



The Effect of Denture Cleanser Materials on Impact Strength of Heat Cure Acrylic Resin

Dr. Nidhal Sahib Mansoor

Dr. Dhifaf Mohammed Saleh

Dr. Shymaa Majed Abd-Alhameed

(B.Sc, M.Sc.).

Abstract

Acrylic denture base is the part of the denture that rests on the foundation tissue & to which the teeth are attached. The main objective of this study was to determine the effect of different cleansers solution on the impact strength of heat cure acrylic resin. Thirty (30) rectangular shape samples from acrylic were prepared with dimension of (55 mm *10 mm *2.5 mm) length, width & thickness. The acrylic was fabricated in the same conventional way for construction base palate. All the specimens were examined by vernier before immersion in solution to check the size of each samples, the samples were divided into three group (A, B & C) each group contain ten samples. The samples in first group (A) were immersed in distilled water, the samples in second group (B) were immersed in peroxide solution, while the sample in the third group (C) were immersed in prepared cleanser solution (citric acid). After period of immersion (for 3 week & 15 minutes every day). Finally each samples rinsed by distilled water & cleaned thoroughly by a piece of cotton before testing. The impact strength was tested in chapy impact machine. The statistical analysis of the results showed that there was no statically significant difference in impact strength value among the testing groups. This means that the all cleanser solution that were used in this study had no effect on the impact strength.

Introduction

Acrylic plastic have been the most widely used & accepted among all denture base materials and it was estimated that represent 95 % of the plastics in prosthodontics. Prior to the introduction of acrylic polymers, different materials had been used for denture bases such as vulcanite, nitrocellulose phenol formaldehyde , vinyl , plastic and porcelain⁵.

The acrylic resins success as denture base and still remains the most popular choice are due to its properties. In addition it required simple

processing equipment and relatively low cost of fabrication process.⁶

The micro porous surface of acrylic denture provides a wide range of environment to support micro organisms that can be threaten the health of the patient. The maintenance of clean denture prosthesis is important for the health of patient and to maintain an esthetic, odor free appliance, and to reduce the number of the microorganism on the dentures.

The mechanical, chemical method and a combination of the two strategies

are available to the patients to facilitate the denture hygiene.¹⁵

Denture cleansers are considered the popular method use by denture wearers for cleaning of their prosthesis.¹⁷

But some denture cleansers may have adverse effects on denture materials. In the present study, the effects of several immersion types of denture cleanser on the impact strength of heat cure acrylic denture base material had been evaluated.

Materials & Methods

preparations the mold of specimens:

Instead of wax pattern preparation, which need more time and effort in its preparation and wax elimination procedure, metal pattern was constructed with a dimension of (55mm × 10 mm × 2.5 mm) length, width & thickness for impact test as illustrated by figure (1). The conventional flasking technique for complete denture was followed in the mould preparation. The lower portion of the denture flask was filled with freshly mixed dental stone (w/p ratio is 25gm/100gm) according to the manufactures instruction. then the metal pattern was coated with the separating media and placed over the stone mixture, after the stone was set the upper half of the flask was positioned on the top of the lower portion and filled with stone. when stone was hardened the metal patterns were removed.

Preparation of acrylic specimens:

The manufactures instruction was followed in proportion & mixing of the polymer & monomer. The P/L ratio was (2.25 gm:1ml), the measured volume of liquid was placed in a clean dry mixing vessel followed by addition of powder, the mixture was then stirred

with a wax knife and left until the dough stage was reached (when it was separated clearly from the walls of the mixing jar)

The packing process was performed while the acrylic was in the dough stage, as recommended by the ADA.¹

The resin was removed from it is mixing jar & rolled, then packed into the mould which previously had been coated with separating medium. The two halves of the flask were closed together and placed under the press with a slow application of pressure to allow even flow of the dough throughout the mould space. The flask was opened and the over flowed material was removed with sharp knife followed by a second trial closure, then the (2) halves of the flask were finally closed together until metal to metal contact had been achieved. The flask was left for (5) minutes under the press before clamping, and then transferred to water bath for curing.

Curing was carried by placing the clamped flasks in water bath and processed by heating at 74 °C for about an hour and half. The temperature was then increased to the to the boiling point for 30 minutes according to ADA.¹

Following completion of curing, the clamped flasks were allowed to cool for 30 minutes at room temperature, and then immersed in water for 15 minutes after that the acrylic pattern were removed from the mould.

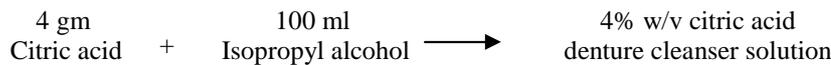
All finishing of acrylic patterns were done with an acrylic bur, then the stone bur was used to get a smooth surface of the samples and followed by sand paper of medium grit to remove any remaining small scratches then the polishing was done with bristle lathe brush & pumice, the glossary surface was obtained with wool brush and polishing paste on dental lathe using

low speed (1500) rpm and the specimens were continuously cooled with water to avoid over heating all the measurement were done by using the vernier.

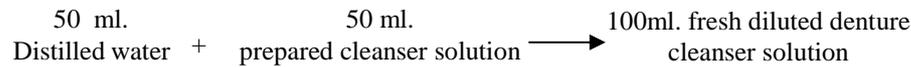
Preparation of cleanser solutions

1- Alkaline peroxide solution:

The solution was prepared according to the manufacture instruction by addition of (1) tablet of alkaline



Prior to the use each prepared denture solution was diluted with an equivalent volume of distilled water, as follows:



After complete processing, (prepared the specimens & cleanser solution).The specimens in the first group were immersed daily in distilled water, and the second group were immersed in fresh denture cleanser (alkaline peroxide).while the specimens in third group were immersed in prepared denture cleanser (citric acid).All the specimens in 3 groups were immersed in denture cleanser solution for 3 weeks, 15 minutes every day and washed thoroughly with tap water for 1 minutes & then with distilled water & returned to their containers containing solution (That was changed every day).¹¹

Finally, each sample rinsed by distilled water & cleaned thoroughly by apiece of cotton before testing.

Impact strength testing

Evaluation of impact strength testing was done according to the procedure given by ASTM.2 with charpy type impact machine which was supplied with a pendulum. In this

peroxide to (150) ml of warm distilled water (50°C).

The solution should be prepared every 12 hours when it needs to be used for longer than 12 hours.

2-The experimental cleanser solution:

Afresh denture cleanser solution was prepared by dissolving the citric acid in isopropyl alcohol (isopropyl alcohol was chosen as solvent to the acid powder due to its antiseptic effect.⁹ as followed:

procedure weight differ according to the material to be tested. The specimens were held horizontally and struck by the pendulum at the center of the tested specimen. The scale reading gives the impact energy in (J).

The value of charpy impact strength was computed by following formula of impact strength. ²

Impact strength (KJ/M²) =E/TW where E is the absorbed energy in (KJ), while T is the thickness of specimen &W is the remaining width at the center of specimens.

Results

Results of impact strength calculated in (KJ/m²) were obtained for thirty specimens in three groups, which include ten specimens in each group that were tested after period of immersion in cleanser solutions.

The mean of impact strength, standard deviation, standard error, maximum and minimum values for each group A(water),B(peroxide) and C (citric acid) solutions are listed in table (1).

The result of A(water) group showed the mean of impact strength was (0.0096) KJ/m² and for group B(peroxide)was (0.0086) KJ/m², while the mean of impact strength for C(citric acid) group was (0.0099) KJ/m² Table (1).

The comparison of impact strength means for the groups A, B&C is shown in Fig. (1).

The descriptive Student t- test for each group is shown in Table(2) which indicated there was no significant differences ($P>0.05$) in impact strength between each group A,B & C.

Discussion

Prostheses have been identified as a source of cross contamination between patient and dental personal.³ Numerous yeast is commonly found in greater abundance on palatal surface of the denture on palate it self which indicated that acrylic act as a reservoir for Infection.⁷

According, it was suggested that treatment would be better directed towards the denture and not towards the mucosa.¹⁸

It can be recommended to use denture cleansers to suppress reinfection denture surface that removed and killed the micro organism.¹²

Immersion technique is suitable method for many elderly patients in long term care hospitals because they can not adequately brush their denture due to deceases, dementia & poor dexterity.⁸

Impact strength is an important properly for acrylic denture base material which have tendency to fracture if accidentally dropped on to hard surface.¹⁰

Harrison, found that an immersion type cleaner is the most suitable because of its low abrasive and effective remove of organic debris. In

this study, the impact strength of heat cure acrylic resin was tested by charpy impact strength after immersion the specimens in the cleanser solution (distilled water, peroxide solution, citric acid) the results showed no significant differences between different groups.

From the result of study the group A(distilled water group)showed non significant difference in mean of impact strength values relative to other groups as shown in table(1). In comparison between all groups the result showed no significant difference in mean of impact strength among testing groups A (distilled water), B (Peroxide) and C (Citric acid) at ($p>0.05$) table (2).

This mean that this type of cleanser solution had no effect on impact strength with this type of heat cure acrylic resin. This study agree with (stern & whitacre) who said that the peroxide cleansers are not effective between 15-30 minutes soaking period is used; it seems to be most effective when the denture is soaked in chemical solution for several hours or over night.¹⁶

The result of present study was in agreement with that obtained by (Pavarina) when they found that there was no significant difference on the hardness of acrylic resin after immersion in any disinfecting solution.¹³

Ruled showed that correctly cured resin was not whitened by alkaline peroxide denture cleaner when it was used as recommended by manufacture.¹⁴

On the other hand the result obtained in present study disagree with those obtained by (Budtz – Jorgensen) found that acid denture cleansers is responsible for the damage of number of denture base materials so it used only weekly or biweekly intervals by over night immersion .⁴

Conclusions

On the basis of the results achieved the following conclusions can be fisted;

There was no statistically significant difference in mean impact strength observed indistilled water group & peroxide group.

No statistically significant difference in impact strength between peroxide group & citric acid group.

The effect of distilled water on impact strength values is negligible compared with citric acid group this mean there were no statistically significant deferens between this groups.

In general, no statistically significant difference in mean impact strength was observed of distilled water group, peroxide group & citric acid group & can be use this solution without effect on impact strength of heat cure acrylic resin.

References

- 1- ADA specification n No.12 (1999)- American dental associated specification no .12 for denture base polymer .Chicago; councilor dental material & device.
- 2- ASTM ,D256 (1985):American stander tests of material ;committal D-256 on standard relating to methods of mechanical & physical testing. American society for testing material
- 3- ADA (1983):American dental association, Council on dental materials, instruments and equipment .Denture cleanser J Am Dent Assoc.; 106; 77- 79.
- 4- Budtz Jorgensen E. (1979): Materials and methods for cleaning dentures Prosthetic Dent, 42(6), 619-623.
- 5- Craig R.G and powers J.M. (2002): Restorative dental material. 11 Th Ed; St Louis: Mosby co.
- 6- Cunningham ,(2000)-Shear bond strength of resin teeth to heat cured and light cured denture base resin ,J oral Rehabil ;27:312-316
- 7- Frank R.M.; Stever P. (1985)- Transmission electron microscopy of plaque accumulation in denture stomatitis Prosthet Dent; 5:115.
- 8- Gornitsky M.,Paradis I.,Landaverde G., Malo A.M., Velly A.M., (2002):A clinical and microbiological evaluation of denture cleansers for geriatric patients in long-term care institutions. J Can Dent Assoc, 68(1), 39-45.
- 9- Hatim N.A., Salem S.A., Khayat I.K.(2003): Evaluating the effect of the denture cleansers on some properties of acrylic resin denture base material (An in vitro study).Al Rafidain Dent J., 3(1), 31-38.
- 10- Harrison Z., Johnson A., Douglas C.W.T. (2004):An in vitro study in to the effect of a limited range of denture cleaners on surface roughness and removal of Candida albicans from conventional heat – cured acrylic resin denture base material. J Oral Rehabil 2004, 31, 460-467.
- 11- Jin C. , Nikawa H.; Makihra S. ;Hamada T. ;Furukawa H. (2003): Change in surface roughness and color stability of soft denture lining materials caused by denture cleansers. J oral Rehabil ,30 : 125-130.
- 12- Nikawa H., Hamada T., Kumago H. (1999):A review of in vitro methods to evaluate the efficacy of denture cleansers . Int J prosthodontics, 12,135.
- 13- Pavarina A. C. ;Vergaina C. E. ; Machado A.L. ; Giampqolo E.T. ; Teraoka M.t. (2003); The effect of disinfectant solutions on the hardness of acrylic resin denture teeth .J oral Rehabil ;30: 749: 752.
- 14- Ruled K.D. (1989): Sterilization of complete denture with sodium hypochlorite. J Prosthet Dent; 51:318-321.
- 15- shay K. (2000) :Denture hygiene. Review &update .Jconemp dent pract; 1(2); 1-8.
- 16- Stern MA, Whitacre RJ. (1981): Avoiding cross-contamination in prosthodontics. J Prosthet Dent, 64(2), 120-122.
- 17- Sheen S.R. &Harrison A. (2000): assessment of plaque prevention on denture using an experimental cleanser. J prosthetic dent; 84 (6): 594 -601.
- 18- Webb B.B . ; Thomas C.J .; Harty D.w. (1998): Effectiveness of two methods of denture sterilization .J Oral Rehbile, 25(6)416-423.

Table (1): Mean distribution of Impact strength among groups.

Groups	No.	Mean	SD	SE	Max	Min
A	10	0.0096	0.00158	0.0005	0.0116	0.0084
B	10	0.0086	0.00167	0.0006	0.0110	0.0063
C	10	0.0099	0.00215	0.0008	0.0126	0.0072

Table (2): t-test of mean impact strength between each group A,B &C.

Groups	t	p-value	C.S.
A-B	0.326	p>0.05	N.S
A-C	0.751	p>0.05	N.S
B-C	0.199	p>0.05	N.S

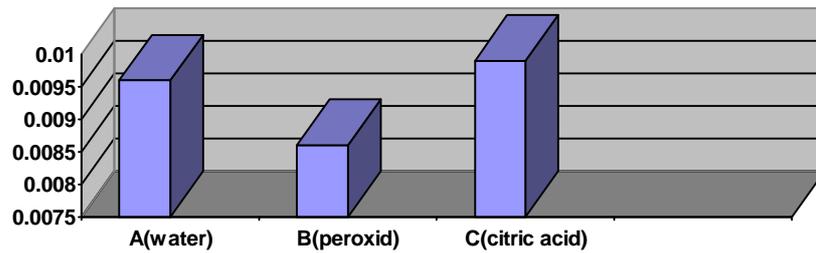


Figure (1): Bar-chart according to the mean values of the impact strength by (KJ/m²) for each group.

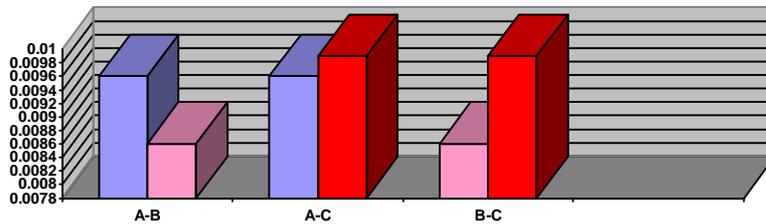


Figure (2): Bar-chart according to the mean values of the impact strength by (KJ/m²) for each group

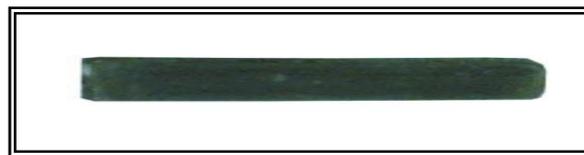


Fig (1): Metal pattern for produce acrylic specimens



Fig (2): Charpy impact device



Fig (3): The specimen after tested impact strength