

## Evaluation the Physical Properties between Flexible, Cold –Cured and Hard Heat-Cured Acrylic Resin (In-Vitro Study)

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**Abstract: Objective:** This study aimed to compare flexible resin system, hard heat-cured acrylic resin and cold acrylic. **Materials and Methods:** This is a comparative study. In which a comparison between the flexible resin system, hard heat-cured acrylic resin and cold acrylic. Tensile strength and transverse strength tests were performed on 100 specimens from each material using computerized testing system. The collected data were analyzed by Statistical Package for Social Sciences (SPSS, version 20). **Results:** The results revealed statistically significant differences in ultimate tensile strength, yield strength, percentage elongation, and modulus of elasticity between the tested specimens. **Conclusion:** It could be concluded that the flexible acrylic resin showed higher value than the other hard acrylic resin and cold acrylic resin.

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**Keywords:** Flexible resin system; hard heat-cured acrylic resin; cold acrylic; elasticity.

### 1. Introduction:

Toothloss, which may be due to several factors including direct trauma, dental problems. Replacement of the missed teeth is very important in order to return the weakness and recover function to optimum level (1).

Decades ago, polymethyl methacrylate has been used for the dentures fabrication. The use of acrylic dentures prostheses has advantages and disadvantages. The disadvantages with these prostheses include difficult to address, brittleness of methyl methacrylate and allergy to methyl methacrylate monomer(2,3).

A flexite denture is one of the partial dentures which comprised of elastic nylon resin, more flexible than plastic. Because it is fixed to the gum, no clasp is needed and more comfortable to wear by the patient used in complete and partial denture constructed by flexite. Polymethyl methacrylate has been used in dentistry for several years ago in the form of temporary crowns and thermal polymerized (4,5).

Flexible dentures are good alternative to conventional dentures, which not only provide good aesthetics and security but also adjust to the persistent movement and elasticity in partially edentulous patients (6,7). The clasps were elastic, did not need periodic modification to keep them fitted. The two materials have similar ratings of Polyamides (nylon plastics). Since their foundation, there has been a constant interest in thermoplastic dental materials (8,9). The flexible framework removable partial dentures (RPD) can switch any number of

teeth, same as the RPD with cast metal. There is, however, one type of removable tooth additional method that can (legally) be fabricated only out of the flexible framework diversity of material (3,4,10).

There are numerous types of RPD's, most of them use as typical denture teeth as replacements for the absent natural teeth. The variation between them is the materials used to backing the denture teeth (10). Flexite plastics are harmless, nonhazardous, comfortable, physically sluggish, and meets the leakage requirements for colors. Flexite plastics are esthetically higher to other plastics. A flexible denture is not a reason for sore spots due to adverse reaction to acrylic resins. Flexible dentures may be used as substitute management plan in restoring the abnormalities such as ectodermal dysplasia (3,6,7,11,12). Thus, this study aimed to compare flexible resin system, hard heat-cured acrylic resin and cold acrylic.

### 2. Materials and methods:

This is an experimental, parallel design study. Eighteen cases that were not happy with their original acrylic dentures were randomly selected. They were provided three types of flexible dentures then they were evaluated using questionnaire and precisely the advantages of new material were evaluated.

#### 1). Tensile strength test:

In this study the Specimens were prepared from the three types of material flexible, cold-cured and

hard heat-cured acrylic resin. Specimens were prepared according to the American Association (ADA) specification No. 12 for denture acrylic resin.<sup>12</sup> The tensile test specimens were dumbbell-shaped and consisted of a central bar of 18mm length and 3mm diameter which blends gradually into two larger ends with 6mm diameter for the machine grip. Specimens were divided into 3 groups (100 specimens each) as follows:

Group 1: flexible acrylic resin

Group 2: hard acrylic resin.

Group 3: cold acrylic resin.

## 2). Flexible acrylic resin:

The waxed up dumbbell shaped pattern was invested in the dental flask and wax was eliminated by boiling while the processing was carried out by using the thermoplastic injection system. The thermo injection was performed by inserting the cartilage that contains the selected shade into the NEW PRESS that was pre-heated to 220°C. After 20 minutes, when the flexible acrylic resin had cooled, deflasking was completed and specimens were finished and polished.

## Hard acrylic resin:

The waxed up dumbbell shaped pattern was fabricated. The wax elimination by boiling followed by backing the acrylic resin, curing, deflasking was completed and specimens were finished and polished.

## 3-Cold acrylic resin:

Mixed the powder and liquid according to manufacture flasking was completed and specimens were finished and polished.

## Dimensions examination:

All finished specimens were examined by the digital caliper.

## Tension test and measuring procedures:

Tensile strength of the test specimens was determined by using the computerized material testing system model LXL plus.

## The transverse strength test:

According to the ANSI/ADA specification NO.12 for denture base resin material, specimens with modification of their thickness. Specimens

consisted of bars of 62mm length, 10mm width and 1mm thickness. Specimens were divided into 3 groups, 100 samples each.

Group 1 was made of flexible acrylic resin.

Group 2 was made of hard acrylic resin.

Group 3: cold acrylic resin.

## Vicker's hardness test:

For determination of the micro-hardness, 100 specimens of the tested flexible acrylic resin and hard acrylic resin were prepared and subjected to transverse strength testing. To diminish the danger of misunderstanding, due to work rigidity. Vicker's micro-hardness test was accomplished by means of a 50mg load and 30 second loading time. Readings were spaced at 50µm from 40 to 600µm depth.

## 3. Results:

Mean values of ultimate strength of the hard acrylic, cold acrylic and flexible acrylic resin samples, statistically significant difference was recorded. The mean value of the ultimate tensile strength of hard acrylic resin and cold acrylic was inferior to that of flexible acrylic resin.

Mean values of the percentage elongation between the hard acrylic, cold acrylic and flexible acrylic resin samples, there was statistically significant difference. The mean value of the percentage elongation of flexible acrylic resin and cold acrylic resin, acrylic, cold acrylic resin and flexible acrylic resin samples, statistically significant difference was recorded. The mean value of flexible acrylic resin was higher than that of hard acrylic resin and cold acrylic resin the hard acrylic cold acrylic resin, and flexible acrylic resin samples, there was statistically significant difference. The mean value of the modulus of elasticity.

This study was approved by the Dental Health Department at Faculty of Applied Medical Sciences, Albaha University. The participants provided consents before enrollment in the study. The participants ensured the right to withdraw at any time during the study.

The data were then analyzed by computerized methods; (Statistical Package for Social Sciences) (SPSS version 20). P values less than 0.05 were considered significant with level of confidence 95%.

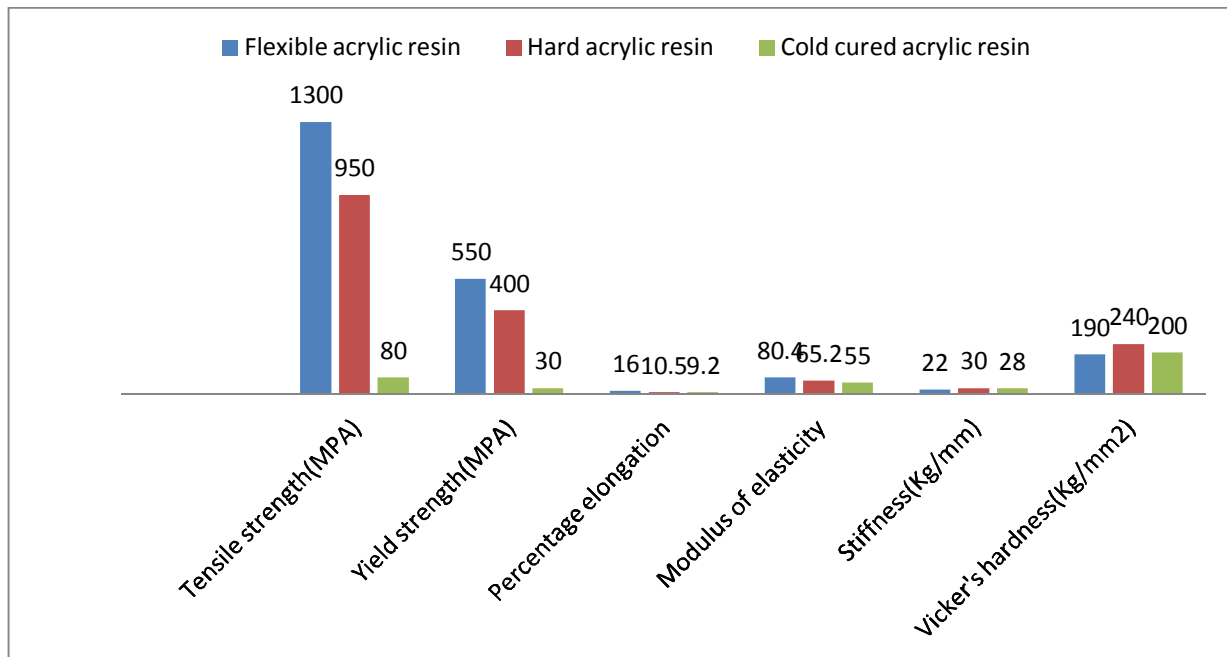
**Table (1): Means, standard Deviation and Duncan’s multiple range tests of flexible and hard acrylic resin.**

	Flexible acrylic resin			Hard acrylic resin			Cold cured acrylic resin		
	Mean	SD	dt	Mean	SD	dt	Mean	SD	dt
Tensile strength(MPA)	1300	9.7	A	950*	7.300	B	80.0*	8.0	C
Yield strength(MPA)	550	5.002	A	400*	4.500	C	30.0*	4.0	B
Percentage elongation	16	1.500	A	10.5*	0.8	B	9.2*	0.7	C
Modulus of elasticity	80.40	2.000	A	65.20*	1.400	B	55.0*	1.10	B
Stiffness(Kg/mm)	22	5.400	A	30.00*	8.400	C	28.0*	8.02	C
Vicker's hardness(Kg/mm <sup>2</sup> )	190	4.008	A	240*	7.05	C	200*	6.0	B

(\*) significant

S.D= standarddeviation. d.t= Duncan's Multiple Range Test.

Means with the same letter are not significantly different at p<0.05



**Figure (1): Means, standard Deviation and Duncan’s multiple range tests of flexible and hard acrylic resin.**

**4. Discussion**

The fabrication of complete / partial dentures so far has been PMMA. This method is not perfect in all procedures and it is better to do an arrangement of virtues rather than one single desirable usage. In spite of several improvements and studies in dental materials, training, and practices across the world, it is so difficult to avoid the problems(2). Patients, who begin wearing dentures at the first age due to many reasons, often, get upset and start searching somewhat better. Although, cast partial denture has been a feasible substitute, the requirement of high talents in preparation (1, 3).

The elasticity of flexible acrylic resin was higher than that of other two types hard acrylic resin and cold acrylic resin. Flexible acrylic resin is the best material that could be used to replace the conventional hard acrylic resin because of its good aesthetic, physic-mechanical, and bio-compatibility properties, and flexible resin system” for their Success denture press.

Acrylic resin is also known by its strength, fights breaking, and high elasticity such most thermoplastic resins. However, the use of acrylic is not common as well as the acetal during occlusal forces (3, 4, 6,8). The Flexite Company established and patented the first pre-shaped tooth-color clasps

identified as Clasp-Eze. This is currently traded global. These materials compromise outstanding esthetics combined with satisfactory physical assets and easy processing features. Its use extended more than the other ones. The material is monomer-free, almost strong, not heavy and waterproof. In order to reduce the show of metal labial clasps, the Flexite Plus is mixed with a metal framework (4,10,11).

#### Conclusion:

It could be concluded that the modulus of elasticity of flexible acrylic resin was higher than that of hard acrylic resin and cold acrylic resin.

#### References:

- Zarb GA, Bolender CL, Carlsson GE. 11th ed. St Louis: Mosby; 1997. Boucher's Prosthodontic Treatment for Edentulous Patients; pp. 337-42.
- American Dental Association Specification No.12 dental base resin material 1999.
- Jagger DC, Harrison A, Jandt KD. The Reinforcement of Dentures. *J Oral Rehabil.* 1999;26:185-94.
- Donovan TE, Cho GC. Esthetic considerations with removable partial dentures. *J Calif Dent Assoc* 2003;31(7):551-7.
- Negruțiu M, Sinescu C, Sandu Liliana, et al.(2004) Guidelines of removable partial dentures, Ed. Marineasa, Timișoara.
- Nishigawa G, Matsunaga T, Maruo Y, Okamoto M, Natsuaki N, Minagi S.(2003) Finite Element Analysis of the Effect of the Bucco-Lingual Position of Artificial Posterior Teeth under Occlusal Force on the Denture Supporting Bone of the Edentulous Patients. *J Oral Rehab*;30:646-52.
- Yunus N, Rashid AA, Azmi LL, Abu Hassan MI.(2005) Some Flexural Properties of a Nylon Denture Base Polymer. *J Oral Rehabil.*;32:65-71.
- Lowe LG.(2004) Flexible denture flanges for patients exhibiting undercut tuberosities and reduced width of the buccal vestibule: a clinical report. *J Prosthet Dent* 2004; 92(2):128-31.
- Phoenix RD, Mansueto MA, Ackerman NA, et al.(2004) Evaluation of mechanical and thermal properties of commonly used denture base resins. *J Prosthodont* 2004;13(1):17-27.
- Beaumont AJ Jr.(2002) An overview of esthetics with removable partial dentures. *Quintessence Int* 2002;33(10):747-55.
- Negruțiu M, Bratu D, Romînu M, et al.(2001) Polimeri utilizați în tehnologia protezelor mobile și mobilizabile. *Revista Națională de Stomatologie* 2001; IV(1):30-41.
- Dhiman RK Col, Roy Chowdhury SK.(2009) Midline Fracture in Single Complete Acrylic vs Flexible Dentures. *MJAFI.* 2009;65:141-5. 7/8/2012.

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