Advances in Bioresearch
Adv. Biores., Vol 6 (2) March 2015:27-34
©2015 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
ICV 7.20 [Poland]

Advances in Bioresearch

ORIGINAL ARTICLE

Comparison of Solubility, Water sorption and Marginal leakage between XenoCem-plus Resin Cement (Dentsplysankin, Japan) and GI Fuji I cement (GC,Japan).

Mahdieh Zarabadipour1, Seied Mohammad Ebrahim Moosavi Sajad2 and Dr shima Aalaei3*
1 Oral Medicine Department, Qazvin University of Medical Science, School of Dentistry, Qazvin , Iran.
2 Prosthodontics Department, Qazvin University of Medical Science , School of Dentistry, Qazvin , Iran.
3 Prosthodontics Department, Qazvin University of Medical Science , School of Dentistry, Qazvin , Iran.
*Corresponding Author: Dr shima Aalaei

ABSTRACT
Fixed prosthesis treatments have a very important role in replacing lost portion of/or extracted teeth. Although the long-term clinical success of this treatments require to have a restoration with desirable features such as retention, stability, preservation of tooth structure, structural durability, marginal integrity and preservation of periodontium, but it is dependent to cement . 32 sound human maxillary premolar teeth were selected, which were not passed over three months from their extraction due to orthodontic treatments. The mean of dye penetration in buccal (A) and lingual surface (B) and the overall mean of dye penetration in two kinds of cements were respectively 0.23, 0.22 and 0.225 mm in GI cement and 0.22, 0.24 and 0.23 mm in Xeno cement. In addition, mean of standard deviations of dye penetration inbuccal and lingual surface and overall mean of dye penetration in two kinds of cements were respectively 0.191, 0.139 and 0.163 in GI cement and 0.141, 0.176 and 0.155 in Xeno cement. The most dye penetration between studied samples was 0.55 mm that it was in buccal surface of GI cement and the lowest dye penetration was 0 mm that it was seenin both cements. In negative control group, was not found dye penetration in samples. There was statistically significant difference between the main groups and positive control group (p <0.05) and there was not statistically significant difference between two main groups of cements from dye penetration (p>0.05). In this study have been compared amount of marginal leakage, percent of solubility and water sorption in two kinds of GI Fuji I and Xenocem-plus luting cement. The main group cemented veneers marginal leakage in both kinds of cements was not significant differencesand both cements for leakage were almost identical. There were statistically significant difference between the main groups and control samples, so that amount of marginal leakage was significantly higher in control groups. In all intervals, the solubility of Xenocem-plus resin cement was lower than GI cement. Therefore, according to the conditions and limitations of this study, Xenocem-plus resin cement has preference to GI cement. In all intervals, the amount of GI cement water sorption was more than Xenocem-plus resin cement. So according to the conditions and limitations of this study, the dimensional stability of Xenocem-plus cement is more than GI cement; Although has been explanted that water sorption can be a positive compensation factor.
Keywords: solubility, water sorption, marginal leakage, XenoCem-plus , GI Fuji I cement

Received 20/10/2014 Accepted 20/12/2014

How to cite this article:
Mahdieh Z, Seied M E M S and Shima A. Comparison of Solubility, Water sorption and Marginal leakage between XenoCem-plus Resin Cement (Dentsplysankin, Japan) and GI Fuji I cement (GC,Japan). Adv. Biores., Vol 6 [2] March 2015: 27-34. DOI: 10.15515/abr.0976-4585.6.2.2734

INTRODUCTION
Fixed prosthesis treatments have a very important role in replacing lost portion of/or extracted teeth. Although the long-term clinical success of this treatments require to have a restoration with desirable features such as retention, stability, preservation of tooth structure, structural durability, marginal integrity and preservation of periodontium, but it is dependent to cement [1] When we prepare the tooth, many of the dentin tubules are exposed, so tubules require protecting by suitable materials to reduce sensitivity and pulpal pain [2] There is no ideal cement for all properties, and dentists should be choosing based on the various clinical conditions [3]

Cement solubility, water sorption and prevention of marginal leakage are important in clinical selection, because each of them shows various behaviors when exposed in water and oral fluids for long periods [4] As always (even in the best conditions) there is an interface between the teeth and restoration margins (about 40 microns), use of cement with low solubility is very more important. Ideal cement when expose to the oral fluid should have resistance to dissolution, because the solubility is one of the failure factors and hazardous for biological compatibility. In fact, when the cement deteriorates, the retention of the restoration decreases that, it can result to failure. On the other hand, water sorption by cement also can be cause of dimensional changes, dye penetration and failures in margins. Solubility can reduce marginal integrity, esthetic (in the metal free restorations) and cement physical properties that eventually it can be cause of restorative treatments failures [5] In the other hand water sorption partly can compensate solubility and its relative effects. Moreover, one of the most basic features of ideal restoration is having marginal integrity, but cast restorations cannot be without gap in margins, so luting cements have a very important role in prevention of marginal leakage with filling of marginal interfaces [6] because presence of exposed cement (exceeded of 40 microns) in the restoration margins can be a major disadvantage for treatment success. Ideal luting cement should be provide a resistant barrier for prevention of marginal leakage, because leakage provide a route for passage of oral fluid, bacteria and their toxic products, that in the ultimate it can be cause of tooth caries, tooth sensitivity, pulp necrosis, periodontal problems and sometimes restoration failure and replacement [5] One of the common cements is Glass Ionomer cement (GI) that, it confronted with more attention, because of having properties such as fluoride release, translucency, adhesion to tooth structures and resistance to dissolution in acid, but this cement also have some disadvantages such as slow setting, sensitivity to presence of moisture and possibility to create pulp sensitivity [3, 7, 8, 9 and 10] Nowadays practitioners are going to use resin cements more than ever,due to micromechanical bond to teeth, dentin adhesion, high tensile and compressive strength and low solubility [7 and 11].

As has been proven that the polymerization degree directly affects on cement's mechanical and biological properties, dual cured resin cements confronted with more attention [12] Recently has been presented resin cement of XenoCem-plus with features such as dual curing, fluoride release, high physical strength, excellent seal under crown, no need to use etching and bonding and comfort use. Some studies reported that after caries, the decementation is the most important factor in treatment failures of fixed prosthesis [9] so, study concerning of solubility, water sorption and marginal leakage is important.

The aim of this study was comparison of solubility, water sorption and marginal leakage between XenoCem-plus resin cement (Dentsplysankin, Japan) and GI Fuji I cement (GC,Japan).

MATERIALS AND METHODS

Marginal leakage:

32 sound human maxillary premolar teeth were selected, which were not passed over three months from their extraction due to orthodontic treatments. Teeth were cleaned by pumice paste (golch dent, Iran) and were examined by the stereomicroscope (MbC, Russia) to detect any caries, crack, old filling and defect, and then,they were kept in 1% sodium hypochlorite solution (Golrang, Iran) at 4° C temperatures for one week. Afterwards,their apexes were sealed by a layer of wax and every toothwas embedded in a prefabricated mold by acrylic resin (Acropars, Iran) and they were transferred to 4° C distilled water.Two acrylicteeth were mounted in every side of the premolar to provide sameoral condition for taking the impressions. 24 hours before teeth preparation, they were transferred to 23± 2° C distilled water.

To have similar convergence in all samples, air turbine (kavo, Brazil) fixed completely on verticalshaftof survior(saeshin, Korea), by self cured acrylic resin (Acropars, Iran).Every mould containing premolar tooth wasfixed and adjusted on horizontal table of survior, thus the teeth preparation done in parallel to the long axis of them. The teeth preparation done under the conventional rules and according to the full metal preparation methods, that consist of chamfer finishing line on the top of cement enamel junction (CEJ) with 6 degree convergence and axial reduction done in two planes. Burs (Diatech, Swiss)were substituted after preparation of six teeth and during preparation we used water and air spray. For similar preparation in all samples, during preparation, occlusal surface of teeth were flattened. Measuring of the prepared teeth were done by a digital caliper (mitutoyo,Japan)to obtain mean dimensions of occlusogingival, mesiodistal and buccolingual 4.10 ± 0.02 mm, 4.17 ± 0.02 mm and 6.48 ± 0.02 mm respectively. Impressions were made by a polyvinyl siloxane material (president regular body, ApadanaTac, Iran) with injection of impression material around the teeth and seating specific customized perforated metal trays containing impression material on the moulds.

The trays had 2_3 mm space around the teeth for impression material and they had just one path of insertion. For enough retention of impression material, in addition to use perforated tray, also we used tray adhesive (Fix DENTSPLY, Deutschland) at all surfaces and impressions were made after complete drying of tray adhesive. The impressions examined not to have any bubbles and accuracy in finishing line area, and defective impressions repeated again. After one hour from removal of impressions, they boxed and poured with a high strength dental stone (ERNEST HINRICH GmbH, Germany) according to the manufacturer's instructions (with a ratio of 100 grams of gypsum powder to 23 ml of distilled water). After setting of the casts, we removed them from molds and carefully ditched the dies. Then we covered finish line area of dies by hardener material of sianoacrilate (Razi, Iran), to increase its resistance for wax up. Other areas covered by two layers of die spacer (Etude, France) except for one millimeter remained to margin. Wax patterns by inlay's wax (Bego, Germany) were made under the same condition, thickness and basic rules for all samples and marginal adaptation carefully evaluated with a magnifying glass (X4).The wax patterns invested by a phosphate bond investment (Deguvest, Germany).
Casting done by predominantly base metal alloy (silver cast Nickle-Chromium, USA). Finally, we polished the external surface of casting by blue, green and brown rubber wheels. Metal crowns adjusted to teeth by using fit checker material (speedex light body, ApadanaTac, Iran); the inner surface interferences removed by ½ round burs and again assessed marginal integrity on the dies by the magnifying glass (X4). Three defective samples removed and new sampleswere madeagain. All metal restoration thickness measured in all areas by digital caliper (mitutoyo, Japan). Thickness obtained was in margins 0.3_0.4 mm and in other areas was 1 mm. Inner surface of the crowns sandblasted with 50 microns aluminum oxide and samples divided into two groups, each group consisted of 10 main samples, 3 negative control samples and 3 positive control samples. All samples cemented with studied cement according to the manufacturer's instructions at 23 ± 1˚ C environment temperature and 50 ± 10% environment humidity.To create uniform mixture of powder we shakethe cement powder pack before its use. Samples were under continuous 5 kg occlusal force for 10 minutes during setting of the cement and the samples of Xenocem-plus group light cured(Coltene, USA) in each buccal, lingual, mesial and distal surface for 40 seconds. Apex of the teeth sealed by light cured composite (Z100,3M, USA) and all main groups teeth root surface covered to 1mm remained to margin by two layers of nail polish (Etude, France). Negative control samples covered by the nail polish at all root and crown surfaces completely, and all surfaces of the positive control samples remained uncovered. The samples incubated for 24 hours in distilled water at 37 ˚ C (Kavoosh Mega, Iran) then,thermocycled (Malek ted, Iran), at 5 and 55˚ C temperature. Exposure time in each water bath considered 30 seconds and interval time between two water baths with 1000 cycle's number considered 20 seconds, that in each water bath existed 2% methylene blue for evaluation of dye penetration. (2% methylene blue solution is obtained from dissolving 2 gram of methylene blue powder in 100 cc of water). After completion of thermocycling, all samples mounted in polyester (Taba, Iran) and sliced by Mecatom device (presi, France), from buccolingual dimension, so that obtained two half of mesial and distal. Sliced samples assessed by stereomicroscope (with X16 zoom) and the amount of dye penetration in main, positive and negative control samples registered by two completely blind observers.
We used ANOVA and Tukey tests for statistical analysis (Tables 1, 2 and 3.)

Solubility:

We prepared 28 samples of the two cements according to the manufacturer's instructions, and cements poured in a circular splitmould (Made of Teflon with twoseparate half and 15.00 mm diameter and 1.00 mm thickness) according to ISO 4049 standard. The moulds filled of cement and they putted between two glass plates to remove excess cements. The Xenocem-plus group sampleslight cured (Coltene, USA) 40 seconds from each side. Prepared samples evaluated for presence of any bubbles or defects, and whileexisted to any problem, replaced with a new sample. We removed completely excess of cements in samples edges and smoothed them by400 grit silicon carbide. 30 minutes after preparation, samples weighted initially (m1) by Digital Scales with 0.0001 gram accuracy (Sartorius, Germany),then transferred to 37° C distilled water. From each type of the cements, we selected randomly 4 groupsthat included 7 samples to weight them in different intervals. The first groups of each type of the cements for 24 hours, the second groups for 72 hours, the third groups for 168 hours (one week) and the fourth groups for 672 hours (28 days) were in 37° C distilled water, after that dried them by cotton cloths to remove completely surface humidity, then samples weighed (m2) and incubated them in 37° C (Kavoosh Mega, Iran) to reach a stable weight and finally recorded stable weight of each sample (m3).
The percent of solubility and water sorption of cement assessed according to the following formula:

$$\text{Percent of solubility} = \frac{|m3 - m1|}{m1}$$

$$\text{Percent of water sorption} = \frac{|m3 - m2|}{m1}$$

Statistical T-tests used to evaluate and compare two types of cements.

RESULTS

Marginal leakage:

The mean of dye penetration in buccal (A) and lingual surface (B) and the overall mean of dye penetration in two kinds of cements were respectively 0.23, 0.22 and 0.225 mm in GI cement and 0.22, 0.24 and 0.23 mm in Xeno cement. In addition, mean of standard deviations of dye penetration in buccal and lingual surface and overall mean of dye penetration in two kinds of cements were respectively 0.191, 0.139 and 0.163 in GI cement and 0.141, 0.176 and 0.155 in Xeno cement.

The most dye penetration between studied samples was 0.55 mm that it was in buccal surface of GI cement and the lowest dye penetration was 0 mm that it was seen in both cements.

In negative control group, was not found dye penetration in samples. There was statistically significant difference between the main groups and positive control group ($p < 0.05$) and there was not statistically significant difference between two main groups of cements from dye penetration($p > 0.05$).

Solubility:

The mean of solubility percent and water sorption of cements in different intervals are respectively in charts 2 and 3.

The most solubility was7.59% (SD 1.01) that it was in group 4 of GI cement,while the lowest solubility was 0.023% (SD 0.0075) that it was in group 1 of Xeno cement.

The results briefly are in tables 4 and 5.In all intervals, the P value obtained 0.00 that, it indicates significant statistically difference. The chart 4 is representative of cements solubility and water sorption process during experiment.

Discussion:

Since laboratory studies are considered useful for evaluation of luting materials before clinically use, the aim of this study was comparison of marginal leakage, solubility and water sorption of two types of cements.

Marginal Leakage:

Since the cast restorations never cannot be without any gap in their margins, always luting cements have a vital role to fill this gap, and prevent marginal leakage. Unfortunately most available luting cements can not certainly prevent from marginal leakage. Leaking of the oral fluids, bacteria and their toxic products can cause gingival inflammation, secondary caries and pulp lesions [5] Use of GI cement is more attentive, due to its desirable characteristic of fluoride release in certain clinically condition, that the risk of caries is much [3 and 7] However nowa days, amount of this feature effect is doubtful about prevention of progression or recurrence of secondary caries [9 and 10]. but in lasts years, before resin cements become more general , this cement had less marginal leakage in compare to other conventional cements, and from this feature considered desirable. With introduction of resin cements, due to excellent adhesion to the teeth, increased general desire to these cements. These cements have desirable features including low solubility, high stability and compatibility with tooth [7 and 11] The concern about their marginal leakage, can be due to shrinkage at the time of polymerization, Also their technical sensitivity should be considered. Use of dye is one of the oldest methods for evaluation of microleakage. In many studies, investigators used silver nitrate solution for assessment of microleakage [13, 14 and 15].One disadvantage of this solution is it's very small particles (0.059 nm) and acidic condition (PH = 4.2) that,may silver particles leakage be greater than expect. Dissolution of calcium phosphate salts at interface of tooth and cement due to acidic environment can result in increasing porosity and dye penetration [16] Thus, in this study we used neutral solution of methylene blue. In some studies has been used foushin color for evaluation of microleakage [17, 4, 18 and 19] so this neutral dye can create relatively similar results to methylene blue. In one study for evaluation of microleakage have been used of macro molecules (Lipopolysacharid and dextrin) [20] but due to lack of practical studies and adequate facilities we did not considered this study. Microleakage evaluation tests by dye are more common than the oral studies (in vivo). May be results of dye penetration in the in vitro were more than clinical reality, due to:

1. Dye spreading is easier than bacteria and their products spreading.

2. Making proteins and formation of debris and finally getting calcifying of those on the margins can somewhat improved intraoral seal.
3. Present of dentinal fluids in teeth can be preventing microleakage in mouth by positive pressure and preparation tubules fibrinogen [18]

In many studies used of the ranking scale to assess of marginal leakage [18, 20, 21, 22 and 23] but in this study due to low leakage (ratio to occlusogingival height) was not possible to use of ranking scale, because microleakage occurred in all samples at 1/3 of gingival. In this study for more accurate assessment also, we considered positive and negative control samples. Positive control samples had not received nail polish in any of its surfaces.

The results of dye microleakage assess expressed that dye penetration in this group samples were very more in both kind of cements; This shows that if teeth have not protective layer, possibly they will have dye penetration from other parts of tooth such as apex and dentin tubules. In the negative control group there was no dye microleakage and this shown that use of two layers of nail polish is adequacy for protection of microleakage. Studies have expression that Termocycle will increase greatly microleakage [23] In numerous studies remaining time in each water bath system was variable between 10 to 120 seconds(24), but between 4 to 30 seconds did not seen difference in dye penetration, that can been due to poor heat conductionof dental tissues(23).Regarding number of thermal cycles also there were not differences for dye penetration between 100-1500 cycles in various studies [24] In the present study during Termocycling,exist2% methylene blue color in water bath system that, this can somewhat to do conditions similar to the oral environment; While in most studies, evaluate dye used before or after thermal change. Since in the oral environment when teeth and restoration are in expose of thermal change, there are possible of oral fluids, bacteria and their products microleakage, synchronization of samples thermal change and dye penetration in this study, mimics partially natural conditions. Although in this study tried to have standard interference between teeth and restoration, (however White shown that, there is no connection between amount of teeth and restoration interference and amount of microleakage (14)) but providing all clinical conditions was not feasible because in the oral environment leak capable molecules are very diverse from the number, size and charge; In addition, in the mouth there are factors that, they are affective on behavior and amount of leakage such as occlusal forces, change of temperature and pH, para function habits and quality of isolation during restoration cementation [22] which provide all of these factors due to complexity, was not possible in the in vitro. In this study all samples have microleakage and dye penetration at least in the one of the buccal and lingual surfaces, which it is in agreement with Gerdole [23] Kramer [25] and Browning [26] studies results. According to these studies, leakage is always possible between tooth and restoration; that reasonable justification is weakening or breaking of bond due to cement inevitable dimensional changes during polymerization. Of course polymerization shrinkage is not only cause of leakage and also same factors are discussed, such as gap in the marginal area, temperature changes of restoration and Luting material, bond damage of restoration and dissolution of smear layer [16, 27 and 28] Even when cement layer is very thin, in early stages of polymerization create gap between teeth and restoration, therefore even before the temperature changes occurred some marginal leakage in some studies(16) that, probably is due tothis inevitable gap. In addition, temperature changes can also make clear stress in cement that is cause of undermining of bonds (even in little cycles) [29] In the evaluation of marginal leakage also should consider the porous nature of cement, solubility and water sorption [13] as dissolution of a part of cement matrix can alter the structure of matter and partly allow to fluid leakage; And amount of this dissolution compensation by water sorption is still in doubt and also is adding to these conditions amount of marginal gap due to break of teeth and cement bands by polymerization dimensional changes. So it's necessary to considering several conditions in evaluation of this marginal leakage. Generally according to this experiment results, the minimum marginal leakage in both kinds of cements was 0 and the maximum leakage wasin the GI cement that it was a little more than maximum leakage of Xeno cement. Butgenerally, there were not significant statistical differences between the main groupsof two kinds of cements. In the oral environmental all restorations are at the fluids and bacterial products that with reduce of cement solubility and marginal leakage can expect long-term clinical success. Despite of same relative microleakage in both cements, should considering that cannot confirming cement only with attention to one feature and in each cement selection should be attention to all features.

Solubility:

Cements solubility and watersorption have more clinical significance that,it's not negligible. Briefly placement of cement in expose of oral fluids can change its behavior and nature. When cement solving in contact with the oral fluids, the next clinical problems occur such as recurrent caries, pulp sensitivity, periodontal problems, and sometimes even relocation and failures of restoration. Cements solubility and water absorption nearly are in evitable and due to this use of cement with minimal solubility and water sorption can increase clinical success [4 and 5] although amount of Luting cement contact with the oral environment is very little, but it should have resistance to wear and dissolution. Excessive loss of luting material in the oral environment can done sub-margination; that actually forming a small slot and this slot in the place of restoration is cause of accumulation of plaque and dye penetration in restoration margins [30] Studies of Luting cements solubility and water sorption are limited than other physical characteristics of this cement. Assessment methods of solubility and water sorption are very simple but they are basic and important. Solubility and water sorption are phenomenon's that, their measurement is simple but, this simply may hide the complexity of its mechanism. Small dimensional changes occur due to water sorption which its observation is not easy. Some materials have inherently porosity and,they can have more water sorption in these porosities. These porosities are cause of no significant dimensions changes when they absorb water, therefore evaluation of amount of matter solubility also seems to be important in evaluation of this difference.

When a substance is placed in the cavity or restoration, its amount of solubility and water sorption can limited with cavity or restoration walls and these factors are not assessable with sheer observe of solubility and water sorption in the disc like sample; but its advantage is evaluation of results under completely controlled condition without any restrictions [31] A positive effect of water sorption in dental materials is partly compensation of shrinkage during polymerization and release of stresses, although the amount of this compensation and obtained marginal adaptation always has been considerable question and there is not guarantee for sure compensation of this amount shrinkage by dimensional changes [31] The result of water sorption is plasticization and reduces of mechanical properties such as strength. Initially, with elimination of absorbed water these changes are reversible, but with temperature increasing and over timing, these changes are irreversible, which is cause of cracking and loss of used material integrity [32] Test conditions can influence solubility rates, affecting factors on solubility caninclude time of immersion, environments temperature and pH, shape and thickness of sample, supporting material and ratio of powder to liquid in cement [33] In this study has been compared a new resin cement (Xenocem - plus) with common Glass Ionomer cement (GI). GI cement for several years used when there was high caries risk, due to having fluoride release characteristics, and still be suitable for dentists. But should be noted that its use mast have a suitable justified in specific clinical condition [8 and 9] Recently, Xenocem-plus resin cement, presented with high dentin adhesive, optimal tensile and compression strength, low solubility and fluoride release that in proportion of the other resin cements, it have suitable prices and more comfortable use, and in addition to more desirable physical and mechanical properties, it releases fluoride such as GI cement. Among of old common cements, GI cement has relatively lesser solubility, for example many studies report that its solubility is lesser than standard cements such as Zinc Phosphate [9 and 30] So in the present study, we selected GI cement due to, common usage in recent years and low solubility in comparison to the old cement. Due to the Xenocem-plus resin cement is relatively new cement and there is not any study on the characteristics of this cement or comparison of that with other standard cements, so in this study used from the results of other resin cements as a reliable result. ISO 4049 standard suggested seven-day immersion in distilled water at 37 degrees for measuring of solubility and water sorption of cement. Due to increased solubility of cement with increasing time of water immersion, in this study, in addition to this, considered more time for immersion and then evaluation of solubility and water sorption. Some in vitro studies used from the acidic environment in the evaluation of cement solubility [33 and 34] according to the ISO 4049 standard proposed evaluation of cement solubility only in the water environments. Because cement-making at all times in an acidic environment can proclamation solubility much greater than clinical reality. Although in Knobloch [35] and Eisenburger (34) study's, despite use of an acidic environment for evaluation of cement solubility, has not been expressed significant statistically differences between acidic and watery environment andhas been statementthat the acidic environment (citric acid) has not an effect on amount of cement solubility. In addition, some studies have used of different laboratory solutions to assess of solubility rate. For example Yanikoglu in his study's used of artificial saliva with different pH [36] but certainly any solution cannot imitate completely complex conditions of the oral environment. Because in the oral environment there is different molecules and materials from size and electrical charge, and also during eating and drinking occur sudden temperature and pH change that cannot rebuilt they in the in vitro environment. In the present study considered intervals of 24 hours, 72 hours, 168 hours (one week) and 672 hours (28 days) to assess the solubility and water sorption. According to this study result, with increasing time, increases the percentage of solubility and water sorption in both kinds of cements. 24 hours after preparing cement, the percentage of Xeno cement and GI cement solubility was respectively 0.02 and 1.33. Studies have stated that early putting of GI cements exposed to water will increase its solubility [37 and 38] Perhaps in terms of cement clinical application, cannot prevent of its contact even more little with water and oral fluids, and therefore in use of cements, should to bear in mind that the clinical uses of them create conditions that immediately expose cement to fluids. In other intervals also the percentage of Xeno cement solubility was significantly less than GI cement that this very low solubility of resin cements can somewhat guarantee its clinical success in the long time. Because a cement that has little solubility in the oral environment, in different clinical conditions with preventing of liquids penetration and better compatibility with tooth structure could play wellness its protective role, meantime filling of tooth and restoration gap. Also on water sorption at all intervals, the percentage of Xeno resin cement water sorption was less than GI cement that, this feature could related to the chemical composition of cement, amount of porosity and surface intrinsic characteristics of each cement. Less water sorption by cements is cause of reduces of dimensional changes and prevent of treatment failure in clinical use. In this study, solubility and water sorption of Xenocem-plus resin cement was lower than GI cement that, this result have perfectly conform with Gelmaz [38], Yoshida [33], Knobloch [35] and Eisenburger [34] studies results. In the present study has been used of disc like examples according to ISO 4049 standard.

Although in the oral environment cement in much smaller and thinner dimension is in the expose of water and oral fluids, but use of samples with these dimensions, providing the possibility of more accurately assessment of weight changes in the in vitro, and using of a homogeneous and uniform mass of cement was more favorable for assessment of disc with a smooth surface area, suitable and testable dimensions. However, all cements solubility in the oral environment is much less than its laboratory solubility; therefore if cement in the in vitro was confirmed for solubility and water sorption characteristics, it also could greatly answer the clinical expectations. Since the introduction of resin cements so far, in all studies, these cement solubility and water sorption has been reported very favorable. Considering to the remarkable difference in amount of solubility and water sorption of these two kinds of cements and the importance of having minimum solubility and water sorption, this features should further considered in clinical selection of cements.

CONCLUSION

In this study have been compared amount of marginal leakage, percent of solubility and water sorption in two kinds of GI Fuji I and Xenocem-plus luting cement. The study results indicate the following points:

The main group cemented veneers marginal leakage in both kinds of cements was not significant differences and both cements for leakage were almost identical. There were statistically significant difference between the main groups and control samples, so that amount of marginal leakage was significantly higher in control groups. In all intervals, the solubility of Xenocem-plus resin cement was lower than GI cement. Therefore, according to the conditions and limitations of this study, Xenocem-plus resin cement has preference to GI cement. In all intervals, the amount of GI cement water sorption was more than Xenocem-plus resin cement. So according to the conditions and limitations of this study, the dimensional stability of Xenocem-plus cement is more than GI cement; Although has been explanted that water sorption can be a positive compensation factor.

REFERENCES

1. Shillingburg HT, Hobo S, Whitsett LD, Jacobi R (1997). Fundamentals of fixed prosthodontics. 3rd Ed p: 119-137, USA, Quintessence.
2. Baldissara P, Comin G, Martone F, Scotti R. (1999). Comparative study of the marginal microleakage of six cements in fixed provisional crowns. J Prosthet Dent 1998; 80: 417-422.
3. Tolidis K, Papadogiannis D, Papadogiannis Y, Gerasimou P. Dynamic and static mechanical analysis of resin lutingCements. J of the mechanical behavior of biomedical materials 2012; 6: 1-8.
4. Dannelly A, Sword J, Nishittani Y, etc. Water sorption and solubility of methacrylate resin-based root canal sealers. J Endod 2007; 33: 990-994.
5. Kevf F, Tuna S.H, Sen M,SafranyA. Water sorption and solubility of different luting and restorative dental cements. Turk J Med Sci 2006; 36(1): 47-55.
6. Rosenstiel M, Behr M, Lang R, Handel G. Influence of cement type on marginal adaptation of all-ceramic MOD inlays. J Dent Mater 2004; 20: 463-469.
7. Hill E.E. Dental cements for definitive luting: A review and practical clinical consideration. J Dent Clin N Am 2007; 51: 643-658.
8. Nakajo K, Imazato S, Takahashi Y, etc. Fluride release from glass-ionomer cement is responsible to inhibit the acid production of caries-related oral stereptococci. J Dent Mater 2006.
9. Davidson CL, Mjor IA: advances in Glass-Ionomer cements. 1st ed. 1999; chapter 8, p:149-170.
10. Wang Y, Darvell B.W. Failure behavior of glass-ionomer cement under Hertzian indentation. J Dent Mater 2008; 24: 1223-1229.

11. Farrel C.V, Johnson G.H, Oswald M.T, Tucker R.D. Effect of cement type and finishing technique on marginal opening of cast gold inlays. J Prosthet Dent 2008; 99: 287-292.
12. Caughman F, Chan D.C.N, Rueggeberg F.A. Curing potential of dual-polymerized resin cements in stimulated clinical situations. J Prosthet Dent 2001; 85: 479-84.
13. White SN, Sorensen JA, Kang SK, Caputo AA. Microleakage of new crown and fixed partial denture luting agent. J Prosthet Dent 1992; 67(2): 156-161.
14. Contrepois M, Soenen A, Bartala M, Laviole O. Marginal adaptation of ceramic crowns: A systematic review 2013; 110(6): 447- 54.
15. 15.PiwowarczykA, Lauer H, Sorensen JA. Microleakage of various cementing agents for full cast crowns.Dent Mater 2005;21:445-453.
16. Ibarra G, Johnson GH, Geurtsen W, Vargas MA. Microleakage of porcelain veneer restorations bonded to enamel and dentin with a new self-adhesive resin-based dental cement.Dent Mater 2007;23:218-225.
17. Sarkis E. Microleakage study of CEREC III restorations. King Saud University Journal of Dental Sciences 2012; 3: 49-53.
18. Boldissara P, Comin G, Mortane F, Scotti R. Comparative Study of marginal microleakage of 6 cements in fixed provisional crowns. J Prosthet Dent 1998;80(4):417-422.
19. Morita M. A study on marginal leakage of crown after cyclic loading test. Nikon HotsetsuGakkaizasshi 2005; 49(5): 694-707.
20. Coleman A.J, Moses M.S, Rickerby H.D. Macromolecular leakage beneath full cast crowns: A two-year in vitro investigation. J Prosthet dent 2001; 85: 20-25.
21. Pan Y.H, Ramp L.C, Lin C.K, Lin P.R. Retention and leakage of implant-supported restorations luted with provisional cements: a pilot study. J of Oral Rehabil 2007; 34: 206-212.
22. Schmid-Schwap M, Graf A, Preinerstorfer A, Watts D, Piehslinger E, Schedle A. Dental materials 2011; 27: 855-69.
23. Gerdolle DA, Mortier E, Ayaw CL, Jacquot B. In vitro evaluation of microleakage of indirect composite inlays cemented with four luting agent. J Prosthet Dent 2005;93(6): 563-570.
24. Li X, Zhao S, Niu L, Tay F.R, Jiao K, Gao Y, et al. Effect of luting cement and thermomechanical loading on retention of glass fibre posts in root canals. J of Dentistry 2014; 42: 75-83.
25. Kramer N, Lohbauer U, Frankenberger R. Adhesive luting of indirect restorations. Am J Dent 2000; 13: 66-76.
26. Browning W.D, Safirstein J. Effect of gap size and cement type on gingival microleakage in class V resin composite inlays. Quintessence Int 1997; 28: 541-544.
27. Thordrup M, Isidor F, Horsted-Bind selv P. A 5-year clinical study of indirect and direct resin composite and ceramic inlays. Quintessence Int 2001; 32: 199-205.
28. Fortin D, SwiffJr E.J, Denehy G.E, Reinhardt J.W. Bond strength and microleakage of current dentine adhesives. J Dent Mater 1994; 10: 253-258.
29. Wendt S.L, Mc Innes P.M, Dickinson G.L. The effect of thermocycling in microleakage analysis. J Dent Mater 1992; 8: 181-184.
30. VenNoort R: Introduction to dental materials, 3rded chapter3.8, china, 2007, Mosby.
31. McCabe JF, Rusby S. Water sorption, dimensional change and radial pressure in resin matrix dental restorative materials. Biomaterials 2004; 25: 4001-4007.
32. Dhanpal P, Yiu CKY, King NM, Tay FR, Hiraishi N. Effect of temperature on water sorption and solubility bof dental adhesive resins. J of Dentistry 2009; 37; 122-132.
33. Eisenburger M, Addy M, Roßbach A. Acidic solubility of luting cements. J of Dentistry 2003; 31: 137-42.
34. Eisenburger M, Addy M, RoBbach A. Acidic solubility of luting cements. J of dentistry 2003; 31(2): 137-142.
35. Knobloch LA, Kerby RE, Mc Millen K, Celland N. Solubility and sorption of resin-based luting cements. J Oper Dent 2000; 25(5): 434-440.
36. YanikogluN, Dymus ZY. Evaluation of the solubility of dental cements in artificial saliva of different PH values. J Dent Mater 2007; 26(1): 62-67.
37. GelmalmazD ,youac C, Ozcan M, Alkumru HN. Eflects of early water contact on Solubility of Glass Ionomer luting cement. J Prosthet Dent 1998; 80(4): 474-47.
38. Marghalani H.Y. Sorption and solubility characteristics of self-adhesive resin Cements. Dental materials 2012; 28: 187-98.