Original Article
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# Prevalence of Finishing Line Location of Prepared Teeth for Cast Posts and Cores and Types of Previous Restorations

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## Abstract

The purpose of this study was to determine the prevalence and characteristics of supra- and subgingival finishing lines on different tooth surfaces prepared for post and core restoration. Sixty endodontically treated teeth were prepared for cast posts and cores with chamfer finishing lines. Before post and core preparation, the lowest height of the clinical crown (LHCC) from the gingival margin was measured on each surface for comparison with LHCC after preparation. The results showed that the number of subgingival finishing line for post and core preparations (80.0%) was greatly higher than those with supragingival finishing line (20.0%). Most of the preparations with subgingival finishing line (N = 48) involved the distal surfaces (75.0%). One-way ANOVA and Tukey's post hoc test showed that there was a significant difference between LHCC's before and after preparation on the buccal surface ($p = .012$). There was a high prevalence of subgingival finishing line on the proximal surfaces. In order to achieve excellent restorations, tooth preparation and impression taking should be carefully considered. Hence, this study strongly suggested further research on which impression material would be most suitable for recording subgingival finishing line.

**Key words:** cast post and core; gingival margin; Supra- and subgingival finishing line

## Introduction

Subgingival caries, existing restorative materials, tooth fractures, or excessively non-carious loss of tooth, may contribute to the loss of coronal structure. The extent of coronal destruction is an important determinant in deciding on which restorative techniques and materials are used in restoring the tooth to normal form and function.[1] Teeth that were once considered nonrestorable and extracted are commonly treated endodontically and

restored to function.[2] These teeth commonly have lost significant coronal dentin as a result of endodontic access or previous dental caries and restoration.[3] It is generally accepted that a post and core is required for restoring most endodontically treated teeth.[4] Successful endodontic therapy has spared many teeth with extensive coronal destruction from extraction; therefore, significant increases in the use of crowns and fixed prosthodontic procedures have been associated with a need for more posts and cores. Immediate placement of dental implants would extend its indication in the future; however, at this moment patients usually prefer to minimize extensive surgical procedures. In addition, as people keep their teeth longer it could be stated that post and core use will continue to increase.[5]

Margins of restoration or finishing line of prepared teeth are one of the most important and weakest links in the success of cast restorations. Attention has been paid in many studies to the local effects of cast restorations on periodontal conditions.[6,7] Perhaps the position of the restoration margin relative to the gingival margin is the most important factor controlling the effects of restorations on gingival health.[8] Whenever possible, the finishing line of the preparation should be supragingival. Since subgingival margins of cemented restorations have been identified as a major factor in periodontal disease, particularly where they encroach on the epithelial attachment.[9] However, in some clinical circumstances, i.e. in cases when the upper anterior region has to be restored by prosthetic means, it is necessary to place the margins of restorations subgingivally.[10] When tooth preparation produced a subgingival finishing line, it is rather difficult to take an impression because of its technical sensitivity including difficulty in accessibility, fluid control and other reasons. Therefore, management of subgingival restorative margins is a crucial factor in achieving an excellent restoration.

To the authors' knowledge, little is known about the prevalence of finishing line preparation for teeth with extensive loss. This study investigated whether there is a subgingival finishing line involved endodontically treated tooth prepared for post and core restoration. The purpose of this study was to determine the prevalence and characteristics of supra- and subgingival finishing lines on different tooth surfaces prepared for cast posts and cores in order to conduct further researches about impression materials and laboratory procedures to achieve excellent restorations.

## Materials and Methods

Sixty endodontically treated teeth, 58 patients, were prepared for cast posts and cores. Patients, 25 male and 33 female, ranged in age from 20 to 69 years, with an average age of 45.5 years (s.d.=13.7). The teeth were finally prepared with chamfer finishing lines by the dental students under supervision in the university clinic. The minimal dentin thickness of the cavity wall as a determining factor for the resistance to functional loads of the crown-root complex was considered 1 mm.[11] The measurements were done after the dental students taking the impressions and pouring the master casts with type IV dental stones (Silky-Rock; Whip Mix, Louisville, KY, USA). In the study cast, the lowest height of the clinical crown (LHCC) from the gingival margin (the reference point) was measured for comparison with LHCC after post and core preparation as shown in the master cast (Fig. 1). The minimum point of the mesial, distal, buccal and lingual surface of

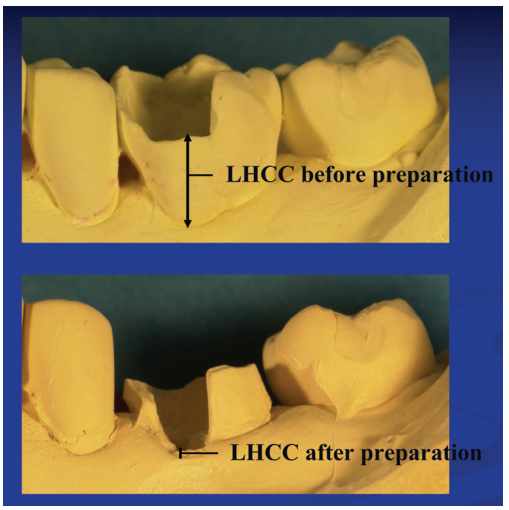


***Fig. 1*** *The lowest height of clinical crown (LHCC) before and after preparation*

each tooth was measured using a periodontal probe (UNC-15; Hu-Friedy, Chicago, Illinois, USA) calibrated in 1 mm increments. Measurements were read repeatedly to 0.5 mm by one examiner.

Statistical analysis was carried out using the paired t-test for comparison between LHCC's before and after preparation on each surface. Differences between LHCC's before and after preparations on different surfaces were analyzed by one-way analysis of variance (ANOVA), followed by Tukey's post hoc test. The level of significance chosen was at $\alpha = .05$.

## Results

Of the 60 post-and-cores evaluated, 80.0% (n = 48) involved equi- or subgingival finishing line and 20.0% (n = 12) involved supragingival finishing line. The number of post and core preparations with subgingival finishing line was greatly higher than those with supragingival finishing line. Molar was the most commonly treated by post and core restoration; this was followed by premolar and anterior teeth (Table 1). Figure 2 shows the previous condition of endodontically treated teeth before post and core treatment. The number of teeth with previous restorations (60.0%) was higher than those with primary caries (40.0%). The majority of previous restorations were fixed crowns.

A total of 48 teeth with subgingival finishing line, one surface involved subgingival finishing line accounted for the majority (45.0%) followed by two surfaces (30.0%), three surfaces (3.3%) and four surfaces (1.7%) accordingly (Table 2). The prevalence of the location of subgingival finishing line (N=48) was 75.0% on distal surfaces (n = 36), 41.7% on mesial surfaces (n = 20), 25.0% on buccal surfaces (n = 12) and 10.4% on lingual surfaces (n = 5). In addition, most proximal subgingival finishing line after preparation were provided because of primary caries (79.2%) when compared with the total number of each previous condition (Fig. 3). In case of resin composites, there were buccal and lingual subgingival margins replaced.

Table 3 a illustrates the average and standard deviations of LHCC's before and after preparation. There were significant differences between LHCC's before and after preparation for all surfaces using paired t-test ($p = .001$). To compare the differences between LHCC's before and after preparation (Table 3b), one-way ANOVA indicated significant differences ($p = .001$) on different surfaces. Tukey's post hoc test showed there was a significant difference on the buccal surface ($p = .012$).

## Discussion

It is clear from the results of this study that there was a high prevalence of post-and-cores associated with subgingival finishing line. If a cast post and core is to be utilized in a tooth with subgingival destruction, the finish line for the crown can be prepared prior to the post-and-core fabrication. Subgingival finishing line preparation is unavoidable when teeth with extensive coronal destruction exist.

***Table 1*** *Number and percentage of tooth type of all post and core restorations*

| Tooth Type | Anterior | Premolar | Molar | Total |
|---|---|---|---|---|
| Supragingival margin | 1 | 4 | 7 | 12 (20%) |
| Subgingival margin | 4 | 9 | 35 | 48 (80%) |
| All post and core restorations | 5 (8.33%) | 13 (21.67%) | 42 (70%) | 60 (100%) |

***Table 2*** *The number of subgingival margin (surfaces) in each post and core after preparation*

| Subgingival margin (surface) | n | % |
|---|---|---|
| 0 | 12 | 20 |
| 1 | 27 | 45 |
| 2 | 18 | 30 |
| 3 | 2 | 3.33 |
| 4 | 1 | 1.67 |
| Total | 60 | 100 |

Because of the current trend to retain natural teeth into the mature years of life; therefore, restoration of teeth with extensive loss should be undertaken properly. However, the subgingival margins of prostheses have always been suspected to have serious implications for the periodontal health of the supporting tissues.[12,13] This agrees with this study that fixed crowns, the majority of previous restorations, were almost placed on subgingival margin led to replacement of restoration. Although much has been written on this subject, there still appears to be controversy regarding the placement of restorative margins. As a result of caries, existing restorative materials, tooth abrasion or fractures, additional resistance and retention form, or esthetic reasons, it often seems favorable or unavoidable to place crown margins at the gingival margin[14]. Richter and Ueno found no difference between sub- and supragingival margins when the fit and finish were of excellent quality.[15] In addition, Sorensen *et al* demonstrated that the better the fit of subgingival margins of cast crowns, the lower is their damaging effect on the periodontal tissues.[16]

There have been some investigations of subgingival margin restorations. Goerig described an effective method of restoring teeth with subgingival and subosseous fractures.[17] Sadan *et al* presented a technique which may be beneficial for the restoration of extensively broken-down mandibular molars exhibiting challenging access to subgingival fractures and divergent roots.[18] These studies support the possibility of subgingival post and core preparation margins. Therefore, it is possible that the margin of post and core restorations can be placed subgingivally. Additionally, a minimal dentin thickness of 1 mm

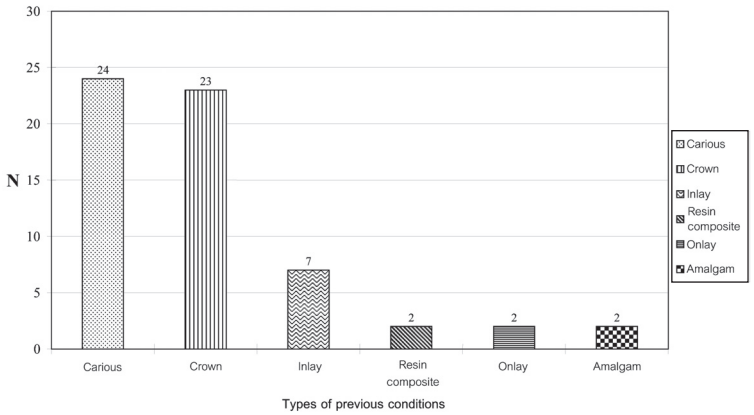


***Fig. 2*** *The number of previous conditions before post and core treatment*

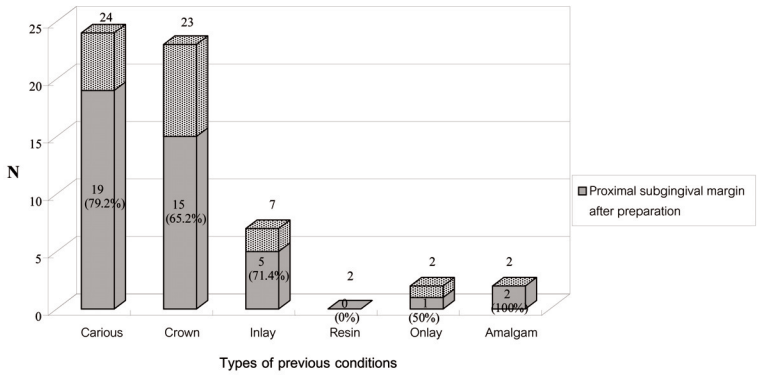


***Fig. 3*** *The number and percentage of proximal subgingival margin after preparation compared with total number of each previous condition*

around the post provides an amount of hard tissue sufficient to stabilize the core material even after crown preparation. Therefore, a cavity wall with less than 1 mm thickness cannot be taken into consideration.[19]

With regard to the topological distribution of this study, most of the post-and-cores were inserted in molars. It is probably because molars are the first of the permanent teeth to erupt into the mouth and more frequently affected by caries before other teeth.[20] The results of this study indicated that post-and-cores with subgingival margins often involved one surface especially the distal surface. Caries is one of the several reasons contributing to loss of coronal structure and most developed on proximal surfaces.[21]

Regarding post and core preparations, there was a significant difference between LHCC's before and after preparation on the buccal surface ($p = .012$). Carious cavitation of cervical enamel, dentin and cementum presents significant restorative problems because gingival margin is the site where water contamination in placing dental materials, marginal leakage and recurrent caries are prone to occur.[22] Additionally, a study of cervical lesions in an unselected population found that 22-23% of subjects were affected by cervical lesions that were wedge-shaped and these increased in severity with age.[23] These carious cavitations and cervical lesions might be relative to the marked difference in buccal surface preparations in this study. Therefore, tooth preparation should be carefully considered in order to achieve an excellent restoration.

It is important to understand the advantages of the cast post and core to realize the limitations of the prefabricated post in such a situation. In the event of extensive coronal destruction, the preparation is usually done under gingival margin. Therefore, unintentional and unnoticed access of saliva would become the problem when using dentin adhesive systems. Frankenberger *et al*[24] has been stated that saliva contamination of etched enamel surfaces decreased bonding to enamel. In addition, it has been suggested that if a canal requires an extensive preparation, a well-adapted cast post and core restoration may be more retentive in function than a prefabricated post and resin core restoration that does not match the canal shape.[25] A 6-year retrospective study of 96 endodontically treated teeth with extensive loss of tooth structure and restoration with the use of cast posts and cores indicated a 90.6% success rate and the traditional custom cast post and core can be recommended.[26] Moreover, a nationwide survey found that cast posts and cores are used by the majority of German dentists as well as Swedish and British dentists.[27-29] Thus, indirect post and core fabrication seems to be the treatment of choice especially for teeth with extensive loss.

***Table 3a*** *Mean and standard deviations (mm) of LHCC's before and after preparation on each surface*

| Surface | LHCC's before preparation | | LHCC's after preparation | |
|---|---|---|---|---|
| | Mean | s.d. | Mean | s.d. |
| Buccal | 4.09 | 2.63 | 2.13 | 1.68 |
| Mesial | 2.21 | 2.05 | 1.08 | 1.29 |
| Distal | 1.68 | 2.08 | 0.82 | 1.73 |
| Lingual | 3.23 | 2.00 | 2.20 | 1.37 |

***Table 3b*** *Mean and standard deviations (mm) of differences between LHCC's before and after preparation on different surfaces*

| Surface | Difference | |
|---|---|---|
| | Mean | s.d. |
| Buccal | 1.96 | 2.09 |
| Mesial | 1.13* | 1.20 |
| Distal | 0.86* | 1.12 |
| Lingual | 1.03* | 1.27 |

*No significant difference at $\alpha = .05$.

## Conclusions

This study showed that 80.0% of the 60 post and core preparations involved equi- or subgingival finishing line. There was a high prevalence of subgingival finishing line on the proximal surfaces. This suggests that an accurate subgingival impression of the proximal surfaces is very important to maintain good oral conditions following prosthetic treatment. Therefore, further study on a subgingival impression should be performed.

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# การศึกษาความชุกของตำแหน่งเส้นสิ้นสุดของฟันหลักชนิดเดือยฟันโลหะเหวี่ยงและชนิดของงานบูรณะเก่า

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## บทคัดย่อ

จุดประสงค์ของการวิจัยนี้เพื่อศึกษาความชุกของเส้นสิ้นสุดเหนือและใต้ขอบเหงือกบนแต่ละด้านของฟันที่เตรียมสำหรับการบูรณะเดือยฟันชนิดโลหะเหวี่ยง การศึกษาดำเนินการโดยการกรอฟันหลักที่รักษาคลองรากฟันแล้วสำหรับเดือยฟันชนิดโลหะเหวี่ยง 60 ซี่ โดยมีเส้นสิ้นสุดแบบรอยตัดเฉียงโค้ง จากนั้นวัดความสูงของตัวฟันจากจุดต่ำสุดถึงขอบเหงือกในแต่ละด้านของฟันเปรียบเทียบก่อนและหลัง ผลการศึกษาพบว่าจำนวนของเส้นสิ้นสุดใต้ขอบเหงือกมีมากกว่าเส้นสิ้นสุดเหนือขอบเหงือก พบตำแหน่งเส้นสิ้นสุดใต้ขอบเหงือกในด้านไกลกลางมากที่สุด จากสถิติการวิเคราะห์ความแปรปรวนแบบทางเดียวและการทดสอบของทูกีย์ (Tukey's post hoc test) แสดงให้เห็นว่าความสูงของตัวฟันด้านแก้มก่อนและหลังการเตรียมฟันมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p$ =.012) โดยสรุป มีความชุกของเส้นสิ้นสุดใต้ขอบเหงือกในด้านประชิดสูง ดังนั้นการเตรียมฟันและการพิมพ์ปากเพื่อให้ได้มาซึ่งวัสดุบูรณะฟันที่ดีมีความสำคัญและควรทำอย่างถูกต้องและระมัดระวัง การศึกษานี้แสดงให้เห็นว่าควรมีการทำวิจัยเกี่ยวกับวัสดุพิมพ์ปากที่เหมาะสมในการบันทึกขอบฟันใต้ขอบเหงือก