showed the Quality of finish lines in tooth preparation among 125 Dies, 7 (5.60%) of the finish lines were Undetectable, 4 (3.20%) of the finish lines were Not Continuous, 2 (1.60%) of the finish lines were Double, 4 (3.20%) of the finish lines were Rough, 3 (2.40%) of the finish lines were Nodules on finish line and 105 (84%) of the finish lines were Detectable finish line. The difference was statistically significant ( $P < 0.05$ ).

In the study of Munira, M., Nahar, F., Khatun, N., Khatun, M. and Sultana, A., et, al 2017, were divided into two groups each containing 30 teeth. In group A, 24(80%) sample had detectable finish line with continued margin and 6 (20%) sample had undetectable finish line with discontinued margin .In group B, 18(60%) had detectable finish line continued margin and 12 (40%) sample had undetectable finish line discontinued margin. In both subdivisions there was no undetectable finish line marginal continuity, the difference in frequency of percentage between two groups were statistically non-significant.

In the study of Mohamed,K.A.,et, al 2017, from the main classified group, the percentage for incidence of each group were as follow, Group 1 (Unidentifiable or light finish line) were =30% mostly in lower molars and upper premolars (40.4%, 32.7%) respectively. Group 2 (Not continuous finish line) were =24% the highest percentage in lower molar (33.3%). Group 3 (Double or several finish line) were =16% the highest was 39.3% of them occur in lower molars also. Group 4 (Rough finish line) were= 22% with (35.9%, 23.1%) in lower molars and upper molars respectively. Group 5 (Nodules on finish line) were = 8% mostly in lower molars (35.7%). independent-samples t-test was conducted which revealed lower molars are the most affected area for all the subdivisions found significant  $p=0.07$ .

In this study the result of quality of finish line of die in fixed prosthodontic laboratory showed that in some area result is different higher percentage and some area are lower percentage than the previous similar type of studies. The result does not coincide with the previous studies because of the choice of post graduate students' depending on the clinical situation of the patients also the infrastructure and internal set up of modern fixed prosthodontic department. In Bangladesh perspective due to the differences between the region, patients and patients with their life style that grossly affect gum diseases specially gingivitis, periodontitis with gum recession. In this circumstances, according to the results obtained from the study does not match the similar status with the result of the previous other study.

## CONCLUSION

From this study it can be concluded that according to location of finish line 88% dies were showed subgingival finish line but in respect of types of finish line 88.40% dies were represented chamfer finish line

and on the basis of quality of finish line 84% showed detectable finish line.

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**DATA AVAILABILITY STATEMENT:** The data presented in this study are available on reasonable request from the corresponding author.

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