# The effect of amount variation of E glass fiber on the flexural Strength of denture base materials

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Abstract

Removable denture each complete or partial are used for the replacement of missing. Because of that, fracture is a common clinical occurrence, which mostly occur in the midline at the base of the dentures, Flexural strength, transverse strength, or modulus of rupture. As this property is variously called, is a strength test of a bar supported at each end, or a thin disk supported along a lower support circle, under a static load. On the flexural strength E-glass, fiber reinforced acrylic denture base. This study was using E-glass fiber (Everstick C&B, Turku, Finland), divided into 2 group, include 1 groups of 1 strep E-glass fiber and groups of 2 strep E-glass fiber. Measurement of flexural strength used the universal testing machine. The results were analyzed by t-test. The result of t-test shows there were

significant differences according to amount because the value of P = .001, p<0.05.

. In conclusion, there were effects of amount on flexural strength of E- glass fiber.

**Key words:** denture base, E-glass fiber, flexural strength.

**Introduction**

The complete or partial dentures used to replace missing naturalistic teeth. To iterate appearance; Improve chewing and ability to speak clearly. The human development of prosthetic therapy has led to an increase in the number of people using removable dentures..( Eglal, 2012)

Removable dentures are made of many materials, including metallic or acrylic. However, Thermoplastic polymethyl methacrylate is the most commonly used material for the construction of removable partial and complete dentures (PMMA)Since its widespread use in 1937, the ease of manufacture, the low cost and the aesthetic aspect of (PMMA) made it one of the best materials used in the manufacture of removable dentures..( Eglal, 2012. Peyton, 1975)

Acrylic resins are processed by a polymerization reaction that uses heat, chemical compounds, or visible light to activate it. Rapid heat curing acrylic resins are the best curing method, reducing denture manufacturing time. (Eglal, 2012. Peyton, 1975)

Flexural strength , transverse strength, or modulus of rupture . as this property is variously called, is essentially a strength test of a bar supported at

each end ,or a thin disk supported along a lower support circle, under a static load ( Anusavice , 2003)

Removable dentures are subjected to different forces inside the mouth, so these prostheses must have sufficient strength to bear these physiological loads. So that the American Dental Association ADA No 27 recommends that, the strength of materials for manufacturing dentures is not less than 80 MPa. (American Dental Association,2003).

**B. Problem of Research**

According to the above-mentioned background, the research problem can be summarized in the following:

Whether there are effect of amount variations of denture base materials on the flexural strength.

**C. Research Objective**

Determine the effect amount variation of denture base materials on the flexural strength.

## III. MATERIALS AND METHODS

### 3.4 Preparation of samples :

### 3.4 .1 model preparation

Glas slide (64mm x 10mm x 3.3mm) were flasked and invested according to manufacturer's instructions in ISO type 3 dental stone (Whip Mix Corp.). The flask was heated for 8 minutes in boil out solution; Wax is washed and separated with boiling solution (Patterson Dental). The final rinse is done with clean water and the halves are left to cool to room

temperature. Lucitone 199 Resin (Dentsply) was mixed with 21g polymer to 10ml monomer to assure wetting of all polymer particles. The jar is covered for 10 minutes to allow the substance to firm up, not sticky or rubbery. Resin was condensed into the mould with finger pressure and the flask was closed in a Pneumatic Flask press (Coe-Bilt) under 6000 pounds of pressure. The flask was then loaded in a spring clamp and placed in a Hanau Curing Unit (Whip Mix) for 9 hours at 163$^{o}$F, followed by 30 minutes in boiling water (212$^{0}$F) per manufacturer instructions. Bench cooling was allowed for 30 minutes and then the flask was immersed in 70$^{o}$F water for 15 minutes prior to deflasking.

**3.4 .2. samples preparation**

Four rectangular specimens of each material, measuring 64× 10 × 3.3 mm, were prepared by filling a mould. After polymerization, 4 specimens of each material were stored in distilled water at 37$^{o}$C for 24 hours (American Dental Association,1993). After 24 hours storage at 37$^{0}$C, the specimens were taken out from the water and dried with tissues, before loading, height and width were measured by a digital micrometer with an accuracy of 0.01 mm (Black and Garth, 1998).

**3.4.3 Three-point bend test and measurement of flexural strength**

Samples were tested using a three-point bend test per guidelines of ISO 20795-1 for denture base polymers. Each sample was placed on circular support beams with a 50mm span. A load was applied with a Universal Testing Machine (Instron) to the center of the samples at a crosshead speed

of 5mm/min until fracture. The moment of fracture was designated as the moment applied load dropped to zero. Data was recorded on Bluehill Sofware (Ver 1.5).

**3.5.** Statistical **analysis:**

Date was analyzed using statistical software (SPSS19.0, SPSSInc). (T .test) evaluated the difference between sample groups (heat cure acrylic resin, could cure acrylic resin).of heat cured acrylic resin and chemical acrylic resin obtained from flexure strength was analyzed by using (T. test) to obtain.

## A.RESULT

Research had been done 8 of E- glass fiber reinforced denture base materials specimens. It was seen 2 strip E- glass fiber reinforced denture base materials gave higher flexural strength than the 1 strep E- glass fiber reinforced denture base materials. The data of flexural strength then had been tested by normality test of using Shapiro-Wilk test which was used with small samples (less than 100), that to determine the suitable statistical method to analyze the current data. In details, when the data belong to normal distribution it was appropriate to use parametric tests.

| **Variables** | **Mean± s.d.** |
|---|---|
| E-glass 1 strip | 135.00±19.62 |
| E-glass 2 strip | 223.59±24.15 |

The result of normality test showed that the data distributed normally because the values of Shapiro-Wilk statistic was not significant ($p > 0.05$) . So to check the hypotheses, the current study will use parametric test.

**The Result of Testing the Hypothesis:**

To examine the hypothesis, the researcher used t-test , to examine the effects of amount on flexural strength for all groups, and the results were in the following table.

Table (2 ). The Result of T-Test

(The Effects of amount on Flexural Strength)

| | t | df | Sig. | Mean Difference | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| E-glass 1 strip | 9.945 | 3 | .001 | 75.83500 | 51.5682 | 100.1018 |
| E-glass 2 strip | 119.378 | 3 | | 118.98425 | 115.8123 | 122.1562 |

The result of t. test shows there were significant differences according to amount because the value of P = .001, $p<0.05$.

**B. Discussion**

Based on the results of research in table 2, there was increase of flexural

Strength of the E-glass fiber 2- strips groups compared to the E-glass fiber 1-strip groups.

The results of this study indicate that the amount of fiber give Significant different on flexural strength. The flexural strength of 2-strips was higher than 1-strip. Thus, there is factors influence the strength of fiber-reinforced denture bass materials, i.e. the fiber volume fraction. From the data of this research, it can be calculated from the fiber volume fraction

a) 1 strip E-glass fiber, 35%.

b) 2 strips E-glass fiber, 70%.

c) 1 strip S-glass fiber, 37.5%.

d) 2 strip S-glass fiber, 75%.

By this detection, We can note that the E-glass fiber 1 strip and S-glass fiber 1 strip have volume fraction <65%, and E-glass fiber 2 strips and S-glass 2 strips have volume fraction>65%.It was declared by Callaghan et al (2006) the fiber volume fraction more than 65% have more strong in the structure of FPD significantly. From this rule it can be said that 2 strips fibers have significant different in flexural strength to 1 strip fiber. This event is conforming by past study in the tensile strength by Vakiparta et al (2004), studied the flexural strength of E-glass fiber with different amount of one and two bundles of fiber, and realization that the E-glass fiber two bundles gave the highest flexural strength than the E-glass one bundle.

(Anusavice, 2009) inclusive the flexural strength. therefore, it is sensible if the E-glass Fiber 2 stripe give higher flexural strength than the E-glass fiber 1 stripe. Ellakwa et al. (2004) that Showed different amount of fiber get better the flexural strength of dental composite confirming the

results of this study. In addition, the results for other studies were similar to the current study reported Loewenstein (1996), Powell et al. (1994) and Ramos et al. (1995). furthermore, in harmony with the present study that reported by Narva et al (2004), the flexural strength of the denture base reinforced with E- glass 1 stripe was higher than that of the denture base reinforced with E glass 2stripe.

Based on the Li et al. (2003) study, when study the difference betuen the dental bridge with no fiber and one, and two bundle fibers reinforced, the results showed the dental bridge with two bundles have the highest flexural strength Compared with the one bundle and non-fiber. In the evaluation by Prejmerean et al (2007), It can be observation that the flexural strength of FRC which contained two bundles of fibers was about 1.5 up to 2 times higher than that of FRC with the same resin matrix and one bundle fibers. In the evaluation by Vakiparta et al (2004), He tested the effect of different quantities of one bundle and two bundles of fibers on the strength of the bending strength of electronic glass fibres. It was found that the glass fibers with two bundles gave more resistance to bending strength than one bundle.

## A. Conclusion

According to the results of the research conducted, it can be concluded that there is an effect of the amount of fibers on the bending strength. Two fiber tapes are stronger than one tape.

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