ORIGINAL RESEARCH

Assessment of flexural strength of denture base resin materials processed using compression molding technique and injection molding technique: A comparative study

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ABSTRACT

Background: The present study was conducted for assessing the flexural strength of denture base resin materials processed using compression molding technique and injection molding technique.

Materials & methods:20 denture base resin specimens were included and were divided into two study groups with 10 specimens in each group: Compression molding group and injection molding group. Specimens were fabricated with standardization done using metal strips. Conventional techniques were used for polishing and finishing. After polishing, all specimens were checked for their dimensions with a digital calliper. Thermocycling was carried out. The Flexural strength of fracture resistance was measured on a computerized, software-based Universal Testing Machine. All the results were recorded in Microsoft excel sheet followed by statistical analysis using SPSS software.

Results: Mean flexural strength of specimens of conventional molding group was 75.35 MPa while that of injection molding group was 89.12 MPa. Significant results were obtained while comparing the mean flexural strength of specimens of both the study groups.

Conclusion: Flexural strength of denture base resin materials processed using injection molding technique is better than that of compression molding technique.

Key words: Injection molding, Compression molding, Denture Base, Resin

INTRODUCTION

Complete dentures are most widely accepted treatment modality for the patients where fixed prosthesis cannot be given. Dentures are fabricated with various materials such as polymethyl meth acrylate. CAD/CAM is the most recent tenchique of processing. Microwave processed, light activated resins are also used.Several types of PMMA denture base resin available today are similar in composition but small variations lead to different physical properties and processing methods. [6]Compression moldingtechnique is most commonly used technique of procession.However, shrinkage and dimensional changes of denture bases during resin polymerization are inevitable and have been well documented.[7] The injection molding technique is used to overcome polymerization shrinkage since it provides better accuracy and marginal sealing than conventional compression molding.,. the present study was conducted for assessing the flexural strength of denture base resin materials processed using compression moulding technique and injection moulding technique.

MATERIALS AND METHODS

The present study was conducted for assessing the flexural strength of denture base resin materials processed using compression molding technique and injection molding technique. 20 denture base resin specimens were included and were divided into two study groups with 10 specimens in each group: Compression molding group and injection molding group. Specimens were fabricated with standardization done using metal strips.

WAXPATTERN FABRICATION

20 Rectangularwax patterns are fabricated measuring

10mm(length) x 4mm (width) x2mm(thickness) using metal mould.

Processing using compresson moulding technique
Wax pattern is flasked using conventional metal flask. Then dewaxing is carried out followed by packing of heat cure acrylic resin. Flask is kept for bench curing for 1 hour the processing is done.Samples are retrieved finshed and polishied. Total 10 samples were fabricated.

Processing using Injection moulding technique:
Duplicates of wax were invested in Type 3 dental stone and flasked. After heating the flask in a boil-out solution and flushing out the wax, the flask was allowed to cool to room temperature. The stone was exposed to separating media. For five minutes, premeasured resin and monomer capsules were mixed in a commercial mixer. The parts of the flask were connected. After inserting the combined capsule's contents into the flask, the pressure injection device was fastened. For five minutes on the bench, the plunger was able to descend and inject material into the mold thanks to the pressure apparatus's connection to a pressurized air source. After 35 minutes of polymerization in boiling water (100°C), the assembly was taken out and promptly submerged in cold water while being kept under pressure for 30 minutes to let it to cool. The created strips were taken out of the cooled flask by opening it. Conventional techniques were used for polishing and finishing. After polishing, all specimens were checked for their dimensions with a digital calliper.Thermocycling was carried out. The Flexural strength of fracture resistance was measured on a computerized, software-based Universal Testing Machine. All the results were recorded in Microsoft excel sheet followed by statistical analysis using SPSS software.

RESULTS
Mean flexural strength of specimens of conventional molding group was 75.35 MPa while that of injection molding group was 89.12 MPa. Significant results were obtained while comparing the mean flexural strength of specimens of both the study groups.

Table 1: Comparison of flexural strength

Groups	Mean	SD	p-value
Conventional molding group	75.35	20.28	0.001
Injection molding group	89.12	35.78	(Significant)

DISCUSSION
Conventional partial and complete dentures are the treatment of choice in many cases due to financial and medical issues.To perform in a complex and dynamic oral environment, an ideal Denture base materials should have a wide range of mechanical, physical, chemical, and biological properties.Mechanically, DBMs should have a high elastic modulus, proportional limit, adequate abrasion resistance, fatigue, and impact strength. Physically, DBMs should have low specific gravity, dimensional stability, good thermal conductivity, radiopaquicity, a coefficient of thermal expansion matching to teeth, and thermal stability. Esthetically, DBMs need to be translucent and have the ability to pigments to match the color of teeth and gums. In addition, there are favorable properties such as low cost, ease of manipulation and repair, ease of cleaning, and long shelf life.[9, 10]Despite the acceptance of compression molding for more than 60 years, attempts to maintain the occlusal contacts developed in the trial denture have necessitated a laboratory remount with occlusal correction. Many factors in the laboratory procedures can lead to alteration of the occlusion during the construction of complete dentures. These factors are related to intrinsic characteristics of the materials and techniques and extrinsic potential errors made by the dental technician or dentist. As a result of the processing technique, incisal pin opening may occur after compression molding and this increase in vertical dimension of occlusion (VDO) needs to be corrected.[11, 12]A new injection system claims to eliminate changes in VDO to produce dentures that require few, if any, adjustments in the laboratory. The denture base material recommended by the manufacturer with this new injection system is mixed in the conventional manner and put in a special detachable plastic cartridge for the injection procedures.[13, 14]Hence; the present study was conducted for assessing the flexural strength of denture base resin materials processed using compression molding technique and injection molding technique.
Mean flexural strength of specimens of conventional molding group was 75.35 MPa while that of injection molding group was 89.12 MPa. Significant results were obtained while comparing the mean flexural strength of specimens of both the study groups. In a similar study conducted by a Nogueira SS et al, authors compared incisal pin opening, dimensional accuracy, and laboratory working time for dentures fabricated by this new injection system with dentures constructed by the conventional compression molding technique.Two groups of 6 maxillary and 6 mandibular dentures were evaluated as follows: group 1 (control), Lucitone 199, compression molded with a long cure cycle; and group 2, Lucitone 199, injection molded with a long cure. Analysis of vertical dimensional changes disclosed significant differences between the groups. There was no appreciable difference in laboratory working time for flasking and molding denture bases between the injection and

compression molding techniques when polymethyl methacrylate resin was used.The injection molding method produced a significantly smaller incisal pin opening over the standard compression moldingtechnique.[15]Patankar, R. C et al, in another previous study, identified the denture with the highest flexural strength (Fs) from these methods.Three groups of 15 PMMA acrylic denture base resins (total 45) were processed into rectangular plates of size 65mm × 10mm × 3mm. The three groups differed in the method of processing as compression molded, injection molded, and prepolymerized CAD/CAM milled resins. The mean Fs of CAD/CAM, injection molding, and compression molding manufacturing techniques are 97.46, 84.42, and 71.72 respectively and standard deviation obtained are 9.93, 10.42, and 11.58, respectively. They concluded that denture bases fabricated through CAD/CAM technique are more sustainable than the compression-molded and injection-molded denture bases.[16]Flexural strength of specimens processed by conventional and injection-molding techniques was compared in another previous study conducted by Gharechahi J et al. Flexural strength of injection-polymerized acrylic resin specimens was higher than that of the conventional method. This difference was statistically significant.[17]Chintalacheruvu et al, in a similar study compared the effectiveness of three different processing techniques and assessed the accuracy of processing techniques through number of occlusal interferences and increase in vertical dimension after denture processing.Mean vertical pin rise (0.52 mm) was reported to more in compression molding technique as compared to injection molding techniques, which is statistically significant. Injection molding techniques exhibited less processing errors as compared to compression molding technique with statistical significance. There was no statistically significant difference in processing errors reported within two injection molding systems.[18]

CONCLUSION

Flexural strength of denture base resin materials processed using injection moldingtechniqueis better than that of compression molding technique.

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