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Effect of Optiglaze Color on Wear Resistance of Heat Cure Acrylic Prosthesis

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Abstract

Statement of problem: The heat cure denture base material's wear resistance. Purpose: The goal of the research was to determine the wear resistance of heat-cured acrylic denture base material after covering it with a light-polymerized glaze. Material and methods. Thirty acrylic resin specimens were divided into three groups depending on the tests, each group consisting of ten specimens (A) control group was unprocessed, group (B) was surface processed with Optiglaze color materials after finishing and polishing, and group (C) specimens were surfaces treated with Optiglaze color materials after finishing but not polishing. The difference in weights before and after the wear test was used to compute the weight loss of each specimen. SPSS version 20 was employed to do a statistical analysis of the data collected. Results: The results of this study show the higher mean values for wear resistance were registered by the (C) group which was 8.7418, followed by the (B) group which was7.3235, while the lowest mean value was related to the (A) group which was7.0883. Conclusions: When compared to group A, there was no statistically significant wear value in heat cure acrylic resin specimens covered with Optiglaze group (C).Clinical implications: This research will help us learn more about surface glazed heat cure acrylic resin denture materials and how they might increase wear resistance. This study will aid dental professionals and technicians in choosing the best polishing and coating material for dentures.

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Keywords: Optiglaze Color; Wear Resistance.

1. Introduction

For decades, acrylic resin polymethyl methacrylate (PMMA) was the most preferred material for denture manufacture due to its numerous benefits, involving good aesthetics, correct fit, oral environment stability, ease of laboratory and clinical manipulation, and low cost of equipment [1]. Nevertheless, it is not regarded as the ideal material owing to its poor mechanical and physical qualities, which make it prone to fracture and deformation [2]. Indentation of PMMA resin surfaces by various hard objects enhances the abrasiveness and wear of the acrylic base material. These events create an ideal habitat for fungal and bacterial colonization, which has been linked to a variety of oral and systemic illnesses [3]. As a result, evaluating the denture base materials' mechanical properties is crucial in determining the influence of various strengthening components when added or treated [4]. Several attempts to increase the qualities of PMMA have been made, including strengthening it with specific components or treating it with glazing materials that have a noticeable improvement in the denture base resin materials' properties [5]. A major difficulty with dentures is that they are subjected to abrasive wearing during their functions and cleaning (such as brushing). As a consequence, the surface hardness of the acrylic resin deteriorates with time, leading to increased chemical and mechanical wear of the denture base components [6]. Plaque buildup on denture base resins is also a source of worry.

Bad denture maintenance and cleanliness cause rapid biofilm formation, which increases the risk of oral diseases like oral candidiasis and denture stomatitis [7]. Oral fungal infections are more common in elderly people who lack the skill to remove aggregated plaque from dentures [8]. Dentures reduce saliva and oxygen passage to oral tissues, resulting in an anaerobic and acidic situation which promotes the development of Candida and microscopic fungi [9]. Optiglaze color materials are a novel class of compounds that have a significant impact on the surface qualities of acrylic denture bases. Optiglaze color is a novel nano-filled substance designed exclusively to stain, glaze, and provide exceptional wear resistance to direct composite, acrylic restorations, such as chair side-milled hybrid ceramic restorations, acrylic dentures, artificial teeth as well as PMMA type materials [10]. The goal of this research was to see how the color of Optiglaze affected the wear resistance of the base materials of heat cure dentures.

Nomenclature

PMMA	polymethayl methacrylate	P	Probability
GC	GC Corporation, Tokyo, Japan company	F	force
Mm	Millimeter	D.f	Degree of Freedom
Π	Fixed ratio	LSD	Liner statistical model
N	Newton	Sig.	significant
No.	Number	RM	Restorative material
Std.	Standard	<	Larger than
Fig.	figure	Nm	Nanometer

2. Materials and Methods

Thirteen acrylic specimens (20x10 mm length, 10mm diameter in dimension) according to device requirements were constructed with the aid of a custom-made cylindrical shape silicone mold from the acrylic resin of the heat cure by ordinary method for curing and flasking by the use of heat cure acrylic resin materials, Fig. 1. The specimens were distributed into 3 groups (with each group having 10 specimens) by surface treatment (Optiglaze color (GC Corporation, Tokyo, Japan). The first group (control) consisted of ten cylindrical heat cure acrylic specimens that were completed and polished following the manufacturer's guidelines for materials without any surface treatment. The second group consisted of ten cylindrical heat cure acrylic specimens that were completed and glazed with (Optiglaze color) as a surface treatment, as directed by the manufacturer, and then put in a Lbo-Light Duo (GC) indirect composite light oven for 90 seconds [11] The third group consisted of ten cylindrical heat cure acrylic specimens that were completed, polished, and glazed with (Optiglaze color) as a surface treatment according to the identical instructions as the second group. A wear rate test was performed on the three groups using specific equipment (Pin on desk wear testing device) developed at the university of technology Material, engineering department, and resistance laboratory-Iraq with great accuracy of results. It was made up of a pin that held the specimen and a stainless steel disk that rotated at 950 rpm. Previously and next to the testing procedure, the specimen was weighted, followed by fixing the specimen to the holder with a 10N load placed on a straight arm, and the device was turned on for ten min. (time of wear testing). The distance between the disc's center and the specimen's center was 65mm. He uses the following calculation to limit wear resistance: as wear resistance (gram/mm) = weight change/slide distance (slide distance=2 radius distance between specimen and disk centers) the number of the test’s cycles time [12]. Following each test, purifying of the disk necessity was done. Before the test, all specimens were sunk in distilled water for 48 hrs.

Fig 1. A) Wax specimens, B) Wax specimens in the dental flask

3. Results

3.1. Statistical analysis

3.1.1. Wear resistance test

The SPSS program version 20, from IBM Corp, was used to perform the statistical analysis of results. A total of (30) measurement of wearing resistance in (gram/mm) was measured for all samples for different three groups that were subdivided according to the surface treatment group A (control) finishing and polishing, group B finishing and polishing with glaze, and group C finishing with glaze process. Means and standard deviations of wearing resistance with minimum and maximum values were recorded for each group as shown in Table 1.

And from Table 1 and Fig. 2, it showed the Descriptive statistics values of the wear resistance means value for three different groups of surface treatment, it showed the lowest mean of wear resistance values was scored by control group A (7.0883), while the highest mean of wear resistance values was belonged to group C, that finished with glaze (8.7418), while we noted the mean value of the group B, that finished and polished with glaze (7.3235) has fluctuated between of the two groups A and C.

ANOVA testing was used to see whether there was any level of statistically significant difference between and within groups as shown in Table 2, From this table, it has been found that the difference in wear resistance value for among three groups after the wear resistance test was statistically significant (P≤0. 05) At (3.993) as a force.

Table 1 Descriptive statistics of the wear resistance for three different groups of surface treatment

Wear resistance				
		Control (A)	finishing and polishing with glaze (B)	finishing with glaze (C)
N	Valid	10	10	10
	Missing	0	0	0
Mean		7.0883	7.3235	8.7418
Std. Deviation		1.2760	1.9495	7.6352
Minimum		5.15743	4.64169	7.22040
Maximum		8.50976	9.54125	9.79912

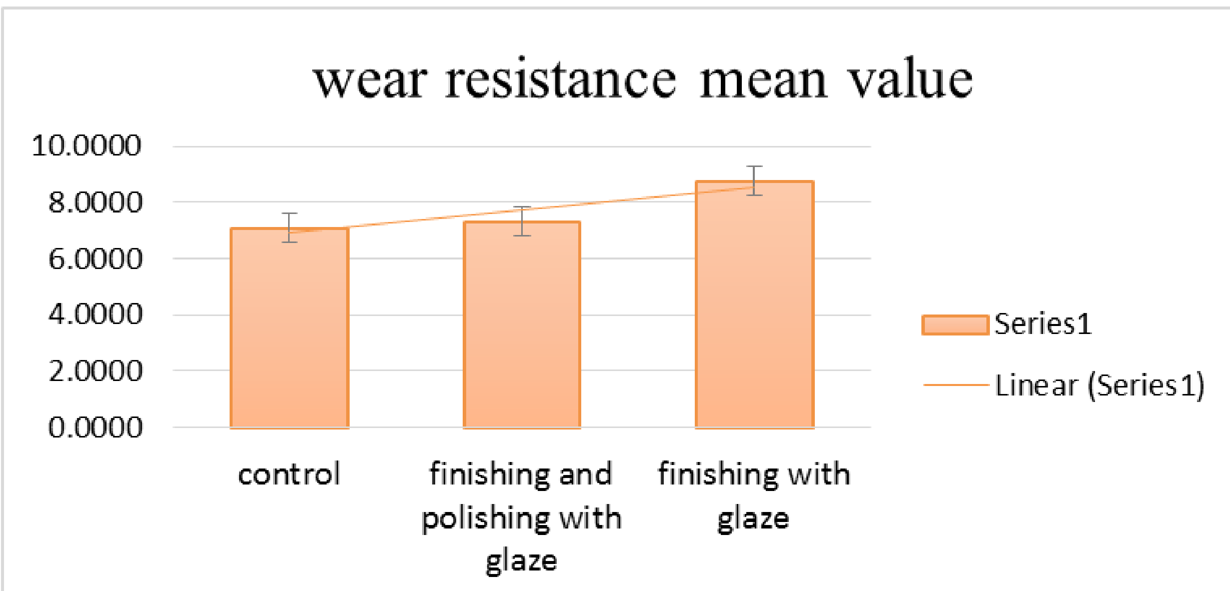

Fig 2. Bar-chart showing the Descriptive statistical values

Table 2 One-way ANOVA test between different three groups of surface treatment wear test

Study groups	Sum of squares	df	Mean square	F	Sig.
Between groups	.000	2	.000	3.993	.030
Within groups	.000	27	.000		
Total	.000	29			

Further, multiple comparisons in Table 3 between groups were done by applying the least significant difference tests (LSD test) at a level of significance (0.05) to see the significant difference between each group. The result of the LSD test Table 3 viewed a non-significant difference (P≤0.05) between group A (controls) and group B (finishing and polishing with glaze). Also, it showed a significant difference (P≤0.05) between group A (controls) and group C (finishing with glaze), with a significant difference (p≤0.05) found between group B (finishing & polishing with glaze) and group C (finishing with glaze).

Table 3 LSD test for multiple comparisons of wear resistance means of each group (A, B, C)

Multiple comparisons						
	(I) f	(J) f	Mean difference (I-J)	Std. error	Sig.	comment
LSD	A	B	23523	063309	.713	No sig. Difference
		C	165353*	063309	.015	sig. Difference
	B	A	23523	063309	.713	No sig. Difference
		C	141829*	063309	.034	sig. Difference
	C	A	165353*	063309	.015	sig. Difference
		B	141829*	063309	.034	sig. Difference

4. Discussion

PMMA is an ancient acrylic resin that is generally utilized in the manufacture of denture bases. Surface properties are required for every denture base material; however, they can be a source of worry since they impact the health of denture wearers' oral tissues. PMMA resin surfaces are porous to indentation by various hard objects, which increases the surface roughnesses and wear of acrylic denture’s base surfaces, allowing plaque to accumulate and causing poor oral hygiene [3]. Various glaze materials have been utilized to maintain dentures, provide a glossy smoother surface, and deter plaque collection by promoting hydrophobicity and low viscosity denture surfaces [13]. According to the null hypothesis, substantial differences were found in the application of nano glazing material on acrylic denture base surfaces, as shown in Table 1. These findings of our study agree with (Kuhar and Funduk, 2005) research that came to prove that the glazing materials might be used as a beneficial glossy sealant coating the acrylic denture to give good wear resistance and prevent the acrylic foundation from abrasion. Denture base materials are traditionally completed manually in the dental laboratory using fine pumice and polishing material, a group (A) [14]. Optiglaze (GC) has recently been created to reduce surface roughness and improve stain and wear resistance [15, 16]. Using Optiglaze (GC), which contains Methacrylate resins, provides a smoother and more coulor stable denture tooth surface than traditional procedures of polishing, according to previous studies [17] and this is the same in the group (B). As wear is defined as a progressive removal of abrasion of materials from solid surfaces as a result of relative motion between two contact surfaces [18], surface hardness is a material's intrinsic physical attribute that indicates how resistant it is to plastic warp. It's also the mechanical attribute that's most commonly employed to describe a material's wear resistance; materials with greater surface hardnesses are thought to be stronger and more resistant to frictions [19]. Surface coating processes have been reported to be effective in reducing the roughness of dental resin-based restorative materials [20] Furthermore, the surface coating could not cover the entire surface imperfections in such circumstances [21]. Denture foundation acrylic resin is polished by dental specialists using efficient processes. Acrylic dentures have been sealed with glazes. The producers claim that aglaze will create the acrylic resin surface flatter and smoother, reducing the buildup of remaining food and plaque adherence, then improving dental hygiene [13]. Nanofilm (Optiglaze) contains attributes like cationic nature, acid resistance, oleophobia, hydrophobia, high flexibilities, antifungal or antibacterial capabilities, abrasion, and corrosion resistance, and it's conceivable as such traits are to be blamed for ‘c’ bacterial adhesions being reduced.[22]. Some studies (Kaplan et al., 1996) demonstrated the effectiveness of liquid polishers when used over rougher surfaces, with polishing improvement, and this agreement with result group (C).[23]. Another study [24] found that the roughness value was adequate to confirm superficial smoothness following applying polisher glaze on finishing/ finishing polishing surfaces of Composite resin materials [24]. According to manufacturing information of material optiglaze polisher has the advantage (highly glossy smoothed surface with good wear and abrasion resistance in addition to esthetic color saving), especially when applied on the finishing surface without polishing techniques, and also in the current study, the denture base material surfaces of the group (c) were finishing with diamond bur and treated with optiglaze polishing material and viewed high wearing resistance and smooth surfaces and this finding come with same advantage of optiglaze material that mentioned to it up in(25).

5. Conclusion

Under the existing circumstances, it is reasonable to infer that:

1. The optiglaze color is a useful tool for achieving polished surfaces and lowering the rate of surface roughness.
2. Using simply the optiglaze color after finishing, it was feasible to produce polished surfaces.
3. Additional research is required to confirm the optiglaze color's clinical validity.

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Reference

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