

Translucency of Clear Acrylic Resin influenced by Oil Paints

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ABSTRACT

Introduction: Clear acrylic resins are widely used in many applications in the field of dentistry such as removable complete and partial dentures. Such materials are also used in the fabrication of scleral part of ocular prostheses when mixed with white oil paints. Therefore, the purpose of the present study was to evaluate the addition of oil paints on translucency of clear acrylic material.

Materials and methods: The study included three main groups. Each group consists of 10 specimens. The concentration of white oil paints has increased from 1 ml to 2 ml, respectively. The translucency test was applied on all specimens.

Results: The results showed that there was a significant decrease in translucency of acrylic following addition of white oil paints. **Conclusion:** the use of white paints has decreased the translucency of acrylic material. The adding of white oil paint at 1 ml to clear acrylic resin is necessary in the manufacture of the scleral part of ocular prostheses to match the colour of natural eye.

KEYWORDS

translucency, oil paints, ocular prosthesis

الخلاصة

الأكريليك هو المادة المستخدمة بشكل واسع في مجالات طب الأسنان وتعويضات الوجه (على سبيل المثال العين الاصطناعية). يتطلب تصنيع العين الاصطناعية استخدام الألوان الزيتية لغرض الحصول على لون مطابق للعين الطبيعية وهذا قد يكون له بعض التأثير على الخواص الفيزيائية لمادة الأكريليك. إن الهدف من هذه الدراسة هو تقييم تأثير إضافة الطلاء الأبيض بتركيز معين على شفافية سطح الأكريليك. شملت الدراسة على ثلاث مجموعات رئيسية. تتألف كل مجموعة من 10 عينات. وقد زاد تركيز نسبة الطلاء الأبيض من 1 مل إلى 2 مل على التوالي. تم تطبيق اختبار الشفافية في جميع العينات. النتائج: أظهرت النتائج أن هناك نقصان في شفافية سطح الأكريليك مع زيادة تركيز الطلاء. الاستنتاج: إضافة صبغة التيتانيوم الوايت أثر بصورة كبيرة على شفافية الأكريليك.

INTRODUCTION

Clear acrylic resins are considered as the most commonly substances used in dentistry in the fabrication of removable prostheses, for example, complete and partial dentures⁽¹⁻²⁾. These materials can be also used over scleral part of artificial eyes when mixed with white oil paints to obtain a colour similar to the natural eye⁽³⁻⁴⁾. For patients with ocular deformity, artificial eyes provide the professional and social acceptance, maintains the size of the socket and increases the patient's confidence in the public^(5,6). Generally, white coloured acrylic materials are widely used to make the scleral part of the artificial eye⁽⁷⁾. However, these materials are not sufficiently available in domestic markets. Clear acrylic resins are, therefore, mixed with oil paints in order to match colour of the natural eye. Materials which are used in construction of ocular prostheses must have appropriate properties such as excellent aesthetics, durability, biocompatibility and non-irritating to the eye socket and bilateral stability⁽⁸⁻⁹⁾. This study was conducted, hence, to assess the translucency of acrylic resin following the addition of white oil paint.

MATERIALS AND METHODS

Materials and sample preparation

The materials utilized in current study, were clear heat polymerizing acrylic (Zhermack, Italy), and titanium dioxide pigment (Grumbacher, USA) as well as Dental stone (Zhermack, Italy) as a mould material. There were 3 main groups. Groups without addition of titanium dioxide were considered as control. White acrylic samples were made of acrylic resin with the addition of oil paint with either 1 ml or 2 ml oil paint.

Preparation of acrylic specimens

Wax patterns with dimensions of 2 mm and 30 mm diameter were manufactured to make acrylic specimens for translucency testing. Acrylic samples were constructed using traditional flasking techniques⁽¹⁰⁾. Wax patterns were centered at the bottom of the metal flask, which was separated with a Vaseline in order to take the stone mould out after deflasking. According to the manufacturer's instructions, dental stone was mixed with water (100g / 25ml), placed at the bottom, wax patterns were positioned with half of them exposed to be easily removed from the mould (Figure 1).



Figure 1. Wax pattern for translucency test

The upper part was coated with a Vaseline following complete set of stone surface, and then positioned over the lower part and filled with dental stone. After one hour, the flask was put into boil out

machine for 5 minutes to remove all the wax. The upper and lower parts were then separated; and detergents were used to remove the waxy residue completely from the stone mould(Figure 2).

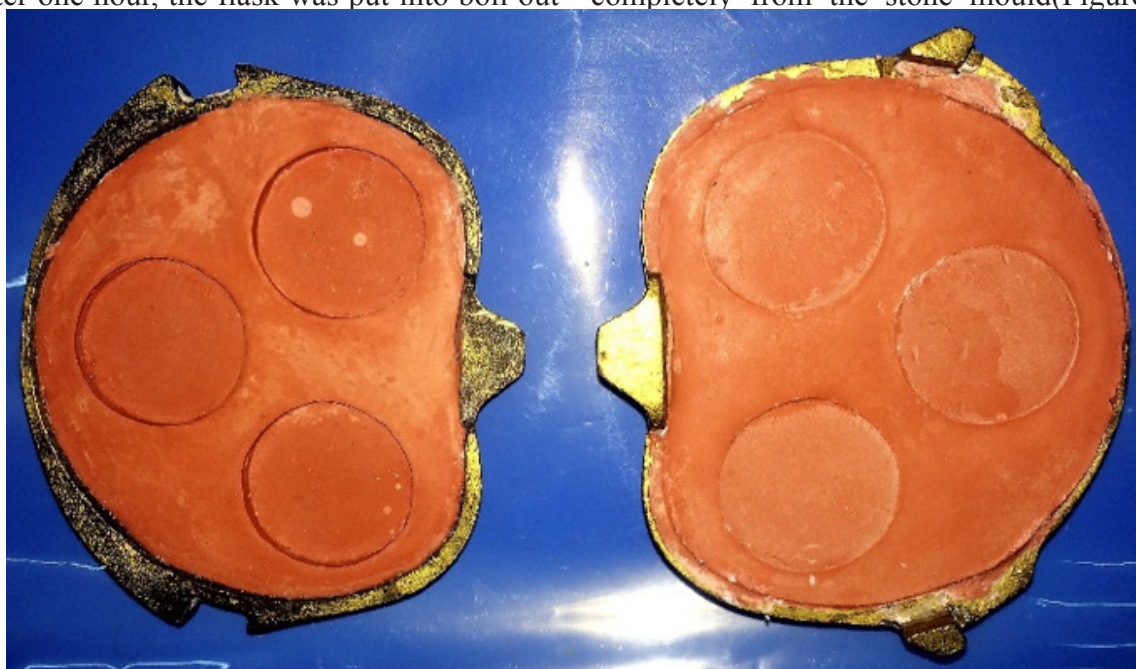


Figure 2 . mould preparation

The control specimens were made by mixing 22g of acrylic powder with 10 ml of monomer. The acrylic was packed into mould when it reached into dough stage. According to the manufacturer instructions, the acrylic was cured in water bath machine. Once curing, the flask was left to cool; and samples were then removed from the flask , finished and polished. The white acrylic specimens were made via the above process with adding 1ml white oil paint to 9ml liquid

monomer for white 1 group, and adding 2ml white oil paint to 8ml of monomer for White 2 group.

Translucency test

The colour of each specimen was measured using a spectrophotometer (Metertech, Taiwan). The specimen was tested three times (left, middle, right); and average readings were calculated for each specimen (Figure 3).



Figure 3. Testing the specimens by UV devise (translucency)

Statistical Analysis

The SPSS v 16 was used to analyze samples data, and provide a summary of mean and standard deviation. The Tukey test and ANOVA test were used

for comparison among groups.

RESULTS

All values of mean and standard deviation are shown in the table 1.

Table 1. mean and standard deviation of all groups for translucency

<i>Groups</i>	<i>Mean</i>	<i>Standard deviation</i>
Control	75.06	14.45
White 1	37.99	10.12
White 2	14.60	5.89

As shown in the table 1, there was a significant decrease in values of mean of translucency with significant reduction in standard deviation for all groups. In addition, one-way ANOVA revealed that

there were highly significant differences among all groups where $P < 0.001$ as illustrated in tukey HSD multiple comparison test (Table 2).

Table (2): Tukey HSD multiple comparison test (ANOVA)

Groups	N	Subset for alpha = 0.05		
		1	2	3
Control	10	75.06		
White 1	10		37.99	
White 2	10			14.60
Sig.		1.000	1.000	1.000

DISCUSSION

In dentistry, acrylic resins are widely used due to their suitable biological, physical and mechanical properties. Such materials are also used for fabrication of scleral part of ocular prosthesis when mixed with oil paints to match the colour of normal eye. The aim of this study was to assess the translucency of acrylic resin following addition of titanium dioxide in two concentrations (1 ml and 2 ml). Translucency is a property of substances that permits the passage of light but disperses the light, so objects cannot be seen through the material⁽¹¹⁾. Translucency of material

depends on their thickness and the scattering and absorption coefficients of the resin, filler particles, organic matrix, pigments, and opacifiers⁽¹²⁻¹⁴⁾. The type, size, and number of internal filler particles affect light scattering in resin materials thus affecting the translucency. Lee (2008)⁽¹⁴⁾ suggested there was an inverse correlation between translucency and filler content thus as the amount of filler increased translucency decreased. Translucency of esthetic materials is usually determined with the translucency parameter or contrast ratio. Translucency parameter refers to the colour difference between a uniform

thickness of material over a black and white background, and corresponds directly to common visual assessments of translucency⁽¹⁵⁻¹⁶⁾. In this study, it was found that there was a significant decrease in values of mean of translucency with significant reduction in standard deviation. The study which was carried out by Aszrin et al., (2016)⁽¹⁷⁾ found that the use of different concentrations of ZrO₂-Al₂O₃-SiO₂ filler exhibits an erratic influence of translucency.

CONCLUSION

With the limitations of the study, the results showed a significant decrease in the translucency of clear acrylic resin following addition of the oil paint. The adding of white oil paint at 1 ml to clear acrylic resin is gradually suitable in the manufacture of the scleral part of ocular prostheses to match the colour of natural eye.

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