

## **Evaluating the Esthetic & Appearance of Ceramic crown build up on a Different Thickness of Metal Casting Substructures**

### **تقييم مظهر و شكل تاج السيراميك المبني على قوالب الصب المعدني مختلفة السمك**

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#### **المستخلص :**

----- من اجل الحصول على افضل مظهر لتعويضات السيراميك التجميلية الثابته هذه الدراسة اعتمدت على مقارنة و تحليل تأثير اختلاف سمك قالب الصب المعدني على شكل و جمالية الشكل النهائي لوحدة السيراميك. سمك قالب الصب يمكن التحكم به بتغيير سمك قالب الشمع الذي يعتبر البناء الاساس للمعدن. الدراسة استخدمت 30 عينه قسمت بالتساوي الى ثلاثة مجاميع (أ، 0.8 مم سمك المعدن) (ب، 0.5 مم) (س، 0.3 مم) بعد الانتهاء من بناء طبقة السيراميك هذه المجاميع قورنت بمدى شدة الشبه من حيث اللون و اللمعان مع وحدة 2M التابعة لشركة VITA Tooth Guide ... هذه المقارنه تمت من قبل فاحص واحد و بطريقه خفيه و عشوائية. اظهرت النتائج بأن الفارق كان كبير بين المجموعتين (أ&ب) (أ&س) بينما الفارق لم يكن واضح بين المجموعتين (ب&س).

\* **Key word:** metal ceramic, ceramic restoration.

\* **Statistical Analysis:** Descriptive statistic\_ Arithmetic mean  
Inferential statistic\_ Independent t-test

\* **Aim of study:** Comparing & analyzing the effect of different thickness of metal alloy casting on the esthetic of the final shape of metal ceramic units.

#### **Abstract**

To get best appearance of fixed ceramic restoration this study depend on comparing & analyzing the effect of different thickness of metal casting on the esthetic & appearance of final shape of metal ceramic units, thickness of metal can be changed by controlling the thickness of wax which is consider the base of the cast .

In this study use 30 samples divided into 3 equal groups which had different metal thickness(A,0.8mm) (B,0.5 mm) (C,0.3mm), after ceramic building and glazing all these samples compare as much as similar to the 2M unit of Vita Tooth Guide company ,this was done by the same examiner using a random blind test.

These groups analyzed between each other using an Independent t-test where it was significant between (A&B) &(A&C) where as it was non significant between (B&C).

#### **Introduction**

Porcelain object have been constructed for thousands of year, but its successfully used for dental prosthesis by the end of the 1800, but it was not until the mid-1950<sup>[1,2]</sup>, that dental porcelain was developed with coefficient of thermal expansion similar to that of existing dental casting alloy<sup>[2,3,4]</sup>.

Dental porcelain is produced from a blend of quarts feldspar, potassium aluminum silicate, sodium aluminum silicate and other oxide, In many dental practices the metal – ceramic

crown is one of the most widely used fixed restoration, this has resulted in part from technologic improvement, in the fabrication of restoration by dental laboratories and in part from the ever greater cosmetic demands that challenge dentists today<sup>[4,5]</sup>

Today the metal ceramic restorations became available commercially. In metal ceramic restoration combine the strength of cast metal with the esthetic of porcelain<sup>[5]</sup>, in these, porcelain is backed onto a thin coping (cast metal substructure), it also need a considerable tooth reduction where ever the metal substructure is to be veneered with dental porcelain<sup>[6,7]</sup>, only with sufficient thickness can the dark color of the metal substructure be masked & the veneered duplicate the appearance of the natural tooth<sup>[8,9]</sup>.

The metal framework must be sufficiently thick to prevent distortion during firing. A minimum of 0.3mm is advocated for the noble metal alloy, 0.2mm is sufficient for base metal alloys<sup>[10]</sup>, also metal thickness less than 0.3mm may lead to distortion during firing<sup>[9]</sup>. The metal ceramic interface must be at least 1 to 1.5mm from all centric occlusal contact and must be distinct to facilitate the removal of excess porcelain<sup>[9,10]</sup>.

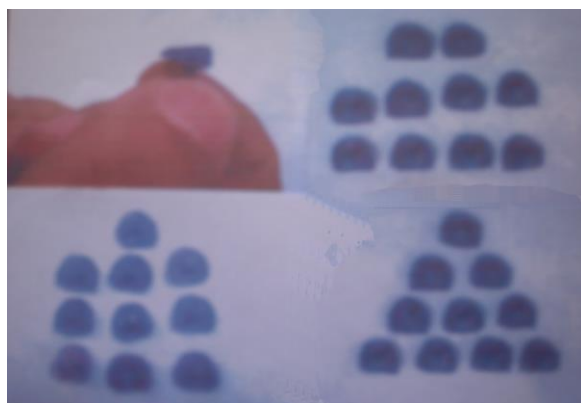
Perhaps the most difficult procedure in esthetic restorative dentistry is to perfectly match a full-coverage restoration to an adjacent natural central incisor<sup>[11]</sup>.

## **Materials& Methods**

30 samples were prepared, their facial (labial) surface similar in shape (width&length) to the labial surface of the left central incisor of the Vita Tooth Guide Company.

first the samples waxed using blue wax (type II\classI, dental industrial) then by spruing , investing & burn out steps converted to a mold, after that used non noble metal (Herum) to obtained a casted metal unit, these procedure repeated 30 times.

Samples were divided into 3 groups had the same diameter (length,width) but differ in the thickness of labial surface,(group A-0.8mm) (group B-0.5mm) (group C-0.3mm), thickness of the metal can be controlled during finishing of the metal samples by using metal gauge & vernia.



*30 samples of blue wax*

## **Ceramic condensation**

According to the manufacture instruction using a small brush to condense the (3 D-Master/Germany) ceramic on the labial surface of these samples ,the opaquer was the first layer that condensed to mask the color of the metal, then the body layer & finally the staining material (2M) were used to simulate the shade of (2M unit) of Vita shade Guide.

The thickness of porcelain layer were controlled in which the thickness of all samples ( metal& ceramic) had become 2mm after glazing.

- Group A/ 0.8mm metal / 1.2mm ceramic
- Group B/ 0.5mm metal / 1.5mm ceramic
- Group C/ 0.3 mm metal/ 1.7mm ceramic

Also the final thickness of the metal covered with ceramic can be determined by using metal gauge that was each labial surface of each sample checked on, in which the whole labial surface had the uniform thickness .



*30 samples after ceramic condensation & glazing*

## **Samples Analysis**

All samples in 3 groups were analyzed for matching to (2M unit Vita Company) by the same examiner depending on Random Blind Test under the following criteria:

- 1- Using the visual matching[12,13].
- 2- The room free from wall covering & decoration highly saturated with color[14].
- 3- The room supplied by one tungsten & two fluorescent light position 2 meters behind the examiner [15].
- 4- In order to have a standard distance, the sample was positioned 40 cm away from the examiner on a neutral off white color apron[15].

The comparisim was categorized as follow:

1. Comparisim fair→ **1**
2. Comparisim good→ **2**
3. Comparisim very good→ **3**

**Result**

Group	1	2	3	4	5	6	7	8	9	10	M
A	1	1	1	2	1	1	1	1	1	1	1.1
B	3	3	2	3	3	1	2	2	2	2	2.3
C	2	2	3	3	3	1	2	2	3	3	2.4

*Table 1: Arithmetic mean*

Table 1 shows the analysis of each group & the arithmetic mean of each group, while the P-value obtained using( Independent t-test) shows that the comparisim was significant between group (A&B) & (A&C), where as the P-value was non-significant between group (B&C) as shown in table 2.

P-value  $\geq 0.05$  Non-significant  
 p-value  $\leq 0.05$  Significant  
 p- value  $< 0.01$  Highly significant

Group	p-value	C.S
A&B	0.025953	Sig.
A&C	0.042993	Sig.
B&C	0.061497	Non-Sig.

*Table 2: Student t-test*

**Discussion**

The visual matching was used because it is the most acceptable ,successful and easy to be done<sup>[12,13]</sup>,also the neutral off white apron was used since this apron color has been shown to be most restful to the dentist<sup>[15]</sup>; Since the light source is one of the major potential problem , several light sources were used to minimize the chance of metameric pairs that may happened<sup>[15]</sup>.

According to the result obtained , The comparison between group( B&C) show non significant difference, but according to the mean obtained from the descriptive statistic which found group( C) had better ability to mask the dark color of the metal and simulate the natural appearance of the natural teeth, this is might be due to the enough thickness of the ceramic that was used above the metal which give the samples its natural esthetic , so it is advisable to use for patients need to restore anterior teeth , matching the color, duplicate the appearance of natural teeth & become much closer to the free metal ceramic unit but with the support of metal substructure.

While in posterior area where the mechanical properties of metal is of prime important to withstand the masticatory force group (B) can be used.

Finally these finding could be applied on esthetic point of view regardless of other variable (mechanical properties).

## **Conclusion**

This study showed that increasing in thickness of ceramic will get the much closer matching to the color of (2M) unit as shown in group (B&C), while when metal thickness increased the ceramic will fail to mask the darkness of the metal as in group (A) that had a significant difference from group( B&C).

Finally can say with the sufficient thickness of ceramic the darker color of the metal substructure be masked & the veneer materials duplicates the appearance of the natural tooth and become much closer & closer to the free metal ceramic unit with the support of metal substructure.

## **References**

1. **Rosentiel.S.F.** , *Contemporary fixed prosthodontics*,3<sup>rd</sup> edition, 2001,Mosby U.S.A.
2. **Weinstien M**,"Fused porcelain to metal teeth" US patent No. 3,052,982,Sept. 1962.
3. **Weinstien M, Weinstien AB**: "Porcelain covered metal reinforced teeth" U.S. patent No. 3,052,983. Sept. 11,1962
4. **Jonston JF**, "Porcelain veneer bonded to gold casting – a progress report", *J prosthet dent* 8:120,1958.
5. **www."Helth.gov**, *material, methods, and indication for the restoration.cast metal& metal-ceramic restoration*" Jun 2005.
6. **James B. summit, J. William Robbins**: " *Fundamentals of operative dentistry a contemporary approach mosby*" USA 2001.
7. **Achal and Prashant**, *metal & porcelain used in permanent crown & bridge* 2<sup>nd</sup> edition 1988.
8. **Wassel. R .,**" crown and extra coronal restorations" *Materials selection*, vol.192,No.4, 199-211,feb.2002.
9. **Seghi R.R,** "spectrophotometric analysis of color differences between porcelain system", *J prosthet dent* 56:35, 1986.
10. **Rosenstiel sf, Johnston** : "the effect of manipulative variables on the color of ceramic metal restorations", *J prosthet dent* 60:297,1998.
11. **Shelly burg H,** "fundamental of fixed prosthodontics", *Quintessence publishing company*,3<sup>rd</sup> edition,1997 .
12. **Bernard T, Paul m,Dan n.**;"*Esthetic dentistry &Ceramic restoration*",2nd edition,London U.K.,1999.
13. **Shigemi I,Kangi I, Kangi I.**, *Reproducibility of tooth color gradation using a computer color matching technique applied to ceramic restoration*",*Jounal Prosth. Dent*,vol.93:179-183;2005.
14. **Goerge A Freedman.**,"*Color Atlas of Porcelain Laminate Venner*"1st edition Euro American Inc.,1990.
15. **Gerald L. Mclaughlin,** "*Color Matching in dentistry- practical application of the organization of color*"*Jounal prosth. Dent.*,29(5):556-559,1997.