

**The Effect of Margin Design and  
Selected Physical Properties of Waxes  
on the Accuracy of Full Coverage  
Crown**

***Thesis***

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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

وَمَا أُوتِیْتُمْ مِّنَ الْعِلْمِ إِلَّا قَلِیْلًا

صَدَقَ اللّٰهُ الْعَظِیْمَ

الاسراء (85)

## Dedication



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## List of Contents

<i>Title</i>	<i>Page No.</i>
List of figures.....	i
List of tables.....	iii
Introduction.....	1
Review of literature.....	3
Aim of the study.....	24
Materials and Methods.....	25
Results.....	43
Discussion.....	74
Summary.....	83
Conclusion.....	85
References.....	86
Arabic summary	

## List of Figures

Fig No.	Title	Page No.
<b>Fig (1)</b>	Hard wax	25
<b>Fig (2)</b>	Medium wax	25
<b>Fig (3)</b>	Soft wax	26
<b>Fig (4)</b>	Investment material	26
<b>Fig (5)</b>	Base metal alloy	27
<b>Fig (6)</b>	Metallic die with chamfer finish line	28
<b>Fig (7)</b>	Metallic die with bevel finish line	28
<b>Fig (8)</b>	Copper counter-die for wax pattern fabrication	29
<b>Fig (9)</b>	Inner and outer counter die	29
<b>Fig (10)</b>	Wax pattern made by hard wax	32
<b>Fig (11)</b>	Wax pattern made by medium wax	32
<b>Fig (12)</b>	Wax pattern made by soft wax	33
<b>Fig (13)</b>	Sprued wax pattern	34
<b>Fig (14)</b>	Burnout furnace	35
<b>Fig (15)</b>	Casted investment	35
<b>Fig (16)</b>	casted metal crowns	36
<b>Fig (17)</b>	metal crown seated on metallic die after casting	36
<b>Fig (18)</b>	metallic holder	37
<b>Fig (19)</b>	metal crown fixed on metallic holder	37
<b>Fig (20)</b>	Stereomicroscope	38
<b>Fig (21)</b>	Schematic drawing showing the measured Vertical marginal gap	39
<b>Fig (22)</b>	Sectioned crown	40
<b>Fig (23)</b>	sectioned crown seated on metallic die	40
<b>Fig (24)</b>	sectioned crown on metallic die fixed by metallic holder	41

<b>Fig (25)</b>	Schematic drawing of the measuring point	41
<b>Fig (26)</b>	Shows the means of the vertical marginal gaps of immediately invested bevel groups.	44
<b>Fig (27)</b>	shows the means of the vertical marginal gaps of immediately invested chamfer groups	46
<b>Fig (28)</b>	Comparison between the vertical marginal gaps of IAa group and IAb group.	49
<b>Fig (29)</b>	Comparison between the vertical marginal gaps of IBa group and IBb group.	50
<b>Fig (30)</b>	Comparison between the vertical marginal gaps of ICa, IDa,IEa groups and ICb,IDb,IEb groups.	52
<b>Fig (31)</b>	Comparison between the vertical marginal gaps of IIAa group and IIAb group.	53
<b>Fig (32)</b>	Comparison between the vertical marginal gaps of IIBa group and IIBb group.	54
<b>Fig (33)</b>	Comparison between the vertical marginal gaps of IICa, IIDa,II Ea groups and IICb,IIDb,II Eb groups.	56
<b>Fig (34)</b>	Shows the means of vertical marginal gaps of immediately invested bevel groups and immediately invested chamfer groups.	59
<b>Fig (35)</b>	Shows the means of vertical marginal gaps of delayed invested bevel groups and delayed invested chamfer groups.	61
<b>Fig (36)</b>	Shows the means of internal adaptation of immediately invested bevel groups.	63
<b>Fig (37)</b>	Shows the means of internal adaptation of immediately invested chamfer groups.	65
<b>Fig (38)</b>	Shows the means of internal adaptation of immediately invested bevel groups and delayed invested bevel groups.	69
<b>Fig (39)</b>	Shows the means of internal adaptation of immediately invested chamfer groups and delayed invested chamfer groups.	72

List of Tables

<i>Table No.</i>	<i>Title</i>	<i>Title</i>	<i>Page No.</i>
<b>Table (1)</b>	Classification of wax patterns		31
<b>Table (2)</b>	Comparison between the vertical margin distances of immediate bevel group.		44
<b>Table (3)</b>	Comparison between the vertical margin distances of delay bevel groups		45
<b>Table (4)</b>	Comparison between the vertical margin distances of immediate chamfer groups		46
<b>Table (5)</b>	Comparison between the vertical margin distances of delay chamfer groups		47
<b>Table (6)</b>	Comparison between the vertical margin distances of immediate bevel hard group and delay bevel hard group		48
<b>Table (7)</b>	Comparison between the vertical margin distances of immediate bevel medium group and delay bevel medium group		49
<b>Table (8)</b>	Comparison between the vertical marginal gaps of ICa group and ICb group.		51
<b>Table (9)</b>	Comparison between the vertical marginal gaps of IDa group and IDb group		51
<b>Table (10)</b>	Comparison between the vertical marginal gaps of IEa group and IEb group		51
<b>Table (11)</b>	Comparison between the vertical margin distances of immediate chamfer hard group and delay chamfer hard group		53

<b>Table (12)</b>	Comparison between the vertical margin distances of immediate chamfer medium group and delay chamfer medium group	54
<b>Table (13)</b>	Comparison between the vertical margin distances of IICa group and IICb group	55
<b>Table (14)</b>	Comparison between the vertical margin distances of IIDa group and IIDb group.	55
<b>Table (15)</b>	Comparison between the vertical margin distances of IIEa group and IIEb group.	56
<b>Table (16)</b>	Comparison between the means of vertical marginal gaps for IAa group and IIAa	57
<b>Table (17)</b>	Comparison between the means of vertical marginal gaps for IBa group and IIBa	57
<b>Table (18)</b>	Comparison between the means of vertical marginal gaps for ICa group and IICa	58
<b>Table (19)</b>	Comparison between the means of vertical marginal gaps for IDa group and IIDa	58
<b>Table (20)</b>	Comparison between the means of vertical marginal gaps for IEa group and IIEa	58
<b>Table (21)</b>	Comparison between the means of vertical marginal gaps for IAb group and IIAb	59
<b>Table (22)</b>	Comparison between the means of vertical marginal gaps for IBb group and IIBb	60
<b>Table (23)</b>	Comparison between the means of vertical marginal gaps for ICb group and IICb	60
<b>Table (24)</b>	Comparison between the means of vertical marginal gaps for IDb group and IIDb	60
<b>Table (25)</b>	Comparison between the means of vertical marginal gaps for IEb group and IIEb	61
<b>Table (26)</b>	Comparison between the adaptation of the immediate bevel groups	62
<b>Table (27)</b>	Comparison between the adaptation of the delay bevel groups	64
<b>Table (28)</b>	Comparison between the adaptation of the immediate chamfer groups	65

<b>Table (29)</b>	Comparison between the adaptation of the delay chamfer groups	66
<b>Table (30)</b>	Comparison between the internal adaptation of IAa group and IAb group	67
<b>Table (31)</b>	Comparison between the internal adaptation of IBa group and IBb group	
<b>Table (32)</b>	Comparison between the internal adaptation of ICa group and ICb group	68
<b>Table (33)</b>	Comparison between the internal adaptation of IDa group and IDb group	68
<b>Table (34)</b>	Comparison between the internal adaptation of IEa group and IEb group	68
<b>Table (35)</b>	Comparison between the internal adaptation of IIAa group and IIAb group	70
<b>Table (36)</b>	Comparison between the internal adaptation of IIBa group and IIBb group	70
<b>Table (37)</b>	Comparison between the internal adaptation of IICa group and IICb group	70
<b>Table (38)</b>	Comparison between the internal adaptation of IIDa group and IIDb group	71
<b>Table (39)</b>	Comparison between the internal adaptation of IIEa group and IIEb group	71

# Introduction

A cast crown is considered satisfactory when it presents suitable retention and resistance form, correct polishing, and good cervical and internal adaptation. However, during the complete crown preparation, failure can occur in any of these steps. In attempt to improve the casting procedure, a wide range of materials and techniques have been reported in an effort to achieve better results.

The marginal fit of a full metal crown is a crucial factor claimed to affect the periodontal status of the tooth and longevity of the restoration. Although it is generally accepted that the marginal errors should be minimized, very little information is available, in the real sense of evidence-based medicine, with regard to the relationship between marginal inaccuracy and longevity of the restoration<sup>89</sup>.

The accuracy of a crown depends mainly on the accuracy of the wax pattern and the type of the finish line used<sup>51,27,26</sup>.

Many procedures in dentistry require the use of waxes<sup>15</sup>. They are used as patterns for inlays, crowns, pontics and partial and full dentures. Waxes are very useful for bite registration and can also be used to obtain impressions of edentulous areas. In the processing of restorative dentistry, waxes are very important for dentists and technicians

Wax is one of the materials that requires more knowledge and skill to manipulate accurately because it has a considerably higher coefficient of thermal expansion (and contraction) than any other dental material. It

often contributes considerably to the inaccuracies of cast dental restorations.

The restoration can survive in the biological environment of the oral cavity if the margins are closely adapted to the cavosurface finish line preparation<sup>69,33</sup>. There are different types of finish line configuration each have its advantages and disadvantages.

In this study we choose two types of finish lines which are chamfer finish line and bevel finish line to determine which one have better marginal accuracy and better internal surface adaptation in conjunction with other factors as the use of different types of dental waxes of different physical properties besides the use of different time elapsed between making the wax pattern and the investment.

# Review of literature

Marginal adaptation is considered to be a primary and significant factor in the prevention of secondary caries and an important indicator for the overall acceptability of full coverage restoration<sup>77, 83</sup>. Marginal accuracy is significantly influenced by the preparation design<sup>80,22</sup>. Geometry of tooth preparation including type of finish line is an important factor in obtaining close marginal adaptation.

## **Margin design**

Proper margin location, configuration and adequate fitness should be obtained for the success of fixed restoration<sup>73,52, 6</sup>. Crown margin is one of the components of cast restoration that most susceptible to failure. Numerous variations in margin design and finish line preparation of casted restorations have been studied to fulfill precise marginal adaptation, and prevention of microbial marginal leakage. The configuration of the finish line dictates the shape and bulk of the restorative material in the margin of the restoration<sup>37</sup>. It also can affect both marginal adaptation and the degree of seating of the restoration. Different shapes of finish lines have been described and advocated. Margin designs used are featheredge, chisel, bevel, chamfer, shoulder, sloped shoulder and shoulder with bevel finish lines<sup>63</sup>. Finish line designs play a very important role in the marginal fit and fracture strength of fabricated casted crowns. Many studies

have been conducted to evaluate the role of finish line on the marginal fit. However most of them reported a conflicting data<sup>21,84,57</sup>

**Fusayama et al. in 1964**<sup>32</sup> cemented full cast metal crowns onto extracted teeth prepared with chamfer, shoulderless and 90-degree shoulder finish lines then sectioned buccolingually and the cement thickness was measured. An increase in the taper of the walls resulted in marked decrease in the thickness of cement on the margins. They observed that shoulderless margin provided the best sealing effect followed by the chamfer and the 90-degree shoulder finishing lines

**El-Ebrashi et al in 1969**<sup>28</sup> and **Dennison in 1978**<sup>23</sup> studied experimental stress analysis on photoelastic models and its relation to different marginal geometry. They found that shoulder with rounded internal line angle and chamfer showed the least stress concentration, and that shoulder with bevels and feather-edges showed the most stress concentration.

**Shillingburg et al. in 1973**<sup>81</sup> measured the change in marginal fit of the porcelain bonded to metal restoration with different marginal preparation, chamfer, shoulder and shoulder with bevel. They found the shoulder and the shoulder with bevel type of margin produced the best fit with no signification (5-10um).

**Berman in 1973**<sup>9</sup>, **Barnes in 1974**<sup>7</sup> and **Pascoe in 1978**<sup>68</sup> studied the effect of finish line design on the casted restoration by measuring the