The conventional denture base resins had many drawbacks. Hence, the objective of this study was to compare the effect of incorporation of silver nanoparticles on mechanical properties of light-cured resin material. **Materials and Methods:** Specimens of acrylic resin (control group) and acrylic resin reinforced with 2% silver nanoparticles (test group) were evaluated for mechanical properties such as impact strength, transverse strength, modulus of elasticity, and deflection. Unpaired t test was used for statistical analysis. **Results:** Mechanical properties of light cure reinforced with silver nanoparticles were significantly higher than conventional light-cured resin (P < 0.05). **Conclusion:** The incorporation of silver nanoparticles into light-cured resin increases the mechanical properties making it more stronger material.

**KEYWORDS:** Light cure resin, resin trays, silver nanoparticles, transverse strength

**INTRODUCTION**

Denture base uses polymethyl methacrylate (PMMA) as the most common material because of its characteristics such as accurate fit, stability, esthetics, simplicity in repair, and inexpensive.[1-3] But fracture resistance needs to be improved in PMMA.[4,5] Low rigidity and poor strength are the main drawbacks of this material, leading to early fracture.[6-8]

Many different techniques were tried to improve various properties of PMMA such as strength and stiffness, stability, abrasion resistance, radiopacity by either self-reinforcement, chemical modification or reinforcement by carbon fibers, glass fibers, and the ultra-high modulus polyethylene.[9-15]

To meet the present and future technological demand, polymer composite materials reinforced with nanoparticles provide mechanical properties of polymers, and electrical and magnetic properties of nanoparticles.[16-19] To increase capacitance density of a material, thinner dielectric films are needed and this is achieved by incorporating nanosized metals.[20,21]

This study was conducted to compare the mechanical properties of 2% silver nanoparticles incorporated light cure resin with acrylic resin.

**MATERIALS AND METHODS**

According to American Dental Association (1975) description and British Standard Institute Specifications,[23] the specimens of light cure resin (control group) and light cure resin reinforced with 2% silver nanoparticles (test group) were prepared. These specimens were processed according to the manufacturer's instructions for each group.

**Impact strength test**

Specimens of 10 mm width and thickness, and 75 mm length were prepared with a standard groove of 2 mm depth at mid by using split brass mold.
The specimen was tested by Charpy’s impact testing machine and the value for impact strength by joules was directly recorded.

Transverse strength, modulus of elasticity, and deflection tests are given as follows:

Specimens of 2.5 mm thickness, 10 mm width, and 65 mm length were prepared for testing the transverse strength, deflection, and modulus of elasticity by Instron testing machine.

Transverse strength was calculated by the following formula: $S = \frac{3FL}{2BD^2}$ KGF/mm² (where $F$ is maximum load, $L$ is space between support [50 mm], $B$ is width of the specimen [10 mm], and $D$ is thickness of the specimen).

The specimens were stored in distilled water for 2–3 days at room temperature before testing to check modulus of elasticity and deflection.

**RESULTS**

Table 1 shows the mean values of light-cured acrylic resin and light-cured acrylic resin reinforced with nano-silver for impact strength, transverse strength, modulus of elasticity, and deflection.

All the mechanical properties of light cure reinforced with nano-silver were significantly more than conventional light-cured acrylic resin.

**DISCUSSION**

In prosthodontics, heat-cured acrylic resin is widely used. The most common drawback is traumatic breakage, which is directly proportional to the impact strength.\(^{[8,14,24]}\)

Transverse strength test is a collection of tensile, compressive, and shear stresses. When the load is applied, the specimen bends and results in strain. The shear stress does not play a significant role in the process.\(^{[17,23-25]}\)

To bear the continuous stress or strain during occlusion, modulus of elasticity is an important property. The modulus is the ratio of the stress to strain for a given stress; the greater the value of the modulus the material will be stiffer.\(^{[13,26]}\)

To overcome the drawbacks of conventional material, many methods were tried such as developing new materials, altering curing methods, and modifying the existing acrylic resin or reinforcement of the acrylic resin with gamma radiation, fibers, and polyethylene powder.\(^{[14,17,18]}\)

But, each method had its own drawbacks. The use of carbon and aramid fibers was not possible in specific areas as the lateral spreading of fibers during pressing caused complications in fabrication of the dentures. However, in this study nano-silver used in very small cuts minimized these difficulties. The esthetic concern was also better in nanoparticles compared to fibers.\(^{[16,17,20]}\)

This study showed that nano-silver particles reinforced with light-cured acrylic resin have more impact and transverse strengths by approximately 43.1%; this may be due to the flexibility of nano-silver reinforcement material to loads of fracture. This was similar to the study conducted by Ali \textit{et al.}\(^{[18]}\) and Serna \textit{et al.}\(^{[24]}\) who concluded that both impact and transverse strengths were increased by the addition of fibers to the material or gamma irradiation.

This study showed that nano-silver particles reinforced with light-cured acrylic resin increased the deflection and modulus of elasticity. This was similar to the results of studies conducted by Smith \textit{et al.}\(^{[27]}\) and Ladizesky \textit{et al.}\(^{[26]}\) as the fibers play an important role as a cross-linking agent.

**CONCLUSION**

The impact and transverse strength, and deflection and modulus of elasticity of acrylic denture base were

| Table 1: Comparison of mean mechanical properties between acrylic resin and light-cured acrylic resin reinforced with nano-silver |
| --- |
| Test | Group | Mean | SD | $P$ Value |
| --- | --- | --- | --- | --- |
| Impact strength | Control group | 0.4879 | 0.051 | $P < 0.05$ |
| | Test group | 0.7983 | 0.051 | |
| Transverse strength | Control group | 91.892 | 11.46 | $P < 0.05$ |
| | Test group | 136.754 | 13.73 | |
| Modulus of elasticity | Control group | 0.33401 | 0.040 | $P < 0.05$ |
| | Test group | 0.50128 | 0.049 | |
| Deflection | Control group | 6.0457 | 0.675 | $P < 0.05$ |
| | Test group | 7.4872 | 0.901 | |

SD = standard deviation
improved by adding silver nanoparticles to the light-cured acrylic material.

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Conflicts of interest
There are no conflicts of interest.

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