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A comparative study to evaluate the mechanical property of chemically activated denture base material, heat activated denture base material and nylon denture base material by immersion in water and disinfectant-An in vitro study

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Abstract

Background and objective: Compatibility between the disinfectant and the type of denture base material should be considered to avoid adverse effects on the hardness of the acrylic resin while selecting a disinfectant for dental prosthesis. This prospective, in vitro study, was conducted to evaluate the effect of disinfection and water immersion on the hardness of chemically activated resin, Heat activated denture base resin, and Nylon denture base material.

Methodology: 60 disk-shaped test samples (8 mm thick and 13 mm in diameter) 20 Samples were prepared using chemically activated denture base resin, 20 samples were prepared using heat-activated denture base resin and 20

samples were prepared using nylon (flexible) denture material, polished, stored in water at 370C for 48 +/- 2 hours. Each material was divided into two groups (control n =10 and disinfectant solution n = 10). Microhardness measurements were made for all test samples with Vickers hardness tester using 25 gf load for 10 seconds (VHN before disinfection). Disinfection methods included scrubbing with 0.525% sodium hypochlorite for one minute rinsed in water and immersed 0.525% sodium hypochlorite for 10 minutes. The disinfection procedures were repeated 4 times, the hardness measurements were made on each specimen (VHN after disinfection). Control specimens were stored in water during the disinfection procedure. After disinfection, all the specimens were immersed in water and hardness tests were performed after half a month, after a month, after 2 months, and after 3 months of storage in water. Statistical analysis of data was conducted with ANOVA and Bonferroni test.

Results: Except control groups revealed a significant decrease in hardness after disinfection, regardless of the disinfectant solutions used. However, this effect was reversed in half a month, after a month, after 2 months and after 3 months of storage in water, all material used for this study exhibited a continuous increase in hardness value during the period of water immersion.

Conclusion: The denture material showed significantly and progressively increased hardness after storage in water. Lower hardness values were exhibited after disinfection. The effect was reversed in half a month, after a month, after 2 months, and after 3 months of storage in water. All materials show more hardness value in water than in disinfectant solution

Keywords: Chemically activated denture base resin, Heat activated denture base resin, Covid19

Nylon (flexible) denture material, 0.525% sodium hypochlorite solution, Vicker's hardness test.

Introduction

Cross-contamination can occur not only through contaminated dentures but also through polishing agents and instrumentation between patients and dental personnel.[1] In dental practice the need for cross – infection control has received increasing attention in recent years because of greater awareness of communicable disease such as SARS-CoV-2 virus (COVID 19), Hepatitis B and acquired immunodeficiency syndrome (AIDS). The spread ofinfection in dental practice by contaminated instruments, impressions, and prosthesis have been emphasized by a number of investigators and it was suggested that every patient should be regarded as a potential risk and appropriate measures should be taken to control spread of infection[2, 20]. Microorganisms can spread by direct contact with blood or saliva from an infected patient in clinical area or by direct contact with microorganisms through impressions, gypsum casts, and dental prosthesis in the clinical and laboratory areas[3].

Studies on different physical and mechanical properties of denture base resins subjected to immersion disinfection have shown that some disinfecting solutions cause changes in these physical and mechanical properties[6]. Hardness of a material is an important property during clinical use, denture base resins materials are immersed in saliva, and during denture storage they are soaked in water or an aqueous cleansing solution. However, some studies showed a gradual increase in surface hardness of some denture base resins after water immersion and this improvement in the hardness property has been attributed in part to leaching of the residual monomer from the resin[1].

Methodology

This prospective, In-vitro study was conducted in Department of Prosthodontics, Crown and Bridge

Including Implantology at Al-Badar Rural Dental College and Hospital, Kalaburagi and Department of Mechanical and Manufacturing Engineering, Navodya Engeneering College, Raichur, Karnataka.

A aluminium master die, 13 mm in diameter and 8mm in thickness was used to make working molds from which disc shaped samples were made of each denture base material. After acrylization using molds as per instruction on their respective manuals, excess resin material was removed and hand polished on both the sides.

Grouping of test samples

Total number of 20 samples of each Chemically activated denture base resin (DPI, Mumbai), Heat activated denture base resin (Heat cure acrylin H high impact resin), Nylon(flexible) denture material (Valplast) are grouped as Material A, Material B and Material C.

Test Samples of material A, B and C were equally divided into 2 groups

Total number of 10 samples each was considered as control group and grouped a1, a2 and a3.

Total number of 10 samples each was considered as 0.525% sodium hypochlorite solution and grouped b1,b2 and b3.

After polishing, all specimens were stored in distilled water at 37°C for 48 hours. Micro hardness indentations were made for all specimens with a vicker's digital micro hardness tester (MMT-X7A) using a 25(gf) load for 10 seconds. The diagonals of the pyramid impressed on the specimen by the Vicker's diamond indentor were measured and noted. Ten indentations were made at different points on each specimen and the mean value was calculated. Vicker's hardness number (VHN) was then calculated for each specimen, and the average value was determined to provide an overall mean value representative of the materials prior to disinfection.

Disinfection procedure:

After the evaluation of the hardness value of each sample before disinfection, each specimen was then scrubbed with 0.525% sodium hypochlorite for one minute, rinsed in water, and immersed for 10 minutes in 0.525% sodium hypochlorite (group b1, b2, b3). Specimens were disinfected 4 times to simulate the clinical condition. After disinfection, the specimens were immersed in water for three minutes and blotted dry. Control specimens (group a1, a2, a3) were maintained in water during the time required to perform the disinfection procedures. Hardness measurements, as previously mentioned, were made again after disinfection.

Measurements of Vickers hardness value of the samples at different time intervals of water immersion

Following disinfection, specimens were stored in distilled water and hardness measurements were made at different time intervals (15, 30, 60, 90 days of water immersion). During water storage, each specimen was individually immersed into 200 ml disposable plastic cups. The distilled water was discarded after each measurement. Each specimen was washed in distilled water, dried with absorbent paper and placed in MMT – X7A (MAT SULWA) digital micro hardness tester and vicker's hardness value of each sample evaluated.

Results

The data were subjected to measure analysis of variance ANOVA, Paired Samples Test and BONFERRONI TEST. The SPSS software (version 16) package was used for statistical analysis. This study was conducted to evaluate the effect of disinfection and water immersion on hardness of three denture base materials.

Table 1: Showing the master chart with mean Vickers hardness value of two different study groups of chemically activated denture base resin.

	Control group a1						0.525% Sodium hypochlorite					
Sn.	Before disinfection (t1)	After disinfection (t2)	15 days (t3)	30 days (t4)	60 days (t5)	90 days (t6)	Before disinfection (t1)	After disinfection (t2)	15 days (t3)	30 days (t4)	60 days (t5)	90 days (t6)
1.	16.12	16.14	17.18	17.35	17.39	17.45	16.22	15.18	16.15	16.65	16.78	17.04
2.	16.18	16.22	17.29	17.36	17.45	17.49	16.18	15.12	16.08	16.68	16.76	17.07
3.	16.15	16.18	17.24	17.22	17.35	17.42	16.24	15.19	16.12	16.62	16.81	17.01
4.	17.12	17.15	17.18	17.33	17.32	17.41	16.22	15.18	16.12	16.62	16.75	17.03
5.	16.88	17.18	17.22	17.35	17.40	17.44	16.15	15.10	16.06	16.56	16.75	16.83
6.	17.33	17.18	17.34	17.32	17.39	17.43	16.15	15.13	16.08	16.56	16.77	17.08
7.	16.16	17.15	17.28	17.35	17.41	17.44	16.19	15.15	16.10	16.68	16.76	16.99
8.	16.18	16.20	17.30	17.36	17.40	17.42	16.20	15.16	16.09	16.65	16.82	16.66
9.	16.78	17.18	17.24	17.45	17.41	17.46	16.22	15.12	16.12	16.60	16.69	16.85
10.	16.14	16.88	17.25	17.34	17.40	17.44	16.23	15.15	16.05	16.66	16.73	17.06

Table 2: Showing the master chart with mean Vickers hardness value of two different study groups of Heat activated denture base resin.

	Control group a1						0.525% Sodium hypochlorite					
Sn.	Before disinfection (t1)	After disinfection (t2)	15 days (t3)	30 days (t4)	60 days (t5)	90 days (t6)	Before disinfection (t1)	After disinfection (t2)	15 days (t3)	30 days (t4)	60 days (t5)	90 days (t6)
1.	18.19	18.14	19.18	19.45	19.59	19.65	17.92	16.88	17.35	17.85	18.78	18.34
2.	18.18	18.22	19.29	19.46	19.55	19.69	17.98	16.82	17.48	17.88	18.06	18.37
3.	18.15	18.18	19.24	19.42	19.55	19.62	17.94	16.89	17.42	17.82	18.19	18.31
4.	18.12	18.15	19.18	19.43	19.52	19.61	17.92	16.88	17.42	17.82	18.07	18.33
5.	18.17	18.18	19.22	19.45	19.50	19.64	17.95	16.80	17.46	17.86	18.25	18.33
6.	18.33	18.18	19.34	19.42	19.59	19.63	17.95	16.83	17.48	17.86	18.26	18.38
7.	18.16	18.15	19.28	19.45	19.51	19.64	17.99	16.85	17.40	17.88	18.21	18.39
8.	18.18	18.20	19.30	19.46	19.50	19.62	17.90	16.78	17.49	17.85	18.22	18.36
9.	18.13	18.18	19.24	19.45	19.51	19.66	17.92	16.72	17.42	17.80	18.08	18.35
10.	18.14	18.21	19.25	19.44	19.50	19.64	17.93	16.85	17.45	17.86	18.18	18.36

Table 3: Showing the master chart with mean Vickers hardness value of two different study groups of Nylon denture material.

	Control group a1						0.525% Sodium hypochlorite					
Sn.	Before Disinfection (t1)	After disinfection (t2)	15 days (t3)	30 days (t4)	60 days (t5)	90 days (t6)	Before Disinfection (t1)	After disinfection (t2)	15 days (t3)	30 days (t4)	60 days (t5)	90 days (t6)
1.	14.12	14.14	15.18	15.35	15.39	15.45	14.22	13.18	14.15	14.65	14.78	15.04
2.	14.18	14.22	15.29	15.36	15.45	15.49	14.18	13.12	14.08	14.68	14.75	15.07
3.	14.15	14.18	15.24	15.22	15.35	15.42	14.24	13.19	14.12	14.62	14.81	15.01
4.	14.12	14.15	15.18	15.33	15.32	15.41	14.22	13.18	14.12	14.62	14.75	15.03
5.	14.88	14.18	15.22	15.35	15.40	15.44	14.15	13.10	14.06	14.56	14.75	15.83
6.	14.33	14.18	15.34	15.32	15.39	15.43	14.15	13.13	14.08	14.56	14.77	15.08

7.	14.16	14.15	15.28	15.35	15.41	15.44	14.19	13.15	14.10	14.68	14.76	15.99
8.	14.18	14.20	15.30	15.36	15.40	15.42	14.20	13.16	14.09	14.65	14.82	15.66
9.	14.78	14.18	15.24	15.45	15.41	15.46	14.22	13.12	14.12	14.60	14.69	15.85
10.	14.14	14.88	15.25	15.34	15.40	15.44	14.23	13.15	14.05	14.66	14.73	15.06

Table 4: Showing the effect of water on the hardness of chemically activated denture base resin, Heat activated denture base resin and Nylon denture material after immersing in water.

Materials		Paired sample test	t	df	Sig.(2-tailed)
Chemically activated resin	Pair1	VHN number Before disinfection(t1)-VHN number after disinfection(t2)	-1.916	6	.104 NS
Heat activated denture base resin	Pair1	VHN number Before disinfection(t1)-VHN number after disinfection(t2)	0.624	6	.556 NS
Nylon denture material	Pair1	VHN number Before disinfection(t1)-VHN number after disinfection(t2)	-4.503	6	.004 HS

Objective 2

Table 5: Showing the effect of disinfectant solution on the hardness of chemically activated denture base resin, Heat activated denture base resin and Nylon denture material after immersing in disinfectant solution.

Materials		Paired sample test	t	df	Sig.(2-tailed)
Chemically activated resin	Pair1	VHN number Before disinfection(t1) –post value at time 0(t2)	340.239	6	.000 HS
Heat activated denture base resin	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2)	33.600	6	.000 HS
Nylon denture material	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2)	6.670	6	.001 HS

Objective 3

Table 6: Showing the effect of water and disinfectant solution on the hardness of chemically activated denture base resin, Heat activated denture base resin and Nylon denture material after immersing in water and disinfectant solution.

Materials		Paired sample test	t	df	Sig.(2-tailed)
Chemically activated resin	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2)	-1.916	6	.104NS
	Pair1	VHN number Before disinfection(t1) –post value at time 0(t2	340.239	6	.000 HS
Heat activated denture base resin	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2)	0.624	6	.556NS
	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2)	33.600	6	.000HS
Nylon denture material	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2	-4.503	6	.004HS
	Pair1	VHN number Before disinfection(t1)- post value at time 0(t2)	6.670	6	.001HS

Table 7: Showing the master chart with repeated measures of ANOVA test of chemically activated denture base resin, Heat activated denture base resin and Nylon denture material on the hardness after immersing in disinfectant solution and for long term water immersion.

Anova test – repeated measures

Groups		VHN number Before disinfection(t1)-	post value at time 0(t2)	post value at 15 days (t3)	post value at 30 days (t4)	post value at 60 days (t5)	post value at 90 days (t6)	F(df1,df2)	P value
Control	Mean	16.3614	16.3786	17.3252	17.4090	17.4710	17.5381	73.135(5,10)	‹0.001
	N	21	21	21	21	21	21		HS
	Std. Deviation	1.69349	1.64560	1.63369	1.68072	1.68147	1.70492		
Test	Mean	16.1843	15.1310	15.8981	16.4243	16.5524	16.7900		
	N	21	21	21	21	21	21		
	Std. Deviation	1.53756	1.42045	1.38717	1.40275	1.40302	1.39346		
Total	Mean	16.2729	15.7548	16.6117	16.9167	17.0117	17.0117		
	N	42	42	42	42	42	42		
	Std. Deviation	1.6007	1.64433	1.66198	1.60815	1.59860	1.58381		

Table 8: Showing the master chart with Bonferroni pair wise comparisons (Total data) of chemically activated resin, Heat activated denture base resin and Nylon denture material on the hardness after immersing in disinfectant solution and for long term water immersion.

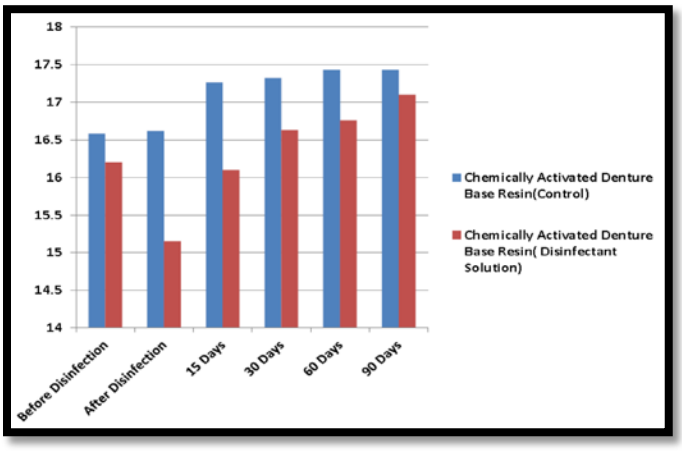
Pairwise Comparisons Measure: measure

(I)	(J)time	Mean Difference	Std. Error	Sig. a	95% confidence interval for difference Lower bound	Upper bound
1	2	.518*	.091	.000	.234	.802
	3	.339*	.111	.061	-.689	.008
	4	-.644*	.082	.000	-.899	-.389
	5	-.739*	.078	.000	-.984	-.494
	6	-.891*	.069	.000	-1.107	-.676
2	1	-.518*	.091	.000	-.802	-.234
	3	-.857*	.044	.000	-.996	-.718
	4	-1.162*	.049	.000	-1.314	-1.010
	5	-1.257*	.051	.000	-1.417	-1.096
	6	-1.409*	.061	.000	-1.601	-1.218
3	1	.339*	.111	.061	-.008	.686
	2	.857*	.044	.000	.718	.996
	4	-.305*	.036	.000	-.417	-.193
	5	-.400*	.042	.000	-.530	-.270
	6	-.552*	.055	.000	-.725	-.380
4	1	.644*	.082	.000	.389	.899
	2	1.162*	.049	.000	1.010	1.314
	3	.305*	.036	.000	.193	.417
	5	-.095*	.008	.000	-.120	-.070
	6	-.247*	.020	.000	-.310	-.185
5	1	.739*	.078	.000	.494	.984
	2	1.257*	.051	.000	1.096	1.417
	3	.400*	.042	.000	.270	.530
	4	.095*	.008	.000	.070	.120
	6	-1.52*	.016	.000	-.20	-1.103
6	1	.891*	.069	.000	.676	1.107
	2	1.409*	.061	.000	1.218	1.601
	3	.552*	.055	.000	.380	.725
	4	.247*	.020	.000	.185	.310
	5	.152*	.016	.000	.103	.201

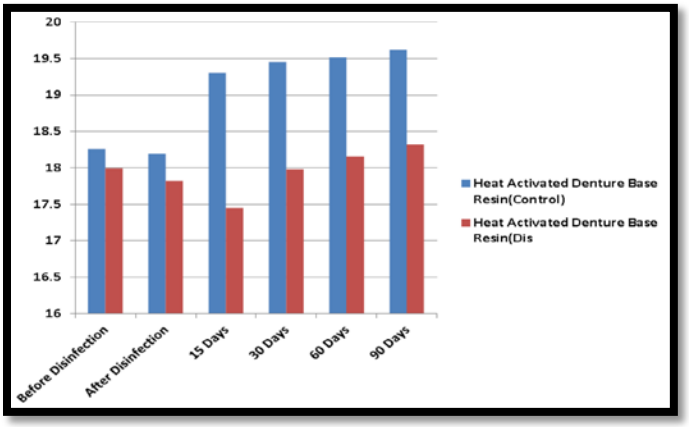
Based on estimated marginal means

* the mean difference is significant at the .05 level. a. Adjustment for multiple comparisons: Bonferroni.

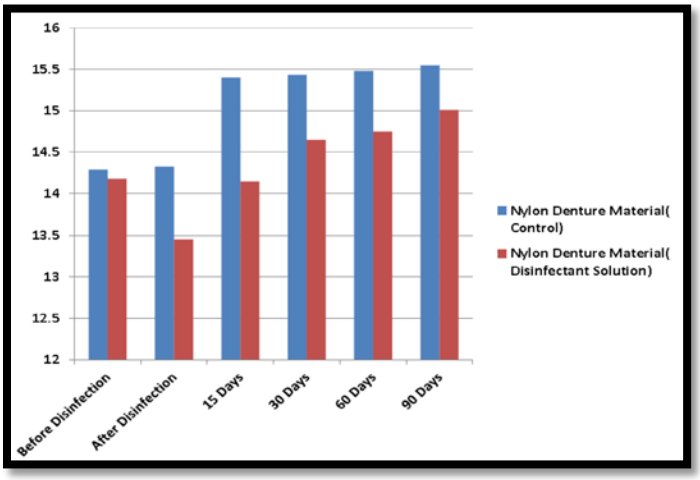
Graph 1: Showing the mean Vicker's hardness value (VHN) of 2 different study groups of Chemically Activated Denture Base resin at different time Intervals



Graph 2: Showing the mean Vicker's hardness value (VHN) of 2 different study groups of Heat Activated Denture Base resin at different time Intervals.



Graph 3: Showing the mean Vicker's hardness value (VHN) of 2 different study groups of Nylon Denture Material at different time Intervals.



Graph 4: Showing the mean Vicker's hardness value (VHN) of 2 different study groups of Chemically Activated resin, Heat Activated Denture Base Resin and Nylon Denture Material at different time intervals.

Results obtained are

Table I and graph I: Shows the master chart with mean vicker's hardness value (VHN) of Chemically activated denture base resin samples. Table includes Vickers hardness value of 10 samples for control Group a 1 (Table 1). 10 samples for 0.525% sodium hypochlorite solution Group b1 (Table 1) which was measured at different time intervals viz. before disinfection (t1), after disinfection (t2), at 15th day (t3), at 30th day (t4), at 60th day (t5), and at 90th day (t6) of water immersion.

Table II and graph II: Shows the master chart with mean vicker's hardness value (VHN) of Heat activated denture base resin. Table includes Vickers hardness value of 10 samples for control Group a2 (Table 2). 10 samples for 0.525% sodium hypochlorite solution Group b2 (Table 2) which was measured at different time intervals viz. before disinfection (t1), after disinfection (t2), at 15th day (t3), at 30th day (t4), at 60th day (t5), and at 90th day (t6) of water immersion.

Table III and graph III: Shows the master chart with mean vicker's hardness value (VHN) of Nylon denture material. Table includes Vickers hardness value of 10 samples for control group Group a3 (Table 3). 10 samples for 0.525% sodium hypochlorite solution Group b3 (Table 3) which was measured at different time intervals viz. before disinfection (t1), after disinfection (t2), at 15th day (t3), at 30th day (t4), at 60th day (t5), and at 90th day (t6) of water immersion.

Graph IV

Shows mean Vicker's hardness value (VHN) of control group and disinfectant solution of chemically activated denture base resin, Heat activated denture base resin and

Nylon denture material at different time intervals. Graphs showed Heat activated denture base resin had more hardness value than chemically activated denture base resin. Nylon denture base material had less hardness value. Denture base resins and Nylon(flexible) denture material showed decrease in hardness after disinfection and the effect was reversed in 15, 30, 60 and 90 days of water storage.

Discussion

Recent focus on the potential for cross contamination between dental patients and dental personnel emphasizes the need for sterile techniques[3]. Dental Prosthesis is brought into a dental office for repair or adjustments are contaminated with bacteria, viruses and fungi. To prevent the transmission of disease, effective infection control procedures should be exercised by dentists, dental auxiliaries and dental Technicians4. The need for cross-infection-control in dental practice has received increasing attention in recent years because of greater awareness of communicable diseases such as SARS-CoV-2 virus (COVID 19), Hepatitis B and Acquired immune deficiency syndrome (AIDS) [2, 20].

A Study of Kahn et al demonstrated transfer of oral flora from a contaminated denture to a disinfected denture through the polishing wheel and the pumice. Therefore to reduce the chances of cross contamination, Dentures should be completely disinfected before being sent to the laboratory and before insertion[1]. Miller et al demonstrated that rag wheels and pumice were major sources of biologically contaminated aerosols in the laboratory[5]. In choosing a disinfectant solution for dental prosthesis, consideration should be given to its compatibility with the type of denture base material to be disinfected to avoid adverse effects. Several studies have emphasized that disinfectants may adversely affect the physical properties of denture base resins. Immersion in certain cleansing and disinfecting solutions may, decrease the transverse strength and hardness; degrade the surface appearance of the resins[13].

Nylon Denture base material could be a useful alternative to Poly (Methyl Methacrylate). PMMA is a special circumstance such as patient allergy to the monomer17. According to Takahashi et al, a 4-month period considered appropriate to evaluate Denture base polymers. However, some studies showed a gradual increase in hardness of Denture base resins after water immersion. This improvement in the hardness property has been attributed in part to leaching of residual monomer from the resin. The residual monomer may adversely affect the mechanical properties of denture base resins by having a plasticizing effect[1]. The 4% chlorhexidine gluconate, 1% Sodium hypochlorite and Amason solutions have been proved effective to reduce the growth of microorganisms in the 10 min immersion period[7]. The immersion period of a denture in a suitable disinfectant solution for an adequate length of time to achieve disinfection or sterilization is a convenient and inexpensive method. However, it has been shown that some disinfectant solutions cause changes in different physical and mechanical properties of denture base resins[8].

The data obtained under the conditions of this study confirmed the hypothesis that the hardness of chemically activated denture base resin, Heat activated denture base resin and Nylon (flexible) denture material could be affected by chemical disinfection and time of storage in water.

To fulfil the first objective i.e., the effect of water on the hardness of denture material (Material A, B & C) after keeping in water (Table 4). For denture base resins and Nylon(flexible) denture material, all the control group (a1, a2, a3) that were stored in water during the

disinfection procedure showed slight increase in the hardness. But when they were immersed in water for 90 days and compared the mean hardness of the samples before water immersion (t1), and at different time intervals (i.e. after disinfection (t2), 15 days (t3), 30 days (t4), 60 days (t5), 90 days (t6), there was a significant increase in the hardness value of the samples at (t3, t4, t5 and t6) time intervals. The increase in hardness may be attributable to the leaching of the residual monomer from denture base material. The residual monomer content may adversely affect the mechanical properties of denture base resins owing to a plasticizing effect which reduces the interchange forces so that deformation occurs more easily under load during hardness tests[6].

To fulfil the second objective i.e., the effect of disinfectants on the hardness of chemically activated denture base resin, Heat activated denture base resin and Nylon denture material (Material A, B & C) after keeping in disinfectant solution (Table 5). The comparison was made between the mean Vickers hardness values of the samples that were obtained before disinfection (t1) and the values obtained after disinfection (t2). Chemically activated denture base resin (DPI -Mumbai), Heat activated denture base resin (Heat cure acrylin H high impact resin), Nylon denture base material. (Valplast) except control groups revealed a significant decrease in hardness after disinfection, regardless of the disinfectant solutions used. For Chemically activated denture base resin, Heat activated denture base resin and Nylon denture material, all the samples that were immersed in solution (b1, b2, & b3 groups) showed a significant decrease in hardness values after keeping in disinfectant solution. The effect was reversed in 15 days (t3), 30 days (t4), 60 days (t5) and 90 days (t6) of storage in water. The use of this concentration was based on a previous study that evaluated the clinical effectiveness of an infection – control protocol for cleansing and disinfecting removable dental prosthesis. The authors observed that 0.525%sodium hypochlorite solution was effective, in the 10 minute test period, in reducing the number of microorganisms of the dentures. A case study was reported that a significant decrease in hardness was observed when heat polymerized resin specimens were immersed in 0.525% sodium hypochlorite solution for seven days[1]. According to the authors, decrease in the hardness was related to the slow absorption of disinfecting chemicals in to the resin resulting in some structural change in the resin.

To fulfil the third objective i.e, To compare the effect of water and hardness on the hardness of Chemically activated denture base resin, Heat activated denture base resin and Nylon denture material (Material A,B,C) after keeping in water and disinfectant solution (Table 6).On comparison of VHN values before disinfection (t1) and after disinfection (t2) shows more hardness value that kept in control group (a1, a2, a3) than as 0.525% sodium hypochlorite solution (b1, b2 & b3 groups). Some studies showed a gradual increase in surface hardness of some denture base resins after water immersion. This improvement in the hardness property has been attributed in part to leaching of the residual monomer from the resin. The residual monomer may adversely affect the mechanical properties of denture base resins by having a plasticizing effect. It has been demonstrated that the rate of diffusion of the monomer out of the resin into water progressively. It has been demonstrated that the hardness, flexural strength, and colour stability of denture base resins can be significantly affected by disinfectant solutions such as glutaraldehyde, chlorhexidine, phenolic-based, alcohol-based, and hypochlorite disinfectants. Bleaching of dentures caused by soaking in chlorine solutions has also been documented. These changes have

been attributed to a structural change in the polymer interstitial matrix. According to Shen et al, certain components of the disinfectant solutions may penetrate into the denture base resin and result in softening of the surface and alteration of the surface morphology. The degree of influence was dependent on the duration of immersion and the types of disinfectants[1].

Conclusion

Within the limitations of this in-vitro study, the following conclusions were drawn:

1. Chemically activated denture base resin, Heat activated denture base resin, and Nylon denture material showed significantly and progressively increased hardness after storage in water.

2. All materials exhibited lower hardness values after disinfection. The effect was reversed in 15, 30, 60 & 90 days of storage in water.

3. In comparison all materials show more hardness value in water than in disinfectant solution.

References

1. Neppelenbroek KH, Pavarina AC, Vergani CE, Giampaolo ET. Hardness of heat-polymerized acrylic resins after disinfection and long-term water immersion. J Prosthet Dent. 2005 Feb;93(2):171-6.
2. Minagi S, Fukushima K, Maeda N, Satomi K, Ohkawa S, Akagawa Y, Miyake Y, Suginaka H, Tsuru H. Disinfection method for impression materials: freedom from fear of hepatitis B and acquired immunodeficiency syndrome. J Prosthet Dent. 1986 Oct;56(4):451-4
3. Leung RL, Schonfeld SE. Gypsum casts as a potential source of microbial cross-contamination. J Prosthet Dent. 1983 Feb;49(2):210-1.
4. Chau VB, Saunders TR, Pimsler M, Elfring DR. In-depth disinfection of acrylic resins. J Prosthet Dent. 1995 Sep;74(3):309-13.
5. Kahn RC, Lancaster MV, Kate W Jr. The microbiologic cross-contamination of dental prostheses. J Prosthet Dent. 1982 May;47(5):556-9.
6. Braun KO, Mello JA, Rached RN, Del Bel Cury AA. Surface texture and some properties of acrylic resins submitted to chemical polishing. J Oral Rehabil. 2003 Jan;30(1):91-8.
7. Pavarina AC, Pizzolitto AC, Machado AL, Vergani CE, Giampaolo ET. An infection control protocol: effectiveness of immersion solutions to reduce the microbial growth on dental prostheses. J Oral Rehabil. 2003 May;30(5):532-6.
8. Seo RS, Vergani CE, Pavarina AC, Compagnoni MA, Machado AL. Influence of microwave disinfection on the dimensional stability of intact and relined acrylic resin denture bases. J Prosthet Dent. 2007 Sep;98(3):216-23.
9. Carvalho CF, Vanderlei AD, Marocho SM, Pereira SM, Nogueira L, Paes-Júnior TJ. Effect of disinfectant solutions on a denture base acrylic resin. Acta Odontol Latinoam. 2012;25(3):255-60.
10. Orsi IA, Andrade VG. Effect of chemical disinfectants on the transverse strength of heat-polymerized acrylic resins submitted to mechanical and chemical polishing. J Prosthet Dent. 2004 Oct;92(4):382-8.
11. Mese A, Guzel KG. Effect of storage duration on the hardness and tensile bond strength of silicone- and acrylic resin-based resilient denture liners to a processed denture base acrylic resin. J Prosthet Dent. 2008 Feb;99(2):153-9.
12. Tsuboi A, Ozawa K, Watanabe M. Water absorption characteristics of two types of acrylic resin obturators. J Prosthet Dent. 2005 Oct;94(4):382-8

13. Tuna SH, Keyf F, Gumus HO, Uzun C. The evaluation of water sorption/solubility on various acrylic resins. Eur J Dent. 2008 Jul;2(3):191-7
14. Yunus N, Rashid AA, Azmi LL, Abu-Hassan MI. Some flexural properties of a nylon denture base polymer. J Oral Rehabil. 2005 Jan;32(1):65-71.
15. Canay S, Hersek N, Tulunoğlu I, Uzun G. Evaluation of colour and hardness changes of soft lining materials in food colorant solutions. J Oral Rehabil. 1999 Oct;26(10):821-9.
16. Ma T, Johnson GH, Gordon GE. Effects of chemical disinfectants on the surface characteristics and color of denture resins. J Prosthet Dent. 1997 Feb;77(2):197-204.
17. Kurtulmus H, Kumbuloglu O, Aktas RT, Kurtulmus A, Boyacioglu H, Oral O, User A. Effects of saliva and nasal secretion on some physical properties of four different resin materials. Med Oral Patol Oral Cir Bucal. 2010 Nov 1;15(6):e969-75.
18. Brożek R, Koczorowski R, Rogalewicz R, Voelkel A, Czarnecka B, Nicholson JW. Effect of denture cleansers on chemical and mechanical behavior of selected soft lining materials. Dent Mater. 2011 Mar;27(3):281-90.
19. Arici N, Ural C. The effects of a denture cleanser on the surface roughness of heat-cured and coldcured acrylic resins. Turkish J Orthod 2013;26:92–97.
20. Patel P, Sanghvi S, Malik K, Khachemoune A. Back to the basics: Diluted bleach for COVID-19. J Am Acad Dermatol. 2020;83(1):279-280.