Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 03, pp.48368-48376, March, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

EFFECT OF GLUTARALDEHYDE AND MICROWAVE DISINFECTION ON DIMENSIONAL ACCURACY OF 2 COMMERCIALLY AVAILABLE HEAT CURED DENTURE BASES

***Suchitra Reddy and Vikas B Kamble**

Rajiv Gandhi University of Health Sciences, University in Bengaluru, India

ARTICLE INFO

Article History:
Received 28th December, 2016
Received in revised form
06th January, 2017
Accepted 18th February, 2017
Published online 31st March, 2017

Key words:
2% alkaline glutaraldehyde,
Microwave, Dimensional accuracy,
Denture base resins.

ABSTRACT

Infectious diseases have become a major concern in the health care fields. Recent increase in incidence of diseases such as hepatitis-B and acquired immunodeficiency syndrome (AIDS) has lead to a significant change in attitude towards the importance of cross infection control in dentistry. It has been reported contaminated prosthesis can transfer microorganisms to prosthesis, materials, equipment, personnel, and patients and can establish a cross contamination cycle. To avoid this, there is a need to establish a disinfection protocol that is effective, clinically viable, inexpensive, and easy to comply with and which should not have physical, mechanical and chemical effect on denture base resin. Routinely, chemical method of disinfecting denture materials is used which includes use of sodium hypochlorite, Glutaraldehyde and chlorine dioxide. Recently, use of microwave energy has been suggested as a simple alternative to prosthesis disinfection with lower operational cost, ease of use, requires no special storage, has no expiration date and doesn't induce resistance to Candida albicans. It has been reported that both the methods are effective in prosthesis disinfection but their effect on dimensional accuracy of denture base resin is still controversial. So the purpose of this study is to evaluate and compare the effect of Glutaraldehyde and microwave disinfection on dimensional accuracy of two commercially available heat polymerized denture base resins.

Citation: Suchitra Reddy, 2017. "Effect of glutaraldehyde and microwave disinfection on dimensional accuracy of 2 commercially available heat cured denture bases", *International Journal of Current Research*, 9, (03), 48368-48376.

INTRODUCTION

Infection control is a topic of intense interest within the dental professionals (Schwartz1989). Sterilisation and disinfection have become popular and widely used methods for eradicating micro-organisms from the surfaces of denture base materials and controlling cross contaminations (Campanha, 2005). Sterilization is a process by which all forms of microorganisms including viruses, bacteria fungi and spores are destroyed. Disinfection is the destruction of most but not necessarily all microorganisms; particularly the highly resistant microbial spores may survive. Disinfection methods are less lethal than sterilisation and are sued only when sterilisation cannot be carried out (Polyzois, 1995). Denture base resins cannot be autoclaved and various methods for its disinfection are recommended. The various disinfection methods for denture base resin are use of glutaraldehyde, sodium hypochlorite, iodoform, chlorinedioxide or alcohol solutions. Immersion in 2% Glutaraldehyde solution for 10min is an effective and commonly used chemical disinfection method for denture base resins. Recently, the use of microwave energy for disinfection of denture base resins has been suggested because of its low operational cost and ease of use. As the acrylic resin denture may be contaminated externally and internally, microwave energy has been recommended as an ideal method of denture disinfection. The goal of any disinfection method is to inactivate infectious viruses and bacteria without damaging the denture base resin and its properties (Shen *et al*., 1989). Dimensional accuracy stability of the denture base is the most desirable property (Consani *et al*., 2006). As the more contact is between the denture base and case, the better the adaptation will be to the oral tissues and its close adaptation of the denture surface to the oral mucosa will result in a more retentive denture (Tefsuya *et al*., 1989). The effect of immersion in 2% Glutaraldehyde solution and microwave disinfection on the dimensional accuracy of denture base acrylic rein is still controversial.

****Corresponding author: Suchitra Reddy,***
Rajiv Gandhi University of Health Sciences, University in Bengaluru, India

MATERIALS AND METHODS

Source of Data

- Type IV gypsum dental stone (Kalabhai Mumbai)
- Maxillary edentulous Silicone rubber mold (M.P Sai enterprises, 2005-model, Mumbai)
- 3mm thick acrylate base plate (M.P Sai enterprises, Mumbai)

- Microwave oven IFB (Model- 23SC1 convention grill, IFB industries Puna)
- Sodium alginate (Cold mould seal, M.P Sai enterprises, Mumbai)

- Two commercially available heat polymerized acrylic resins

    1. DPI heat cured acrylic resins
       Dental Products of India,
       Bombay Burma Tradings, Wallace, Mumbai.

    2. Pyrax heat cured acrylic resin
       Pyrax resin polymers, 114/2,
       Krishna kunj civil lanes, Roorkee.

- Profile projector (6cTokyo, Japan, Mity tuyo PJ-250 with accuracy of 0.005mm)
- 2% Gluteraldehyde (Cidex, M.P Sai enterprises, Mumbai)

- Transverse cutting device

    1. The Mysore Kirloskar limited, Model-COBRA
    2. Size-9", Machine No. 53/9h/10027. Year 1988

- Vaccum plasticizer (Biostar)

    1. Scheu-dental, Briebsdrudc -5c bar, Sicherung
    2. 3, 15-A, No.3/096, Made in Germany.

- Vaccum Mixer (V-mix, Yoshida, Japan, No. NG-41)
- Instant Adhesive (Fevikwick, Pidilite industries, Regent chambers, Mumbai)
- Acrylizer (Emmevi, Setting Milanese, Via Darwin)
- Modelling wax (Maarc Shiva products, Mumbai)

Objectives of the study

The study was conducted to evaluate:

- To evaluate the effect of 2 % alkaline Glutaraldehyde and microwave disinfection on the dimensional accuracy of two commercially available heat cured acrylic denture base resins.
- To determine the disinfection method which has least effect on dimensional accuracy of denture base resins.

MATERIALS AND METHODS

Sixty stone casts (Fig. 6), free of voids and alveolar ridge crest imperfection were selected to fabricate acrylic resin denture base. For standardizing the thickness of the acrylic resin denture base, 3 mm thick bioacrylic sheet was plasticized on each stone cast with vacuum plasticizer (Fig. 7). The excess was trimmed and then the bioacrylic sheet was fixed to the cast using soften modelling wax. The sets were then embedded in metal flasks with dental stone according to conventional flasking procedures (Fig. 8 & 9). After one hour, flasks were kept in boiling water for 10 minutes to soften the wax. The flasks were opened and the bioacrylic sheets were discarded. Two brands of commercially available heat cured acrylic resins were selected for the study namely DPI and PYRAX (Fig. 12 &13).

Both the materials were mixed and manipulated according to the manufacturer's instructions, and when dough stage was reached the resin bulk was packed into the mould in the flasks. After bench curing the flasks were immersed in water at room temperature and polymerized at 74o c for 9 hours in polymerizaing unit. The flasks were allowed to cool slowly to room temperature. The denture bases were then deflasked carefully. All the denture base specimens were trimed by using abrasive stone to remove the excess acrylic resin flash. Finishing and polishing of the acrylic denture base resin was done sandpaper, rag wheel with pumice slurry, and cotton buff in usual manner (Fig. 2). 30 specimens for each brand of denture base resin were selected. These 30 specimens of each brand of denture base resin were further divided into 3 groups as per the disinfection procedure as follows.

Group I: Control

Group II: Disinfection by immersion in 2% alkaline glutaraldehyde for 10 minutes (Fig. 16).

Group III: Disinfection by microwave energy at 650 W for 6 minutes (Fig. 17)

The acrylic resin denture bases were immersed individually in 150ml of distilled water in a glass container. The glass container was placed on rotating table and microwave oven was adjusted for 650W for 6 min. The denture base specimens were immersed in water because denture base acrylic resins are transparent to microwave energy.

Testing of specimens: After disinfection procedure, each acrylic resin denture base specimen was dried and allowed to cool to room temperature. Each acrylic resin denture base in control and disinfection group were then placed on their respective stone casts which were numbered earlier. The acrylic resin denture bases were attached securely using instant adhesive placed on the ridge crest of stone cast in anterior, middle and posterior region, avoiding the area where transverse cuts are to be made. This was done to avoid displacement of acrylic denture base from the stone cast while transverse section of the acrylic resin denture base and cast was set. The cuts were made at canine, first molars and posterior palatal region. To guide and standardize the cuts, the stone cast had landmarks on both the sides of the base at these three respective regions which were previously done in the silicone mould (Fig. 20).

The discrepancies between the inner surface of the denture base and the cast were measured using a profile projector with accuracy of 0.001 mm (Fig. 5). The transversly cur specimens were placed in travelling stage and visualize with the lens focused at the points using a profile projector with a traveling stage calibrated to 0.001 mm at 5 points. the measurements were measured in three sections at five points, corresponding to right marginal limit (point A), left marginal limit (part B), right ridge crest (point C), left ridge crest (point D) and palatal midline E (Fig. 21). Arithmetical mean of the discrepancy found at each point of each section was considered as the total discrepancy value for each section. The average of each section i.e. canine, molar & posterior palate region was taken as overall discrepancy value for each specimen. All the procedure was carried out by a single individual and the data was recorded and statistically analyzed. Using ANOVA and Turkey post hoc procedure.

RESULTS

Fig 1 Materials used

Fig 2 equipments used

Fig 3 Microwave oven

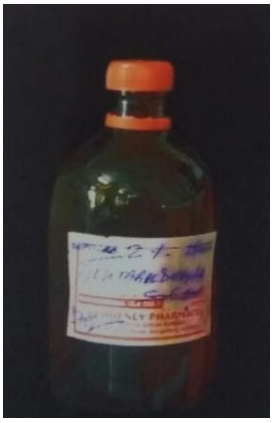


Fig 4. 2% alkaline Glutaraldehyde

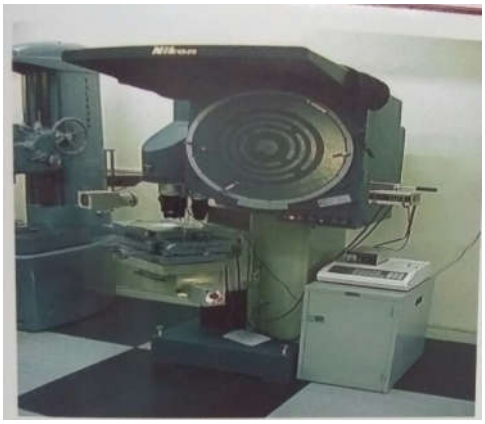


Fig 5 Profile projector

Fig 6 Pouring of silicone rubber mould

Fig 7. Vaccum adaptation of bioacrylic sheet

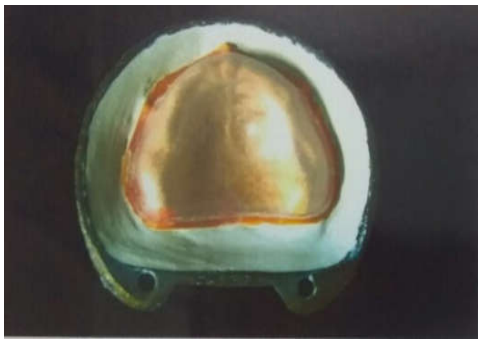


Fig 8. flasking of adapted bioacrylic sheet

Fig 9. Mould obtained after flasking

Fig 10. Flask under Hydarulic pressure

Fig 11. Deflasking of the mould

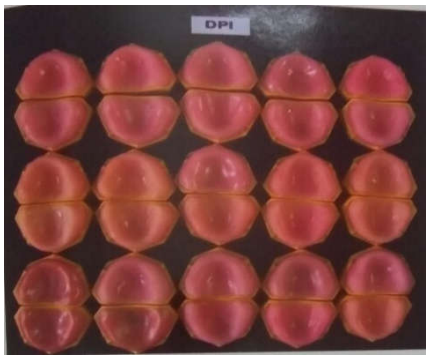


Fig 12. Cured specimens of DPI before disinfection

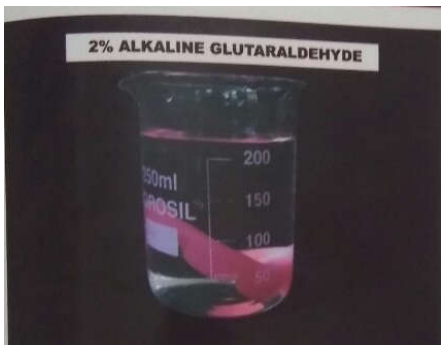


Fig 13. Cured specimens of PYRAX before disinfection

Fig 14. Disinfection in 2% alkaline Glutaraldehyde

Fig 15. Disinfection in microwave oven

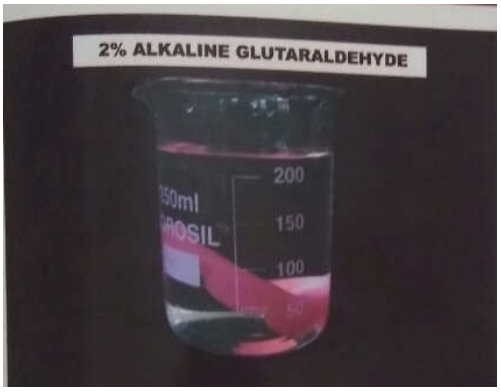


Fig 16. DPI specimens after disinfection and transverse sectioning

Fig 17. PYRAX specimens after disinfection and transverse sectioning

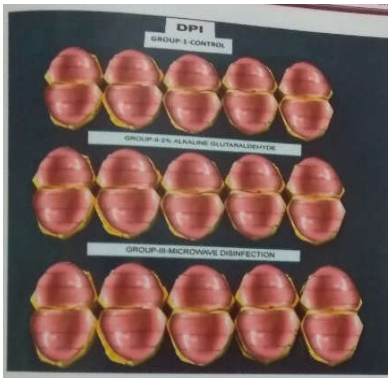


Fig 18. Sample showing section at three regions i.e, canine, molar and posterior palate region A=canine region, B=molar region, & C=palate region

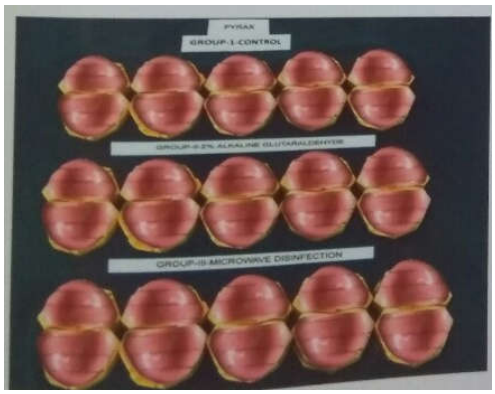


Fig. 19.

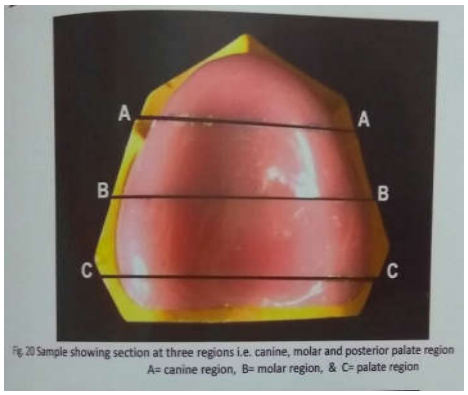


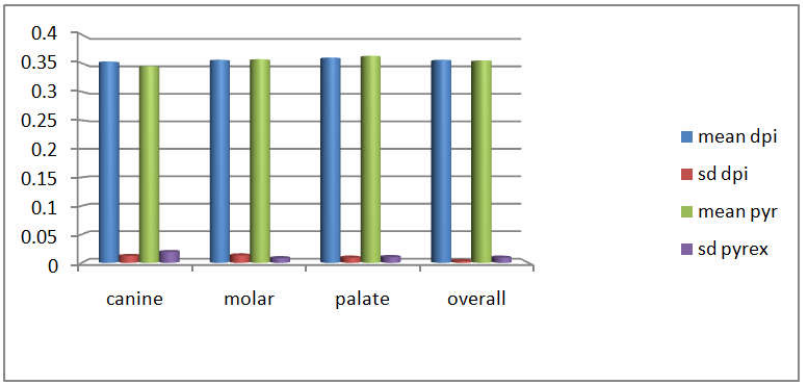
Fig. 20.

Fig 21 Sample showing section at the points where measurement were made

A=right marginal limit B=left marginal limit C=right residual ridge crest D=left residual ridge crest E=midline

Table 1. Mean and SD of discrepancies (mm) at canine, molar, posterior palate and overall region in control group with DPI and PYRAX denture base resin

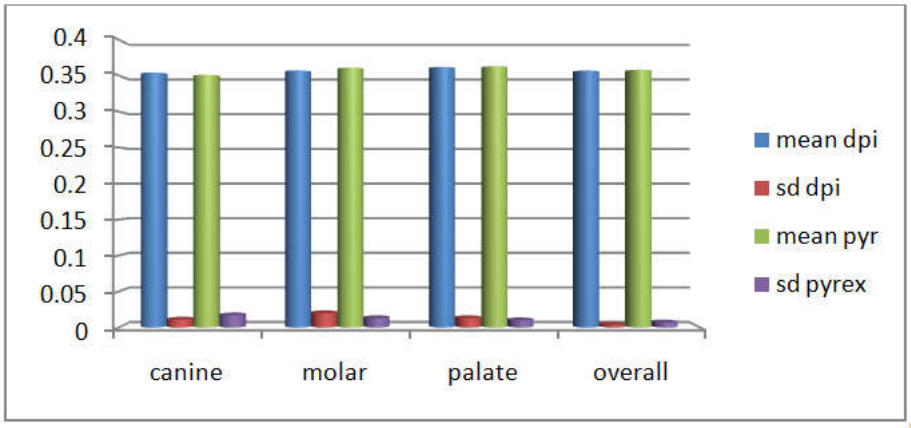
Denture base resin	Canine region		Molar region		Posterior palate region		Overall	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
DPI	0.353	0.012	0.356	0.013	0.360	0.009	0.356	0.003
PYRAX	0.345	0.019	0.357	0.008	0.363	0.010	0.355	0.009



Graph 1. Mean and SD of discrepancies (mm) at canine, molar, posterior palate and overall region in control group with DPI and PYRAX denture base resin

Table 2. Mean and SD of discrepancies (mm) at canine, molar, posterior palate and overall region in 2% alkaline glutaraldehyde disinfection group with DPI and PYRAX denture base resin

Denture base resin	Canine region		Molar region		Posterior palate region		Overall	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
DPI	0.354	0.011	0.357	0.020	0.362	0.013	0.357	0.004
PYRAX	0.351	0.017	0.361	0.013	0.363	0.010	0.358	0.007



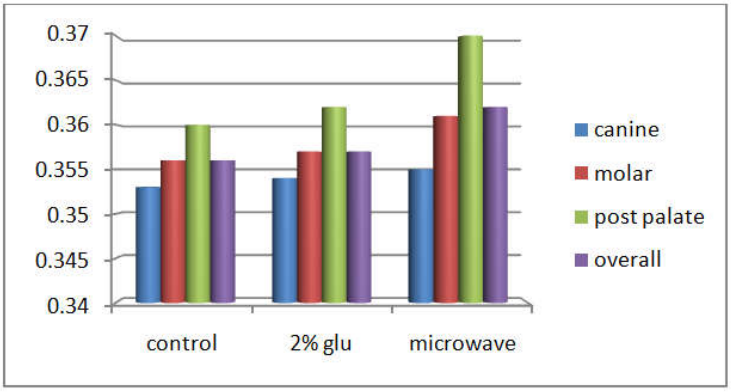
Graph 2. Mean and SD of discrepancies (mm) at canine, molar, posterior palate and overall region in 2% alkaline glutaraldehyde disinfection group with DPI and PYRAX denture base resin

Table 3. Comparision of the three groups (control, 2%glutaraldehyde, Microwave) with respect to discrepancies at canine, molar, posterior palate region with DPIdenture base resin by ANOVA and pairwise comparision of the groups by Tukeys Multiple post hoc procedures

Source	Df	Sum of squares	Mean square	F value	P value	Level of significance
Group	2	0.0000853	0.0000426	0.28	0.759	Non Significant
Region	2	0.0015329	0.0007664	4.97	0.009	Significant
Error	85	0.0131144	0.0001543			
Total	89	0.0147325				

Comparision of the three groups (control, 2%glutaraldehyde, Microwave) with respect to discrepancies at canine, molar, posterior palate region with DPIdenture base resin by ANOVA and pairwise comparision of the groups by Tukeys Multiple post hoc procedures

groups	P value	level of significance
Control vs 2% Glutaraldehye	0.604	Non Significant
Control vs Microwave	0.504	Non Significant
2% Glutaraldehye vs Microwave	0.802	Non Significant



Graph 3. Comparison of three groups (Control, 2% alkaline Glutaraldehye, Microwave) with respect to discrepancies at canine, molar, posterior palate and overall region with DPI denture base resins by one way ANOVA and pair wise comparison of three groups by Tukeys Multiple post hoc procedure

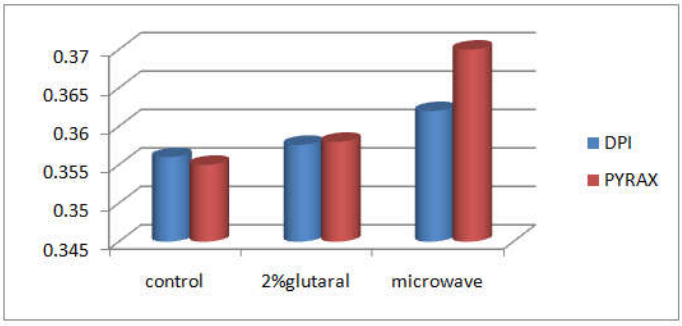
Table 5. Comparision of the three groups (control, 2%glutaraldehyde, Microwave) with respect to discrepancies at canine, molar, posterior palate region withPYRAX denture base resin by ANOVA and pairwise comparision of the groups by Tukeys Multiple post hoc procedures

Source	DF	Sum of squares	Mean square	F value	P value	Level of significance
Group	2	0.0012114	0.0006057	2.17	0.121	Non Significant
Region	2	0.0058267	0.0029133	10.42	0	Significant
Error	85	0.0237599	0.0002795			
Total	89	0.030798				

Comparison between the group		
groups	P value	Level of Significance
Control vs 2% Glutaraldehye	0.216	Non Significant
Control vs Microwave	0.112	Non Significant
2% Glutaraldehye vs Microwave	0.315	Non Significant

Table 6. Comparison of DPI and Pyrax resin with respect to overall means of control, 2% alkaline glutaraldehyde and microwave disinfection group

Denture base resin	Group	Region	P value	Level of significance
DPI	Control	Canine Molar	0.147	Non Significant
		Molar Posterior Palate	0.951	Non Significant
		Canine Posterior Palate	0.151	Non Significant
	2% Glutaraldehyde	Canine Molar	0.644	Non Significant
		Molar Posterior Palate	0.48	Non Significant
		Canine Posterior Palate	0.264	Non Significant
		Canine Molar	0.716	Non Significant
		Molar Posterior Palate	0.038*	Significant
	Microwave	Canine Posterior Palate	0.02*	Significant
Comparison between the group				



Graph 5. Comparison of DPI and Pyrax resin with respect to overall means of control, 2% Alkaline glutarldehyde and microwave disinfection group

DISCUSSION

In this study for microwave disinfection method, the acrylic resin denture bases were immersed individually in 150ml of distilled water in a glass container and placed on rotating table and microwave oven was adjusted for 650 W for 6 min. Placing of the specimens in water during microwave exposure provides uniform heating of the specimens. This was considered to be adequate to kill organisms even within the pores of the material. It is also suggested by Ikawa JY *et al* and Friedrich EG *Et al* that the wetting of the materials before microwave irradiation obtains effective disinfection (Neppelenbroek *et al*., 2003). Another reasoning for immersion of the specimens in water was to provide parallel load to absorb energy to protect the magnetron (Rohrer, 1985). There are various methods to measure the space between the denture and the cast models to check the dimensional stability of the denture base material. Amongst these methods sectioning of the base/cast and measuring the discrepancy between the inner surface of denture base and the cast using a profile projector was used in this study. In this study, sections of the base/cast set were done at three sections i.e. canine region, molar region and posterior palate region.

In each section the discrepancy was measured at five points corresponding to right marginal limit (Point A), left marginal limit (Point B), right ridge crest (Point C), left ridge crest (Point D) and palatal midline. Arithmetical mean of the discrepancy found at each point of each section was considered as the total discrepancy value for each section. This method was followed earlier in various studies done by Rafael Leonardo Xedieck Consani *et al*. (2007), Sabrina Pavan *et al*. (2005), Rafael Leonardo Xediek Consani *et al*. (2008), Rafael L X Consani *et al*. (2002). In this study mean of each section was taken as overall value of discrepancy for each specimen to get the comprehensive discrepancy for each specimen. ANOVA test for DPI denture base material showed that, all the groups i.e. control, 2% alkaline glutaraldehyde, and microwave disinfection group did not have significant effect but region wise i.e. Canine, Molar, and Posterior palate had significant effect. Comparison between the groups showed that, when control group was compared with 2% alkaline glutaraldehyde there was little increase in discrepancy, but this was statistically insignificant.

When control group was compared with microwave there was little increase in discrepancy, but this was statistically insignificant. When 2% alkaline glutaraldehyde was compared with microwave disinfection group then no significant difference was seen. When comparison was made in control group between regions, i.e. when canine region was compared with molar region, molar region was compared with posterior palate region and canine region was compared with posterior palate region, no significant difference was found. When comparison was made in 2% alkaline glutaraldehyde group between the regions i.e. when canine region was compared with molar region, when molar region was compared with posterior palate region, and when canine region was compared with posterior palate region no significant difference was found. When comparison was made in microwave disinfection group between regions, i.e. when canine region was compared with molar region then no significant difference was seen, but when molar region was compared with posterior palate and canine region was compared with posterior palate region then significant difference was found.

ANOVA test for PYRAX denture base resin showed that, all the groups i.e. control, 2% alkaline glutaraldehyde, and microwave disinfection group did not have significant effect but regions i.e. Canine, molar, and posterior palate had significant effect. Comparison between the groups showed that, when control group was compared with 2% alkaline glutaraldehyde little increase in discrepancy was seen, but this was not statistically significant. When control group was compared with microwave there was little increase in discrepancy, but this difference was statistically insignificant. When 2% alkaline glutaraldehyde was compared with microwave disinfection group then no significant difference was seen. When comparison was made in control group between regions, i.e. when canine region was compared with molar region, when molar region was compared with posterior palate region and when canine region was compared with posterior palate region, no significant difference was found When comparison was made in 2% alkaline glutaraldehyde group between the regions i.e. when canine region was compared with molar region, when molar region was compared with posterior palate region, and when canine region was compared with posterior palate region no significant difference was found. When comparison was made in microwave disinfection group between regions, i.e. when canine region was compared with molar region, when molar region was compared with posterior palate and canine region was compared with posterior palate region then significant difference was found in all three regions. In this study, when region wise analysis was done to verify the discrepancy at canine, molar and posterior palate region for both the acrylic resin denture base i.e. DPI and PYRAX it was seen that, least discrepancy was seen in canine region followed by molar region and then posterior palate region in all the groups i.e. control group, immersion in 2% alkaline glutaraldehyde group and microwave disinfection group. Both DPI and PYRAX showed least discrepancy in canine region followed by molar region and then posterior palate region. may be due to association between anatomic condition of the anterior region and acrylic resin polymerization shrinkage, where stress release does not cause significant base distortion. In addition, the topographic form of the anterior arch may limit the stresses released after mould separation. The posterior palatal region is flatter and less restrictive and permits strain release producing more evident distortion in this region causing greater base inaccuracy, whereas the first molar region shows intermediate dimensional change. This can even be justified as, although volumetric shrinkage is about 8% after processing, at present, the properties of acrylic denture resins are the best overall for complete dentures. Such a large volumetric change might see to make these materials unsuitable, but volumetric shrinkage seems to have little effect on the more important linear shrinkage. Although linear shrinkage has been calculated at 2%, this amount does not actually occur. Phillips has reported that linear shrinkage is usually from 0.2% to0.5% for various commercial resins. The greatest effect of linear shrinkage is usually on the palate of the maxillary denture, resulting in a space between palatal portion on the cast and the processed denture (Brace and Plummer, 1993). These results were in agreement with studies by Rafael Leonardo Xediek Consani *et al*. (2007), Sabrina Pavan *et al*. (2005), Rafael Leonardo Xediek Consani *et al*. (2008), Rafael L X Consani *et al*. (2002). When both the denture base materials were analysed in microwave disinfection group, it was seen that, both DPI and PYRAX showed least discrepancy in canine region followed by molar region and then posterior palate region. The

difference of discrepancy between DPI & Pyrex was not statistically significant in canine, molar, palate and overall region. Overall least discrepancy in all regions was shown by DPI denture base resin followed by PYRAX denture base resin and this difference was not statistically significant. Region wise same pattern as seen in control group was followed by microwave disinfection group. When control group was compared with microwave disinfection group, both the denture base resin materials i.e. DPI and PYRAX showed little increase in discrepancy in microwave disinfection group, but this difference was insignificant. The increase in discrepancy can be justified as the microwave irradiation at 650 W for 6minutes probably causes the water molecules to vibrate 2-3 billion times a second, thus producing friction that resulted in heating of the water the high temperatures associated with the movements of the molecules probably cause the water molecules to defuse more rapidly into the polymer. In a study done by Thomas C J and Webb B C (Webb, 1998), found that microwave disinfection at 604 W for 10 min caused linear dimensional alteration of complete dentures in vertical and horizontal directions, but reduced exposures (331 W for 6 min) caused less alteration. In a previous study, done by Polyzois G L *et al*. (Polyzois, 1995), showed that microwave disinfection at 500W for 3 and 15 min did not promote clinically relevant linear alteration, but the test specimens were resin rectangles and not denture bases. On the other hand, Dyer RA reported that all denture bases polymerized by conventional water bath or microwave energy exhibited significant distortion after repair with microwave-cured acrylic resin at 500 W for 3 minutes.

The increase in discrepancy shown by PYRAX denture base resin in immersion in 2% alkaline glutaraldehyde and microwave was 0.003mm and 0.015mm respectively. This amount of variation is very minimum and are clinically insignificant. According to Sabrina P *et al*, (Jacson, 1989), variation in measurement from less than 0.040mm to 0.0150mm in the fit of the record bases to the master cast would be clinically insignificant. Discrepancies of these amounts would be almost undetectable. It is understood that, any disinfection method should not cause damage to denture base resins and its properties. Although soft tissue displacement of only 0.25 mm would be necessary to allow almost complete sitting of the denture base on the oral tissues, disinfection procedures should not cause dimensional changes or distortion in denture bases, since these factors can compromise the retention and stability of the denture bases[42]
All these results were only after one disinfection cycle of 2% alkaline glutaraldehyde and microwave disinfection and future study is required to see the effect of disinfection techniques after repetitive disinfection cycles.

Conclusion

Within the limitations of the study it was concluded that:

- Both the acrylic resin denture base materials i.e. DPI and PYRAX, showed more dimensional accuracy in control group, followed by immersion in 2% alkaline gluteraldehyde group & microwave disinfection group.
- In control group, PYRAX acrylic resin denture base material showed more dimensional accuracy as compared to DPI acrylic resin denture base material. This difference was not statistically significant.
- Amongst both the disinfection techniques, immersion in 2% alkaline gluteraldehyde group showed least effect on the dimensional accuracy of both the acrylic resin denture base materials tested followed by microwave disinfection group. This difference was not statistically significant.
- The least effect of immersion in 2% alkaline gluteraldehyde group, was shown by DPI followed by PYRAX acrylic denture base material. This difference was not statistically significant.
- The least effect of microwave disinfection group was shown by DPI followed by PYRAX acrylic denture base material. This difference was not statistically significant.
- When region wise analysis was done, both the brands of acrylic resin denture base materials showed least discrepancy in canine region followed by molar region and maximum discrepancy in posterior palate region in all the groups tested.

REFERENCES

Anthony, D.H., Peyton, F.A. 1962. Dimensional accuracy of various denture base materials. *J Prosthet Dent*., 12: 67-8

Anthony, D.H., Peyton, F.A. 1959. Evaluating dimensional accuracy of denture bases with a modified comparator. *J Prosthet Dent,* 683-692

Asad, T., Watkinson, A.C., Hugget. 1992. The effect of disinfection procedures on flexural properties of denture base acrylic resins. *J prsothet Dent.,* 68;191-195.

Assery, M., Sugrue, P.C., Graser, G. N., Eisenbery, K. D. 1992. Control of microwave contamination commercially available cleaning solutions. *The Journal of Prosthetic dentistry*., 67;275-277

Webb, B.C. *et al*. 1998. Effectiveness of two methods of denture sterilization. *Journal of Oral Rehaiblitat*ion 24;416-423

Baydas, Bayindir, Akyil. Effect of processing variables (Different compression paking process and investment material types) and time on the dimensional accuracy of polymethyl methacrylate denture bases. Dental materials Journal;2003;22;2;206-203

Baysen, A., Whiley, R., Wright, P. S. 1998. Use of microwave energy to disinfect a long-term soft lining material contaminated with candida albicans or staphylococcus aureus. *J Proshthet dent.,* 79;454-458

Brace, M., Plummer, K. 1993. Practical denture disinfection. *J Prosthet Dent.,* 70:538-54

Buergers R, Rosentritt M, Brachert W S, Behr M, Handel G, Hahnel S. efficacy of denture dsinfection methods in controlling Candia albicans colonization in vitro. Acta Odontologica Scandinavica, 2008;66:174-180

Burns, D. R., Kazanoglu, A., Moon, P. C., Gunsolley, J. C. 1990. Dimensional stability of acrylic resin materials after microwave sterilization. *Int J Prosthodont.*, 3;489-493

Campanha, N. H., Pavirana, A. C., Vergani, C. E., Machado, A. L. 2005. Effect of microwave sterilization and water storage on Vikers hardness of acrylic resin denture teeth. *J Prosthet Dent.,* 93:483-487.

Chau, V. B., Saunders, T. R., Pimsler, M., Elfring, D. R. 1995. In-deapth disnfection of acrylic resins *J Prosthet Dent.*, 74:309-313

Chiayi Shen, Javid. 1989. Effect of glutarldehyde base disinfectants on denture base resins. *J Prosthet Dent.*, 61;583-589

Consani, R. L. X., Iwasaki, R. Y., Mesquita, M. F., Mendes, W. B., Consani, S. 2008. Effect of repeated simulated disinfections by microwave energy on complete denture base adaptation. *The Open Dentistry Journal*. 2;61-66.

Consani, R. L. X., Lira, A. F., Mesquita, M. F., Consani, S. 2006. Linear dimensional change in acrylic resin disinfected by microwave energy. *Cienc Odontol Bras*, 9:2:34-39

Consani, R. L. X., Mesquita, M. F., Nobilo, M. A., Henriques, G. E. P. 2007. Influence of simulated microwave disinfection on complete denture base adaptation using different flask closure methods. *J Prostthet Dent.*, 97:173-178.

Consani, Domitti, *et al*. 2002. Effect of commercial acrylic resins on dimensional accuracy of the maxillary denture base. *Braz Dent J.,* 13;1;57-60

Council on dental materials and equipments. Infection control recommendations for the dental office and dental laboratory JADA, 1988;116;241-248

Council on dental therapeutics. Gudielines for infection control in the dental office and commercial dental laboratory. JADA, 110;1985;969-972

Crowford, J. J. 1985. State-of- the-art :practical infection control in dentistry. *JADA*, 110,1985: 629-633

Da Breo, E. L., Herman, P. 1891. A new method of measuring dimensional change. *The journal of prothtehtic dentistry,* 65;5;718-722

Debby, S. Wong, Cheng, 1999. *Et al*. Effect of processing method on dimensional accuracy and water sorption of acrylic reins dentures. *J prosthet dent.,* 81;300-304.

Dixon, D. L., Breeding, L. C., Faler, T. A. 1999. Microwave disinfection of denture base materials colonized with candida albicans. *J Prosthet Dent.,* 81; 207-214.

Fisher, W.T., Chandler, H.T., Brudvik, J. S. 1972. Reducing laboratory contamination. *J. Prosthet. Dent,* February; 1972;27; Pg 221-225

Huggett, T., Zissis, A., Harrision, A., Dennis, A. 1992. Dimensional accuracy and stability of acrlylic resin denture bases *J Prosthet Dent.*, 68;634-640

Jacson, A. D, Grisius R J Fenster R K; Lang B R. The dimensional accuracy of two denture base processing methods. *International Journal of Prosthdodontics.* 2;421-428

Kahn, R. C., Lancaster, M. V., Kate, W. 1982. The microbiologic cross- contamination of dental prostheses. *J prosthet. Dent.,* 47:556-559

Katberg, J. W. 1974. Cross-contamination via the prosthetic laboratory. *J. Prosthet. Dent.,* October, 1974;32 :pg 412-419

Kimoto, S., Kobayashi, N., Kobayashi, K., Kawara, M. 2005. Effect of bench cooling on the dimensional accuracy of heat-cured acrylic denture base. *Journal of Dentistry*, 3:57-63

Lin, J.J., Cameron, S. N., Runyan, D. A., Craft, D. W. 1999. Disinfection of denture base acrylic resin. *J Prosthet Dent.*, 81:202-206

Monfrin, Nataro, Gassino. 2005. Dimensional contour stability of acrylic resin bases for complete dentures before and after water sorption. *Int J Prosthdodont.,* 18; 480-482

Neppelenbroek, K. H., Pavarina, A. C., Spolidorio, D. M. P., Vergani, C. E., Mima, E. G. O., Machado, S. L. 2003. Effectiveness of microwave sterilization on three hard chair side reline resins. *Int J Prosthodont.,* 16;616-620

Pavan, S., Filho, Santos, Mollo F. 2005. Effect of microwave treatments on dimensional accuracy of maxillary acrylic resin denture base. *Braz Dent J.,* 16;119-123.

Pavan, S., Filho, J. N. A., Santos, P. H. D., Mollo, F. 2005. Effect of microwave treatments on dimensional accuracy of maxillary acrylic resin denture base. *Braz Dent J.,* 16;119-123

Polyzois, G. L., Ziss, A. J., Yannikakis, S. A. 1995. The effect of glutaraldehyde and microwave disnfection on some properties of acrylic denture resin. *Int J Prosthodont.* 1995;8;150-154

Polyzois, Ziss, Yannikakis S. 1995. The effect of glutaraldehyde and microwave disinfection on some properties of acrylic denture resins. *Int J Prosthdodont*. 8;150-154.

Rohrer, M. D., Bulard, R. A. 1985. Microwave sterilization. JADA., 110;194-198

Sanders, J. L., Levin, B., Reitz, P. V. 1991. Comparison of the adaptation of acrylic resins cured by microwave energy and conventional water bath. *Quintessence Int*., 22;181-186

Sartori, E. A., Schmidt, C. B., Walber, L. F., Shinkai, R. S. 2006. A. effect of microwave disinfection on denture base adaptation and resin surface roughness. *Braz Dent J.,* 17

Schwartz, R. S., Burgess, J. O., Bradley, D. V. 1989. The Use of Warm Solutions for more rapid disinfection of prostheses. *Int j Prosthodont,* 2:518-523

Seiko, R. S., Vergani, C. E., Pavarina, A. C., Compagnoni, M. A, Machado, A. L. 2007. Influence of microwave disinfection on the dimensional stability of intact and relined acrylic resin denture bases. *J Prosthet Dent*. 98:216-223

Shen, C., Zjavid, N. S., Colaizzi. 1989. The effect of glutaraldehyde base disinfectants on denture base resins. *J Prosthet Dent.,* 61:583-589.

Silva, M. M., Vergani, C. E., Giampaolo, E. T., Nappelenbroek, K. H., Spolidorio, D. M. P., Machado, A. L, 2006. Effectiveness of microwave irradiation on the disinfection of complete dentures. *Int J Proshtodont* 19;288-293

Skykora, *et al*. 1997. Improved fit of maxillary complete dentures processed on high expansion stone casts. *Journal of Prosththetic dentistry.,* 72;2;205-208

Tefsuya, 1989. Resin denture base : Review of accuracy and method op polymerization. *The International Journal of Prosthodontics,* 2 : 555-562

Tefsuya, 1989. Resin denture base: Review of accuracy and method op polymerization. *The International Journal of Prosthodontics*, 2 : 555-562

****