

Effect of water absorption on three different types of composite resin material [invitro study]

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تأثير امتصاص الماء على ثلاثة أنواع مختلفة من مواد الراتنج المركب

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Abstract:

The purpose of this study was to compare the water absorption of three different composite resin materials. **Materials and Methods:** A total of 30 wax sheet samples were prepared and polymerized using light, with 10 samples from each group. Each sample had a depth of 2 mm and a diameter of 8 mm. The samples were stored in a desiccator for 24 hours until a stable weight was achieved. The weight of each sample was then measured using highly sensitive scales. To calculate water absorption, measurements were taken again at the end of days 1, 7, and 30. The obtained data were analyzed using One-Way ANOVA. **Results:** The results indicated that the 3M group exhibited the lowest water absorption, while the Tetric and Tokuyama groups showed equal and higher levels of water absorption. **Conclusion:** Statistical evaluation of the water absorption of composite resins after 30 days revealed that the 3M composite resin material demonstrated the lowest values. This finding is associated with the structure of the restorative material.

Keywords: Composite Resins; Water Sorption; Nanohybrid Composites; In Vitro Study; Restorative Dentistry.

المخلص

الهدف من هذه الدراسة هو مقارنة امتصاص الماء لثلاث مواد مختلفة من الراتنج المركب. **المواد والطرق:** -تم تحضير ما مجموعه 33 قرص أسطواني وبلمرة بال ضوء 03 من كل مجموعة، كل عينة بعمق 2 مم وقطر 8 مم. تم حفظ العينات لمدة 22 ساعة في آلة تجفيف حتى الوصول إلى وزن مستقر. ثم تم قياس وزن كل عينة على مقاييس شديدة الحساسية. لحساب امتصاص الماء، تم إجراء القياسات مرة أخرى باستخدام المقاييس الحساسة في نهاية 0 و 7 و 33 يوماً تم تقييم البيانات ينتج عن ذلك أن ANOVA التي تم الحصول عليها من خلال تحليل التباين أحادي الاتجاه. **النتائج:** -حيث أن امتصاص الماء الأدنى يكون امتصاص الماء من حيث 3M مجموعة الامتصاص تتيرا أن سرما والتوكوياما المتكافئ أعلى في امتصاص الماء. **الخاتمة:** - عندما تم تقييم امتصاص الماء للراتجات المركبة في نهاية 33 يوماً إحصائياً لوحظ أن مادة الراتنج المركب 3M أظهرت أقل القيم. هذا مرتبط ببنية المادة التصالحية.

Introduction

The most popular materials are dental composites because of their performance and esthetic qualities, as well as their capacity to stick to the tooth structure. Filler particles and a polymer matrix made of different methacrylate and/or acrylate monomers, dimmers, and/or oligomers, along with additives, make up dental composite materials (1).

One of the main drawbacks of esthetic restorations, which are becoming more and more popular in both anterior and posterior teeth, is that they go through a series of dimensional changes both during and after implantation. These modifications are seen to be among the primary causes of the bond's failures. Better proximal surface contouring, enhanced wear resistance, decreased polymerization shrinkage, increased fracture resistance, and biocompatibility are all provided by composite inlays. (4) Composite inlays have the disadvantages of being more expensive, requiring two appointments to fabricate a temporary restoration, and having little chance of being repaired.,with the development of adhesive dentistry in recent years, methods for repairing badly damaged teeth have undergone significant modification. (5). Dentistry is evolving to become less and less invasive the preservation of dental tissues becoming a major concern for practitioners (6). Indirect bonded restorations are therefore more and more common and reliable (7) However, complete crowns are still a viable alternative with extended survival rates (8) and are especially recommended for certain indications, such as strongly discolored teeth that require coverage or bridges with precise attachment for detachable prosthesis crown replacement. In any event, teeth that need a complete crown are frequently badly injured with significant structural loss, necessitating root canal therapy. It is debatable if receiving a root canal further weakens the tooth. (9,10).

There are several approaches to the core build-up, the most traditional being a direct core build-up with amalgam. The latter is still regarded by some writers as one of the finest choices for core build-ups with significant tissue loss and has good mechanical qualities and clinical performances. (11,12) However, due to a number of factors, including lack of adherence to tooth tissues and esthetic, political, and environmental concerns, this substance is gradually vanishing from dental offices. Another option is the bespoke metallic cast post and core, which has been linked to more dramatic failure modes but is clinically well-established and still a viable option in terms of restoration lifetime (13). They also require longer clinical and lab time and involve additional costs For these reasons along with the progress made over the years in adhesive technology (resin composites (RCs) are more and more used by practitioners as core build-up materials These restorations save time for the practitioner who can build the core in one go and one appointment and is less expensive for the patient14).

Reestablishing a patient's lost natural dental esthetic is one of the major topics of today's dentistry. In addition to function and fonation, color, shape, and structural and position abnormalities of anterior teeth may result in significant esthetic problems for patients. The technique preferred frequently to solve such problems is to cover the teeth with dental crowns, but excessive tooth preparation and damage are some disadvantages of crowns. As a result, laminate veneer restoration has been used in dentistry in recent years as a more esthetic and more conservative treatment option (15).

The oral environment has a major impact on the properties of dental restorative materials. Water sorption can affect the mechanical and physical characteristics of dental restorative materials like composite. (16).

Composite resin materials may be impacted by water sorption if their mechanical qualities and wear resistance are diminished, the inorganic filler-organic matrix bond is broken, or the

leftover monomers are released. This phenomenon will decide a decline in the mechanical properties of the material, decreasing the durability of the restoration: the properties of the organic matrix can be permanently changed, and the solubility phenomenon will release the qualities of the material compounds from the composite restoration.(17). The purpose of this experiment was to compare the changes in the water absorption values of three different composite resin materials.

Material and Methods

Martial use: - Three composite material all urged for use as contents material were examined.A total of 30 were inclined from two together type of three various of Nano suffused composite sticky substance each composite material group.

Group1: Tetric N-Ceram (IVOCLAR).

Group2: Tokuyama.

Group3: 3MTMESPE FiltekTMZ250XT.

Table1: The components of the composite type and manufactures.

Composite material	Composition	Classification	Manufacturer company
Estehte sigma Quick	Bis-GMA (urethane urethane dimethacrylate and decandiol dimethacrylate) dimethacrylate and trietyline glikol dimetakrilat,silicazirconium	Nanohybrid	Tokuyama
3M TM ESPE	Bis-GMA UDMA(urethane dimethacrylate (UDMA)- Carboxylic acid mod-ified dimethacrylate (TCB resin Bis-EMA PEGDMA AND TEGDMA resins(Triethyleneglycol dimethacrylate (TEGDMA)	Nanohybrid Univarsal	3M TM ESPE Filtek TM Z250XT
Tetric N-Ceram	Bis-GMA UDMA TEGDMA Barium glass ytterbium trifluoride(40nm and 3000nm)	Nanohybrid	IVOCLAR Rvivadent schann liecchtenstein



Figure1: Preparation of the Samples.

Preparation of the Samples

The samples accompanying a measure of 2mm girth and 8mm diameter ($n=10$) were adapted in fuller coating forma Using an spoken spatula, each material was established on the fuller sheet forma fixed at equal sizes. To specify a smooth surface, and the material full was somewhat stuff into fuller sheet forma incite piece of see-through polyester film on bottle tiny drop it was before covered accompanying another piece of The material was carpeted accompanying Mylar(presentation of action on continuous film) strips and compacted betwixt 2 glass slabs to kill voids and expel extravagance composite sticky substance material. Pressure accompanying mirror slide was used over a clear band.

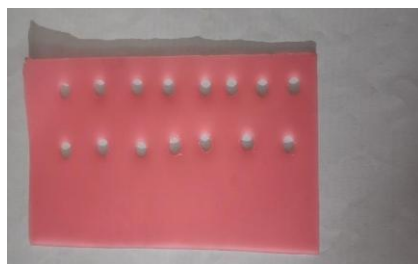


Figure2

Figure 3:celluloid strip



Figure 4:glass slab



All samples were irradiated accompanying light helping cure whole (Elipar™ Freelight 2 LED, 3M ESPE, St. Paul, MN, USA) at an force of 1000 mW/cm² on each side for 40s(74). The width of the light tip is 5 mm. During beam, the light tip was moderately transported about the example top surface and so forth examples were pretended to have an equal polymerization. Then an LED light beginning (Light cure) was used over the jug for 20sec each side , and later killing the mirror and clear band, the light was used repeated for 20 brief time period each side



Figure5 Water sorption

All varieties were established in a desiccator at 37°C for 24 hours, stocked in another desiccator samples were established in water purified by distillation bath at 37±1°C and abandoned in an brooder for 24 hours, After 24 hours of consistency the samples in the brooder they were distant and established on penetrate paper (Whatman) disgraced dry to kill excess water and before weighed correctly utilizing an energetic examining balance At the end of the 1st epoch for the matters to reclaim a resistant burden At the end of this ending the samples were calculated repeated and written All the samples were before abandoned in water purified by distillation in an brooder for 7 days afterwards that they were removed drained and weighed repeated. The alike processes were periodic in the end of 30 days and the principles calculated were written.



Figure 6: distilled water bath

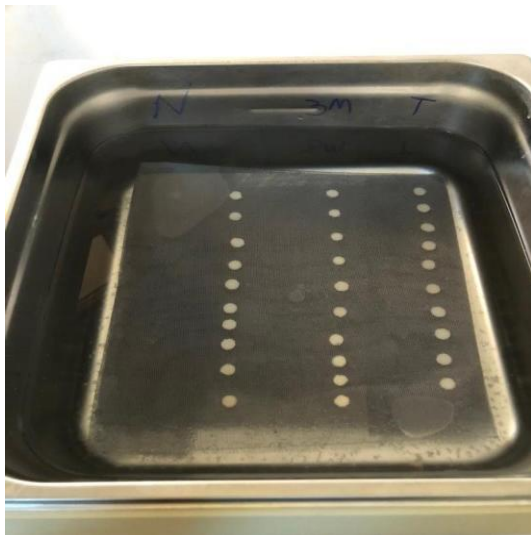


Figure7: the specimens of composite.



Figur8: Electrical Analytical Balance.

Result

Data acquired was resolved statistically using study of difference (ANOVA) and Student's t test. The data was resolved utilizing multivariate approach of repeated measures study of difference (ANOVA) of SPSS Version 13.00. All disc samples shown percentage bulk changes accompanying time when consumed water purified by distillation, but percentage bulk change evenly decreased accompanying period.

Table 1

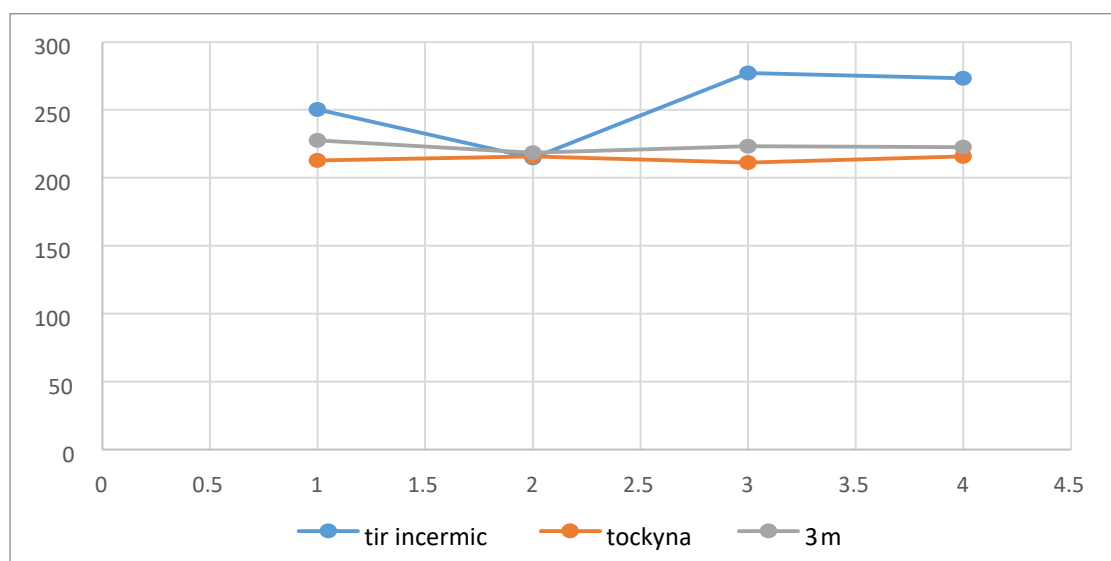
ANOVA						
	Sum of Squares	df	Mean Square	F		p-value
Between Groups	36662.93	2	18331.46	7.79675		0.304
Within Groups	117958.1	27	4368.818			
Total	154621	29				P>.001

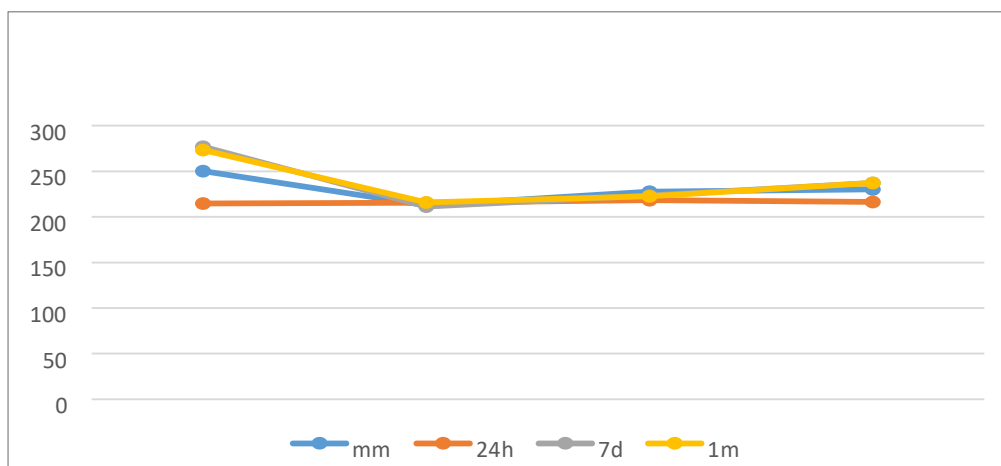
Table 2

Multiple Comparison						Ns
	Mean Difference	Std. Error	95% Confidence Interval		t	p-value
			Lower Bound	Upper Bound		
Tetric N-Ceram	57.49000*	11.26894	34.3680	80.6120	66.039	.000
Tokuyama	57.49000*	11.26894	80.6120	34.3680	32.062	.000
3m	50.67000*	11.26894	73.7920	27.5480	36.439	.000

The mean difference is significant at the 0.05 level.

Through the former table, we notice that skilled are distinctnesses in water incorporation middle from two points the groups cause the p-profit is inferior 0.005. For contrasting betwixt groups, the t-test was secondhand. Statistical reasoning granted that skilled are dissimilarities in water incorporation, as rude water assimilation 3M group, tetric and tokuyama and equal water incorporation is maximal in water incorporation.





Discussion

Tuan.N.A.T.R. et al⁽¹⁸⁾ This study is contradictory with our study, it has existed proved that sour drinks did influence the water sorption characteristics. The spread coefficient, water sorption and solubility for some composites were considerably raised later exposure in sour answer. However, there are still additional determinants that play an important part to decide water sorption traits such as stuffing stowing, stuffing size stuffing type and polymer origin. The 3M composite bestowed the highest water sorption..

yogesh kumar et al⁽¹⁹⁾ this study, it has existed proved that sticky substance-composite specimens examined were erect to go through growing water incorporation over a ending of 7 weeks. Charisma (Microhybrid composite) however, revealed statistically defeater in competition strength in an liquid surroundings. By contrast, Beautifill II (Giomer) and Tetric N-Ceram (Nanohybrid composite) were the smallest stable fabrics, on account of the inclusion of hydrophilic monomers.

Fatma M EL.S, et al⁽²⁰⁾ this study is irregular accompanying our study, The lowest water assimilation mean was establish tetric N-ceram in micro-composite sticky substance composite while two together polyacid reduced sticky substance composite and giomer have taller water absorption principles.

Rafed M AL bader et al⁽²¹⁾ In this study, we determine the sorption values, akin to the IOS4049; the intentional dental material (dental filling) has demonstrated effective performance in oral liquid conditions, rendering it suitable for indirect composite restoration.

Shqran Hamid Alabbadi et al⁽²²⁾ Tokuyama and Tetric N-Ceram nanohybrid composite resin shown higher water absorption in distilled water. 3M it demonstrated lower sorption in distilled water

Shatha A Kareem et al⁽²³⁾ Within the disadvantage concerning this study it has happened shown that sticky substance composite samples examined were establish to undergo liberal water incorporation over a ending 4 weeks toukyama composite still granted statistically the greatest establishment in an liquid atmosphere attended by giomer restoration material by contrast Z250 and tetric n ceram was the slightest resistant material on account of the inclusion of hydrophilic monomers.

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In this study water incorporation raised firmly for all materials. The portion burden change displayed a shift to increase accompanying moment of truth of water storage. This study decides that over a ending of individual months, the dissimilarities in water sorption ability of the four composite resin matters are had connection with the dissimilarities for stuffing stowing in the composite resin origin. With individual irregularity, the composite sticky substance

matters accompanying the largest portion of something that takes up had the slightest water sorption competency afterwards one months of depository in waters.

Conclusion

All the composite therapeutic material absorbs few amount of water. The water assimilation of the composite grant permission decrease the tangible and machinelike characteristics of the composites; therefore, it should to grant the type of the material before offset the situation. In this study when the water incorporation of composite resins last of 30 days were judged statistically, it was noticed that 3M composite sticky substance material revealed hostile principles. This is had connection with the construction of the therapeutic material.

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