

**Republic of Iraq  
Ministry of Higher Education  
And Scientific Research  
University of Baghdad  
College of Dentistry**



**Marginal and internal fitness of full contour CAD/CAM  
crowns fabricated from zirconia, lithium disilicate, zirconia-  
reinforced lithium silicate and hybrid dental ceramic by  
silicone replica technique  
(A comparative *in vitro* study)**

A thesis

submitted to the Council of the College of Dentistry  
at the University of Baghdad in partial fulfillment of the  
requirements for the degree of Master of Science in Conservative  
Dentistry

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2015 A.D.

1437 A.H.

# Abstract

Accurate marginal and internal fitness of all ceramic crowns are very important considerations for the clinical success from the biological and mechanical points of view. The objective of this *in vitro* study was to evaluate and compare the marginal and internal fitness of full contour CAD/CAM crowns made from four different materials (zirconia, lithium disilicate, zirconia-reinforced lithium silicate and hybrid dental ceramic) using silicone replica technique.

Dentoform tooth of the maxillary left first permanent molar was prepared according to a standard protocol with 1.5mm occlusal and axial reduction and 1.2mm heavy chamfer finishing line, with a convergence angle of 6°. The prepared tooth was then duplicated to have a master metal die. Thirty-two impressions for the master metal die with two-stage putty-wash impression technique were taken and poured with die stone to obtain thirty-two stone dies. The stone dies were then divided into four groups of eight dies each according to the material used for the fabrication of full contour CAD/CAM crowns as follow: **Group I:** crowns fabricated from zirconia (InCoris TZI C, Sirona); **Group II:** crowns fabricated from lithium disilicate (IPS e-max CAD, Ivoclar); **Group III:** crowns fabricated from zirconia-reinforced lithium silicate (VITA Suprinity, VITA Zahnfabric); **Group IV:** crowns fabricated from hybrid dental ceramic (VITA Enamic, VITA Zahnfabric). All crowns were fabricated by using Sirona CEREC in-Lab CAD/CAM System with 80 µm die spacer. After milling with software (version 4.02), crowns of Group I, II and III were subjected to further firing procedures according to their manufacturer's instructions, while the crowns of Group IV were subjected to polishing procedure only. Marginal and internal gaps were measured by silicone replica technique, in which low viscosity addition silicone impression material was used for the cementation of each crown on the master metal die. To support this thin silicone film, a heavy body silicone impression material with a contrasting color was poured in the inner surface of the crown to form one piece with the film of the light body impression material to obtain

a silicone replica. This silicone replica was then sectioned bucco-lingually and mesio-distally, and the thickness of the light body was measured using a digital microscope (at a magnification of 180 X). The measurements were done at twenty one pre-determined points for each specimen; these points representing four different areas of measurement (margin, chamfer, axial, and occlusal).

The results of this study, showed that for all tested groups different levels of adaptation were observed and the least gap recorded at the axial area, while the largest gap recorded at the occlusal area. The least marginal, internal and total gaps were recorded for Group IV ( $60.12 \mu\text{m} \pm 11.80$ ,  $125.25 \mu\text{m} \pm 5.42$  and  $92.12 \mu\text{m} \pm 8.32$  respectively) with statistically highly significant difference when compared with all other groups, followed by Group I ( $113.37 \mu\text{m} \pm 6.58$ ,  $160.25 \mu\text{m} \pm 4.16$  and  $136.50 \mu\text{m} \pm 4.20$  respectively), while the highest marginal, internal and total gaps were recorded by Groups II and III with statistically non-significant differences between them. The results of this study also showed that there was a statistically highly significant difference between marginal and internal gaps of each group with a positive correlation between marginal and internal gaps for all tested groups. However, the marginal, internal, and total gaps of crowns fabricated from hybrid dental ceramic and zirconia were within the clinically acceptable range.

As a conclusion it seems that the difference in the chemical composition of the CAD/CAM materials used in this study and the difference in their need for post-milling firing procedures may reflect the difference in the marginal, internal, and total fitness of the fabricated all ceramic crowns.