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Comparative Evaluation of Effect of Various Denture Cleansing Solutions on Impact Strength of Heat Polymerized Denture Base Resins.

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Abstract

Aim: To evaluate and compare the effect of various denture cleansing solutions on impact strength of heat polymerized denture base resins.

Materials and Methods: A total of 50 specimens of denture base acrylic resin were fabricated with dimensions measuring 65mm length* 10mm width* 3mm thickness as per the International Organization for Standardization 1567. The samples were divided into five groups with 10 samples per group. These samples were immersed in Distilled Water, Soap Water, Clinsodent, Fittydent, Neem aqueous extract and distilled water being the control group. This immersion was done for 10 days, three times for 30 minutes each to simulate 30 days of cleaning. The impact strength of these specimens from each group was tested with the help of IZOD impact strength tester. The impact strength was measured and analysed using post-hoc and ANOVA test.

Results: The samples showed a reduction in impact strength after immersion in the four groups of denture cleansers in comparison with distilled water. The impact strength of denture base material when immersed in distilled water was highest (71.38J/m) and it was least when immersed in neem aqueous extract (63.67 J/m).

Conclusion: The study concluded that denture cleansers reduced the impact strength of heat polymerized denture base resin; however, results were within clinically acceptable range. Hence, the study infers that patients can use commercially available denture cleansers by following manufacturer's instructions and soap water after every meal. Natural plant extract such as neem aqueous extract can be used as denture cleanser.

Keywords: Denture Cleansers, Heat Polymerized Denture Base Resin, Impact Strength.

Introduction

Completely or partially missing teeth can be dealt by placing artificial teeth which fulfil the aesthetic and functional requirements. Patient compliance for dentures is high since it involves a non-invasive procedure and is convenient to use. In spite of many denture materials

being available in the market, heat polymerized denture base resin is one of the most commonly used material due to its ease of handling, aesthetic simulation of the gingival tissues, adequate strength and cost effectiveness.[1]

Commercially available denture cleansers are prescribed and used. Also, plant essential oils such as tea tree oil and lemongrass oil can be used as component of denture cleanser as both the essential oils have been proven to remove biofilm formed by C. albicans.[2] Moreover, Neem has proven to have immune-modulatory, anti-inflammatory, anti-hyperglycaemic, anti-ulcer, antifungal, anti-bacterial, anti-oxidant and anti-carcinogenic properties.[3] A combination of these helps in maintaining denture cleanliness.

Maintenance of these dentures is very important in order to extend the durability and longevity of the denture base materials. Various chemical means of denture cleansing are available such as enzymes, alkaline hypochlorite, acids, disinfectants and alkaline peroxides and considered the second most popular mode of denture cleansing.[4] In medically compromised patients like the ones suffering from Alzheimer's disease, epilepsy, or very old patients, the use of chemical denture cleansers may have been the only method of maintaining denture hygiene.[5] Studies revealed that immersion of dentures in denture cleansers adversely affected the impact strength of denture base resin.

The purpose of this study was to evaluate and compare the impact strength of the denture base resin after immersing it in two conventional denture cleansers, soap water, natural plant extract such as neem aqueous extract and distilled water being used as the control group.

Materials And Methods

Fabrication of samples

Five brass metal blocks with dimensions measuring 65mm length* 10mm width* 3mm thickness were fabricated to make test samples. These metal blocks were invested in dental flasks (Jabbar and Co-products, Delhi, India) by using dental plaster following manufacturer's instructions for water-powder ratio, mixing time, and setting time using mechanical vibrator to avoid entrapment of air bubbles. After the final set of the plaster, the base flask and counter flask was separated and the metal blocks were removed.

Conventional type of heat polymerized denture base material (Dental Products of India) was mixed as per manufacturer's instructions (polymer monomer ratio 3:1 by volume) and packed at dough stage. The samples were bench cured for 1 hour and polymerized using short curing cycle (74^0C for 2 hours followed by 100^0C for 1 hour). After bench cooling for an hour, the samples were deflasked and finishing and polishing of the samples were done. A vernier caliper was used to verify the dimensions of the acrylic blocks.

The samples were divided into 10 per group and were immersed in their respective solutions; Distilled Water (control group), Soap Water (Dettol original)[6], Clinsodent, Fittydent and Neem Aqueous Extract diluted as per the manufacturer's instructions. Neem aqueous extract was prepared by using 15.0 gram of dry powder of neem leaves with 100 ml of sterile distilled water in a round bottom flask with occasional shaking. The extract was then filtered through a muslin cloth for coarse residue and finally through Whatman No. 1 filter paper and kept in an airtight amber coloured container.[7] To simulate 30 days of cleaning, the samples were immersed in their respective solutions 3 times for 30 minutes each for 10 days.[1] The samples were tested using IZOD'S pendulum impact testing machine by the un-notched method. The swinging pendulum was used to break the un-notched specimens which were clamped at one end vertically. The

load at which the specimen fractures was noted and values obtained were tabulated for statistical analysis.[8]

Results

Statistical analysis was done using the Statistical Package for the Social Sciences version 22.0 (SPSS Inc, US). Impact strength results were analysed statistically using ANOVA and POST-HOC test. For all test, p value was considered statistically significant ($p < 0.05$). Results were indicated in frequencies.

The mean impact strength of distilled water is 71.38J/m+/-16.89 and the mean impact strength of soap is 67.96J/m+/-32.71 and the mean impact strength of Clinsodent is 70.24 J/m+/-25.37 and the mean impact strength of Fittydent is 68.53 J/m+/-26.08 and the mean impact strength of neem aqueous extract is 63.67 J/m +/- 25.69.

Multiple comparisons of impact strength between distilled water and soap (3.42 J/m), Clinsodent (1.14 J/m), Fittydent (2.85 J/m) and Neem Aqueous Extract (7.71 J/m) showed that the difference was not statistically significant. Multiple comparisons of impact strength between soap and Clinsodent (-2.28 J/m), Fittydent (-0.57 J/m) and Neem Aqueous Extract (4.29 J/m) showed that the difference was not statistically significant. Multiple comparisons of impact strength between Clinsodent and Fittydent (1.71 J/m) and Neem aqueous extract (6.57 J/m) showed that the difference was not statistically significant. Multiple comparisons of impact strength between Fittydent and Neem Aqueous Extract (4.86 J/m) showed that the difference was not statistically significant.

The average mean values of impact strength of heat polymerized acrylic denture base resins when immersed in respective denture cleansers were tabulated in table no 1 and graph no 1.

Discussion

Poly-methyl-meth-acrylate (PMMA) was introduced by Dr. Walter Wright in 1937 and continues to be the material of choice for fabrication of denture bases.[9] Maintaining cleanliness of dentures is of significant importance, the lack of which can lead to formation of denture plaque, mucosal inflammation and denture-induced stomatitis. For satisfactory denture cleansing, a combination of both mechanical and chemical methods is required. Impact strength is a measure of the energy absorbed by a material when struck by a sudden blow. Fracture of the denture base by dropping on the floor or bent and fractured in cleaning is often seen and is a high-strain-rate fracture occurs usually out of the mouth.[10] Various factors have been taken into consideration for influencing mechanical properties of heat polymerized denture base resin and the effects of denture cleansers on impact strength of heat polymerized denture base resin.

Many studies have been conducted to evaluate the efficiency and effect on physical as well as mechanical properties of heat polymerized denture base resins after using natural plant extracts like triphala churn, aloe vera, cashew leaf as denture cleanser.[11,12] As seen in previous literature, not much research is being carried out regarding the use of neem aqueous extract as a denture cleanser and till date liquid handwashing soap has been preferred by the dentists as well as patients.

Therefore, this study was conducted to evaluate and compare the impact strength of the denture base resin after immersing it in two commercially available denture cleansers, soap water, natural plant extract such as neem aqueous extract and distilled water. The results showed that the impact strength of denture base acrylic resin decreased after immersion in all the denture cleansers; the highest reduction in strength was seen after immersion in neem aqueous extract followed by Fittydent, Clinsodent, soap water and the least reduction in impact strength was seen with distilled water. Intergroup comparison of impact strength and impact energy showed a reduction in values;

however, it was not clinically significant. The reduction in impact strength of all the denture cleansers was within clinically acceptable ranges.

Conclusion

Within the limitations of this study, following conclusions were made:

1. Immersion of heat polymerized denture base resins in denture cleansers decreases its impact strength, however it is within clinically acceptable range, therefore can be safely used.
2. Aqueous neem extract has anti-microbial properties and it does not adversely affect the impact strength of denture base resin and therefore can be recommended as a denture cleanser.

References

1. Anjum R, Dhaded SV, Joshi S, Sajjan CS, Konin P, Reddy Y. Effect of plant extract denture cleansing on heat cured acrylic denture base resin: An in vitro study. J Indian Prosthodont Soc 2017;17:401-05.
2. Koseki Y, Tanaka R, Murata H. Development of antibacterial denture cleaner for brushing containing tea tree and lemongrass essential oils. Dental Materials Journal 2018;37(4): 659-666
3. Barua DR, Basavanna JM, Varghese RK. Efficacy of Neem Extract and Three Antimicrobial Agents Incorporated into Tissue Conditioner in Inhibiting the Growth of *C. Albicans* and *S. Mutans*. J Clin Diagn Res. 2017;11(5): ZC97-ZC101.
4. Khajuria R, Sudan T, Sudan S, Patel V. Efficacy of sodium hypochlorite and sodium perborate in strains removal in acrylic resin. HECS Int J Com Health and Med Res 2018;4(1):51-53
5. Ragher M, Prabhu UM, Ittigi JP, Naik R, Mahesh CS, Pradeep MR. Efficacy of denture cleansers on Impact strength of Heat Polymerized Acrylic Resins. J Pharm Bioall Sci 2017;9(1): S241-5.
6. Kumar B, Sandhu PK, Kumar AN, Patil CP. A comparative study for plaque removing efficacy between commonly used denture cleansers in India. J Indian Prosthodont Soc 2017;17(3):295-300.
7. Nayak A, Nayak RN, G Soumya B, Bhat K, Kudalkar M. Evaluation of Antibacterial and Anticandidial Efficacy of Aqueous and Alcoholic Extract of Neem (Azadirachta Indica). IJRAP 2011;2(1):230-235.
8. Praveen B, Babaji HV, Prasanna BG, Rajalbandi SK, Shreeharsha TV, Prashant GM. Comparison of impact and fracture morphology of different heat cure denture acrylic resins: An in vitro study. J Int Oral Health 2014;6(5):12-6
9. Peyton FA. History of resins in dentistry. Dent Clin North Am 1975;19:21-22.
10. Jadhav R, Bhide S V, Prabhudesai P S. Assessment of the impact strength of the denture base resin polymerized by various processing techniques. Indian J Dent Res 2013;24:19-25
11. R. Sushma, Sathe TT, Farias A, Sanyal PK, Kiran S. “Nature Cures:” An Alternative Herbal Formulation as a Denture Cleanser. Ann Afr Med 2017;16(1):6-12.
12. Shetty PJ, Hegde V, Gomes L. Anticandidal efficacy of denture cleansing tablet, Triphala, Aloe vera, and Cashew leaf on complete dentures of institutionalized elderly. J Ayurveda Integr Med 2014;5(1):11-4.

Legends Figures and Tables

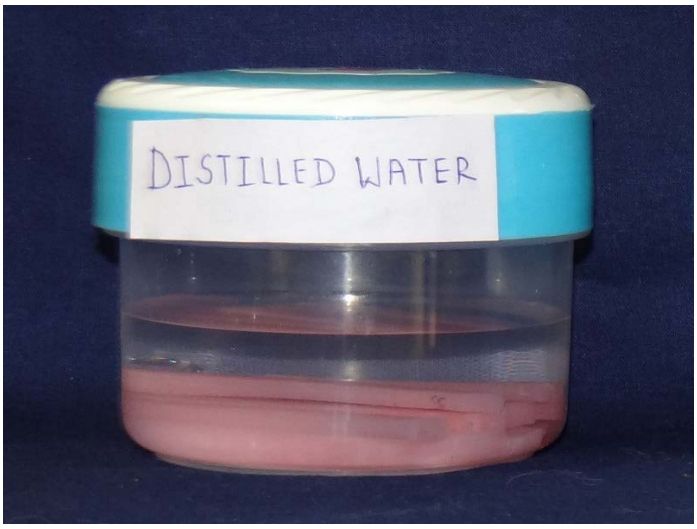

Figure 1

Figure 2

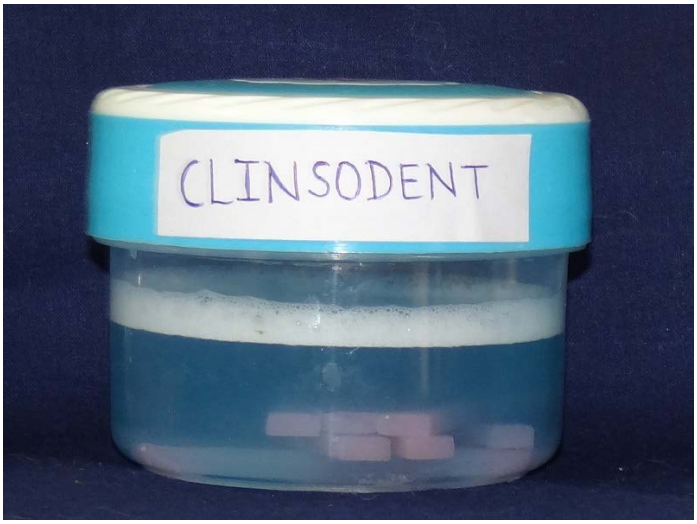

Figure 3

Figure 4

Figure 5

Figure 6

Graph 1: Comparison of the mean and standard deviation of impact strength of various groups

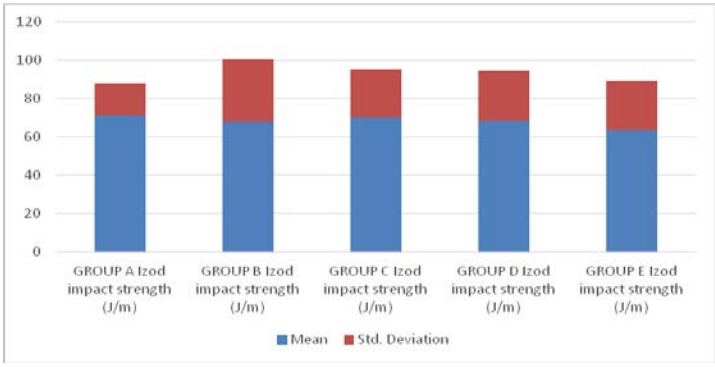

Table 1: The mean and standard deviation of impact strength of all groups

	Sample size per group	Mean	Std. Deviation
Distilled Water	10	71.3800	16.89989
Soap	10	67.9600	32.71986
Clinsodent	10	70.2400	25.37721
Fittydent	10	68.5300	26.08256
Neem Aqueous Extract	10	63.6700	25.69600

Table 2: Manufacturer details for all materials and duration of immersion

Groups	Denture cleansing solution	Number of blocks	Time
A	Distilled water (control group)	10	30 minutes
B	Soap water (Dettol original handwash, India)	10	1:1 soap water ratio for 30 minutes
C	Commercial denture cleanser (Clinsodent-ICPA Health product Limited India)	10	30 minutes
D	Commercial denture cleanser (Fittydent-Dr. Reddy's Laboratories Ltd. India)	10	30 minutes
E	Neem aqueous extract (Manakarnika Aushadhalaya, Pune, India)	10	30 minutes

Table 3: Post Hoc Tests

Multiple Comparisons			
Dependent Variable: IMPACT STRENGTH (J/M)			
Tukey HSD			
(I) Group	(J) Group	Mean Difference (I-J)	Sig.
Distilled	Soap	3.42000	.998
	Clinsodent	1.14000	1.000
	Fittydent	2.85000	.999
	Neem aqueous extract	7.71000	.962
Soap	Distilled	-3.42000	.998
	Clinsodent	-2.28000	1.000
	Fittydent	-.57000	1.000
	Neem aqueous	4.29000	.996

	extract		
Clinsodent	Distilled	-1.14000	1.000
	Soap	2.28000	1.000
	Fittydent	1.71000	1.000
	Neem aqueous extract	6.57000	.979
Fittydent	Distilled	-2.85000	.999
	Soap	.57000	1.000
	Clinsodent	-1.71000	1.000
	Neem aqueous	4.86000	.993
	extract		
Neem aqueous extract	Distilled	-7.71000	.962
	Soap	-4.29000	.996
	Clinsodent	-6.57000	.979
	Fittydent	-4.86000	.993

Table 4: Analysis of variance test ANOVA IMPACT STRENGTH (J/M)

	F	*p value*
Between Groups	0.130	0.971