International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Short Communication

Evaluation of Bond Strength of Cross Linked Acrylic Denture Teeth with Various Denture Base Resins Processed by Micro Wave Polymerization: An In Vitro Study

G.Sriramaprabu[1], K.Vinayagavel[2], C.Sabarigirinathan[3], P.Rupkumar[1], J.Baranikrishnan[4], S.Elavarasan[5], T.Jeyanthikumari[6], M.Kanmani[6], V.Parimala[6]

[1]Associate Professor, [2]Professor, [3]Professor and HOD, [6]Senior Assistant Professor, [5]PG Student, Department of Prosthodontics, Tamilnadu Government Dental College and Hospital, Chennai.
[4]Associate Professor, Dept. of Dental Surgery, Govt. Vellore Medical College, Vellore.

Corresponding Author: K.Vinayagavel

Received: 02/07/2015 *Revised: 11/08/2015* *Accepted: 25/08/2015*

ABSTRACT

Conventional denture base materials processed by the microwave method possessed adequate physical properties like hardness, transverse strength and color stability. Despite the ability of the denture base polymers to bond chemically to the acrylic denture teeth, debonding between them still remains the most common type of failure in a denture. The assessment of the bond strength of cross linked acrylic denture teeth with three heat cure denture base resins polymerized by microwave method was carried out in this study.

Key words: Acrylic resins, Cross linked teeth, Bond strength, Microwave curing system.

INTRODUCTION

The microwave energy is independent of thermal conductivity and it is a more efficient and convenient method of heating denture base resins which polymerize rapidly. Microwave processing is cleaner and more time-efficient than conventional technique and provides excellent dimensional accuracy. [1] This study was conducted to evaluate the bond strength of cross linked acrylic teeth with three commercially available denture base resins polymerized by microwave method.

Aim of This Study: To evaluate the bond strength of cross linked acrylic denture teeth with three heat cure denture base resins, polymerized by microwave method.

MATERIALS AND METHODS

The following materials were used for the study.

S.No	Name of the material	Trade Name & Manufacturer
1)	Heat cure Acrylic resin	Acralyn-H, Asian Acrylates , Mumbai, India
2)	Heat cure Acrylic resin	DPI, Dental Products of India, Mumbai, India
3)	Heat cure Acrylic resin	Trevalon , Dentsply India , Gurgaon, India
4)	Cross-linked acrylic anterior denture teeth	Acrypan XL, Mold G3, Shade A1, Ruthinium Group, Italy.

The maxillary central incisor teeth were used which are waxed to a wax block and acrylyzed using the above denture base materials. A microwavable Fibre Reinforced Plastic flask (FRP) and a domestic microwave oven (LG) with variable watt control used for the microwave polymerization of the samples.

Grouping of the Samples: A total of 30 samples were prepared were divided into 3 groups with 10 samples in each group.

S.No	Groups	Denture Base Material
1	Group M1	Acralyn-H
2	Group M2	DPI
3	Group M3	Trevalon

Wax Pattern preparation: The ridge lap areas of central incisors were waxed on to the beveled surface of a rectangular wax block. The slope of the beveled surface aligned each denture tooth such that the long axis of the tooth was at 45º from the base of the wax block.

Fig:1 WAX PATTERNS

Fig:2 MICROWAVE FLASK

Fig:3 MICROWAVE CURING

Processing of the Microwave Polymerized Samples: The three heat cure denture base materials –Acralyn –H, DPI, and Trevalon are used. After a bench cure for 30 minutes, the flask is placed in the microwave oven. A polymerization cycle of 8 minutes at 180 watts, followed by 4 minutes resting and 3minutes at 540 watts was followed. The FRP flask was bench cooled for 30 minutes at room temperature before deflasking in the usual manner.

Testing of the Samples: The samples were tested in Lloyds Universal Testing Machine LR100K using Nexygen software. For all specimens, the interface was inspected and the failure was classified as either adhesive or cohesive in nature. Failure occurred when the tooth became dislodged from the resin block or when the tooth on the resin block fractured and separated.

Fig 4 Testing of Sample in Lloyd's Machine

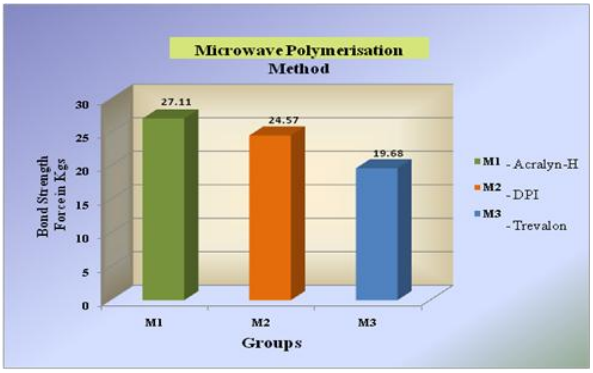

Fig 5. Bar Diagram

Table I:Bond strength by Microwave polymerization Method

Samples	Group M1 Force in Kg	Group M2 Force in Kg	Group M3 Force in Kg
1	26.34	24.57	19.65
2	28.42	25.61	20.31
3	27.33	23.39	19.32
4	26.90	24.13	18.04
5	26.56	25.15	21.08
6.	26.33	24.56	19.64
7	28.43	25.60	20.33
8	27.33	23.39	19.32
9	26.90	24.13	18.04
10	26.56	25.15	21.08
Mean	27.11	24.57	19.68

Table II: Analysis of Variance One –Way Anova between the Groups

Denture Base Resins Force in Kg						P Value
Acralyn-H		DPI		Trevalon		
Mean	SD	Mean	SD	Mean	SD	
27.11^{c}	0.82	24.57^{b}	0.87	19.68^{a}	1.14	$<0.001^{**}$

Note: 1. ** Denotes significance at 1% level
2. Different alphabets a, b, and c between groups denotes significance at 5% level

Table I - shows the mean force of debonding for the microwave polymerized groups M1 (Acralyn –H), M2 (DPI), and M3 (Trevalon). Acralyn –H shows the maximum bond strength of 27.11Kgs followed by DPI and Trevalon

Table II– shows statistical analysis of Variance One-way Anova between M1,M2,M3 Acralyn –H with maximum bond strength followed by DPI and Trevalon .The statistical analysis between M1,M2,M3 shows a difference of bond strength with a p value of <0.001 which denotes significance at 1% level

DISCUSSION

Debonding of acrylic teeth from denture base remains a major problem in Prosthodontic practice. This detachment may be attributed to a lesser ridge lap surface. [2] The microwave energy is absorbed by the object and is instantly changed to heat by means of dielectric heating. Here the inside and outside of the substances are heated equally and the temperature increases much more quickly than ordinary conduction heating. The advantages of curing denture resin by microwave energy include a greatly reduced curing time, less cumbersome equipment and a cleaner method of processing. [3] In a microwave oven, the electromagnetic waves with a frequency of 2450MHz and wavelength of 12 cm cause the methylmethacrylate molecules to rapidly change directions above 5 billion times a second. Consequently, numerous intermolecular collisions occur, which bring about rapid heating of the resin. Microwaves act only on the monomer, which decreases in the same proportion as the polymerization degree increases. Therefore the same amount of energy is absorbed by less and less monomer, making the molecules increasingly active. A form of self regulation of the curing program takes place and leads to complete polymerization of the resin. [4] Microwave curing at low temperature results in a resin with little residual monomer and good dimensional accuracy. [5]

In this study a genuine attempt has been made to compare the bond strength of acrylic resin teeth with three denture base resin cured by microwave polymerization. The microwave polymerized groups Acralyn –H (Group M1) showed maximum bond strength of 27.11Kgs followed by DPI and Trevalon.

CONCLUSION

This in-vitro study was conducted to evaluate the influence of microwave energy polymerization on the bond strength of three commercially available heat cure denture base resins with a cross linked denture tooth. Among the three resins Acralyn –H showed maximum bond strength with microwave energy followed by DPI and Trevalon. The conclusions of this study are limited to acrylic teeth mounted on rectangular blocks of resin and hence not directly relevant to the clinical denture forms. Although,

conclusively good bond strength values were obtained for microwave curing of the samples from this study, ultimately clinical evaluation must be done.

REFERENCES

1. Phiip W.Wallace, Gerald N.Graser Michael L. Myers, Howard M. Proskin . Dimensional accuracy of denture resin cured by microwave energy. Prosthet. Dent 1991; 66:403-409
2. Patil S.B., Naveen B.H. and Patil N.P. Bonding acrylic teeth to acrylic resin denture bases: a review. Gerodontology 2006; 23; 131-139.
3. Sanders, Levin, Reitz. Comparison of the adaptation of acrylic resin cured by microwave energy and conventional water bath. Quintessence International 1991 Volume 22 , Issue 3 Pages: 181 – 186
4. De Clerck J.P., Microwave polymerization of acrylic resins used in dental prostheses. Journal of Prosth. Dentistry May1987 ;57;650-658
5. Bafile M, Graser GN, Myers ML, Li EK. Porosity of denture resin cured by microwave energy. J Prosthetic Dent. 1991 Aug; 66(2):269-74.

How to cite this article: Sriramaprabu G, Vinayagavel K, Sabarigirinathan C et al. Evaluation of bond strength of cross linked acrylic denture teeth with various denture base resins processed by micro wave polymerization - an in vitro stud. Int J Health Sci Res. 2015; 5(9):498-501.

****