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RESEARCH ARTICLE

STRENGTH OF DENTURE BASE RESINS REPAIRED USING DIFFERENT DESIGN OF REPAIR AND REPAIR MATERIAL AN IN-VITRO STUDY

Dr. Ulfat Majeed and Dr. Beenish Javed

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Abstract

Purpose: The aim of the present study was to evaluate and compare the flexural strength of self-cure and visible light cure denture base resin as repair material using different design of repair.

Material and Method: Forty samples of dimensions 65 x 10 x 2.5 mm were made of heat cure acrylic resin and the prepared intact specimens were divided into two equal parts, i.e. 31mm each. Samples in pairs were placed in the mould of dimension 65 x 10 x 2.5 mm with 45° bevel and butt joint design and a gap of 3 mm was created in middle of mould for adhering with self cure and visible light cure repair material. Testing was done for flexural strength on Universal testing machine.

Result: Significant differences were found among the groups in terms of repair resin type ($P < 0.001$). Flexural strength of samples with bevel design and repaired with self cure resin was higher than those repaired with visible light cure resin.

Conclusion: The repair design and procedure with self cure acrylic resin exhibited significantly higher flexural strength than that of visible light-cure resins.

Introduction:-

Denture fracture is most commonly encountered in dental practice despite of being various improvements done to prevent it.[1] There are various causes of fracture like low resistance to impact, flexure or fatigue etc. These fractures are often related to inherent stress on the denture base that happens over time.[2] Therefore, denture repair seems to be an alternative choice because making a new denture may be impractical as it requires proper scheduling as well as financial planning.[3]

The repair of fractured prosthesis can be accomplished using acrylic resins that include heat polymerized , auto polymerized, light polymerized, or microwave polymerized acrylic resins.[4] . Autopolymerising acrylic denture base resin and visible light cure denture base resins both are convenient to use, fast polymerization, no warpage as they dont require heat application, but due to some biocompatible issues of autopolymerising acrylic resin like residual monomer leeching, irritation to tissues its use is debatable. Khan, Razavi & von Fraunhofer[5] (1988) and Ishigami et al.[6] (1993) demonstrated that both visible light-cured and heat-cured resin have comparable values for transverse strength but was contradicted by (Anderopolous)[2]. Unfortunately the repaired denture can refracture owing to weaker bond between heat polymerized and repair material. One of the principal factors which can vary the strength of repaired joint is its design[7]. Accordingly the present study has been designed to evaluate the strength and efficiency of visible light cure denture base resin as a repair material.

Corresponding Author:- Dr. Ulfat Majeed

Methodology:-

Fabrication Of Samples:

In this present study for the fabrication of samples of desired shape and size a rectangular shaped prefabricated glass die with dimension of 65 x 10 x 2.5 mm was used, From this prefabricated glass die putty index was made to form the mould. Mould was filled with modelling wax to form pattern of desired dimension, then the wax patterns were invested using Type III gypsum product in Hanau flask, followed by dewaxing and acrylization. Acrylized samples were finished and polished. The finished intact specimens were divided into two equal parts, i.e. 31mm each with a bevel of 45° and butt design. Samples in pairs were placed in the mould of dimension 65 x 10 x 2.5 mm with gap of 3 mm in middle of mould for adhering with the repair material. Each fractured sample was given joint design according to their respective groups i.e. Group A (Bevel joint design followed by repair with autopolymerising resin), Group B (Bevel joint design followed by application of bonding agent and repair with VLC), Group C (Butt joint design followed by repair with autopolymerising resin), Group D (Butt joint design followed by application of bonding agent and repair with VLC), After repair with self cure the samples were kept in the pressure pot under pressure of two bars at 37 degree for 15 min and samples repaired with visible light cure denture base resin were placed in light curing unit for 10 minutes. Before testing, the specimens were stored in water at room temperature for 1 day. Repaired samples were tested for flexural strength on Universal testing machine.

Results:-

The recorded data was compiled. Welch's t test was applied for inter group comparison of data. The mean flexural strength values and SDs of the groups are presented in Table 1and 2. Significant difference was found between the groups being tested with ($P<0.001$). In Group A, repair with autopolymerising denture base material with bevel joint design showed a higher (121.1MPa) and with visible light cure denture base material showed a lower (49.1MPa) flexural strength value.

Table 1:- Descriptive statistics of flexural strength among various groups.

	N	Mean	SD	Min	Max	Variance
GROUP A	10	121.14	17.14	83.56	143.32	293.86
GROUP B	10	49.07	4.78	40.89	55.82	22.80
GROUP C	10	117.79	13.10	90.11	135.25	171.50
GROUP D	10	37.51	3.62	31.22	43.11	13.10

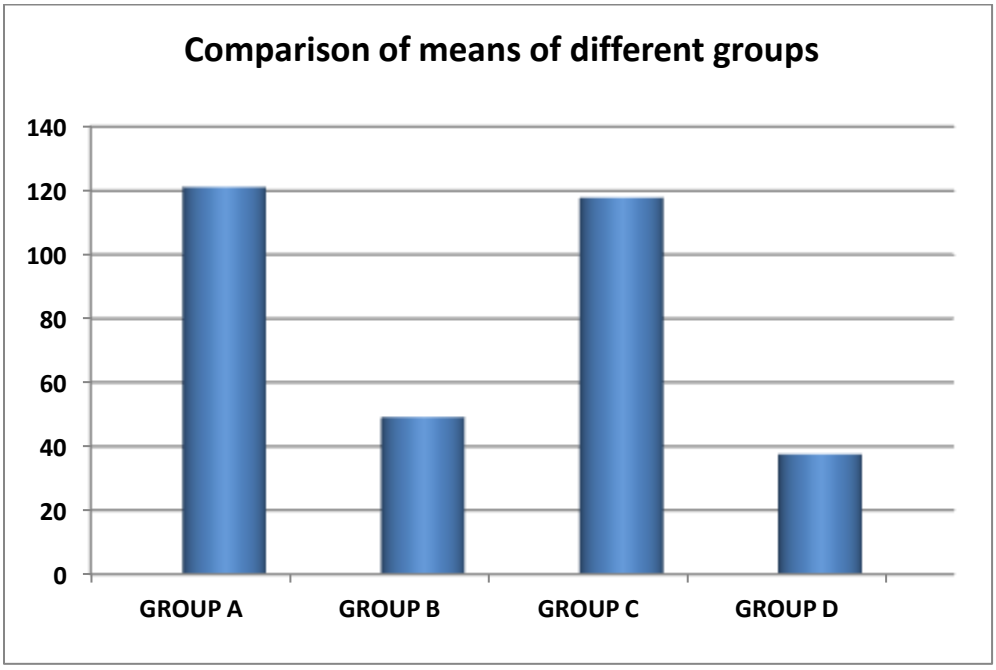

Fig. 1:- Mean flexural strength among various groups.

Table 2:- Welch's t test for intergroup comparison based on flexural strength among various groups.

GROUPS	T Statistic	Df	P-value	95% confidence interval	
				Lower bound	Upper bound
GROUP A vs GROUP B	12.80	10.38	<0.0001	59.59	84.54
GROUP A vs GROUP C	0.49	16.83	0.6295	-11.05	17.75
GROUP A vs GROUP D	15.09	9.80	<0.0001	71.25	96.01
GROUP B vs GROUP C	-15.58	11.35	<0.0001	-78.38	-59.05
GROUP B vs GROUP D	6.10	16.77	<0.0001	7.55	15.56
GROUP C vs GROUP D	18.68	10.36	<0.0001	70.75	89.80

Discussion:-

The present study evaluated the effect of repair design and repair resin type on heat polymerized denture base resin. The results of the present study rejected the null hypothesis that the repair design has no effect on the bond strength of repair material. In the present study flexural strength of visible light cure denture base resin to heat polymerized acrylic resin was significantly lower than autopolymerising acrylic resin to heat polymerized acrylic resin because of high viscosity and poor adhesion of visible light cure resin as repair material. This finding was supported by Andreopoulos et al.[2] and Dixon et al. [8]

In the present study, the repair joint design that was used was 45° bevel and butt joint design. The results showed that heat polymerized resin has the highest repair strength with 45° bevel joint design in both repaired groups with autopolymersing resin as well as visible light cure resin. The results are consistent with the results of Ward et al.[9] Harrison et al.[10] and Vojdhani et al.[4] who also concluded that the strength of repairs made with round and 45° bevel joint contour were similar and significantly greater than those with a butt joint design. Also it is easier to prepare and finish a beveled joint, moreover the advantage of using 45° bevel joint is that the geometry is easy to achieve clinically, also it increases the interfacial bond area and shifts the interfacial stress pattern more toward a shear stress and away from more damaging tensile stress, which in turn could be the reason for the improved values in flexural strength than butt, round and rabbet edge profile.[11]

Conclusion:-

Within the limitations of the study following conclusions can be drawn :

1. The specimens repaired with VLC resin showed significantly lower flexural strength than specimens repaired with autopolymerizing acrylic resin.
2. The flexural strength of repair material to denture base resin was higher with 45° bevel joint design than with butt joint design.

Clinical Implication:-

1. Based on the results of this study, Autopolymersing acrylic resin and visible light cure resin both can be used to repair acrylic resin denture base but autopolymersing acrylic resin provide stronger repair than visible light cure acrylic resin.
2. This study also suggests that to increase the strength of repair, joint design is an important factor to be considered during repair.

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