

The Effect of Curing Time on Fluoride Release from Composite Resin Material

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ABSTRACT

Aim: This study aims to measure the amount of fluoride release in deionized water from two composite resins materials (Kerr and Tetric ceram) over period of one month. By using different curing time for curing the composite. **Materials and Methods :** Two types of composite resin materials were used. They are Tetric ceram and Kerr composite resins divided into five groups for each type of materials used, each group contain ten sample materials and cured with different time of curing which are (20,30,40,50,60) seconds. The samples measured fluoride release after storing in 5ml of deionized water then incubated incubator at 37°C for 24 hours. **Results:** The amount of fluoride release was affected by the period of curing time. The materials which cured at (20,30,40) seconds gave high amount of fluoride release while the materials which cured at (50,60) seconds gave low amount of fluoride release. **Conclusions:** The amount of fluoride release from composite resins materials were affected by curing time. There is an increase in the amount of fluoride release by decreasing the period of curing time and decreasing by increasing the period of curing time.

Key words: Curing time, fluoride release, composite resin.

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INTRODUCTION

Fluoride is an effect cariostatic agent many dental materials have been designed to provide fluoride to the oral environment⁽¹⁾.

According to the current understanding restorative materials that slowly release fluoride extra local cariostatic effect^(2, 3) not only the secondary caries be reduced at restoration margins, but adjacent teeth are also believe to be benefit from constant fluoride release⁽⁴⁾.

Thus they function in accord with the major cariostatic mechanism of fluoride, which is believed to be its action to promote remineralization and to influence the morphology of teeth by reducing enamel solubility and by suppressing oral cariogenic bacteria⁽⁵⁾.

Dental composites consisting of a polymerizable resin matrix, reinforcing glass particle filler and saline coupling agents are becoming more popular in modern dentistry⁽⁶⁾. These glass practical resin matrix composites have good a esthetic properties and strength making them the most

widely used materials for restorations of anterior teeth⁽⁷⁾.

The polymariozable resin matrix typically contains one or more monomer such as ethleneglycol dimetha crylate (Bis-GMA), Urethan edimeth crylate (UDMA) and triethylen eglycol dimetha crylate (TEGDMA). The strength of a restorative material is an important parameter in relation to the liability of fracture of restoration under occlusal load⁽⁸⁾.

High initial strength is important and it is desirable that a material maintain its strength over time in an aqueous environment it has been found that resin composite and poly acid-modified resin composites either maintain mechanical properties or suffer a reduction in strength and hardness, depending on brand of material and testing conditions⁽⁹⁾.

Regarding polyacid-modified resin composites, the under lying rationale is based on the idea that as water from saliva diffuses in to the material, the carboxylic acid groups of the polymer will release hydrogen ions. These hydrogen ions then

attack the fluoride containing filler particles. This mean that although initially small, the release of fluoride may become of substantial magnitude after a certain period of time in an aqueous environment⁽¹⁰⁾.

The development of new photo activation methods raised the concern that low curing rates may alter the final structure of the polymer and negatively affect the material's chemical and physical properties, in spite of reaching degrees of conversion similar to the reached with the use of continues high intensity photo activation⁽¹¹⁾.

MATERIALS AND METHODS

Fifty disk samples were prepared from each type of materials used. Fifty disk samples for tetric ceram composite resin and fifty disk samples for kerr composite resin, each ten samples were cured with same period of time which are (20,30,40,50,60) seconds.

The samples were prepared by pouring the material into stainless steal mold with dimension (2.5 mm depth, 10 mm diameter). Two glass slides used to compress the materials, during this a stainless steal wire was incorporated into each disk sample to be served as an attachment. All samples were then cured by the light curing gun. The curing was in four perpendicular points for each surface of each disk

sample. Each ten disk samplers were cured for same period of time, all samples were cured as follow:(20,30,40, 50, 60) sec. All these preparations were done for the two types of the materials used in this study (tetric and kerr composite resin)⁽¹²⁾.

After curing the disks samples were removed from the mold and suspended in to a poly ethylene test tubes. Each test tube contains 3 ml of deionized water. All the samples were stored in an cubature at 37°C for 24 hours. The samples then removed from the test tube and placed in a new test tube which contain 3 ml of deionized water and again put it in the incubator.

The tubes which contain the de-ionzied water from the first day were buff-ered by of (TISAB) solution 3ml of (total ionic strength adjusting buffer)⁽¹³⁾. The measurement of the amount of fluoride released by using ion specific electrode with the Radiometer device. The amount of the fluoride released was assigned under the first day. This method was re-peated every 30 days.

The fluoride release measurement ppm were done by calibration curve method⁽¹⁴⁾.A standard solutions were prepared according to the dilution low for solutions as shown in Figure(1)⁽¹⁵⁾.

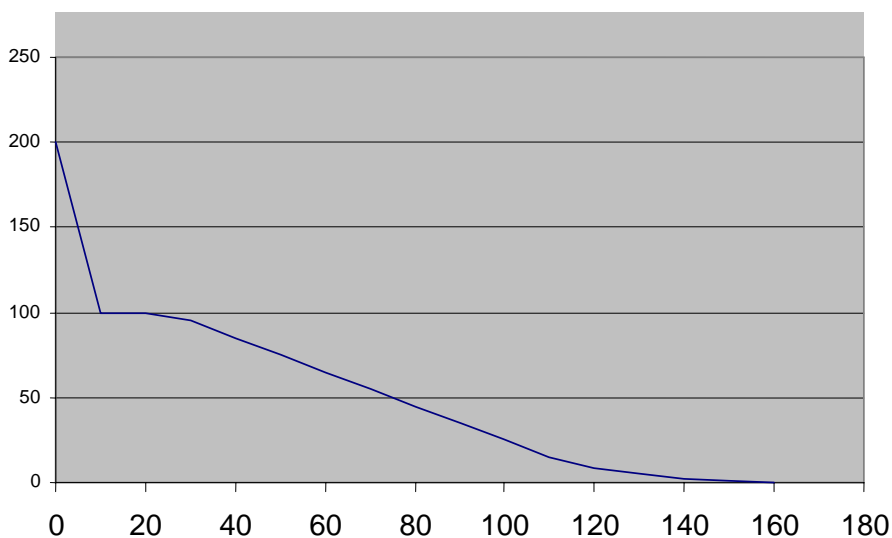


Figure (1) Standard solution curve prepared from standard solution.

RESULTS

The results obtained in mille volt (mv) and then converted to ppm by the use of curve. A curve of fluoride release were

drawn from samples as shown in Figure (2) for tetric composite resin and Figure (3) for kerr composite resin.

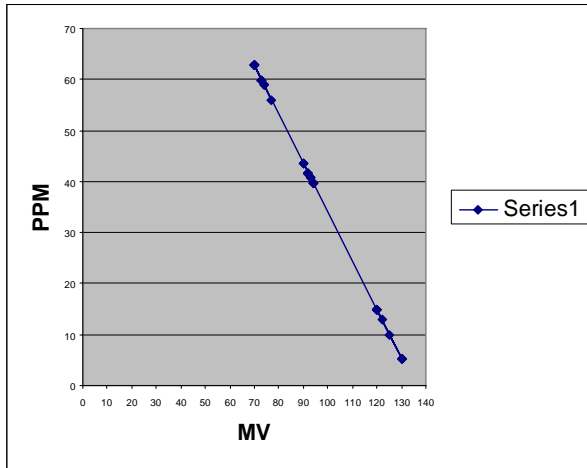


Figure (2) Fluoride released from Tetric in the first day

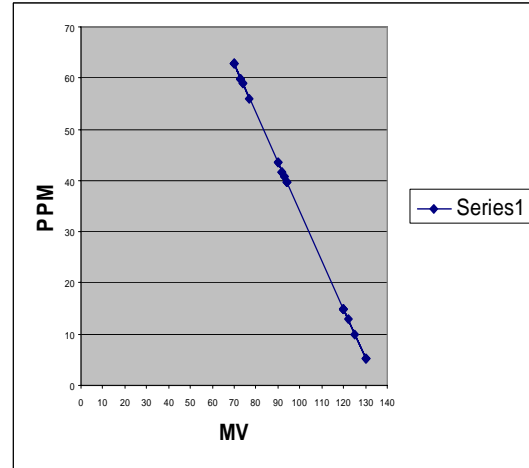


Figure (3) Fluoride released from Kerr in the first day

ANOVA test were done for the amount of fluoride released at different curing time for the two type of the materials used and the result were tabulated in

Tables (1 and 2) the result showed that there was a significant difference of the means among the tested groups at ≤ 0.01 .

Table (1) Mean and Standard deviation for the amount of fluoride released from Tetric composite resin

Source of variance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups					
Within Groups	8652.554	6	1574.592	17.621	.000
Total	259862.689	413	420.912		
	262554.243	419			

Df: degree of freedom

Table (2) Mean and Standard deviation for the amount of fluoride released from Kerr composite resin

Source of variance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups					
Within Groups	2568.460	6	532.077	11.039	.000
Total	25893.230	203	114.208		
	24582.690	209			

Df: degree of freedom

The amount of fluoride released from the samples cured at low curing time which (20,30 and 40) sec shown higher than the amount of fluoride released from

samples which cured at high curing time (50 and 60) sec for the two types of materials used in this study.

DISCUSSION

The amount of fluoride released from the composite resin as F, AlF₆ or as fluoro phosphate compounds principally deriving from glass particles that had no reaction at mixture time⁽¹⁶⁾.

In Addition to the fluoride containing glass fillers compound embedded in to the matrix may also due to the presence of fluoride from YF₃ (Ytterbium fluoride)⁽¹⁷⁾.

In this study by the use of low curing time (20,30,40) seconds will lead to increase of the amount of fluoride release while when increasing in the period of curing time (50,60)seconds there was a decrease in the amount of fluoride release. This is due to the increase of the degree of conversion of C=C double bond to C—C a single bond and leading to cohesion of the polymer net works which reduce the frontal mobility of carboxyl groups. This will lead to obstruction of the amount of the fluoride released from the materials at the high degree of curing time (50 and 60) seconds⁽¹⁸⁾.

CONCLUSION

The amount of fluoride release was affected by the period of curing time. The materials which cured at (20,30,40) seconds gave high amount of fluoride release while the materials which cured at (50,60)seconds gave low amount of fluoride release.

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