

**Evaluation of The Internal Fit of Thin Ceramic Veneers Using  
Group (Glamsmile) and Individual Cementing Application  
Protocols. An In-Vitro Study.**

Thesis

Submitted to  
The Faculty of Oral and Dental Medicine  
Cairo University

Department research plane: Goal (5) objective (F)

In Partial Fulfillment for Master Degree in Fixed Prosthodontics

**By**

**Mohamed Mahmoud Abdelgawad Abdelfattah**  
Demonstrator in Fixed Prosthodontics Department,  
Faculty of Oral and Dental Medicine, Cairo University

B.D.S., Faculty of Oral and Dental Medicine  
Cairo University (2009)

Faculty of Oral and Dental Medicine  
Cairo University  
(2016)

## **Supervisors**

### **Dr. Mohamed Labib Zamzam**

Professor, Fixed Prosthodontics department  
Faculty of Oral and Dental Medicine  
Cairo University

### **Dr. Carl Hany Halim**

Assistant Professor, Fixed Prosthodontics department  
Faculty of Oral and Dental Medicine  
Cairo University

## **Judgment Committee**

### **Dr. Atef Shaker Ibrahim**

Professor, Fixed Prosthodontics department  
Faculty of Oral and Dental Medicine  
Cairo University

### **Dr. Osama Saleh Abdelghany**

Assistant Professor, Crown and bridges department  
Faculty of Dental Medicine  
Al-Azhar University

# Contents

	Page No.
Dedication .....	i
Acknowledgment .....	ii
List of tables .....	iii
List of Figurers .....	v
Introduction .....	1
Review of literature .....	4
Statement of the problem .....	44
Aim of the study .....	45
Materials and methods .....	46
Results .....	94
Discussion .....	107
Summary and conclusion .....	122
References .....	126
Arabic summary .....	

## Dedication

To my father, mother and family, for their loving care and support.

## Acknowledgement

First, I am deeply thankful to **Allah** for granting me to accomplish this work.

I am grateful to **Prof. Dr. Mohamed Labib Zamzam** Professor of Fixed Prosthodontics, Faculty of Oral and Dental Medicine, Cairo University, for his great help, continuous encouragement and effort.

I am also grateful to **Assistant Prof. Carl Hany Halim** Assistant Professor of Fixed Prosthodontics, Faculty of Oral and Dental Medicine Cairo University, for his valuable guidance, support & help.

I am thankful to all staff members of Fixed Prosthodontics Department, for their help.

## List of Tables

<b>Table number</b>	<b>Table title</b>	<b>Page number</b>
1	Chemical composition of the IPS e-max CAD block.	46
2	Physical and mechanical properties of the IPS e-max CAD block.	47
3	Chemical composition of Variolink N resin cement.	48
4	Physical and mechanical properties of Variolink N resin cement.	48
5	Chemical composition of Monobond N.	49
6	Sample grouping.	53
7	Mean, standard deviation (SD), median, minimum and maximum values and results of one-way ANOVA test for the comparison between the mean internal fit values ( $\mu\text{m}$ ) for the group and individual cementation protocols.	95
8	Mean, standard deviation (SD), median, minimum and maximum values and results of one-way ANOVA test for the comparison between the mean internal fit values ( $\mu\text{m}$ ) for the group and individual cementation protocols (prepared subgroups).	98

9	Mean, standard deviation (SD), median, minimum and maximum values and results of one-way ANOVA test for the comparison between the mean internal fit values ( $\mu\text{m}$ ) for the group and individual cementation protocols (Non-prepared subgroups).	98
10	Mean, standard deviation (SD), median, minimum and maximum values and results of one-way ANOVA test for the comparison between the mean internal fit values ( $\mu\text{m}$ ) for the prepared and non-prepared subgroups for the group cementation protocol.	101
11	Mean, standard deviation (SD), median, minimum and maximum values and results of one-way ANOVA test for the comparison between the mean internal fit values ( $\mu\text{m}$ ) for the prepared and non-prepared subgroups for the individual cementation protocol.	101
12	Mean, standard deviation (SD), median, minimum and maximum values and results of one-way ANOVA test for the comparison between the vertical marginal gap values ( $\mu\text{m}$ ) for the group and individual cementation protocols (prepared subgroups).	104



## List of Figures

<b>Figure number</b>	<b>Figure title</b>	<b>Page number</b>
<b>1)</b>	IPS e- max CAD blocks.	<b>46</b>
<b>2)</b>	Variolink N resin cement.	<b>47</b>
<b>3)</b>	Monobond N.	<b>49</b>
<b>4)</b>	Hydrofluoric acid.	<b>50</b>
<b>5)</b>	Frontal view of Nissin cast.	<b>51</b>
<b>6)</b>	Upper occlusal view of Nissin cast.	<b>51</b>
<b>7)</b>	Putty index on cast.	<b>54</b>
<b>8)</b>	Putty index and the cast	<b>55</b>
<b>9)</b>	Sectioned putty index on the cast	<b>55</b>
<b>10)</b>	Three wheel diamond depth cutter stone	<b>57</b>
<b>11)</b>	Tapered diamond stone with round end.	<b>58</b>
<b>12)</b>	Laminate veneer preparation for upper right central and lateral incisors.	<b>58</b>
<b>13)</b>	Laminate veneer preparation for upper right canine.	<b>59</b>
<b>14)</b>	Laminate veneer preparation for upper right first and second premolars.	<b>59</b>
<b>15)</b>	Finishing the preparation using finishing yellow coded tapered with round end diamond stone	<b>60</b>

	using a conventional low speed hand piece.	
<b>16)</b>	Each preparation was checked for uniformity and continuity of the finish line by stainless steel dental probe.	<b>60</b>
<b>17)</b>	Sectioned putty index in place after teeth preparation.	<b>61</b>
<b>18)</b>	Anterior wax pattern on cast.	<b>62</b>
<b>19)</b>	Premolar wax pattern on cast.	<b>62</b>
<b>20)</b>	Sectioned putty index and wax patterns on cast.	<b>63</b>
<b>21)</b>	A digital caliper was used to check the thickness of the wax patterns.	<b>63</b>
<b>22)</b>	Designing the Glamsmile veneers.	<b>64</b>
<b>23)</b>	Designing the Glamsmile veneers. (Frontal view)	<b>65</b>
<b>24)</b>	Designing the Glamsmile veneers. (Frontal view)	<b>65</b>
<b>25)</b>	Designing the Glamsmile veneers. (Lateral view – left side)	<b>66</b>
<b>26)</b>	Designing the Glamsmile veneers. (Lateral view – right side)	<b>66</b>
<b>27)</b>	Designing the Glamsmile veneers. (Incisal view)	<b>67</b>
<b>28)</b>	InEos X5 scanner.	<b>69</b>
<b>29)</b>	Scanning the model.	<b>70</b>
<b>30)</b>	Scan phase.	<b>70</b>
<b>31)</b>	Model phase (margin detection).	<b>71</b>

<b>32)</b>	<b>Model phase (insertion axis selection).</b>	<b>71</b>
<b>33)</b>	<b>Model phase (copy line).</b>	<b>72</b>
<b>34)</b>	<b>Design phase.</b>	<b>72</b>
<b>35)</b>	<b>Design phase (biocopy over design).</b>	<b>73</b>
<b>36)</b>	<b>Milling phase.</b>	<b>73</b>
<b>37)</b>	<b>Milling process.</b>	<b>74</b>
<b>38)</b>	<b>Laminates on cast in the pre crystallized format after milling (bluish-gray color).</b>	<b>74</b>
<b>39)</b>	<b>Ceramic furnace (Programat 500)</b>	<b>75</b>
<b>40)</b>	<b>The crystallized and glazed veneers on the model.</b>	<b>75</b>
<b>41)</b>	<b>Veneers in the tray (back view).</b>	<b>78</b>
<b>42)</b>	<b>Veneers in the tray (top view).</b>	<b>78</b>
<b>43)</b>	<b>Veneers in the tray (anterior view).</b>	<b>78</b>
<b>44)</b>	<b>Application of the silane coupling agent.</b>	<b>79</b>
<b>45)</b>	<b>Application of the bonding agent.</b>	<b>79</b>
<b>46)</b>	<b>Application Variolink N resin cement.</b>	<b>80</b>
<b>47)</b>	<b>Variolink N resin cement applied on the fitting surfaces of the veneers.</b>	<b>80</b>
<b>48)</b>	<b>Seating of the tray on the model.</b>	<b>80</b>
<b>49)</b>	<b>Excess cement around the veneers.</b>	<b>80</b>

<b>50)</b>	Removal of the excess cement using brush.	<b>81</b>
<b>51)</b>	Curing of resin cement for 3 seconds.	<b>81</b>
<b>52)</b>	Removal of excess cement using hand instrument.	<b>82</b>
<b>53)</b>	Removal of the tray from the cast.	<b>82</b>
<b>54)</b>	The cast after the tray removal.	<b>83</b>
<b>55)</b>	Removal of excess cement using hand instrument.	<b>83</b>
<b>56)</b>	The cast after the excess cement removal.	<b>84</b>
<b>57)</b>	Removal of interdental excess cement using interdental saw.	<b>84</b>
<b>58)</b>	The interdental saw.	<b>84</b>
<b>59)</b>	Finishing the veneers margins using finishing stone.	<b>84</b>
<b>60)</b>	The finished veneers cemented on the cast (anterior view).	<b>85</b>
<b>61)</b>	The finished veneers cemented on the cast (left side view).	<b>85</b>
<b>62)</b>	The finished veneers cemented on the cast (right side view).	<b>85</b>
<b>63)</b>	The finished veneers cemented on the cast (occlusal view).	<b>85</b>
<b>64)</b>	Etching of fitting surface of laminate veneer with hydrofluoric acid.	<b>86</b>
<b>65)</b>	Application of silane coupling agent.	<b>87</b>
<b>66)</b>	Application of the bonding agent.	<b>87</b>
<b>67)</b>	A celluloid matrix was placed at the proximal surfaces.	<b>89</b>

<b>68)</b>	Application of the resin cement.	<b>89</b>
<b>69)</b>	Veneer placement.	<b>89</b>
<b>70)</b>	Removal of excess cement using brush.	<b>89</b>
<b>71)</b>	Light curing of the resin luting cement for 40 seconds.	<b>89</b>
<b>72)</b>	Removal of excess cement using hand instrument.	<b>89</b>
<b>73)</b>	Finishing the margins using finishing stone.	<b>90</b>
<b>74)</b>	Anterior view of the finished veneers.	<b>90</b>
<b>75)</b>	Right view of the finished veneers.	<b>90</b>
<b>76)</b>	Left view of the finished veneers.	<b>90</b>
<b>77)</b>	Occlusal view of the finished veneers.	<b>90</b>
<b>78)</b>	Teeth were imbedded in transparent chemically polymerized acrylic resin (epoxy resin).	<b>93</b>
<b>79)</b>	The specimens were vertically sectioned in a labio-lingual direction using a very thin diamond coated stone (about 0.5mm diameter).	<b>93</b>
<b>80)</b>	The sectioned specimen.	<b>93</b>
<b>81)</b>	The Stereo microscope.	<b>93</b>
<b>82)</b>	Bar chart representing mean values of the internal fit for comparison between individual cementation protocol and group	<b>96</b>

	cementation protocol.	
<b>83)</b>	Representative stereomicroscopic image showing internal fit for the group cementation protocol.	<b>97</b>
<b>84)</b>	Representative stereomicroscopic image showing internal fit for the individual cementation protocol.	<b>97</b>
<b>85)</b>	Bar chart representing mean values of the internal fit for comparison between prepared subgroups for the individual cementation and group cementation protocols.	<b>99</b>
<b>86)</b>	Bar chart representing mean values of the internal fit for comparison between non-prepared subgroups for the individual cementation and group cementation protocols.	<b>100</b>
<b>87)</b>	Bar chart representing mean values of the internal fit for comparison between non-prepared and prepared subgroups for the group cementation protocol.	<b>102</b>
<b>88)</b>	Bar chart representing mean values of the internal fit for comparison between non-prepared and prepared subgroups for the individual cementation protocol.	<b>103</b>
<b>89)</b>	Bar chart representing mean values of the vertical marginal gap for comparison between individual cementation protocol and group cementation protocol.	<b>105</b>

<b>90)</b>	Representative stereomicroscopic image showing vertical marginal gap for the group cementation protocol.	<b>106</b>
<b>91)</b>	Representative stereomicroscopic image showing vertical marginal gap for the individual cementation protocol.	<b>106</b>