

Effect of Continuous Echo-Planer Imaging Pulse (EPI) on Residual Monomer and Color stability of self-Cure Acrylic resin

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ABSTRACT

Research deals with effect of energy levels and transition of this energy in between (T1) and (T2) energy level called "energy gap." And the effects of this gap, On residual monomer and color stability of self-cure acrylic resin.

1. INTRODUCTION

1.1 "SELF" OR "COLD" CURE ACRYLIC RESIN

Self-cure acrylic resin present in powder and liquid and these materials are called "temporally denture base material" the polymer is basic component of powder in a small sphere called beads or pearls and it contain a preside present in an amount of 1% and decomposed by chemicals and polymerization process happened. Self-cure acrylic resin is the most widely used denture base materials since it is simple and low cost f processing. Their flexibility is still acceptable since the work is for Temporally materials and it is strength is adequate beside it's high water sorption with low water solubility make good dimension stability compare with other materials used for same purpose, and it is color stability and tissues compatibility usually good with no taste or odor.^[1] The electrical properties of self-cure acrylic resin can be sharply affected by the absorption of humidity, it is resistance to arcing is excellent, and since PMMA is electrostatic which can spoil it's appearance (attraction of dust), this drawback can be corrected by using of ant-static product's^[2].

1.2 "T1" AND "T2" RELAXATIONS AND ENERGY GROUPS

"T1" or longitudinal or "spin-lattice relaxation" time refer to events happened from start of magnetization until it reach equilibrium, and the nuclei during "T1" give-up the energy gained from the transmitted radio-freugag pulse to returne to equilibrium and the hydrogen-nuclei are bond with other atoms to form a molecule. So, this arrangement called "lattice"^[3]. "T2" or "transverse relaxation" time is refer to decreasing value of magnetization and loss of magnetization, thus the nuclei continuous to loss their energy to another nuclei and the energy transfer from one spin to another so energy-gap happened.^[4]

1.3 ECHO-PLANER IMAGING AND ENERGY-GAP

Echo-planer imaging (EPI) represent on area of pulse sequence changes, and by these changes in pulse sequence an energy gap possible to be created.^[5] So, the fastest sequence produced as little as "50" mili-scord, and (EPI) will show excitation pulse at every 90° RF., a radio- frequency refocusing of sequence will happen and during this refocusing a transition process of energy will happen since hydrogen has only single electron and single proton and high possibility of free induction energy happen.^[6]

2. COLOR EVALUATION AND RESIDUAL MONOMER OF THE TEST SELF-CURE ACRYLIC

Self-cure acrylic resin and acrylic generally is well-known for it's exceptional optical properties since it is uncrystallized polymer with an remarkable transparency (92% light transmission) in the visible range from 380 to 780 μm .^[7] The angle of total light reflection an inner-surface is to be 41 to 42° which allow to be used for making light "conductors" and "fiber-optic filament" and it is refraction index for ($\lambda = 587.6$ nm. helium) is to be 1.497 which makes it a material suitable for monufaction optic product.^[8]

Residual monomer represent a degree of deformation and it's existence is an indication to the altering of physical and mechanical properties of acrylic resin.^[9] Degree of residual monomer released can be further improved by following a period of immersion in a hot water, so free-radicals exist in the polymerization acrylic released out for acrylic.^[10] Residual monomer concentration varies with the methods and the condition of polymerization and the variation in the chemical composition and purity of the commercially available resin systems.^[7] (EPI) energy cause effects in the monomer, which may alter in some properties of the acrylic resin so, the same amount of energy is absorbed by less and less monomer making the molecules actively work.^[11]

3. GOALS OF RESEARCH

3.1 One on most important goals of the research is to estimate and evaluate the effects of (EPI) on energy self-cure monomer, and study this effects on the residual monomer and color stability degree.

4. EXPERIMENT DESIGN

4.1 The samples of self-cure acrylic resin made a ADA specification for acrylic resin color stability test, and these samples will e recheck checked for residual monomer test. Samples, placed inside (MRI) machine, but this time it will not exposed to (MRI) wave, but to energy gap. to design experiment, so that are energy pass for "T1" to "T2", samples will expose to (EPI) resulted from energy-gap happened and after that samples will removed from device and submitted to multiple-test to study and evaluate results.



Figure (1): show samples preparation and flasking

5. RESULT

The results below were don by the use of statistical analysis "student – test" to compare between two main sample groups:

- Control samples "unexposed to EPI energy wave".
- Exposed samples " samples submitted to EPI energy wave".

The results shown in the following tables

1- Color stability test results

Two Sample T-Test and Confidence Interval

Table (1): Two sample T- test for control samples vs exposed samples

| | N | Mean | StDev | SE Mean |
|---|---|--------|-------|---------|
| Control | 6 | 220.50 | 1.05 | 0.43 |
| expose 1 | 6 | 211.17 | 1.17 | 0.48 |
| 95% CI for mu control - mu expose 1: (7.88, 10.78) | | | | |
| T-Test mu control = mu expose 1 (vs not =): T= 14.56 P=0.0000 DF= 9 | | | | |

2. Residual Monomer Test Results

Two Sample T-Test and Confidence Interval

Table (2): Two sample T – test for control samples vs exposed samples.

| | N | Mean | St Dev | SE Mean |
|--|---|-----------|-----------|----------|
| Control | 6 | 0.0021167 | 0.0000753 | 0.000031 |
| expose 2 | 6 | 0.02283 | 0.00117 | 0.00048 |
| 95% CI for mu control - mu expose 2: (-0.021946, -0.01949) | | | | |
| T-Test mu control = mu expose 2 (vs not =): T= -43.32 P=0.0000 DF= 5 | | | | |

6. DISCUSSION

6.1 Residual monomer results of control and tested sample

Results founds for control samples of self-cured acrylic resin show a release-rate of un-reacted monomer, this accepted since it is one of disadvantage of the material and it can alter-a number of its properties. Results found for samples exposed to (EPI) energy released between "T1" and "T2" energy changes is agree to some degree with finding of.^[6, 12] since a higher rate of release is happened compare with that for control, this explain by "T1" Time is an basic parameter for degree of proton change since "EPI" mainly affect monomer move then powder of the polymer, so the absorbed energy by monomer will faster the released un-reacted monomer and falsify the value of "T1" relaxation time as found when (aluminum silicon glass) tested or other vitremer material which have the same degree of hydrogen atoms in chemical composition when tested in this experiment.^[13]

6.2 Color stability results for control and tested samples

Results found for control pink samples tested for color stability is totally agree with.^[14] Who found that composition of acrylic (chemical composition) contain mercuric sulfide and other pigment, which can arrange itself in special form and inter-act with light pass through it, resulted in Absorption, transmission, scatter wave. Results found for (EPI) energy-gap exposed acrylic samples shown a reduce in the amount of light. Transmitted and higher rated absorption and this can agree with finding of^[15] who found that physical and mechanical properties of materials are largely dependent on the configuration of their stvatural build- up, and agree to some degree with finding of.^[16]

CONCLUSION

The experimental work done in this study makes the use of Echo-planner Imaging pulse (EPI) energy an essential component of analyses, and for many physical, and mechanical and bio-medical aspects. The results obtain for "residual monomer" and "color stability" of self-cured acrylic resin can lead to more studies on material under different condition and increasing the ability to obtain images of molecule or sub-moleculars environments using this methods to enhance correlations of composition with mechanical properties to ultimate the goal of optimization materials properties.

REFERENCES

- [1] An dot., Sasaki H., Igarashiy T., (2011): Effects of dental alloys and magnetic keeper on (MRI)., J. Radio: (208); 165-170.
- [2] Tanasiewicz M. (2011): Magnetic resonance imaging in human teeth internal space visualization for requirements of dental prosthesis, J. Clin. Exp. Dent. (1); 6-11.
- [3] Lee M., Yau HT., Yang M., (2010): MRI used in dental laboratory. Dent. Today; (88): 90. 92-3.
- [4] Park J. W., Song H. H., Roh H. S., Kim Y. K., Lee J Y. (2013): Correlation between clinical diagnosis based on RDC/TMD and MRI finding of TMG internal derangement., Int. J. Oral Maxillofac. Surg; (41). 103-108.
- [5] Shafiei F., Honda E., Takahashi H., Sasaki T., (2003): Artifacts from dental casting alloys in magnetic resonance imaging. J. Dent. Res.; (8) 82: 602-66.
- [6] Burchardt VD., Lewicka BM., (2013): Disturbing effect of different dental material on the (MRI) results: preliminary study. Acta of Bioengineering and Biomechanics; (15): 4.
- [7] Antonio T., Anna Ciajolo., Stanzione F., Carmela R., (2014): Infrared spectroscopy of some carbon-based materials relevant in combustion: Qualitative and quantitative analysis of Hydrogen, Carbon; (74): 127-138.

- [8] Carpentien Y., Ferand G., Dartoris E., Brunetto R., Charon E., Cao At., (2012): Nano struction of carbonaceous dust as seen through the position of the 6.2 and 7.7 μm ABS. *Astron Astrophy*; (40A): 548.
- [9] Suraj S., Chhabra T., Raghav D., Singh D., Prince K., Sukant S., (2014): Residual monomer content of repair autopolymerizing resin after microwave post polymerization treatment. *European Journal of Prosthodontics*; (2): Issue 1.
- [10] Rodinkor O. V., A. Bugaichenko Valsov A., (2014): Compositional surface layered sorbents for pre-concentration of organic substances in the air analysis. *Talanta J.*; (11); 40.
- [11] Ajaib B., Gurmet S., Ravi S., (2004): Analysis of the β -methylene carbon NMR chemical shifts: from vinylidene chloride co-polymers to a general analysis of polymers. *J. eurpolym J.*; (11); (08).
- [12] Nayaki N., Parabarathi N., (2014): the spectroscopic (FT-IR FT-Ramay and NMR), first order hyper polarizability and HOMO-Lumo analysis of 2-Meccapto-4(3H)-quinazolinone., *J. Spectrochimica Acta Molecular and Biomolecular spectroscopy*; (129): 572-583.
- [13] Schulte T., Oehring E., Chanrand S., Rosenbloom M., Sullivan E., Pfefferbanm A., (2011): Age-related reorganization of function network for successful conflict resolution: a combined Function and Stractical MRI Study., *J. neurobiolaging*; (32): 2075-2090.
- [14] Craig RG., Power J. M., and Wataha J. C., (2004): Dental material: properties and manipulation; Mos. By Com.: 268-269.
- [15] Neville R. M., Hazra A. M., Remillat F., Farrow I. R., (2014): Transverse stiffness and strength of kirigami zero-V PEEK honey combs *J. Compstruct.*; (114): 30-40.
- [16] Kavukcuoglu N. B., Pleshko N., (2011): Infrared and Raman microscopy and imaging of Biomaterials; Temple University, Philadelphia, PA., USA.