

Differences in gloss value of temporary crown materials acrylic resin and composite resin before and after brushing with whitening toothpaste

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ABSTRACT. The temporary crown must meet the patient's aesthetic needs even if it is used only for a while, especially gloss. It is believed that composite resin does not produce odor but shows minimal shrinkage, lower heat generated during polymerization, and is more aesthetically pleasing. Therefore, this material is one of the choices so the clinicians can improve the patient's aesthetic needs. Nowadays, people demand clean and whiter teeth. Brushing with whitening toothpaste is believed to affect the surface of the composite resin. The design of this study was a laboratory experiment. The sample in this study was a temporary crown material of acrylic resin and self-polymerized composite resin with a sample size of 26 mm x 26 mm x 2 mm. All samples were tested using a gloss meter, followed by univariate statistical analysis to determine each group's mean gloss value and standard deviation. The research was continued using Wilcoxon statistical analysis to determine the difference in each group's temporary crown material gloss value. The results showed a significant difference in all temporary crown materials gloss value before and after brushing with whitening toothpaste. The conclusion of this study state that the composite resin material group has a better gloss value than acrylic resin material. Composite resin can maintain gloss value at gloss standard, even after brushing with abrasive toothpaste

KEYWORDS: Temporary crown, Gloss, Gloss Meter

INTRODUCTION

Temporary dental crowns are partial dentures securely attached to one or more abutment teeth to replace one or more missing teeth.¹ Temporary crown aims to restore function, aesthetics, and comfort. After the preparation stage, exposed dentin must be protected from thermal stimulation, chemicals, mechanical disturbances, and bacterial contamination of the oral cavity. This protection can be obtained with a temporary crown, which is used over 2-6 weeks or until the completion of a final crown.²

In some cases, such as partially edentulous patients undergoing implant treatment, temporary crowns are temporary for a relatively long period (6-12 weeks).³ Temporary crowns must meet biological, aesthetic, and mechanical requirements. Materials used to make temporary restorations can come from preformed/prefabricated crowns (stainless steel crowns, aluminum shell crowns, polycarbonate,

polymer, and celluloid crown shapes) and customized provisional (acrylic resin and composite resin temporary crown materials).⁴ Types of acrylic resin materials for temporary restorations are polymethyl methacrylate (PMMA) resin, polyethyl methacrylate resin (PEMA), and polyvinylethyl methacrylate resin (PVMA). The composite resin materials consist of bis-acryl, bis-phenol A glycidyl methacrylate (bis-GMA), and urethane dimethacrylate (UDMA).⁴ Doctors often choose certain materials based on ease of manipulation, cost, setting time, and polishing. It will affect the demands of patients who are increasingly critical of aspects of aesthetics.⁵

Aesthetic success in temporary crowns is influenced by optical appearance, which is directly related to surface roughness, color stability and gloss value. If factors affecting aesthetic quality, such as surface smoothness of the restoration, are

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not considered, it will lead to increased plaque accumulation.⁶ The smooth surface of the temporary crown is believed to improve the quality of the restoration in terms of reflecting light, which is defined as the gloss value. Brushing your teeth with water can already cause an abrasive effect.⁷

MATERIALS AND METHODS

The research design used was an experimental laboratory. The sample in this study used a self-polymerized acrylic resin and a self-polymerized composite resin made in the form of a test plate with a size of 26 mm x 26 mm x 2 mm, which was adjusted to the size of the Gloss Meter. This study's total number of samples was 20, with ten models for each group of self-polymerized acrylic resin (SNAP) and self-polymerized composite resin (SMARTEMP®). The mold is printed using putty Flexceed Putty Type. Then the temporary crown material was filled with self-polymerized acrylic resin (SNAP) and self-polymerized composite resin (SMARTEMP®), and the mold was pressed with a

The existence of various types of materials in the manufacture of temporary crowns that continue to develop makes clinicians have to be able to choose temporary crown materials that can meet aesthetics, including the gloss value of temporary crowns.

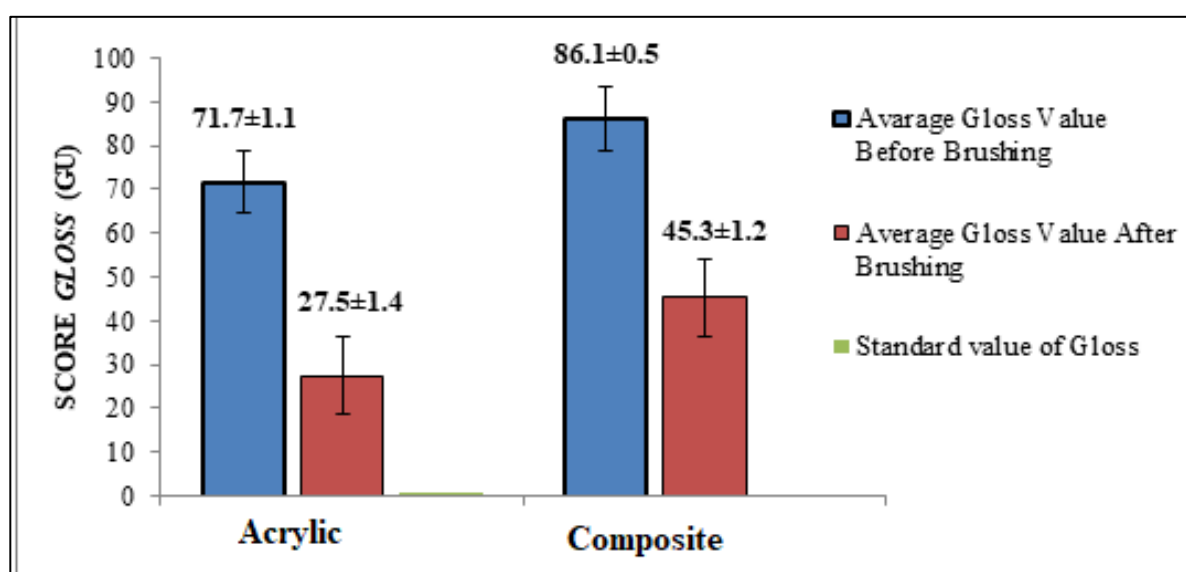
glass object. After setting, the sample is released from the mold. The temporary crown material was polished using a rotary grinder with abrasive papers #1000 and #1200. The initial gloss value was tested on the sample with a gloss meter ETB 0686 before whitening toothpaste. Then the selection was brushed with Colgate Optic White toothpaste and an electric toothbrush (Miniso Japan) for 1 hour, equivalent to the habit of brushing teeth twice a day for 15 days. With an estimated brush duration of 4 minutes a day. After brushing with whitening toothpaste, I tested the final gloss value with a gloss meter ETB 0686.

RESULTS

In the first chart, the average gloss value in the acrylic resin group before brushing was $71.7 \text{ GU} \pm 1.1$, then decreased to $27.5 \text{ GU} \pm 1.4$ after brushing. The average gloss value on the composite resin

before brushing with whitening toothpaste showed a higher gloss value of $86.1 \text{ GU} \pm 0.5$ decreased to $45.3 \text{ GU} \pm 1.2$ after brushing with whitening toothpaste. It shows the same trend as in acrylic resin (Figure 1).

Figure 1. Average Gloss Value of Temporary Crown Material Acrylic Resin and Composite Resin Before and After Brushing with Whitening Toothpaste



DISCUSSION

In this study, the average gloss value was divided into two groups: acrylic resin before and after brushing with whitening toothpaste and composite resin before and after brushing with whitening toothpaste. The average gloss value in this study indicates the presence of a sample with a moderate gloss value above and below the standard value. The pressure and direction can cause variations in this value at the time of polishing performed by the operator on each sample are not entirely the same, and the operator's experience in using the polishing tool is minimal, so that it can result in different glosses values in each instance.

Manual stirring technique in the preparation of temporary crown material samples while acrylic resin can also lead to air trapping in the self-polymerized acrylic resin matrix, resulting in the formation of internal porosity, which can affect the gloss value. Another cause is the uneven surface of the sample due to the non-standard direction and pressure on the staining apparatus. It follows Fresnel's law which states that the gloss value can increase due to an increase in the specular angle and is influenced by the illumination angle of the measurement results.⁸

This study's temporary crown material for acrylic resin consisted of powder and liquid. The composition of the powder is PMMA and peroxide (initiator). Meanwhile, liquid acrylic resin consists of a methacrylate monomer and activator. This type of resin produces high polymerization shrinkage so that it can affect the gloss value.⁹ Polymethyl methacrylate material has low wear resistance. Although this material is strong, easy to add, and has pleasing aesthetics, this material has the main disadvantage of shrinking and releasing heat during polymerization, which can damage the pulp and gingiva.

This factor supports producing a smooth restoration surface and a good gloss value.¹⁰ Polymerization of the temporary crown material shrinkage of acrylic resin can occur during the setting process, which will lead to an increase in the density of the material and a contraction in the volume of the material. The polymerization shrinkage associated with thermal shrinkage can occur during temperature changes from the polymerization temperature to a lower room temperature.¹⁸

This study's results align with previous studies that stated that the surface gloss of temporary crowns on all materials was significantly reduced due to brushing simulation and depending on the material used.⁹ Whitening toothpaste and non-

whitening toothpaste are believed to affect the material's surface properties by increasing surface roughness and decreasing gloss value. The increase of surface roughness after brushing results from the high abrasive particles in whitening toothpaste.^{10,11} Calcium pyrophosphate in whitening toothpaste (Colgate Optic White) is believed to contribute to an increase in surface roughness reflected in a reduced gloss value. It indicates that the abrasive can affect the surface of the sample. The acrylic resin used in this study using PMMA resin is most often used to manufacture temporary crowns. The type of resin used to fabricate temporary crowns can affect the surface of the restorative material. This type of resin produces high shrinkage polymerization so that it can affect the gloss value.^{12,13}

In this study, the type of resin used to manufacture temporary crowns is bis-acryl. This resin provides lower polymerization shrinkage and good transverse strength, generating less heat than other resins.¹¹ This material can be used in temporary restorations over extended periods. This resin contains filler materials, namely salinated glass and silica filler. In this study, the gloss value of the quick crown material while the composite resin was better than acrylic resin. It can be caused by the presence of filler content, namely silanated glass and silica filler in the crown material while the composite resin.^{12,14}

The filler content in the composite resin reduces the contraction that occurs during polymerization. Lower contraction compared to acrylic resin can reduce the occurrence of polymerization shrinkage.¹⁶ In addition, the greater the amount of filler, the polymerization shrinkage will also be reduced. The filler will replace the number of monomers in the material so that the number of monomers that react to form covalent bonds is also reduced, and this also causes a decrease in polymerization shrinkage.¹⁷

Toothpaste containing less abrasive particles can slow down the rate of gloss reduction by slightly increasing the surface roughness of the composite resin. Gloss, on the surface, is a parameter that is easier to see clinically by doctors and patients.¹² In this study, the toothpaste used was Colgate Optic White, which has a high abrasive level with Relative Dentin Abrasive (RDA) of 100 RDA, and toothpaste contains abrasives such as Calcium carbonate and Hydrated silica.^{16,17}

The abrasives contained in toothpaste can cause the softer resin matrix to erode, thereby exposing the filler particles.^{18,19,20} Abrasive materials contained in toothpaste combined with mechanical brushing can cause exposure and release of filler particles. This

can cause a change in the gloss value, where the gloss value represents the change in each

measurement of the gloss value before and after brushing in each sample.²¹

CONCLUSION

Although this study still has several weaknesses, it can be concluded that there is a significant difference between acrylic resin and

composite temporary crown materials before and after brushing with whitening toothpaste with a significance value of $p=0.005$ ($p<0.05$)

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