

Effect of Continuous Echo-Planer Imaging Pulse (Epi) on Residual Monomer and Color Stability of Self-Cure Acrylic Resin

Ahmed I Al-Khyet

Assistant Lecturer, Department of Prosthodontic Dentistry, Mosul University, Iraq

*Corresponding author

Ahmed I Al-Khyet, Assistant Lecturer, Department of Prosthodontic Dentistry, Mosul University, Iraq, E-mail: identist82@G.mail.com

Submitted: 20 Nov 2018; Accepted: 10 Dec 2018; Published: 31 Dec 2018

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.

Introduction

"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 its 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].

"T1", "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-frequency pulse to returnee 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].

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].

Color Evaluation and Residual Monomer of the Test Self-Cure Acrylic

Self-cure acrylic resin and acrylic generally is well-known for its exceptional optical properties since it is UN crystallized polymer with a 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 (= 587.6 nm. helium) is to be 1.497 which makes it a material suitable for optic product [8].

Residual monomer represents a degree of deformation and its 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].

Goals of Research

One on most important goals of the research is to estimate and

evaluate the effects of (EPI) on energy self-cure monomer, and studies these effects on the residual monomer and color stability degree.

Experiment Design

The samples of self-cure acrylic resin made a ADA specification for acrylic resin color stability test, and these samples will be rechecked for residual monomer test.

Samples, placed inside (MRI) machine, but this time it will not be exposed to (MRI) wave, but to energy gap. To design experiment, so that energy pass from "T1" to "T2", samples will be exposed to (EPI) resulted from energy-gap happened and after that samples will be removed from device and submitted to multiple-test to study and evaluate results.

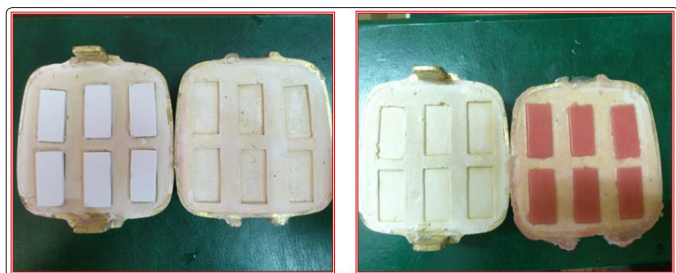


Figure 1: show samples preparation and flasking

Result

The results below were done 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

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				

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	StDev	SE Mean
control	6	0.0021167	0.0000753	0.000031
expose 1	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				

Discussion

Residual Monomer Results of Control and Tested Sample

Results found for control samples of self-cured acrylic resin shown a release-rate of un-reacted monomer, this is accepted since it is one of the disadvantages of the material and it can alter a number of its properties.

Results found for samples exposed to (EPI) energy released in between "T1" and "T2" energy transition changes is agreed to some degree with findings of [6,12]. Since a higher rate of release is happened in exposed sample compared with that for control, this is explained by "T1" Time is an basic parameter for degree of proton change since "EPI" mainly affects monomer more than 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 treated in the same experiment environments [13].

Color Stability Results for Control and Tested Samples

Results found for control pink samples tested for color stability is totally agreed with [14]. Who found that composition of acrylic (chemical composition) contains mercuric sulfide and other pigments, which can arrange itself in special form and interact with light passing through it, resulted in absorption, transmission, and scatter wave.

Results found for (EPI) energy-gap exposed acrylic samples shown reduce in the amount of light transmitted and higher rate of absorption and this can be agreed with findings of who found that physical and mechanical properties of materials are largely dependent on the configuration of their structural build-up, and agree to some degree with findings of [15,16].

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 obtained for "residual monomer" and "color stability" of self-cured acrylic resin can lead to more studies on material under different conditions and increasing the ability to obtain images of molecules or sub-molecular environments using these methods to enhance correlations of composition with mechanical properties to ultimately achieve the goal of optimization of material properties.

References

1. Andot, Sasaki H, Igarashi 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: 92-3.
4. Park JW, Song HH, Roh HS, Kim YK, Lee JY (2013) Correlation between clinical diagnosis based on RDC/TMD and MRI findings 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

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 et al., (2012) Nano struction of carbonaceous dust as seen through the position of the 6.2 and 7.7 μm ABS. AstronAstrophy 40A: 548.
9. Suraj S, Chhabra T, Raghav D, Singh D, Prince K et al., (2014) Residual monomer content of repair autopolymerizing resin after microwave post polymerization treatment. European Journal of Prosthodontics 2: 1.
10. Rodinkor OVA, BugaichenkoValsov 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 copolymers to a general analysis of polymers. J eurpolym J 11: 8.
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 of SpectrochimicaActa 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 Structural MRI Study. J neurobiolaging 32: 2075-2090.
14. Craig RG, Power JM, Wataha JC (2004) Dental material: properties and manipulation Mos By Com 268-269.
15. Neville RM, Hazra AM, Remillat F, Farrow IR (2014) Transverse stiffness and strength of kirigami zero-V PEEK honey combs. J Compstruct 114: 30-40.
16. Kavukcuoglu NB, Pleshko N (2011) Infrared and Raman microscopy and imaging of Biomaterials; Temple University, Philadelphia, PA., USA.

Copyright: ©2018 Ahmed I Al-Khyet. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.