

# EFFECT OF DIFFERENT DENTURE CLEANSERS ON THE SURFACE ROUGHNESS IN COBALT CHROMIUM CAST ALLOY

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## ABSTRACT:

**Statement of the problem:** Denture cleansing agents are commonly used to clean the denture surfaces contaminated with plaque and food debris. However, their effect in inducing surface roughness over metal denture bases needs to be studied further.

**Aim:** To evaluate the effect of denture cleansers in inducing surface roughness in cobalt-chromium alloys.

**Materials and Methods:** Twenty cobalt-chromium specimens of dimensions 10x10x1mm were cast and immersed in four experimental denture cleansers for a period of one week. Group 1: 0.12% chlorhexidine based denture cleanser, Group 2: NaOCl based denture cleanser, Group 3: Distilled water, Group 4: Sodium perborate monohydrate based denture cleanser. The specimens were assessed for surface roughness using a non-contact profilometer and the surface roughness values were expressed as 'Ra' respectively.

**Results:** The mean surface roughness observed for Group 1=1.44±0.24, Group 2=3.31±0.71, Group 3= 1.48±0.38, Group 4= 2.38±0.11 respectively. ANOVA showed statistically very high difference between the experimental denture cleansers F=21.311 and p value <0.0001.

**Conclusion:** Sodium hypochlorite based denture cleansers caused maximum surface roughness followed by sodium perborate and chlorhexidine based denture cleansers.

## Introduction:

Proper cleansing and meticulous maintenance of cast partial dentures is important to preserve the health of the denture bearing oral mucosa. Microbial biofilm on the tissues and denture surface is a significant adjuvant in the pathogenesis of denture stomatitis.<sup>[1]</sup> Surface roughness may contribute to the positively correlated rate of microbial colonization, adhesion of microorganisms and biofilm maturation on surfaces.<sup>[2][3][4]</sup> Denture cleansers are the most preferred chemical cleansing methods, which have been suggested for the disinfection of the prosthesis. The best cleanser should fulfil most of the requirements of an ideal cleanser while not causing any kind of alteration in the structure of the prosthesis.<sup>[5][6][7]</sup>

Alkaline peroxides or perborate are effective on newly formed plaque and stains, and to be effective it has to stay in contact with the denture surface for a long period.<sup>[1][8]</sup> Alkaline hypochlorites are effective on stains, mucin, and other organic substances, as well as against bacteria and fungi.<sup>[1][9]</sup>

## Aim:

The aim of this study was to evaluate in the effect of different denture cleansers on the surface roughness of Co Cr cast alloys.

## Objective:

- To estimate the surface roughness induced by various denture cleansers on Co-Cr cast alloy.
- To evaluate and compare the effect of various denture cleansers on the specimens.

## Null hypothesis:

There is no difference in the amount of surface roughness induced by denture cleansers in cast partial dentures.

## Alternate hypothesis:

There is difference in the amount of surface roughness induced by denture cleansers in cast partial dentures.

## Material and Methods:

Twenty Cobalt-chromium specimens of dimension 10x10x1mm were cast and prepared and divided into 4 groups of 5 specimens each. The categorised specimens were immersed in 4 denture cleansers over a period of one week. The 4 experimental groups were:

- Group 1: 0.12% chlorhexidine based denture cleanser(Periogard)
- Group 2: NaOCl based denture cleanser
- Group 3: Distilled water
- Group 4: Sodium perborate monohydrate based denture cleanser(Fittydent)

The specimens were subjected to surface roughness evaluation using Profilometer prior to immersion in the denture cleansing agents. The specimens were immersed in their respective cleanser solutions for 1 week and a temperature of 37°C was maintained. The immersed specimens were retrieved and the surface roughness was observed in the center-most area of the specimen (2x2mm) using a non-contact laser profilometer (Fig 1), (Taylor Hobson, Leicester, England) and the surface roughness values were expressed as ‘ Ra ‘ respectively. The obtained data were tabulated and subjected to statistical analysis.

## Results:

The mean surface roughnesses (Ra) for the experimental denture cleansing agents following immersion were, Group 1=1.44±0.24 Group 2=3.31±0.71 Group 3= 1.48±0.38 Group 4= 2.38±0.11 respectively.(Table 1)

Analysis of variance was done to test the difference between the means in the experimental groups. There was a statistically very high significant difference between the experimental groups with F=21.311 and p value <0.0001. (Table 2)

Figure 1: Non-contact laser profilometer(Taylor Hobson, Leicester, England)

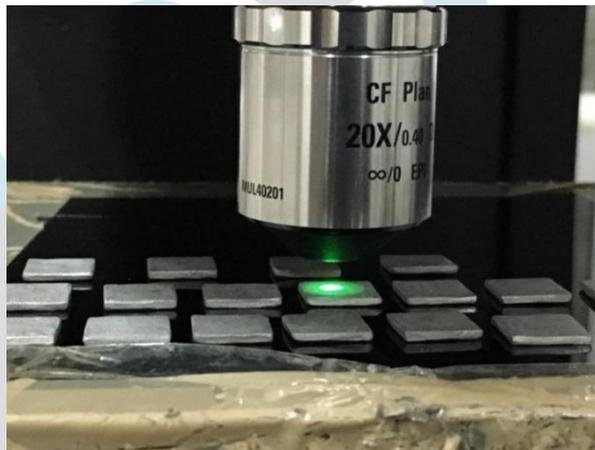


Table 1: Descriptive data for surface roughness (Ra)

		N	Mean	Std.Deviation	Std. Error	95% confidence interval for mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Postop	Group1	5	1.4420	0.24468	0.10943	1.1382	1.7458	1.05	1.64
	Group2	5	3.3100	0.71481	0.31967	2.4224	4.1976	2.34	4.31
	Group3	5	1.4800	0.38685	0.17300	0.9997	1.9603	1.10	2.07
	Group4	5	2.3800	0.11937	0.05339	2.2318	2.5282	2.27	2.56
	Total	20	2.1530	0.87906	0.19656	1.7416	2.5644	1.05	4.31

**Table 2: One-way ANOVA**

		Sum of squares	Df	Mean Square	F	Sig.
Postop	Between Groups	11.743	4	3.914	21.311	0.000
	Within Groups	2.939	16	0.184		
	Total	14.682	20			

**Discussion:**

The results of the present study negated the null hypothesis and observed significant amounts of surface roughness with the various denture cleansers used.

Sodium hypochlorite is a very effective disinfectant used in various dental procedures. This is commonly used in disinfection of root canals. Sodium hypochlorite disintegrates into nascent chlorine which is a potential free radical which exhibits the germicidal effect. However, this nascent chlorine invariably affects the surface of the cast partial denture by dissolving the superficial layer of the alloy in varying proportions and thus induces a marked roughening of the tissue surfaces. This can lead to salivary sorption and subsequent plaque accumulation which can be deleterious to the health of the oral mucosa. Sodium perborate releases nascent oxygen and constitutes a similar effect. This study observed sodium hypochlorite dentures induced maximum amount of surface roughness followed by sodium perborate, chlorhexidine and distilled water.

The longevity of any dental prosthesis depends on the maintenance and cleanliness of the prosthesis, which depends on the proper homecare procedures carried out by the patient. Inadequate cleaning of the denture leads to accumulation of food debris, which in turn harbours bacteria and salivary mucin resulting in malodour. On long-term effects, it leads to degradation of mechanical properties of the denture material and affects the oral mucosal health of the patient. The most routinely followed method for cleaning the dentures were overnight soaking in any commercially available denture cleansing solutions.<sup>[1][8][10][11]</sup> Sodium hypochlorite solution acts by direct dissolution of the polymer structures in organic matrix.<sup>[1][3][9][12]</sup> Sodium perborate acts by producing effervescence which results in mechanical loosening action between the denture surface and the debris. 0.2% Chlorhexidine is an effective plaque control agent. They have a bacteriostatic effect at lower concentrations and a bactericidal effect at higher concentrations.<sup>[12]</sup>

In clinical situations, these denture cleansers can induce more surface roughness over the acrylic surfaces thereby, increasing the susceptibility for staining and microbial colonisation. The effects of mechanical tooth brushing of the dental prosthesis may additionally increase the surface roughness. Hence, all these parameters should be taken in to consideration while prescribing denture cleansing agents to the patients using cast partial dentures.

**Conclusion:**

Sodium hypochlorite based denture cleanser induced maximum surface roughness followed by sodium perborate based denture cleanser, chlorhexidine based cleanser and distilled water. Hence this behaviour needs to be taken into consideration while giving denture hygiene instructions and modifications to be suggested to alleviate this effect.

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