Evaluation of Various Finish Line Configuration Established by Various Dental Students-A Retrospective Study

Sai Teja Reddy M, Subhabrata Maiti* and Keerthi Sasanka

Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

Abstract

**Purpose:** The aim of this study was to retrospectively evaluate the various types of finish line configuration given on different teeth for patients undergoing fixed dental prosthesis treatment. **Materials & Methods:** A total of 996 patient data were taken from 8600 of patient data after reviewing, duplicate and missing entries were omitted. So a total of 722 entries were evaluated. The data was collected from patient records in Saveetha Dental College, over a period of one year. The evaluation was based on the type of finish line configuration given by the dental students, both the undergraduates and postgraduates in their fixed dental prosthesis cases. **Statistical Analysis:** The results of the study were subjected to statistical analysis. Data analysis was done using SPSS software version 23.0. Chi-square test and frequency evaluation was done to evaluate the most frequently used finish line configuration. **Results:** It was found that the shoulder finish line was widely used followed by chamfer finish line configuration. p=.193(p>0.05), although is statistically not significant and indicates strong evidence for the null hypothesis the trend is towards shoulder finish line. **Conclusion:** The present study concluded that most of the dental students preferred shoulder finish line configuration followed by chamfer, knife edge and the least frequently used finish line configuration is feather edge and radial shoulder on the tooth surface for their fixed partial dental treatment. The trend is towards shoulder finish line mainly because of esthetics and zirconia as a material of choice.

**Keywords:** Finish line; Chamfer; Feather edge; Radial shoulder; Fixed prosthesis

**Introduction**

The aim of FPD is to restore function and esthetic of lost intraoral structures without affecting the oral and general health of the patients. [1]

Ill-fitting restoration potentially affects abutment teeth and supporting periodontium as it provides access and host for oral bacteria adherence which can cause secondary caries and traumatic periodontal irritation. [2,3]

The goal of the prosthodontist is to control oral disease while restoring esthetics and function with durable, biocompatible restorations.

Knowledge of the responses of periodontal tissues to artificial crowns and fixed partial dentures is crucial in the development of treatment plans with predictable prognosis.

Design of tooth preparations can have an effect upon the success of individual restorations and upon the success and continued use of techniques and types of restorations as well. Precise well-fitting cast metal restorations have some discrepancies between the margins of the restoration and the preparation of abutment teeth. Poor marginal discrepancy creates high plaque accumulation and exposes the cemented region to the oral environment, which increases micro-leakage and leads to periodontal diseases. Finally restoration losses its mechanical stability and failures occur. [4]

Insufficient adaptation of restorations may result in an increase in plaque accumulation, ultimately which can result in pulpal...
For an extensively damaged tooth or to replace a missing tooth, even in the advanced developing technique to restore missing teeth, traditional crowns are still indicated for many patients. It involves a sequence of tooth preparation, framework trial, ceramic layering and final cementation. Tooth preparation is defined as the ‘mechanical treatment of dental diseases or injury to hard tissues that restore a tooth to the original form. [9]

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 favourable tissue response from artificial crown contour.

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.

The requirements of a successful restoration margin are that they must fit as closely as possible against the finish line on the cast, it acts as a wax trial depends on the finish line on the cast, it allows to inspect and the patient can clean them.

Functions of the finish line, the correct marginal adaptation of wax trial depends on the finish line on the cast, it acts as a measure of tooth structure that is removed, it is used to evaluate the accuracy of impressions made for indirect restorations, it helps to evaluate the quality of the die and in accurate die trimming and it helps determining the restoration is fully seated while cementation.

Types of finish lines are Chamfer finish line, Heavy chamfer finish line, Shoulder finish line, shoulder with bevel, radial shoulder, knife edge finish line, feather edge finish line. 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. [10] Subgingival marginal openings in the range of 39 to 119 μm and supragingival margins of 2 to 51 μm were judged to be clinically acceptable. [11] The maximum acceptable marginal opening was 120 μm ranging from 100 to 120 μm. [12] Byrne reported that discrepancies of less than 10 μm were routinely possible. [13] Heavy chamfered and rounded shoulder finish lines have been advocated for all-ceramic crowns. [14]

Many studies which involved case reports [15], surveys [16], systematic reviews [17-19], literature reviews, [20-23] in vivo studies, [24-26] in vitro studies [27,28] and retrospective studies [29] were carried out by our team previously. We are currently focusing on epidemiological studies by the dental clinicians in an institutional setting. The main objective of the study is to find the most frequently used finish line configuration and the association between the finish line on various tooth surfaces, a type of restoration material given by undergraduate and postgraduate students. Previously our team has a rich experience in working on various research projects across multiple disciplines, [30-44] Now the growing trend in this area motivated us to pursue this project.

**Methodology**

**Sample collection**

A total of 996 patient data were taken from 86000 of patient data after reviewing, duplicate and missing entries were omitted. So a total of 716 entries were evaluated. The data was collected from the patient database of Saveetha dental college between 01 June 2019 and 31 March 2020. Samples with improper data and repetitions were excluded from the study and ethical approval was done by the institutional review board (SDC/SIHEC/2020/DIASDATA/0619-0320). 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.

**Inclusion criteria**

Patients with informed consent and Patients undergoing fixed partial denture treatment.

**Exclusion criteria**

Patients without informed consent and Complete or partial edentulous patients with removable prosthesis.

**Statistical analysis**

The results of the study were subjected to statistical analysis. Data analysis was done using SPSS software. Frequency evaluation and Chi-square test was done to evaluate the type of finish line configuration given to various teeth by different groups of students. Dependent variables include the type of finish line configuration given, teeth receiving fixed restoration treatment and the type of practitioner (undergraduate and postgraduate). Independent variables include age and sex of the patient.

**Results and Observations**

From the retrospective study, 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 [Figure 1].

Figure 1: The bar graph showing the percentage of various finish line configurations given by dental students. X axis represents the type of finish lines and Y axis represents the total percentage of the procedures. The highest percentage of finish line used was shoulder followed by chamfer, radial shoulder, knife edge and feather edge.

In all metal types of restoration, a total of 25 cases were reported in that shoulder is the most commonly used with a count of 20, followed by chamfer with 3 count and radial shoulder with 2 count. In metal ceramic types of restoration, a total of 179 cases were reported in that shoulder is the most commonly used with a count of 142, followed by chamfer with 32 count, radial shoulder with 3 count and knife edge with 2 count. In all ceramic types of restoration, a total of 512 cases were reported in that shoulder is the most commonly used with a count of 388, followed by chamfer with 104 count, radial shoulder with 16 count, knife edge with 3 count and feather edge with 1 count. Association between the type of finish line and the type of final restoration, material was done using Chi square test (Chi-Square Value=5.723, Phi Value=.089 and p-value=.257) and found to be statistically not significant [Table 1] and also phi value shows the weak correlation present.

Table 1: The table shows the correlation of materials used in final restoration with the type of finish line configuration and the p-value is 0.257 (>0.05) and found to be statistically not significant.

<table>
<thead>
<tr>
<th>Restoration</th>
<th>Chamfer</th>
<th>Feather edge</th>
<th>Knife edge</th>
<th>Radial shoulder</th>
<th>Shoulder</th>
<th>Chi-square value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All metal</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>20</td>
<td>5.723</td>
</tr>
<tr>
<td>Metal ceramic</td>
<td>32</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>142</td>
<td>P value 0.257</td>
</tr>
<tr>
<td>All ceramic</td>
<td>104</td>
<td>1</td>
<td>3</td>
<td>16</td>
<td>388</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>1</td>
<td>5</td>
<td>21</td>
<td>550</td>
<td></td>
</tr>
</tbody>
</table>

The bar graph shows the percentage of finish line configurations given to various final restorative materials used.

In all metal restoration, the shoulder is the most commonly used with an overall percentage of 2.79%, and least is radial shoulder with overall percentage of 0.28%.

In metal ceramic types of restoration, the shoulder is the most commonly used with an overall percentage of 2.79% and least is knife edge with overall percentage of 0.28%.

In all ceramic types of restoration, shoulder is the most commonly used with an overall percentage of 54.19% and least is feather edge with an overall percentage 0.14% [Figure 2].

Figure 2: The bar diagram shows the association between finish line configurations and various materials used. X axis represents the material used for final restoration and Y axis represents the total number of procedures with fixed restorative treatment. Chi-Square Value=5.723 and p-value=.257 (>0.05). Although statistically not significant it is implied that the majority of the finish lines established were shoulder finish
lines in all ceramic restorations rather than metal ceramic and all metal restorations.

In restoring the upper anterior region, a total of 270 cases were reported in that shoulder is the most commonly used with a count of 207, followed by chamfer with 59 count and radial shoulder with 4 count. In upper posteriors, a total of 163 cases were reported in that shoulder is the most commonly used with a count of 134, followed by chamfer with 23 count, radial shoulder with 4 count and knife edge with 2 count. In lower anteriors, a total of 98 cases were reported in that shoulder is the most commonly used with a count of 73, followed by chamfer with 22 count, radial shoulder with 1 count, knife edge with 1 count and feather edge with 1 count. In Lower posteriors, a total of 185 cases were reported in that shoulder is the most commonly used with a count of 136, followed by chamfer with 35 count, radial shoulder with 21 count, knife edge with 5 count and feather edge with 1 count. 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 [Table 2] and also phi shows weak correlation.

The bar diagram shows the percentage of various finish line configurations given to various teeth, in the upper anterior region, shoulder is the most commonly used with an overall percentage 28.91% and least is radial shoulder with 0.56%. In upper posteriors, the shoulder is the most commonly used with an overall percentage of 18.72%, and least is knife edge with an overall percentage 0.28%. In lower anteriors, shoulder is with an overall percentage 10.20%. In Lower posteriors, shoulder is with an overall percentage 18.99% and least is with feather edge with an overall percentage of 0.28% [Figure 3].

In undergraduate students, a total of 492 cases were reported in that shoulder is the most commonly used with a count of 354, followed by chamfer with117 count, radial shoulder with 15 count, knife edge with 5 count and feather edge with 1 count and among postgraduates, a total of 224 cases were reported in that shoulder is the most commonly used with a count of 196, followed by chamfer with 22 count and radial shoulder with 6 count. Association between the type of finish line and different practitioners was done using Chi square test (Chi-square value=23.09, Phi value=.180 and p-value=.001) and found to be statistically significant with weak correlation present [Table 3].
The bar diagram shows the percentage of type of finish line configuration given among undergraduate and postgraduate students. In undergraduate students, shoulder is the most commonly used with an overall percentage of 49.44%, and least is feather edge with an overall percentage of 0.14% and among postgraduates, shoulder is the most commonly used with an overall percentage of 27.37% and least is radial shoulder with an overall percentage of 0.84% [Figure 4].

**Figure 4:** The bar diagram shows the association between finish line configuration and undergraduate, postgraduate students. X axis represents the dental students and Y axis represents the total number of procedures with fixed restorative treatment. Association between the type of finish line and dental students (UG & PG) was found to be statistically significant. Chi-Square value=23.09, p-value=.001 (p<0.05). Most of the students in undergraduate and postgraduates used shoulder as their finish line configuration.

### Discussion

From this study, it is evident that most of the students preferred to use shoulder finish line configuration for their maximum cases and all ceramic material as their final choice of material with a percentage of 76.5 and 71.5. In postgraduate students, only three finish lines have been used, among that shoulder the highest frequency followed by chamfer and radial shoulder with a count of 196, 22 and 6. In undergraduates, shoulder has been widely used followed by chamfer, radial shoulder, knife edge and feather edge with a count of 34,117,15,5 and 1. The escape path of the cement at the margins decreases as the crown is seated on a prepared tooth. Different finish lines have different effect on the escape of cement during the cementation process greater increases in marginal discrepancies are to be expected for greater degrees of finish line curvature abutment; thus, any preparations, which conform to higher degrees of abutment finish line curvature in labio-lingual gingival recession, should be avoided.

Supragingival margin design may be considered in an effort to reduce the degree of finish line curvature of abutment teeth. Marginal width <0.3 mm-knife edge/feather edge
Marginal width up to 0.3 mm-Chamfer
Marginal width>0.3 mm-shoulder

Increasing the depth of the finishing line, it is possible to improve the marginal gap of the substructure. Average marginal gap of chamfer preparation (28-32 microns) and that of a rounded shoulder preparation (25.4-30.2 microns) with regards to zirconia comings milled in CAD/CAM. Fusayama et al. reported that feather edge margin has the best sealing effect followed by the 45-degree shoulder and 90 degree shoulder. Shoulder and chamfer finish line expressed a vertical discrepancy far below at 120 microns, rounded shoulder finish line preparation has the better seat because it allowed the cement to escape more easily. Finish line designs or ceramic types did not influence the marginal fit of all ceramic copings used. Minimal marginal discrepancy remains an essential factor for clinical success of all-ceramics crown restorations. However, marginal discrepancy is influenced by various manufacturing process parameters but finish line configuration of preparation is one of the primary stage design parameter.

The occlusal cement thickness was maximum with the feather edged preparation, followed by the long chamfer and chamfer marginal design. These margins did not allow the castings to completely seat. This is because these margins seal earlier and start the filtration process sooner. They substantially decrease the closing angle between the tooth preparation and the restoration and do not allow the cement to escape easily.

Due to esthetic reasons, all ceramic has been widely used as their final restorative material. Generally, a shoulder finish line is preferred for all ceramic restorations where sufficient thickness of the margin is required for structural durability. Some cases there is really no need for a thick shoulder finish line if the restoration is for full metal. The finish line should be chosen based on clinical situation, location and material used.

### Conclusion

Within the limitations of the current study, it was found that most of the students have used shoulder finish line for their fixed dental prosthesis treatment. There is a trend towards shoulder finish line as the dentistry is going towards esthetics demand and all ceramic material is the treatment of choice but always the decision should be taken by the dentist based on
clinical situation for a long lasting successful treatment outcome.

References


