DOI: 10.7860/JCDR/2026/81234.23752

Original Article

Dentistry Section

Comparative Evaluation of Surface Treatment and Metal Mesh Reinforcement on Flexural Strength of Repaired Heat Polymerised Acrylic Resin Denture Base: An In-vitro Study

PRIYANKA RAJENDRA MASRAM[1], SUNIL RONAD[2], SUREKHA GODBOLE[3], GIRIJA ARUN DODAMANI[4], SURESH NAGARAL[5]

ABSTRACT

Introduction: Edentulism, or the loss of natural teeth, poses a significant public health burden. Complete dentures play a vital role in restoring the overall quality of life. Polymethyl Methacrylate (PMMA) is the preferred denture base material, but is prone to fracture under stress. Denture repair success depends on strong adhesion between the fractured parts, where surface treatment and reinforcement can enhance Flexural Strength (FS). Among various techniques, airborne-particle abrasion using Aluminium Oxide (Al_2O_3) and reinforcement with metal mesh are widely used to improve mechanical performance. Although both methods have been studied individually, comparative data under uniform experimental conditions remain limited.

Aim: To assess the effect of surface treatment and reinforcement using metal mesh on the FS of repaired heat polymerised acrylic resin denture base.

Materials and Methods: This in-vitro experimental study was conducted at the Department of Prosthodontics and Crown and Bridge, Annasaheb Chudaman Patil Memorial Medical College (ACPM) Dental College campus, Dhule, Maharashtra, India, from June 2022 to September 2022. A total of 48 samples were fabricated and divided into three groups, 16 specimens in each group, i.e., Group A, Group B, Group C with the dimensions 65×10×2.5 mm included in the present study. Group A samples were sectioned into two halves, repositioned in the flask and repaired using heat-cure acrylic resin without any surface treatments or reinforcement. The resin was polymerised using the short curing cycle, i.e., 74°C for two hours followed by 100°C for one hour, after which the specimens were bench-cooled and deflasked. Group B samples were treated with the airborne-particle abrasion process with 100 μmm Al_2O_3 for 10 seconds at a pressure of 0.2 MPa from a distance of 10 mm after fracture. Group C specimens were reinforced with metal mesh. The FS was analysed with a universal testing machine, a 3-point bend test. Comparison of surface roughness, comparison of FS among three groups was statistically significant, using one-way Analysis of Variance (ANOVA) test or Kruskal-Wallis test with p-value $p \leq 0.05$, followed by a post-hoc test for pairwise comparison.

Results: Among all the groups, surface treatment (group B) had the highest value, i.e., 73.73 and standard deviation, followed by reinforcement by metal mesh (group C), which is 61.14 and the control group (group A) is 55.13, respectively. Differences among all groups were statistically significant ($p \leq 0.05$).

Conclusion: Surface treatment with Al_2O_3 significantly improved the FS of repaired heat polymerised PMMA denture resin. Although metal mesh reinforcement demonstrated a numerical increase in FS, the difference was not statistically significant.

Keywords: Aluminium oxide, Denture repair, Polymethyl methacrylate

INTRODUCTION

Edentulism is the condition of edentulousness, or being devoid of natural teeth. The practice of primary care is evidently affected by edentulism and is considered to be a great public health burden [1]. Complete dentures are essential for edentulous patients, offering functional restoration for mastication and speech, as well as enhancing aesthetics and overall quality of life, which makes them a fundamental component of dental prosthetics [2].

The early 20th century marked the beginning of modern denture material and techniques, and since then, continuous improvements have been driven by innovations in clinical biomaterials and biological research. These advancements have aimed to enhance the fit, function, and longevity of complete dentures, making them more comfortable and effective for patients [2,3].

Since the 1930s, PMMA has been the material most frequently used for constructing denture bases. PMMA is favoured because of various desirable properties like satisfactory appearance, dimensional stability, and ease of processing [4]. Despite these advantages, PMMA has some drawbacks. During use, denture bases are subjected to various stresses such as compressive, tensile, and shear forces, which can lead to fractures. To withstand these stresses, denture bases must have good mechanical properties, with FS being particularly important [5]. Denture fractures are a common complication post-insertion, resulting from factors like flexural fatigue and impact. Continual flexing leads to flexural fatigue, which ultimately can deteriorate the material, leading to failure under normal loads. Mechanical causes of fracture include faulty design, fabrication errors, and poor material choices [5].

Repairing fractured dentures involves joining the broken parts with a repair material, where successful adhesion is the key. Proper surface preparation, which ensures a strong bonding interface, is crucial for improving repair strength and reducing stress concentration [6]. Denture repair process comprises of heat-polymerised, autopolymerising, and light-polymerised acrylic resins. In which their high polymerisation temperature increases the mechanical and chemical properties of these resins [7].

A variety of mechanical and chemical surface treatments are in use to extend the bond strength between the base and repair materials. These treatments encompass bur grinding, airborne-particle abrasion with 25 μm Al_2O_3 particles, carbon dioxide laser application, immersion in methyl methacrylate, and treatments with crude solvents like chloroform, acetone, and methylene chloride [8].

Reinforcing PMMA with metal oxides results in enhanced physical and mechanical properties and also augments patients' sensation of hot and cold stimuli, resulting in better food sensation and healthier oral mucosa. Using Al_2O_3 particles with a size of 25 μm in sandblasting is a common practice in dentistry [9] and other industries where surface preparation and enhancement of material properties are important [5]. Using Al_2O_3 to augment flexural potency in denture base materials is relevant for improving the longevity and durability of dental prostheses. It may also contribute to reducing the incidences of fractures or failures, particularly in patients prone to dropping their dentures or experiencing significant biting forces [5].

Among the various reinforcement methods, metal mesh reinforcement is economical and it takes less time. It extensively increases denture strength and decreases the chances of failure. Metal mesh offers ease of maintenance, good acid and alkali resistance, corrosion resistance, high tensile strength, toughness, wear resistance, and durability. It also processes well at common temperatures and allows for diversification in use, particularly with stainless steel mesh [10]. Proper application and handling are essential to achieve the best results [11]. Metal mesh-reinforced dentures are particularly beneficial for patients with strong bite forces or when replacing multiple missing teeth in a single arch. Beyond enhancing FS, metal mesh-reinforced dentures also offer advantages in terms of stability, comfort, and reduced risk of fractures compared to traditional acrylic-only dentures [11,12].

Although various studies have examined individual methods to improve the FS of denture base resins, comparative analysis of airborne-particle abrasion with Al_2O_3 and metal mesh reinforcement under standardised conditions remains limited [8,11,12].

This in-vitro study uniquely compares these two strengthening approaches on repaired heat-polymerised acrylic resin denture bases, offering clinically relevant evidence to enhance denture repair performance. Hence, the study aimed to compare the effect of airborne-particle abrasion with Al_2O_3 and metal mesh reinforcement on the FS of repaired heat polymerised acrylic resin denture bases.

Null hypothesis: The null hypothesis of the study is that there is no significant difference in the FS of repaired heat polymerised acrylic resin denture base specimens subjected to surface treatment and those reinforced with metal mesh.

Alternative hypothesis: The alternative hypothesis of the study is that there is a significant difference in the FS of repaired heat polymerised acrylic resin denture base specimens subjected to surface treatment and those reinforced with metal mesh.

MATERIALS AND METHODS

This in-vitro experimental study was conducted at the Department of Prosthodontics and Crown and Bridge, (ACPM) Dental College campus, Dhule, Maharashtra, India, from June 2022 to September 2022. Ethical approval from the Institutional Ethics Committee was taken before initiating the study (Ref.No. 2242/JMF'Sacpmdc/IEC/2022).

Sample size calculation: This calculator has used the following formula to compute the sample size [13], sample size was estimated by using the data obtained from a previous study conducted by Alkurt M et al., [14]. Sample size has been estimated based on a statistical model called the ANOVA model. In general, for k study groups, the total number of possible pairwise comparisons is represented as K = k(k–1)/2. For these pairwise comparisons, the hypotheses were formulated as follows:

H_0: μA = μB

H_1: μA ≠ μB

where μA and μB represent the mean values of groups A and B, respectively. The required sample size was calculated for each pairwise comparison, and the largest estimated value was considered as the final sample size for the study. In the formula, N denotes the sample size required for an individual comparison, with n/2 samples allocated to each study group.

This calculator uses the following formulas to compute sample size:

$$N = \frac{2\sigma^2(Z1\text{-}\alpha/2\tau + Z1\text{-}\beta)^2}{(\mu A - \mu B)^2}$$

where,

κ =nA/nB is the matching ratio=1

σ is standard deviation = 18.07

μA is mean of Group A=53

μB is mean of Group B=36 [14]

α is Type I error = 0.05

τ is the number of comparisons to be made =3

β is Type II error = 0.10 i.e., 1-β is power = 90%

Substituting these values in the above-mentioned formula, the sample size estimated was n = 31, i.e., n/2 =15.5 ≈ 16 samples per group are required.

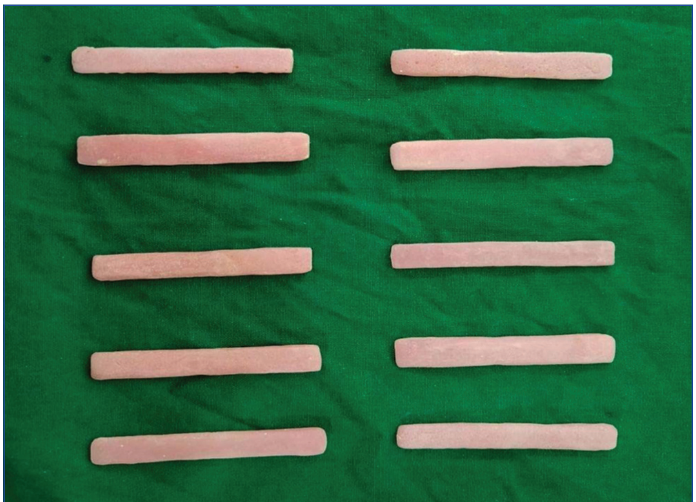
Inclusion criteria: Specimens should be of dimensions 65×10×2.5 mm, with and without surface irregularities, and specimens were included.

Exclusion criteria: Specimens having surface irregularities, roughness and specimens with voids and defects were excluded.

Study Procedure

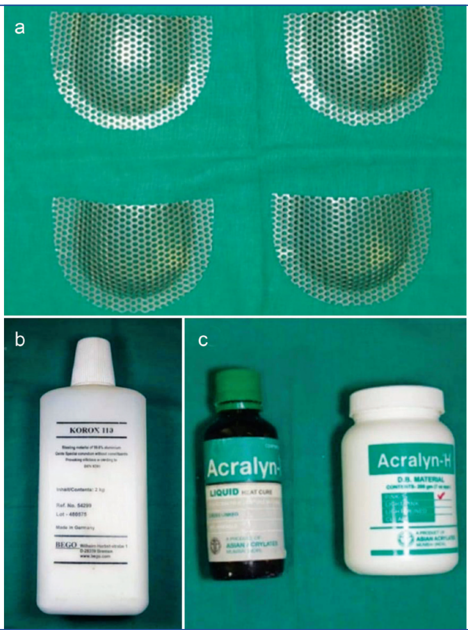
The present study was done to assess the effect of surface treatment and reinforcement using metal mesh on the FS of repaired heat polymerised acrylic resin denture base.

Customised samples of heat cured acrylic denture base material were fabricated using a stainless-steel mould with dimensions of 65×10×2.5 mm as per the American Dental Association (ADA) Specification No.12 for denture base resins [Table/Fig-1] [11].



[Table/Fig-1]: Customised samples of heat cured acrylic denture base material were fabricated using stainless steel mould with dimensions of 65×10×2.5 mm as per the ADA Specification No.12 for denture base resins.

Materials employed in the study are presented in [Table/Fig-2]:



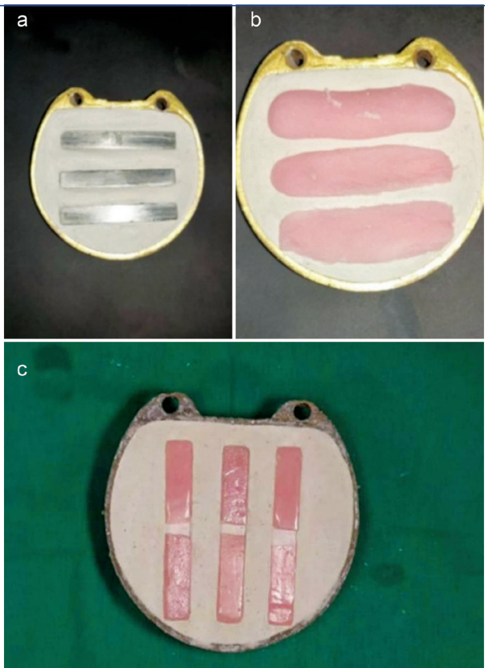
[Table/Fig-2]: Material used in the study.

Preparation of specimen: Sixteen samples were prepared by the compression moulding technique for measuring the FS of repaired heat polymerised acrylic resin denture base.

A stainless-steel mould of 65×10×2.5 mm dimensions was made up with medical-grade stainless steel rod (according to ADA No.12 for denture base resins).

A customised sample of heat cured acrylic denture base material was prepared with a stainless-steel mould of the above-mentioned dimension. Petroleum jelly was applied to the flask. Mixing of dental plaster was done in a rubber bowl as per the manufacturer's instructions. The mixed dental plaster was poured into the base of the flask and three stainless-steel moulds were placed on the surface of the dental plaster and allowed to set.

Once the plaster was set, application of cold mould seal counter flasking was done with a pour of dental plaster and clamped [Table/Fig-3]. After the dental plaster was completely set, the flask was removed, opened and the moulds were removed and cleaned with a brush. After flask cleaning, a cold mould seal was applied to both the flask and counter-flask dental plaster and left for drying.



[Table/Fig-3]: Flasking procedure.

A 3:1 by volume is the ratio in which PMMA (Acralyn-H) was mixed. The acrylic dough was packed in the mould space in slight excess once the heat cure resin reached its dough stage. The excess was taken out by trial packing with a damp cellophane film. The flask was opened and the cellophane sheet was removed. The acrylic resin material was checked for correct packing and after evaluation, the final closure of the flask was done.

The flasks were kept at room temperature for 30 to 60 minutes for bench curing following the final closure. The polymerisation of heat cure resin was done by a long curing cycle, i.e., 74°C for eight hours, followed by 100°C for one hour in an acrylising unit. Later, bench cooling was done, followed by deflasking of the cured acrylic samples.

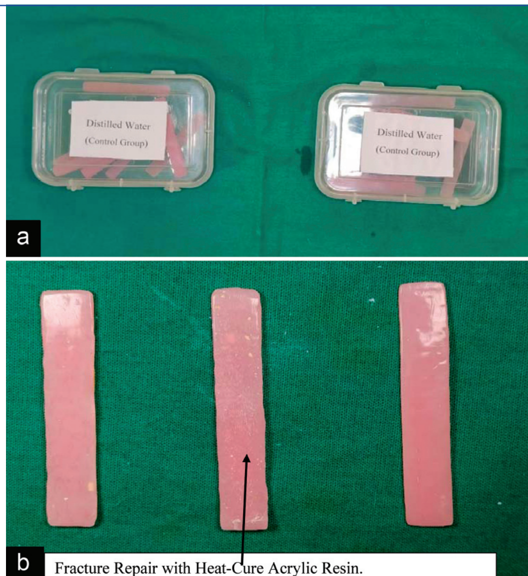
Samples were retrieved and checked for any surface irregularities, voids or any defects. Samples with voids and irregularities were discarded and the remaining cured samples were trimmed, finished with sandpaper and polished.

Uneven spots were smoothened by removing excess material with a sharp scalpel and fine scissors. Polishing was done by applying lustrol gloss varnish. Both lustrol base liquid and catalyst liquid were squeezed onto the mixing pad, homogenously mixed and applied. Samples were dried for five minutes at room temperature.

Number samples and grouping: For the study, 48 samples were fabricated and divided into three groups (n=16 per group).

- **Group A (Control group) -** Group without any surface treatments and reinforcement. Samples were sectioned into two halves, repositioned in the flask and repaired using heat cure acrylic resin without any surface treatments and reinforcement. The resin was polymerised using the short curing cycle i.e., 74°C for two hours, followed by 100°C for one hour, after which the specimens were bench-cooled and deflasked.
- **Group B -** Group treated surface treatment with airborne particle abrasion process with 100 μmm Al_2O_3 for 10 seconds at a pressure of 0.2 MPa from a distance of 10 mm after fracture.
- **Group C -** Group with reinforcement with metal mesh.

Control group specimens [Table/Fig-4]: Samples were separated evenly into two halves and placed back into the flask for packing. After dewaxing the two halves were attached by using heat cure acrylic resin without any surface treatment or reinforcement. The heat cure resin was polymerised by short curing cycle i.e., 74°C for two hours followed by 100°C for one hour in acrylising unit. Later bench cooling was done followed by deflasking of the cured acrylic samples.

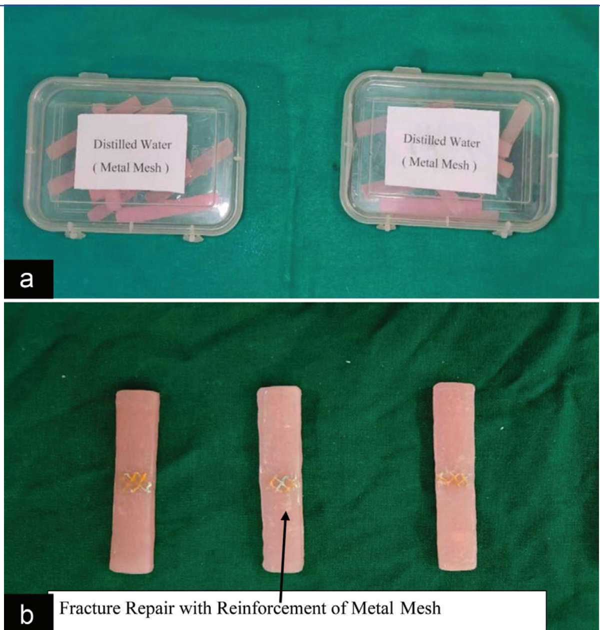


[Table/Fig-4]: Group A (Control Group): A) Group without any surface treatments and reinforcement; B) Fracture repair with heat cure acrylic resin.

Surface treatment procedure (Al_2O_3): The specimens were sectioned into two halves to create a repair gap and then repaired with heat-polymerised acrylic resin as mentioned above. The samples were surface treated by using sandblasting with airborne particle abrasion with 100 μmm Al_2O_3 for 10 seconds at a pressure of 0.2 MPa, from a distance of 10 mm, before repairing the gap [Table/Fig-5] [11].

[Table/Fig-5]: Group B: A) Surface treatment with airborne particle abrasion process with 100 μmm Al_2O_3 for 10 second at a pressure of 0.2 MPa from a distance of 10 mm after fracture; B) Fracture repair with surface treatment by Al_2O_3

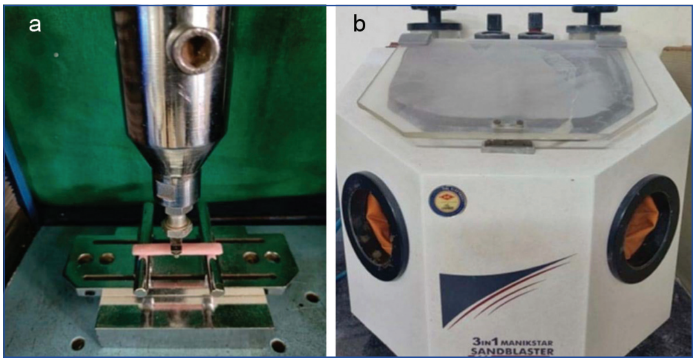
Reinforcement of metal mesh: The specimens were sectioned into two halves to create a repair gap and then repaired with heat polymerised acrylic resin, but after trial packing, the flask was reopened and metal mesh was placed in the gap and packing was done is shown in [Table/Fig-6].. The heat cure resin was polymerised by a short curing cycle i.e., 74°C for two hours, followed by 100°C for one hour in an acrylising unit. After polymerisation, the flask was bench cooled, followed by deflasking of the cured acrylic samples. All specimens were stored in distilled water at 370°C for one week before testing.



[Table/Fig-6]: Group C: a) Surface treatment with reinforcement with metal mesh; b) Fracture repair with reinforcement of metal mesh.

Checking Flexural Strength (FS) of different specimens: A Universal Testing Machine (UTM) was used to analyse the FS. A 3-point bend test was performed immediately after removing the specimens from the distilled water without drying the specimens. This test was performed on a UTM (Shimadzu AG-100kNIC). A custom made stainless-steel device with a 50 mm span distance between the 2 supports was used with a crosshead speed of 5 mm/min. A load was applied in the centre of the specimens. The specimens were loaded until the first sound of a crack was detected and the load (N) was recorded is depicted in [Table/Fig-7]. The following formula was used to record the FS of specimens:

$S=3WL/2\ bd^2$, where S is the FS (in megapascals), W is the fracture load (in newtons), L is the distance between the supports (50 mm), b is the specimen width (10 mm), and d is the specimen thickness (2.5 mm) [11].



[Table/Fig-7]: Checking Flexural Strength (FS) of different specimens by using Universal Testing Machine (UTM).

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software version 26.0 with a level of significance at 5%. Comparison of surface roughness, comparison of FS among three groups was executed using one-way ANOVA test or Kruskal-Wallis test, followed by post-hoc test for pairwise comparison.

RESULTS

Descriptive details of Flexural Strength (FS) are depicted in [Table/Fig-8].

Groups	N	Mean±SD	Minimum	Maximum
Group A (control group)	16	55.13±7.76	45.6	72.4
Group B (surface treated with Al_2O_3)	16	73.73±18.62	40.8	117.6
Group C (reinforced with metal mesh)	16	61.14±19.41	25.2	105

[Table/Fig-8]: Descriptive details of Flexural Strength (FS) of all groups (MPa).

Among all the groups, surface treatment treated with Al_2O_3 (group B) had the highest mean and standard deviation, followed by reinforcement by metal mesh (group C) and the control group (group A), respectively. This signifies that FS increases in specimens after repair.

Comparison of FS between and within groups is shown in [Table/Fig-9]. There was a comparison of the FS between three groups. Comparing groups with each other, it showed that there was a statistically significant difference in FS among the three groups ($p \leq 0.05$).

Variables	Sum of squares	df	Mean square	F	Sig.
Between groups	2882.23	2	1441.12	5.517	0.007*
Within groups	11755.4	45	261.231		
Total	14637.6	47			

[Table/Fig-9]: Comparison of Flexural Strength (FS) among the three groups.
One-way ANOVA test; * indicates a significant difference at p ≤0.05

Pairwise comparison of FS among groups is depicted in [Table/Fig-10].

Group pair	Mean difference	p-value
Group B vs group A	18.60	0.006*
Group C vs group A	6.01	0.549
Group C vs group B	-12.59	0.082

[Table/Fig-10]: Pairwise comparison of Flexural Strength (FS) among groups.
Post-hoc tukey test; *indicates a significant difference at p≤0.05

The FS of group B surface treatment treated with Al_2O_3 were seen to be high as compared to group A. A numerical increase in FS was observed in group C compared to group A; however, the difference was not statistically significant.

On comparison between group B and group C; the FS of specimens treated with airborne-particle abrasion using Al_2O_3 , (group B) was higher. However, the FS of group B were seen to be significantly greater than that of group A.

DISCUSSION

Complete dentures are typically fabricated for elderly patients. However, several younger individuals with congenitally malformed teeth or edentulous arches also call for complete dentures. Adequate ridge height is indispensable for denture retention, as it prevents horizontal and vertical movement of the prosthesis. However, with advancing age, residual ridge resorption occurs, and this process is influenced by various factors, including anatomical, mechanical, and metabolic factors, and is more common in females.

Denture base fabrication uses diverse polymeric materials. Though PMMA has been used abundantly, the physical and mechanical properties does not meet the requirements of an ideal denture base material. Since it is susceptible to fracture under cyclic loading and water absorption, which can negatively affect its mechanical properties [4].

Flexural fatigue and impact are two forces which results in fractures in dentures. Repeated flexing of the material results in flexural fatigue and is a form of fracture whereby microscopic cracks develop in areas of stress concentration. The cracks will fuse with sustained loading, which results in a growing fissure that insidiously weakens the material.

One desirable property for denture base materials is its high impact resistance, which helps prevent fractures if the patient accidentally drops their dentures. Among all resins; heat-polymerised resins are commonly used to repair fracture denture. The procedure for using heat cure acrylic resin is simple and may even be time-saving in simple repair situations such as re-bonding a de-bonded tooth [15]. Similarly, AlQahtani M and Haralur SB conducted a study where a fractured denture base was repaired with heat cure acrylic resin, cold cure resin and light cure resin. The PMMA specimens modified with heat cure acrylic resins show an appreciably elevated load to fracture compared to cold cure resin and light cure resin [16]. Additionally, Faot F et al., performed a study wherein denture base repaired with heat cure acrylic resin showed enhanced FS in contrast to self-cure resin and light cure resin [17].

In the present study, heat cure acrylic resin was also used for repairing a fractured denture base. The specimens repaired using heat cure acrylic resin showed maximum capacity of 73.73 MPa [Table/Fig-8]. But main disadvantage of using heat cure acrylic resin as a repair material is its poor adhesion to the fracture surface, as there is no mechanical interlocking, which results in fracture fatigue and causes fracture of the denture base at the same location. Ana M et al., stated the same conclusion in their study, wherein they used heat cure resin to repair dentures [5]. Similarly, Sarac YS et al., in their study, concluded that heat cure acrylic resin shows poor bonding when used to bond with fracture denture base material [18]. Several mechanical and chemical surface treatments have been used to improve the bond strength between the base and repair materials for repairing fractured dentures. The different processes involve bur grinding, airborne-particle abrasion with 25 μmm Al_2O_3 particles, carbon dioxide laser application, immersion in methyl methacrylate, and treatments with organic solvents such as chloroform, acetone, and methylene chloride (dichloromethane) [19].

As per ADA specifications no. 12, acrylic resin denture base surface should not have any bubbles or voids when seen with bare eyes. In the present study, no voids or bubbles were viewed. The mean FS values for group A and group B were 55.13 MPa and 73.73 MPa, respectively, which were statistically significant and it was observed that the FS of surface treated heat cure acrylic resin had been improved when compared with the control group.

The outcomes of the study were in agreement with research conducted by Barzegar A et al., which stated that the impact of incorporating alumina nano-particles on the FS of heat polymerised acrylic resin have shown promising results in enhancing mechanical properties [20]. Also, Chladek G et al., conducted the study where the results showed a higher efficacy of abrasive blasting in increasing the bending strength [19]. Similarly, a study conducted by Vojdani M et al., establish that the FS and hardness significantly augmented by reinforcing the heat cured acrylic resin with 2.5 wt% Al_2O_3 powder with no surface roughness [21]. In addition to this Jain V et al., concluded that Al_2O_3 alleged improved filler for the reinforcement of PMMA resin. Since it has the potential to improve FS, thermal diffusivity and decrease water adsorption [22].

The primary purpose of incorporating metal mesh is to reinforce the acrylic resin and prevent fractures. The study conducted by Jameson WS showed that the metal mesh is embedded within the acrylic resin of the denture base, usually in the palatal area of the maxillary denture or the lingual flange of the mandibular denture. This strategic placement helps to distribute stress more evenly across the denture [23].

In the present study, metal mesh had reinforced into the fractured heat cure acrylic resin which in turn was used to repair fracture denture base. After testing under the UTM machine and comparing with the control group, it was established that the FS of the metal mesh was 61.14 MPa and the control group was 55.13 MPa. The numerical increase in FS observed in group C compared to group A was not statistically significant. Similarly, a few more studies are in accordance with the results [24-26].

At the same time, there are a few disadvantages of using metal mesh. It doesn't look aesthetically appealing on the labial portion of the denture while smiling. It is susceptible to corrosion and has a weak bond to acrylic denture base. In some cases, the patient may be sensitive to metal contact. Some authors have proposed a practice of masking the colour of metal mesh using self-cure acrylic resin to evade the unaesthetic visibility of metal [22].

In the present study, the null hypothesis is rejected and within the limitations of this study, it was concluded that on comparing FS of repaired heat cure resin by surface treatment provided better FS than that of repaired heat cure resin reinforced with metal mesh.

No similar reports in the literature search coincide with the use of the same materials and testing protocol that might allow a direct comparison to this study. Though there were changes in the FS of repaired heat cure acrylic resin in the present study, the results were statistically significant.

Although this investigation was performed under controlled laboratory conditions, the outcomes carry clear clinical value. Denture fractures are frequently encountered, and the strength of the repaired site is critical for long-term success. The enhanced FS achieved through airborne-particle abrasion and metal mesh reinforcement indicates that these techniques can help produce stronger and more reliable denture repairs, potentially reducing repeat fractures and improving patient comfort and denture longevity.

Clinically, these reinforcement methods may be especially useful for patients with heavy masticatory forces, parafunctional habits, or a history of recurrent denture fractures. Therefore, the present in-vitro findings offer practical guidance for selecting effective approaches in denture repair.

Limitation(s)

The present study was conducted in an optimised laboratory environment; however, clinical conditions might vary and also the facets assosciated with insertion and handling possibly will have a credible effect on the mechanical properties of the materials and their appearance in-vivo.

CONCLUSION(S)

The present study showed that after surface treatment of heat cure acrylic resin with AL_2O_3 mechanical interlocking results, which in turn increase the bonding of heat cure resin to the fracture denture base and increase the FS of repaired heat cure acrylic resin. Metal mesh reinforcement demonstrated a numerical increase in FS compared to the control group; however, the difference was not statistically significant.

REFERENCES

[1] Al-Rafee MA. The epidemiology of edentulism and the associated factors: A literature Review. Journal of Family Medicine and Primary Care. 2020;9(4):1841-43.
[2] Kattimani PT, Shah T, Pareek V, Parmar P, Nigam H, Shah P. A comparative study of palatal shapes and flexural properties of edentulous maxillary conventional heat polymerized acrylic resin denture bases with glass fibre/metal mesh reinforced bases. J Dent Med Sci. 2019;18(1):51-70.
[3] Vaidya S, Suganna M, Kapoor C. Complete denture prosthodontics: An insight into past, present and future. Indian J Med Res. 2014;14(2):31-35.
[4] Zafar MS. Prosthodontic applications of Polymethyl Methacrylate (PMMA): An update. Polymers. 2020;12(10):2299.
[5] Diaz-Arnold AM, Vargas MA, Shaull KL, Laffoon JE, Qian F. Flexural and fatigue strengths of denture base resin. The Journal of Prosthetic Dentistry. 2008;100(1):47-51.
[6] Yadav NS, Khare S, Mishra SK, Vyas R, Mahajan H, Chitumalla R. In-vitro evaluation of transverse strength of repaired heat cured denture base resins without surface treatment and with chemical and mechanical surface treatment. J Int Oral Health. 2015;7(8):89-92. PMID: 26464547; PMCID: PMC4588798.
[7] Anusavice KJ. Mechanical properties of different types of denture base acrylic resins. In: Phillips RW, editor. Phillips' science of dental materials. 13th ed. St. Louis (MO): Elsevier; 2021.
[8] Akin H, Kirmali O, Tugut F, Coskun ME. Effects of different surface treatments on the bond strength of acrylic denture teeth to polymethylmethacrylate denture base material. Photomed Laser Surg. 2014;32(9):512-16.
[9] Kim HK, Ahn B. Effect of Al2O3 sandblasting particle size on the surface topography and residual compressive stresses of three different dental zirconia grades. Materials (Basel). 2021;14(3):610.
[10] Alkali-Resistant SS304/SS316 Stainless Steel Woven Mesh (SS304/SS316) [Internet]. [cited 2025 Nov 3]. Available from: https://www.steelwovenwiremesh.com/sale-18420351-alkali-resistant-stainless-steel-woven-mesh-ss304-ss316.html.
[11] Im SM, Huh YH, Cho LR, Park CJ. Comparison of the fracture resistances of glass fiber mesh- and metal mesh-reinforced maxillary complete denture under dynamic fatigue loading. J Adv Prosthodont. 2017;9(1):22-30.
[12] Agarwal P, Arunachalam S, Saha A, Agrawal G, Shrivastava RK, Pandey SK. Fabrication of metal mesh reinforced single maxillary denture. JPID. 2021;5(1):21-25.
[13] Chow S, Shao J, Wang H. Sample size calculations in clinical research. 2nd ed. Boca Raton (FL): Chapman & Hall/CRC Biostatistics Series; 2008. p. 71.
[14] Alkurt M, Yeşil Duymuş Z, Gundogdu M. Effect of repair resin type and surface treatment on the repair strength of heat-polymerized denture base resin. J Prosthet Dent. 2014;111(1):71-78.
[15] Pereira Rde P, Delfino CS, Butignon LE, Vaz MA, Arioli-Filho JN. Influence of surface treatments on the flexural strength of denture base repair. Gerodontology. 2012;29(2):e234-e238.
[16] AlQahtani M, Haralur SB. Influence of different repair acrylic resin and thermocycling on the flexural strength of denture base resin. Medicina. 2020;56(2):50.
[17] Faot F, Da Silva WJ, Da Rosa RS, Del Bel Cury AA, Garcia RC. Strength of denture base resins repaired with auto-and visible light-polymerized materials. Journal of Prosthodontics: Implant, Esthetic and Reconstructive Dentistry. 2009;18(6):496-502.
[18] Sarac YS, Sarac D, Kulunk T, Kulunk S. The effect of chemical surface treatments of different denture base resins on the shear bond strength of denture repair. The Journal of Prosthetic Dentistry. 2005;94(3):259-66.
[19] Chladek G, Adeeb S, Pakieła W, Coto NP. Effect of different surface treatments as methods of improving the mechanical properties after repairs of PMMA for dentures. Materials. 2024;17(13):3254.
[20] Barzegar A, Ghaffari T, Parizad A. Effect of incorporating aluminum oxide nanoparticles on thermal conduction and flexural strength of acrylic resins. Dental Research Journal. 2022;19(1):33.
[21] Vojdani M, Bagheri R, Khaledi AA. Effects of aluminum oxide addition on the flexural strength, surface hardness, and roughness of heat-polymerized acrylic resin. Journal of Dental Sciences. 2012;7(3):238-44.
[22] Jain V, Arora N, Chawla A, Mathur VP. Effect of Addition of Sapphire (Aluminium Oxide) or silver fillers on the flexural strength thermal diffusivity and water sorption of heat polymerized acrylic resins. International Journal of Prosthodontics and Restorative Dentistry. 2013;1(1):21-27.
[23] Jameson WS. Fabrication and use of a metal reinforcing frame in a fracture prone mandibular complete denture. J Prosthet Dent. 2000;83:476-79.
[24] Fonseca RB, Kasuya AV, Favarão IN, Naves LZ, Hoeppner MG. The influence of polymerization type and reinforcement method on flexural strength of acrylic resin. The Scientific World Journal. 2015;2015(1):919142.
[25] Ellakwa AE, Morsy MA, El-Sheikh AM. Effect of aluminum oxide addition on the flexural strength and thermal diffusivity of heat-polymerized acrylic resin. Journal of Prosthodontics. 2008;17(6):439-44.
[26] Ying-hui L, Gui-lan S. Flexural strength of denture bases repaired with metal wires. Journal of Clinical Rehabilitative Tissue Engineering Research. 2010;14(8).

PARTICULARS OF CONTRIBUTORS:
1. Senior Lecturer, Department of Prosthodontics Crown and Bridge, SPDC, Sawangi, Wardha, Maharashtra, India.
2. Professor, Department of Prosthodontics Crown and Bridge, ACPM, Dhule, Maharashtra, India.
3. Professor and Head, Department of Prosthodontics Crown and Bridge, SPDC, Sawangi, Wardha, Maharashtra, India.
4. Professor and Head, Department of Prosthodontics Crown and Bridge, ACPM Dental College, Dhule, Maharashtra, India.
5. Professor and Head, Department of Prosthodontics Crown and Bridge, Dayanand Sagar College of Dental Sciences, Bangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Priyanka Rajendra Masram,
Nagar Parishad Layout, Near Mehar Centre, Ward No. 7, Deoli-442101, Wardha, Maharashtra, India.
E-mail: priyankamasram.prostho@dmiher.edu.in

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jul 09, 2025
- Manual Googling: Apr 11, 2026
- iThenticate Software: Apr 14, 2026 (6%)

ETYMOLOGY: Author Origin

EMENDATIONS: 8

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 18, 2025**
Date of Peer Review: **Oct 11, 2025**
Date of Acceptance: **Apr 16, 2026**
Date of Publishing: **Jul 01, 2026**