

Enamel Thickness After Preparation of Tooth for Porcelain Laminate

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Abstract

Objective: In this investigation the thickness of enamel in the gingival, middle, and incisal thirds of the labial surface of the anterior teeth were measured regarding preparation of the teeth for porcelain laminate veneers.

Materials and Methods: Part one, 20 extracted intact human maxillary central and lateral incisors ten of each were selected. The teeth were imbedded in autopolymerize acrylic resin. Cross section was performed through the midline of the incisal, middle and cervical one-third of the labial surface of the teeth. The samples were observed under reflected stereomicroscope and the thickness of enamel was recorded. Part II, the effect of different types of preparation on dentin exposure was evaluated. Thirty maxillary central incisor teeth were randomly divided into two groups: A: Knife-edge preparation. B: Chamfer preparation.

All samples were embedded in autopolymerize acrylic resin using a silicon mold. The samples were cut through the midline of the teeth. The surface of the samples were polished and enamel and dentin were observed under the stereomicroscope.

Results: Data were analyzed by ANOVA-one way test. The results of this study showed that the least enamel thickness in the central incisor was 345 and in lateral incisor is 235 μ this thickness is related to the one-third labial cervical area. Maximum thickness in maxillary central and lateral incisors in the one-third labial incisal surface was 1260 μ and 1220 μ , respectively. In the second part of the study, the tendency of dentinal exposure was shown with the chamfer preparation, but no dentinal exposure was found in the knife-edge preparation. The differences between groups were significant ($p < 0.05$).

Conclusion: The knowledge of enamel thickness in different part of labial surface is very important. The thickness of enamel in the gingival area does not permit a chamfer preparation. The knife edge preparation is preferable in gingival area.

Key Words: Thickness; Knife Edge; Chamfer; Laminate; Porcelain

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INTRODUCTION

The use of porcelain laminate veneer restorations as an effective and minimally invasive restoration has been well established [1, 2].

The long-term clinical success of porcelain veneers depends on careful case selection, treatment planning and tooth preparation. The technique requires a shallow reduction of the

enamel on the labial surface [3,4]. Some authors believe tooth preparation is unnecessary for porcelain veneer restoration [5]. There are three reasons tooth preparation is necessary; strength, seat and color. The preparation for porcelain veneer should take place in the enamel to maximize the resin bond strength and decrease the tensile stresses in the porcelain [6,7]. There are different approaches in tooth preparation for porcelain laminate. One is the conservative approach and the other is the more radical approach. The aim of this study is to report the enamel thickness on labial surface of the maxillary central and lateral incisor teeth and effect of different preparation on the exposure of the dentin.

MATERIALS AND METHODS

Part I: Enamel thickness: In this study, twenty extracted intact maxillary central and lateral incisors (ten of each) were used for periodontal involvement. The teeth were cleaned and stored in distilled water.

Teeth were imbedded in autopolymerized acrylic resin. The central and lateral samples were divided into two groups, each consisting of ten incisors. For evaluation of enamel thickness, the cross section was preformed through the midline of cervical, middle and incisal one-third labial surfaces of the teeth (Discplan sectioning machine). The surface of the samples were polished and the enamel thickness on the labial surface of the teeth were observe and recorded in μm under the stereomicroscope.

Part II: Effect of the different type of preparation on dentin exposure. Thirty maxillary central incisors free of caries that were extracted because of periodontal involvement were used. The teeth were stored in a physiologic solution. All teeth were randomly divided into two groups.

1. Chamfer preparation: fifteen maxillary incisors
2. Knife-edge preparation: fifteen maxillary incisors

In the chamfer group, the round diamond bur #010 was used and a shallow groove was prepared on the labial surface. The groove depth was checked with a stereomicroscope and an optimum of $300\mu\text{m}$ and deviation of $100\mu\text{m}$ was accepted. The preparation was then continued with the cylindrical round end diamond point # 016. The shallow chamfer was placed in the cervical margin using cylindrical round end bur #016. For knife-edge preparation a shallow groove similar to chamfer preparation was prepared on the labial surface and the groove was checked with a microscope and then the preparation was continued. For the cervical area, the preparation was limited to scrubbing the cervical margin and the preparation was completed. The teeth were imbedded in polyester acrylic resin using a silicon mold. The samples were cut through the midline of the teeth. The surface of the samples were polished and the enamel and dentin were observed under the stereomicroscope. The data were analyzed by two- way ANOVA test and showed no significant difference among groups.

RESULTS

Part one: The result of this study showed that the least enamel thickness in the central incisor and the lateral incisor in the one-third labial cervical area is 345μ and 235μ , respectively. Maximum thickness in the maxillary central and lateral in the one-third labial incisal area is 1260μ and 1220μ , respectively. The mean and standard deviation of enamel thickness in cross section in central and lateral in the one-third incisal, middle and cervical part was as follows:
 $945\pm 3/5$, 620 ± 290 , 410 ± 345 , 925 ± 205 , 630 ± 160 and 367 ± 132.5 .

Part two: The tendency of two types of preparation; knife-edge and chamfer in dentin exposure was evaluated. The result of this study showed the tendency of dentinal exposure is much higher with the chamfer preparation.

No dentinal exposure has been found in the knife-edge preparation; whereas, in the chamfer group more than half of the teeth showed dentinal exposure in the cervical area (Tables 1 and 2).

DISCUSSION

Tooth preparation for porcelain laminate should be interenamel to maximize the resin bond strength. The resin bonding is a quite reliable and predictable method in the enamel [8].

with the newest-generation of dentin bonding agents, the bond strength of porcelain to the dentin is far superior the bond strength of porcelain to the enamel [9,10]. For bonding of porcelain laminate veneer the presence of enamel and its thickness is necessary. During preparation of the tooth for laminate veneer, conservation of the enamel is very important [11-13].

Fractures, microleakage, and the bonding are all failures that can be linked to preparations situated in dentin [14,15].

Table 1. Chamfer Preparation

NO	A	B	C
1	2	224	-
2	2	230	-
3	1	144	-
4	2	350	-
5	2.6	220	-
6	3	350	-
7	1.6	330	-
8	1.7	96	-
9	2.3	160	-
10	1.2	178	-
11	1.6	300	-
12	1.4	160	-
13	1.6	32	-
14	1.7	160	-
15	1.9	336	-

A-Distance between the margin and the CEJ in mm. B- Depth of preparation in μ . C- Dentinal exposure

Table 2. Knife-Edge Preparation

NO	A	B	C
1	1.4	280	-
2	2.3	350	-
3	1.4	400	+
4	3	400	+
5	1.2	450	+
6	2.1	350	-
7	2	400	+
8	3	300	-
9	1.3	330	+
10	2.5	400	+
11	1.2	200	+
12	1.3	280	-
13	1.9	450	+
14	3	320	-
15	1.5	400	-

A-Distance between the margin and the CEJ. in mm. B- Depth of preparation in μ . C- Dentinal exposure

When preparation margins are completely located in the enamel, microleakage is minimal or none at the composite tooth interface [16-18]. In preparation of porcelain laminate, one of the major issues is awareness of the enamel thickness in different parts of the labial enamel surface. In this study, the thickness of enamel in different places of labial surface was measured. This measurement is an important guide for the preparation of the tooth in laminate veneer. The most critical area is the labial gingival third. This study showed the mean thickness of enamel at the gingival third is 410 μ on the maxillary central incisor and 367 μ on the maxillary lateral incisor.

There are two approaches in the preparation of tooth for porcelain laminate in the cervical area, chamfer and knife-edge preparations. The interest in chamfer preparation is because of cosmetics and avoidance of over contouring. The knife-edge preparation is believed to end up with the over contouring. The result of this study showed that in the knife-edge preparation there is no risk of dentin exposure, whereas in chamfer preparation the risk of dentinal exposure is significantly higher in the preparation of porcelain laminate.

In knife-edge preparation, the removal of the serrated, over hanging enamel prisms is essential and enough [19], and from the laboratory point of view, the gingival margin could play as a guide in fabrication of the laminate without jeopardizing the contour and esthetics of the teeth integrity.

CONCLUSION

1- The knowledge of enamel thickness in different parts of the labial surface is very important and it could be a great help in conservation of the enamel.

2- The thickness of the enamel in the gingival area does not permit a chamfer preparation. The knife-edge preparation is preferable in the gingival area. The reported data may serve as a guide for porcelain laminate preparation.

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