ISSN: 0975-766X
CODEN: IJPTFI
Available Online through *Research Article*
www.ijptonline.com

ANALYSING FLEXURAL STRENGTH OF RESIN DENTURE BASE, INCORPORATED WITH CARBON NANO PARTICLES

S.Suvitha*[1], Dr.V.Ashok[2]
Final year BDS, Department of Prosthodontics ; Saveetha Dental College, Chennai.
Email: suvithasuresh10@gmail.com

Received on: 18-04-2017 *Accepted on: 06-06-2017*

Abstract:

Aim and Objective:

Aim of this study is to analyse the flexural strength of resin denture base which is incorporated with carbon nano particles.

Materials and Method:

Acrylic specimens in size of 5*3and depth of 3mm were prepared and divided into 5groups: acrylic containing carbon nano particles in four different concentration of 0.25%,0.50%,0.75% and 1% in addition to a control group. To prepare acrylic block with nano partials, carbon nano particles were added to the monomer. All specimens were stored in artificial saliva for 24 hours and underwent Flexural strength test by universal testing machine .

Background:

The most widely used materials in dentistry is Polymethylmethacrylate (PMMA),due to its aesthetics, ease in production, processability and reparability. It has been widely used material since 1930's to produce denture base acrylic resin. Besides having good dimensional stability, low water sorption and resemblance to oral tissue but the only drawback seen during the clinical service is its ability to fracture. One of the reasons of fracture is its low resistance to impact.

Reason: The purpose of this study is to incorporate carbon nano particles as impact modifiers into the denture base resin appears to be a good approach to produce stronger and more fracture resistant materials.

Keywords: Acrylic resin, Carbon nano particles, Flexural strength.

Introduction:

The most widely used materials in dentistry is Polymethylmethacrylate (PMMA),due to its aesthetics, ease in production, manipulation, finishing and polishing, processability and reparability also it needs inexpensive

equipment[1]. It has good dimensional stability, low water sorption and resemblance to oral tissue but the only drawback seen during the clinical service is its ability to fracture. This variation in mechanical properties can be modified by chemical correction of polymeric structure by additives like polyethylene glycol dimethacrylate, also fibres and particles incorporations into acrylic resins are useful method of altering the mechanical properties[2,3].

One of the reasons of fracture is its low resistance to impact.A wide interest has been generated regarding use of Nano particles in dentistry.

Studies have been reported on use of silver and titanium nano particles in altering the mechanical property of acrylic resins. Carbon Nano particles are macromolecular form of carbon with high potential of biological application in modifying acrylic resins mechanical, physical and chemical properties[4,5].Among various mechanical properties the flexural strength(FS) has achieved special concern. A standard minimal limit for flexural strength was established by ISO 20795-1(2008) international standard for any acrylic resins type in dentistry base polymer[6,7]. It has been reported that ultimate flexural strength of any polymerised material may not be less than 50 MPa. It is mandatory to evaluate the effect of additive or modifier on mechanical properties of acrylic resins which may result in reduction of their strength below the standard level[8,9].

The purpose of this study is to incorporate carbon nano particles as impact modifiers into acrylics resin, to produce stronger and fracture resistant materials.

Materials and Method:

Acrylic specimen of size 5*3cm and depth of 3mm were prepared and divided into 5 group, they are acrylic resins containing carbon Nano particles in four different concentration of 0.25% , 0.50% ,0.75% and 1% in addition to control group. To prepare acrylic block with nano particles, carbon nano particles were added to the monomer. All specimens were stored in artificial saliva for 24 hours and under went flexural strength test by universal testing machines.

The maximum force (F) necessary to produce fracture of the specimen was recorded in Newton (N). The flexural strength Q was calculated in (MPa) for all specimens using Equation (1).

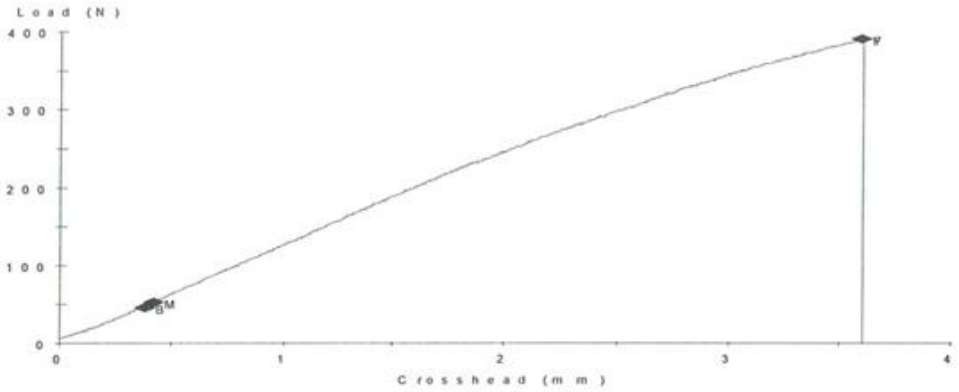
$$Q=3FI/2BH^2 \qquad \text{(Equation1)}$$

where “F” is the maximum/fracture force in Newton (N), “I” is the distance between the two supporting points in (mm); “B” is the specimen width in (mm) and “H” is the specimen height subjected to bending in (mm).



Fig:1. Universal testing machine, Fig:2.Control block. Fig:3.Test sample

A report of single sample was given in fig :4



Specimen Results:

Name	Value	Units
Width	30.00	mm
Thickness	3.00	mm
Area	**90.00**	mm^2
Peak Load	**390.388**	N
Ultimate Tensile Strength	**4.337**	MPa

Fig :4

Results:

Five different sample group, each contained about5 specimen incorporated with carbon nano particles were tested using universal testing machines. The mean flexural strength of each group in mega pascals is illustrated in table:1

Table:1. ANOVA test showed statistically insignificant difference between groups of types of acrylic resin.

Samples	Mean (FS)
Control group	3.85MPa

0.25%	3.77MPa
0.50%	3.79MPa
0.75%	3.51MPa
1%	3.64MPa

MPa	Sum of squares	Difference	Mean square	F	Significans
Between groups	.361	4	.090	.429	.786
With in groups	4.204	20	.210	.429	.786
Total	4.565	24	.300	.429	.786

Control group shows highest flexural strength of 3.85 MPa

Whereas samples with carbon nano particles shows least FS than that of control group. The mean difference between control group and samples are .78 which not significant.

Discussion:

The results revealed that none of the study groups even the control group, could reach the standard level of ISO:2008for flexural strength.According to the results of one way ANOVA and post hoc test, no significant difference was observed between both control group and test group.It is seen that 0.25% of carbon nano particles has fextural strength close to control group with 3.77 MPa , 0.50% of carbon nano particles has fextural strength 3.79 which is also close to 0.25% sample, where as sample with 0.75% and 1% shows least flexural strength of 3.51MPa and 3.64MPa respectively. The flextural strength of a acrylic resins decreases as increasing in concentration of carbon nano particles. AR strength depends on the quality of PMMA and also the additive particles which act as a impurities. Though carbon has high strength in metallurgyits bonding with acrylic resins has less significants. Bonding strength between carbon and acrylics can be studied using scanning electron microscope[10].

Conclusion: Within the limitations of this study, it was concluded that incorporation of carbon nano particles into acrylic resins can adversely affects the flextural strength of the final products and this effect is directly correlated with the concentration of nano particles.

Reference:

1. Ahmed,M.A and EbrahimM.I. (2014)Effect of Zirconium Oxide NanoFillers Addition on the Flexural Strength,Fracture Toughness, and Hardness of HeatPolymerized Acrylic Resin. World Journal of Nano Science and Engineering, 4, 50-57. http: // dx. doi. org/10.4236/ wjnse. 2014. 4 2008.
2. Sasaki, H., Hamanaka, I., Takahashi, Y. and Kawaguchi, T. (2015) Effect of Reinforcement on the Flexural Properties of Injection-Molded Thermoplastic Denture Base Resins. Journal of Prosthodontics. http: //dx. doi .org /10.1111/jopr. 12419
3. Shirkavand, S. and Moslehifard, E. (2014) Effect of TiO2 Nanoparticles on Tensile Strength of Dental Acrylic Resins. Journal of Dental Research, Dental Clinics, Dental Prospects, 8, 197-203.
4. Bai Yu, IIsong P, Taesung B, Kyounga K, Fumio W, Motohiro UO, Minho L. Carbon nanotubes coating on Ti substrate modified with TiO2 nanotubes. J Wuhan Univ Technology-Mater Sci Edu 2011.
5. Kou W, Aksaka T, Wakari F, Sjogren G. An in vitro evaluation of biological effects of CNT-coated dental zirconia" ISRN Dentistry,
6. Aeran, H., Kumar, V., Uniyal, S. and Tanwer, P. (2015) Nanodentistry: Is Just a Fiction or Future. Journal of Oral Biology and Craniofacial Research, 5, 207-211.
7. Elsaka, S.E., Hamouda, I.M. and Swain, M.V. (2011) Titanium Dioxide Nanoparticles Addition to a Conventional Glass-Ionomer Restorative: Influence on Physical and Antibacterial Properties. Journal of Dentistry, 39, 589-598.
8. Sodagar, A., Bahador, A., Khalil, S., Shahroudi, A.S. and Kassaee, M.Z. (2013) The Effect of TiO2 and SiO2 Nanoparticles on Flexural Strength of Poly(methyl methacrylate) Acrylic Resins. Journal of Prosthodontic Research, 57, 15-19.
9. Andreotti, A.M., Goiato, M.C., Moreno, A., Nobrega, A.S., Pesqueira, A.A. and dos Santos, D.M. (2014) Influence of Nanoparticles on Color Stability, Microhardness, and Flexural Strength of Acrylic Resins Specific for Ocular Prosthesis. International Journal of Nanomedicine, 9, 5779-5787.
10. The effect of TiO2and SiO2nanoparticles on flexural strength of acrylic resins Ahmad Sodagar ,Atefe Saffar Shahroudi *, Mohammad Zaman Kassaee PhD.