

INFLUENCE OF FILLER TYPES OF COMPOSITE RESIN ON WEIGHT CHANGE AFTER STORAGE IN NATURAL SALIVA (IN VITRO STUDY)⁺

تقييم تأثير مقدار التغيير الوزني لجزيئات الحشوات الراتنجية بعد تخزينها في اللعاب الطبيعي
(دراسة مختبرية)

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Abstract:

This in vitro study evaluate the influence of filler maker of four types of composite resin on weight change of these specimens of composite after immersed in natural saliva.

Four samples of each tested materials were placed in plastic cylindrical mold in dimension (4x6x10 mm).Which provided with cover from to same material & device for standardization of composite , The materials were manipulated according to manufactures instruction and accured by astralis light cure device , all specimens were kept in natural fresh saliva was collected daily from person 2 hours after the break fast and , so tested specimen apply on glass container for each type of composite specimen. The specimens were removed from mold and cure . The weight of each sample was measured on Analytics electronic Balance weekly until 6 weeks and record the results.

The weight change of each specimen was determined and the showed statistically high significant difference on weight change with glass inomer resin when comparing with other specimens . and less significant between feltick Z250 and packable composite resin , also less significant Z250 and Z100 composite resin .

المستخلص:

هذا البحث يتضمن تقييم التغيير الوزني لجزيئات مادة الحشوات الراتنجية بعد تخزينها في اللعاب الطبيعي في دراسة مختبرية ، اخذ لهذا البحث اربعة انواع من الحشوات الراتنجية تختلف في تركيباتها الجزيئية .

الحشوات وضعت في قوالب اسطوانية مصنوعة من لدائن البلاستيك الشفافة في قياسات هي (٤ملم x ٦ ملم x ١٠ملم) وهذا القالب مجهز بغطاء بلاستيكي ايضاً ، وصنع ايضاً ثقل مكون من سطح معدني مرتبط بيد تحمل ثقل ٤٠٠ غم فعند وضع المادة في القالب وفق التعليمات الموجودة في المادة وتغطيتها بالغطاء البلاستيكي ووضعها فوق قطعة زجاجية ملساء يتم وضع هذا الثقل فوقها بطريقة عمودية وبضبط قوي لغرض التخلص من مادة الراتنج الزائدة وايضاً ليكون الضغط متساوي على اجزاء الحشوة

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يتم ازالة الراتنج الزائد بواسطة مجس الاسنان الحاد ، من ثم استخدام جهاز البلمرة الضوئي لمدة عشر ثواني لكل سطح من اسطح النموذج ثم يتم صقله وتنعيم سطحه والقيام بقياس وزنه بواسطة جهاز الكتروني حساس ومن ثم خزن جميع النماذج في اللعاب الطبيعي الذي تجميعه يومياً من الاشخاص والقيام بقياسه اسبوعياً ولمدة ست اسابيع ومن ثم تسجيل النتائج .

لوحظ هناك فرق احصائي كبير بين **Glass inomer composite resin** وبين باقي الانواع الثلاثة الباقية ، وايضا فرق احصائي بين **feliteck Z250** وبين **packable composite resin** وايضاً هناك فرق بسيط بين **feliteck Z250 poclable** وبين **Swisstic composite resin** .

Introduction:

Dental resin composite are composed of fillers in an acrylic monomer matrix that is subsequently polymerized to form a solid. These composites are finding increased use in tooth cavity restoration[1] . The size and volume fraction of filler particles, the resin composition, the filler-matrix interfacial bonding, and the polymerization condition have all been shown to influence the composite properties[2]. The composite filler composed of particulate silicate glasses. Particles different size to achieve higher filler levels can enhance the strength, modulus and wear resistance, curving and post-cure heat treatment of resin increase the degree of conversion and strength[3]. The microstructural improvement in filler treatment resin compositions and cure conditions resulted in significant enhancement in wear resistance of composites[4]. Even with these improvement, resin composites still brittle with relatively small restorations[5]

Recently, a new generation of tooth-colored restorative materials such as flowable (low-viscosity) composites, compomers, and glass-ionomer became available. Flowable composite have lower volumes of filler than the conventional composite resins. As a result, these materials are less viscous which makes them a good choice for pit and fissure restorations[6].

In 1999 packable or condensable composites were introduced to the profession as an amalgam substitute. They contain higher filler content and exhibit more uniform filler distribution[7]. This results in a stiffer consistency with improved handling characteristics preparations. However, problems associated with these restorative materials have also been demonstrated. These restorative materials are continually bathed in saliva, and water absorption[8].

Saliva is a biological fluid secreted in abundant quantity and at a relatively regular rate[9]. The main component of saliva are water which contain 99% of water. Water determine the volume of saliva secreted per unit time, that is to say 500 to 1500 ml per day[10]. So the other component of saliva are the electrolytes (Na⁺, K⁺, Ca⁺, Cl⁻, HCO₃⁻) buffer its vary according to salivary flow. So contain lipid & the concentration (1.3 mg\dl), & protein, the glycoprotein, albumin & protein enzyme[11]

Saliva containing water (99%) absorption by composite restorative material is the amount of water absorbed through the exposed surface and into the body of the material[12]. For based composites, water absorption may induced weakening of the resin matrix and break down of the resin / filler interface[13] So to be expected absorption of water will be accompanied by hydroscopic expausion, which may be able to compensate the effect of polymerization shrinkage and to relieve the stress[14]

The objective of these study were to investigated weight change of different light curved composite restoration materials, following short term and long term storage in natural saliva .

Materials and Methods:

A specimen from each groups was placed into plastic cylindrical molds were mode of transparent plastic slices in diminction of 4mm (highness) x6mm (width) & 10mm (length) which supplst with cover- made of the some materials . Also used advice specially designed for standardization of composite application , The device consist of metal broad with fixed handle which attached to 400g weight . When the materials were manipulated according to the manufacture instruction, the cover of mold are placed over the plastic cylindrical mold & pressed with weight which placed vertically on glass slab surface and sever moved until the excess was removed with sharp prob . By this device , standardizations of pressure of condensation was confined , after curing the specimens were removed from the mold with finishing & polishing it with rabber cup and hand pieces .
The weight of each samples was measured at on Analytic electronic Balance weekly in glass container.

Collection of saliva:

Fresh, whole, healthy saliva was collected daily from the author 2 hours after the breakfast and apply on the glass containers. Each container for each type of composite

Type of composite:

- 1.Packable composite (Hybrid).
- 2.Swisstic composite (Microhybrid).
- 3.Z 250 composite (Microhyrid).
- 4.Poly acid glass inomer resin (compomer).

The specimen of all types of composite stored in container and tested weakly for 6 weeks. The tested done by using electron balance device to measured the change in weight of specimen & record the result.

Results:

Table (1)Descriptive statistics of the all values through 6 week

Type of composite	Immediately after cured	After 1 week	After 2 weeks	After 3 weeks	After 4 weeks	After 5 weeks	After 6 weeks	Mean	SD	Min	Max
Feltic Z250 composite resin	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.1	0.082	2	2.0
Swiss composite resin	1.9	2.0	2.1	2.1	2.1	2.3	2.3	2.11	0.15	1.9	2.2
Packable composite	1.7	2.0	2.0	2.0	2.0	2.1	2.1	1.99	0.13	1.7	2.1

resin											
Light-cured glass-ionomer resin	2.2	2.8	2.9	3.0	3.5	2.8	4.1	3.2	0.648	2.2	4.1

Table (2) the results of the means , standard derivations maximum , and minimum weight of test specimens .

	Z250	Swiss	Packable	Light-cured
Mean	2.1	2.11	1.99	3.2
SD	0.082	0.15	0.13	0.648
Min	2	1.9	1.7	2.2
Max	2.2	2.3	2.1	4.1

Form this table , its shown that there is statistically highly significant difference ($P < 0,01$) when comparing the glass inomer resin with other specimens.

Bar chart showing mean for all the groups .

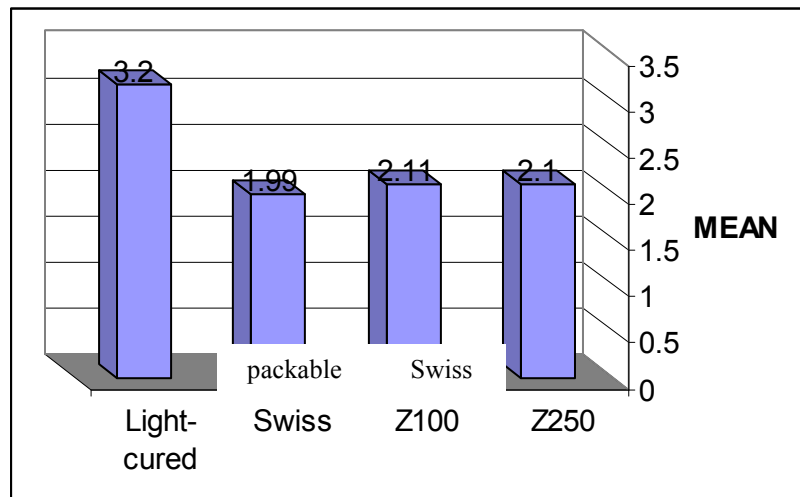


Table 3 (ANOVA table) compare between four groups

	T	P-Vol	Significance
1x2	0.548	0.604	Significant
1x3	3.361	0.015	S
1x4	5.066	0.002	HS
2x4	5.618	0,001	HS
2x4	5.986	0,001	HS

Discussion:

This study was conducted to evaluate the weight change of various light-cured restorative material after storage in natural saliva. Saliva fluid contains 99% water and a variety of inorganic and organic species, together with bacterial flora complex [14]. Water absorption causes the polymer portion composite to swell and promotes diffusion and absorption of any unbound monomer [16]. Some water absorption may cause undesirable effects such as softening of the resin matrix, resin degradation of the silane present in the interface between matrix and particles [17]. In new generation composite, the major design changes are directed primarily reducing the polymerization shrinkage and has physical and mechanical properties that make it an effective restorative for bond anterior and posterior restorations, which reduced the polymerization shrinkage and increased the initial double bond monomer and degree of conversion that achieved by developing a new diluent monomer that decreasing shrinkage and reduce the stress on bond interface [18]. In this study use the composed resin as z 250 and swisstic composite was used which are described as microhybrid composite resin was used which are contain colloidal silica particles as the inorganic filler (35-60 wt%). Composite consisting of small particle size result in smooth, polished surface in the finished restoration that is less receptive to plaque or extrinsic stain [19]. However because of greater surface area per unit volume of these microparticle, these materials can not be heavily filled because these type of resin composite contain considerably less filler than hybrid composite as packable composite resin so have water absorption greater than these composite [20]. Packable composite which consist of colloidal silica and ground particle of glass heavy metals and the total filler content being approximately (70-700wt%) the best physical & mechanical properties are identified with this category of composite, with increased or higher filler content exhibit lower water absorption values [21]. Thus, one factor related to the water absorption may be related to particle size and filler content of the restorative material. In this study, found the water absorption was higher in content. The water absorption of light-cured glass ionomer resin is difficult to compare with that of other resin materials, since light-cured glass ionomer resin are hydrophilic and absorption higher with dehydration occur, because the class-ionomer composite resin are cured initially shrink by 2.0% to 3.0%, resin provides shrinkage compensation over time, resulting in an overall volumetric change of only 0.5% shrinkage effect has been solved by hydrophilic shrinkage by taking water from oral environment into restoration materials initiating an acid-base reaction which further strengthens the matrix network and lead to fluoride release [22].

Conclusion:

1. There is a highly significant difference in weight change for light-cured glass ionomer resin comparing with other groups
2. There is no significant difference between the swisstic and z 250 feltik composite resin.
3. There is no significant difference in weight change between z250 and packable composite resin.
4. The weight change of composite resin is depend on the type of filler content.

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