



## EFFECT OF MORINDA CITRIFOLIA AS STORAGE SOLUTION ON THE SURFACE ROUGHNESS OF HEAT CURE ACRYLIC RESIN – AN INVITRO STUDY

### Dental Science

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### ABSTRACT

Denture cleansing is important to increase denture longevity, maintain the health of oral mucosa and improve patient's quality of life. Chemical disinfectants have been widely used as denture cleansers which effectively remove organic and inorganic matter from denture surface. Another important consideration is that the mechanical and physical properties of acrylic resin should remain un-altered. Morinda citrifolia L has been found to have antibacterial efficacy but its effect on the surface roughness of heat cure acrylic resin has not been studied.

#### Objectives

To evaluate and compare the surface roughness of polished heat cure acrylic resin after storage in distilled water and solution of Morinda citrifolia L (Noni).

#### Material and methods

Ten disc shaped specimens (2mm thickness x 5mm diameter) was fabricated using heat cure acrylic resin and divided into 2 groups. All the specimens were polished and baseline surface roughness (Ra) values were measured using surface roughness tester (Profilometer). Group 1 specimens (n=5) was stored in distilled water (Control group) and Group 2 specimens (n=5) was immersed in a solution of Morinda citrifolia L (Noni) for 2 weeks. Surface roughness (Ra) measurements after immersion was measured using surface roughness tester (Profilometer). The results obtained were statistically analysed using Mann-Whitney test to compare between the groups and Wilcoxon signed rank test was used to compare the time points between groups.

#### Results

Statistical analysis results of Mann-Whitney test showed, at baseline the mean rank value of water and Noni as 6.0 $\mu$ m and 5.0 $\mu$ m and after 2 weeks the mean rank value of water and Noni was 6.40 $\mu$ m and 4.60 $\mu$ m respectively. There is no statistical difference between both the groups as the p-value (0.602 and 0.347) is higher than p<0.05. The statistical analysis results of Wilcoxon signed rank test showed mean rank value of water at baseline and after 2 weeks as 2.00 $\mu$ m and 4.50 $\mu$ m and of Noni was 2.67 $\mu$ m and 3.50 $\mu$ m respectively. There was no statistical difference between the time points of water and Noni as the p-value (0.686 and 0.897) is higher than p<0.05.

#### Conclusion

Surface roughness values of heat cure acrylic resin at baseline and after immersion in water and Noni was similar and statistically there was no significant difference between the groups.

### KEYWORDS

Morinda citrifolia, profilometer, heat cure acrylic resin

#### Introduction

The success of complete denture treatment is not completed with the insertion of the finished and polished prosthesis. Regular maintenance of the prosthesis by the denture wearers and periodical consultation with the prosthodontist are essential for the long term use of the dentures. Care of dentures and the mucosal tissues of the edentulous mouth is important for overall health, especially in older persons. Every surface in the oral cavity, natural or synthetic becomes covered within about 30 minutes with a 0.5-1.5  $\mu$ -thick precipitate of salivary glycoprotein and immunoglobulin that is termed pellicle. The pellicle in turn provides a substrate to which oral debris (such as mucin, food particles and desquamated epithelial cells) and microorganisms (bacteria and fungi) readily adhere. Maintenance of adequate denture hygiene through mechanical or chemical methods or both is essential to minimize and preferably eliminate adverse tissue reactions. Denture cleansing is important to increase denture longevity, maintain the health of oral mucosa and improve patient's quality of life. Chemical disinfectants have been widely used as denture cleansers which effectively remove organic and inorganic matter from denture surface. The use of chemical disinfectants should not have any effect on the physical and mechanical properties of the acrylic resins mainly on the surface roughness which could lead to microbial adhesion on the surface which can cause denture related problems and discomfort to the patient. Morinda citrifolia (Noni) is a versatile medicinal plant has a broad spectrum of pharmacological activities and was being used in the treatment of various diseases traditionally. Many studies reported that the extract of Morinda citrifolia showed anti-bacterial efficacy but

its effect on the surface roughness of heat cure acrylic resins has not been studied yet. Water is the most commonly used storage medium for complete dentures which does not alter the properties of the acrylic resins. The present study was done to compare and evaluate the surface roughness of polished heat cure acrylic resins after storage in distilled water and solution of Morinda citrifolia (Noni).

#### Materials and methods

Ten disc shaped specimens (2mm thickness x 5mm diameter) were fabricated using heat cure acrylic resin (DPI heat cure, Mumbai). The modeling wax No.2 ( Hindustan dental products, Hyderabad) was prepared to the required dimension and using conventional flasking method for denture fabrication, the wax dies were flaked and dewaxing done (Fig.1). After the wax was completely removed, the separating medium (cold mould seal) was applied on the mold and left to dry. Poly methyl methacrylate acrylic resin material (DPI heat cure, Mumbai) were taken in a porcelain jar and mixed as per manufacturers instruction, when the material reached dough stage it is packed in the mold. After 30 minutes of bench curing, the flask is kept for short curing cycle. The flask is opened after curing and the acrylic disc were removed, surface irregularities were smoothed using coarse and fine sand papering using a mandrel. The specimens were polished with pumice powder and water slurry and dry polishing was carried out using yellow high shine polishing compound (Rouge) and cotton puff. The baseline roughness value (Ra) were measured using surface roughness tester.

Ten specimens were divided into two groups. Group 1 specimen (n=5) was immersed in distilled water and Group 2 specimen (n=5) was immersed in solution of *Morinda citrifolia* (Noni) for 2 weeks (Fig.2). After 2 weeks the specimens were removed and air dried, surface roughness testing was done for each specimen and the values were recorded using surface roughness tester (Fig.3a,b).

The data thus obtained were subjected to statistical analysis using SPSS Software (IBM SPSS Statistics for windows, Version 22.0). The variables did not follow normal distribution, therefore to analyse the data non parametric methods were applied. To compare the values between the surface roughness after immersion in distilled water and *Morinda citrifolia*, Mann-Whitney test was done and to compare the time points with water and *Morinda citrifolia*, Wilcoxon signed ranks test was done. The significance level is fixed as 5% (p<0.05).



Fig.1 Mold after dewaxing and



Fig.2 Specimen stored in Noni Water



Fig.3a) shows surface roughness testing done on the heat cure acrylic resin specimen using profilometer, b) the readings recorded are shown in the monitor



**Results**

Surface roughness values (Ra) obtained at baseline were recorded for each sample and after two weeks of immersion in water and Noni the values obtained were recorded. The values obtained did not show any significant changes between both the storage medium. The statistical analysis results of Mann-Whitney test showed at baseline, the mean rank value of water and Noni to be 6.0µm and 5.0µm and after 2 weeks, the mean rank value of water and Noni was 6.40µm and 4.60µm respectively. There is no statistical difference between both the groups as the p-value (0.602 and 0.347) is higher than p<0.05. The statistical analysis results of Wilcoxon signed rank test showed mean rank value of water at baseline and after 2 weeks as 2.00µm and 4.50µm and that of Noni was 2.67µm and 3.50µm respectively. There was no statistical difference between the time points of water and Noni as the p-value (0.686 and 0.897) is higher than p<0.05.

**Table: I Surface roughness value at baseline and after immersion in water and Noni (Ra-µm)**

SAMPLE	STORAGE MEDIUM	BASE LINE(µm)	AFTER 2 WEEKS(µm)
1	Water	0.3112	0.3557
2	Water	0.3084	0.2540
3	Water	0.1014	0.1232
4	Water	0.0493	0.1076
5	Water	0.4404	0.3153
6	Noni	0.1770	0.1939
7	Noni	0.1077	0.0917
8	Noni	0.0996	0.1187
9	Noni	0.3170	0.3454
10	Noni	0.0665	0.0865

(Surface roughness values (Ra) of heat cure acrylic resins at baseline and after immersion in water and Noni are measured in µm).

**Table: II Mann-Whitney Test to compare values between Water and Noni**

	Medium	N	Mean Rank	P-Value
Baseline (µm)	Water	5	6.00	0.602
	Noni	5	5.00	
After 2 weeks (µm)	Water	5	6.40	0.347
	Noni	5	4.60	

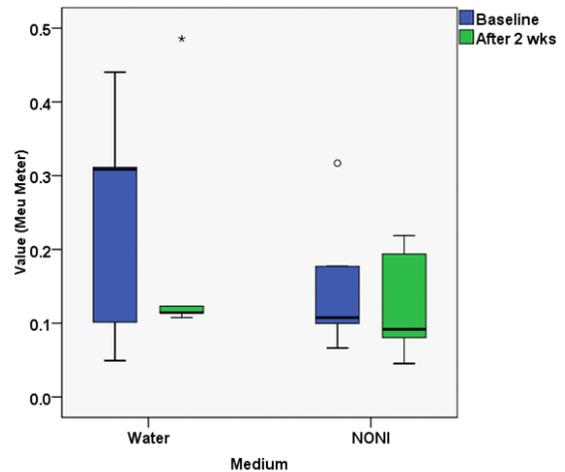
**Table: III Wilcoxon Signed Ranks Test to compare values between time points in Water**

		N	Mean Rank	P-Value
After 2 weeks (µm) - Baseline (µm)	Negative Ranks	2	4.50	0.686
	Positive Ranks	3	2.00	

**Table: IV Wilcoxon Signed Ranks Test to compare values between time points in Noni**

		N	Mean Rank	P-Value
After 2 weeks (µm) - Baseline (µm)	Negative Ranks	2	3.50	0.893
	Positive Ranks	3	2.67	

**Chart : I Combined values of water and Noni baseline and after 2 weeks**



**Discussion**

The complete denture success not only depend on the proper fabrication of the prosthesis and the type of material used, maintenance of the denture after insertion is also as equally important. Denture hygiene is important to increase denture longevity, to maintain the health of oral mucosa and improve patient's quality of life. Dentures when not worn should be placed in water or cleansing solution. Chemical disinfectants have been widely used as denture cleansers which effectively remove organic and inorganic matter from denture surface<sup>1</sup>. Using disinfectants as storage medium could result in changes in the mechanical and physical properties of the acrylic resins used for processing the dentures<sup>2,3,4</sup>. Various studies have reported that use of disinfection solution alter the hardness and surface roughness of acrylic resins. In 2004 Debra et al<sup>5</sup>, evaluated the Surface roughness of acrylic resins (auto-polymerizing ) and fixed partial denture materials at baseline and after storage in artificial saliva and artificial saliva – coffee solutions. The results showed Significant differences in surface roughness of provisional crown materials when polished under same condition and surface roughness increased for nearly all materials after storage in either moist environment. Azevedo et al in 2006<sup>6</sup>, conducted a study on effect on hardness and surface roughness of two disinfecting solution (1% sodium hypochlorite & 4% chlorhexidine) on two chair side reline resins versus a heat polymerizing denture base resins and concluded that the disinfecting solution caused no apparent damage on the surface roughness and hardness of the materials. Carvalho CF et al in 2012<sup>7</sup>, evaluated the hardness, surface roughness and mass loss of acrylic denture base resin after immersion in 1% sodium hypochlorite, 2% gluteraldehyde and 4% chlorhexidine for 60 minutes. Surface

roughness of acrylic denture base resin shows vulnerable changes after immersion in disinfectant solution and no significant change in the hardness of the material. The study conducted by Neppelenbroek et al, suggest that the chemical disinfection adversely affect the hardness of 2 heat polymerized denture base materials ( Lucitone 550 and QC-20) and after immersion in water for 15 days the effect was reversed and long term storage in water showed progressively increased hardness<sup>8,11</sup>.

Morinda citrifolia, a leafy extract shows pharmacological effect on treatment of various diseases including microbial infection. A large number of beneficial effects have been claimed and the knowledge on the chemical composition of Noni has considerably increased over recent years. A number of in vitro and in vivo studies demonstrate a range of potentially beneficial effects. In 2009 Selvam et al<sup>9</sup>, conducted a study on the antibacterial effect of Morinda citrifolia against E. coli, Staphylococcus aureus and Proteus vulgaris and they concluded that the extracts of Morinda citrifolia showed moderate antibacterial effects against the 3 organisms compared to standard levofloxacin. In 2015 Shafath ahmed et al<sup>10</sup>, evaluated the anti-bacterial efficacy and effect of Morinda citrifolia L (NONI) mixed with irreversible hydrocolloid for dental impressions. The author concluded that Morinda citrifolia L. mixed with irreversible hydrocolloid decreased the percentage of microorganisms when compared with water but did not affect the surface quality or dimensional stability of the casts. In the present study a solution of leafy extract showed no significant change in the surface roughness of a heat cure acrylic resins after immersion for 2 weeks. As this is an in vitro study done for a shorter duration, further clinical trials to be done to substantiate the effectiveness of Morinda citrifolia as a storage medium for prostheses fabricated using heat cure acrylic resins.

### Conclusions

Within the limitations of the current study, the following were concluded:

1. The extract of Morinda citrifolia L. as storage medium for heat cure acrylic resin shows no significant change on the surface roughness of the material.
2. It can be effectively used as a denture disinfectant without any changes in the properties of the resin.

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