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# Effect of Eight Different Disinfection Methods on the Surface Roughness and Flexural Strength Properties of Acrylic Resins: In Vitro Study

## Sekiz Farklı Dezenfeksiyon Yönteminin Akrilik Reçinelerin Yüzey Pürüzlülüğü ve Eğilme Mukavemetine Etkisi: İn Vitro Çalışma

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**ABSTRACT Objective:** The method used to clean and disinfect dentures can affect the surface properties and flexural strength of dentures. The purpose of this study was to evaluate the effects of eight different disinfection methods on the surface roughness and flexural strength of heat-polymerized acrylic resins. **Material and Methods:** A total of 108 acrylic resin blocks were divided into nine groups (n=12) according to disinfection procedure: Group 1: distilled water (control group), Group 2: 100% white vinegar, Group 3: 50% white vinegar, Group 4: 2% glutaraldehyde, Group 5: 3% hydrogen peroxide, Group 6: 5% sodium hypochlorite, Group 7: 2% sodium hypochlorite, Group 8: microwave, and Group 9: ultraviolet (UV) light. The effects of the disinfection methods on acrylic resins were examined by analyzing the surface roughness measurement of acrylic resins using a profilometer and the flexural strength values. The Kolmogorov-Smirnov and Levene tests were used to control the normal distribution of the data and the homogeneity of the variances, respectively. The surface roughness and flexural strength values were analyzed using one-way analysis of variance and post hoc Tukey's test. **Results:** There was an increase in surface roughness values in all the groups except the control and UV groups (p>0.05). Decreased flexural strength was found in all the groups except the control, 50% white vinegar solution, and UV groups (p>0.05). **Conclusion:** Only UV sanitizer caused the least negative effect among other disinfection methods in terms of surface roughness and flexural strength.

**Keywords:** Disinfection; anti-bacterial agents; flexural strength; denture bases

**ÖZET Amaç:** Dental protezleri temizlemek ve dezenfekte etmek için kullanılan yöntem, protezlerin yüzey özelliklerini ve eğilme mukavemetini etkileyebilir. Bu çalışmanın amacı, ısı ile polimerize edilmiş akrilik reçinelerin yüzey pürüzlülüğü ve eğilme mukavemeti üzerine 8 farklı dezenfeksiyon yönteminin etkilerini değerlendirmektir. **Gereç ve Yöntemler:** Toplam 108 akrilik reçine blok dezenfeksiyon prosedürüne göre 9 gruba (n=12) ayrıldı: Grup 1: distile su (kontrol grubu), Grup 2: %100 beyaz sirke, Grup 3: %50 beyaz sirke, Grup 4: %2 glutaraldehit, Grup 5: %3 hidrojen peroksit, Grup 6: %5 sodyum hipoklorit, Grup 7: %2 sodyum hipoklorit, Grup 8: mikrodalga ve Grup 9: ultraviyole (UV) ışık. Akrilik reçinelerin profilometre ile yüzey pürüzlülük ölçümü ve eğilme mukavemeti değerleri analiz edilerek dezenfeksiyon yöntemlerinin akrilik reçineler üzerindeki etkileri incelendi. Verilerin normal dağılımını ve varyansların homojenliğini kontrol etmek için sırasıyla Kolmogorov-Smirnov ve Levene testleri kullanıldı. Yüzey pürüzlülüğü ve eğilme mukavemeti değerleri, tek yönlü varyans analizi ve post-hoc Tukey testi kullanılarak analiz edildi. **Bulgular:** Kontrol ve UV grupları hariç tüm gruplarda yüzey pürüzlülük değerlerinde artış görüldü (p>0,05). Kontrol, %50 beyaz sirke solüsyonu ve UV grupları hariç tüm gruplarda eğilme mukavemetinde anlamlı ölçüde azalma olduğu bulundu (p>0,05). **Sonuç:** Sadece UV ışınları, yüzey pürüzlülüğü ve eğilme mukavemeti bakımından diğer dezenfeksiyon yöntemleri arasında en az negatif etkiye neden olmuştur.

**Anahtar Kelimeler:** Dezenfeksiyon; antibakteriyel ajanlar; eğilme dayanımı; protez kaideleri

The most common treatment method for the rehabilitation of edentulous patients is complete dentures. Since studies have shown that edentulousness increases with aging, the use of complete dentures in the geriatric patient group is quite common.[1,2]

While the rate of edentulousness decreases by about 1% per year in industrialized countries, the overall number of edentulous patients remains constant or slightly increases with increasing with life expectancy.[2] The elderly population rate in Türkiye

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has increased by 17% during the last five years. This rate is estimated to be 10.2% in 2023.[3] The population of those aged over 75 years in the United States is estimated to increase at a rate of 61% in 20 years, and 41.5% of this population is anticipated to require complete dentures.[1] State-sourced data reveal the need for complete dentures.[4] Before the prostheses are completed in the laboratory and delivered to patients in the clinic, disinfection must be performed for infection control. As sterilization using autoclaves cannot be used in the disinfection of complete dentures, disinfection methods involving chemical solutions or mechanical tools are used.[5] Furthermore, it has been reported that the prosthesis should be cleaned effectively by the patient in order to maintain the longevity of the full dentures and to preserve the health of the soft tissues.[5-7] In cases using complete dentures, bacterial plaque adheres to the acrylic surface and if the plaque is not removed, prosthetic stomatitis can be seen in soft tissues and finally many local and systemic diseases.[6-9] These problems are related to the fact that the prosthesis poses a threat by preparing the ground for an infection that may occur in another part of the body.[9]

The vast majority of patients use only limited methods such as rinsing under running water or brushing with a toothbrush for complete denture cleaning. The dexterity required for this cleaning process is also limited, especially in geriatric patients.[5,6] These simple forms of plaque elimination are relatively inadequate and may not satisfactorily remove microorganisms or fungal colonies accumulating on prosthetic surfaces.[7-9] Previous studies have shown that 11%-67% of patients using complete dentures have *Candida albicans* infection due to poor hygiene.[9]

In order to maintain the health of the oral environment and to reduce the accumulation of biofilm on the surface of the prosthesis, it may be necessary to use chemical methods as well as mechanical methods.[6,8,10] Several denture cleansers have also been proven to be effective disinfectants, such as vinegar solution, glutaraldehyde solution, hydrogen peroxide solution, sodium hypochlorite solution, microwave (MV), and ultraviolet (UV) light.[5-7,11-21] The method to be chosen for the disinfection of prostheses should be compatible with the disinfected material and should not have harmful effects.[14,22] Classical studies indicate that complete dentures should preserve their physical and mechanical properties during use, not interact with oral fluids, and not allow bacterial attachment. Bacterial adhesion takes place in four stages: moving to the surface, initial adhesion, attachment, and colonization.[8] Surface energy and roughness affect these stages. However, roughness is considered to have a greater effect than surface energy.[23] The surface roughness of the resin material causes the formation of biofilms, the attachment of microorganisms, and consequently microbial colonization.[24] Studies have indicated that the surface topography of complete dentures is important for the adhesion and retention of microorganisms and that this ratio is high on rough surfaces.[6,25] Polymethylmethacrylate (PMMA), known as acrylic resin, is the most widely used material in complete denture production. It is commonly used because of its strong physical and aesthetic properties, easy access, and easy manipulation.[5,26] Disinfectant solutions can affect resin surface roughness and flexural (transverse) strength resistance.[11,16,27] Denture cleaning solutions should effectively remove residues and microorganisms on the denture surface. However, during the microbiological cleaning of prostheses, chemical cleaning agents should not cause physical, chemical, or mechanical changes in the prostheses.[12,28,29] Theoretically, as a prosthesis will be exposed to prosthesis cleaning agents several times during its use, it is important to know whether these substances have a high plaque removal effect and whether they have a detrimental effect on the prosthetic material.

Polymer molecular weight and particle size, residual monomers, plasticizer composition, amount of crosslinking agents, structure of the polymer matrix, denture base thickness, patient factors, type of polishing and disinfection chemicals affect the flexural strength of acrylic resins.[5,30] Although there are various studies in the literature on the effects of existing chemical disinfectant on the surface roughness and flexural strength of PMMA, data on the effect of many agents and especially the effect of UV lights is scarce. The purpose of this study was to evaluate whether different disinfection methods affect the surface roughness and flexural strength of PMMA. The null hypothesis of the study was that the disinfection method has no effect on the surface roughness and flexural strength of PMMA.

## MATERIAL AND METHODS

In this study, wax molds (Cavex Set-Up Regular, Cavex Holland BV, Haarlem, Holland) were prepared using a special mold made of stainless steel with an internal area of 65 mm×10 mm×3.3 mm (International Organization for Standardization 1567) to standardize the samples and facilitate the production of acrylic resin blocks.[31] The prepared wax molds served as a mold in the flask. A set of thermosetting powder (PMMA) and liquid (methyl methacrylate, dimethacrylate) was used to make PMMA acrylic blocks (Meliodent, Heraeus Kulzer, Hanau, Germany). In accordance with the manufacturer's recommendations, acrylic samples were prepared by mixing the acrylic paste with the powder at a powder/liquid ratio of 35 g: 14 mL (powder: liquid). Following the flasking process, the acrylic resin, polymerized with heat, was crushed according to the manufacturer's recommendations. A total of 108 acrylic resin blocks (65 mm×10×3.3 mm) were obtained. After the samples removed from the flask were trimmed by using a handpiece, their surfaces were polished with 600 and 1,200 grid silicon carbid abrasive paper (Met Rolls, Kemet, London, England). After deflasking, samples were trimmed in order to remove excess acrylic pieces and the surface of the samples polished with 600 grid silicon carbide papers (English Abrasives, English Abrasives Ltd., London, England) under water. The polishing process of the samples was completed with "pumice+brush" and then "polishing paste+felt".

After the finishing process was completed, the samples were kept in distilled water at 37 °C for 24 h. The samples were then cleaned with distilled water for 20 min in an ultrasonic cleaner (Bransonic 2510 JMTH, Branson Ultrasonics Corp., Danbury, CT, USA). Then, they were divided into nine groups with 12 samples in each group using the disinfection method: Group 1: control group (n=12) in distilled water for 10 min; Group 2 (n=12): in 100% white vinegar for 10 min; Group 3 (n=12): in white vinegar diluted with 50% distilled water for 10 min; Group 4 (n=12): in 2% glutaraldehyde for 10 min; Group 5 (n=12): in 3% hydrogen peroxide for 10 min; Group 6 (n=12): in 5% sodium hypochlorite for 10 min; Group 7 (n=12): in 2% sodium hypochlorite for 10 min; Group 8 (n=12): in MV with 650 W power for 3 min; and Group 9 (n=12): with UV light (wavelength disinfection processes were performed by waiting for 20 min at 280 nm). The disinfectant materials used and the duration of application are presented in Table 1.

Before and after the disinfection process, the surface roughness measurement of the samples was made with an optical profilometer (Phase View Optical Profiler, Verrieres Le Buisson, France). The average surface roughness value (Ra) of each sample was calculated by recording values from three different regions. After the surface roughness measurement, a three-point bending test was performed to determine the flexural strength of the samples. During the flexural strength test carried out on a universal testing device (Universal Testing Machine, Lloyd Instruments, LRx, Fareham Hant, UK), the distance between the metal supports to be placed on the test device was adjusted to 50 mm, and a breaking speed of 5 mm/min and directional force were applied perpendicular to the center of the sample. The refraction values were automatically recorded in the computer system of the device in Newtons, and the flexural strength values were calculated according to the following formula:

$T=3Wl\backslash 2bd^2$

TS=Flexural (Transverse) strength ($N/mm^2$)

W: Load at fracture (N)

L: Distance between supporting wedges (mm)

b: Width of the samples (mm)

d: Thickness of the samples (mm)

Statistical analyses were performed using IBM SPSS Statistics 20.0 software (IBM Corp. Released 2011; Armonk, NY: IBM Corp., USA). The Kolmogorov-Smirnov and Levene tests were used to control the normal distribution of the data and the homogeneity of the variances, respectively. The surface roughness and flexural strength values were analyzed using one-way analysis of variance (ANOVA) and Tukey's honestly significant difference test, respec-

**TABLE 1:** Groups solutions and contact times.

| Groups | Solution | Time (minutes) |
|---|---|---|
| 1 | Control group distilled water | 10 min. |
| 2 | 100% white vinegar (Kemal Kükrer. Eskişehir, Türkiye) | 10 min. |
| 3 | 50% white vinegar (Kemal Kükrer. Eskişehir, Türkiye) | 10 min. |
| 4 | 2% glutaraldehyde (Klorhex; Drogsan İlaç. Ankara, Türkiye) | 10 min. |
| 5 | 3% hydrogen peroxide (Farmax; Distribuidora Amaral Ltd Farmax, İstanbul, Türkiye) | 10 min. |
| 6 | 5% sodium hypochlorite (Wizard; Rehber Kimya. İstanbul, Türkiye) | 10 min. |
| 7 | 2% sodium hypochlorite (Wizard; Rehber Kimya. İstanbul, Türkiye) | 10 min. |
| 8 | MW oven on high power (650 watt) (MD 2084; Arçelik. İstanbul, Türkiye) | 3 min. |
| 9 | UV sanitizer on high power (280 nm) (UV pasifik. İstanbul, Türkiye) | 20 min. |

tively. The statistical significance level was set to 0.05 in all analyses.

## RESULTS

The surface Ras of the study groups are shown in Table 2. The highest Ras were measured in Group 6 (5% sodium hypochlorite) (Ra: 0.21±0.018 µm), whereas the lowest Ras were measured in Group 1 (control group) (Ra: 0.11±0.038 µm). Using the one-way ANOVA, the disinfection method was found to affect the acrylic surface roughness [degree of freedom (df)=8, F=13.275, p=0.000].

When the differences between the groups were evaluated using Tukey's test, Group 1 had a statistically significant difference compared with the other groups except Group 9, but no significant difference was obtained between the other groups (p<0.05). As shown in the descriptive table, the disinfection methods increased the surface roughness to a certain extent (Table 2).

As a result of one-way ANOVA analysis, it was observed that there was a significant difference between the groups in terms of flexural strength (df=8, F=23.273, p=0.000). Table 3 presents the mean flexural strength values and standard deviation data. Considering the difference between the groups 1, 3, and 9 were identified to be statistically significantly different from the other groups (p=0.00). When the flexural strength was examined, the highest fracture resistance was found in Group 1 (control group; 99.85±2.7), and the lowest fracture resistance was found in Group 6 (5% sodium hypochlorite; 77.76±5.3; Table 3). In the disinfection process, the flexural strength was observed to be negatively affected, especially by 100% white vinegar (Group 2), 5% sodium hypochlorite (Group 6), and 650 W power and MV (Group 8) (Table 3).

**TABLE 2:** Mean surface roughness values (Ra: mµ).

| Groups | Mean (Ra: mµ) | SD |
|---|---|---|
| Control group (Group 1) | 0.1109[a] | 0.038 |
| 100% viner (Group 2) | 0.1882[bd] | 0.031 |
| 50% dilution of vinegar (Group 3) | 0.1694[bc] | 0.040 |
| 2% gluteraldehyde (Group 4) | 0.1743[bcd] | 0.025 |
| 3% hydrogen peroxide (Group 5) | 0.1787[bd] | 0.025 |
| 5% sodium hypochlorite (Group 6) | 0.2109[d] | 0.018 |
| 2% sodium hypochlorite (Group 7) | 0.1866[bd] | 0.031 |
| MW oven on high power (650 watt) (Group 8) | 0.1922[bd] | 0.02 |
| UV sanitizer on high power (Group 9) | 0.1400[ac] | 0.007 |

Ra: Roughness value; SD: Standard deviation; MW: Microwave; UV: Ultraviolet.
*Different superscript lowercase letters indicate significant differences in columns (p<.05)

**TABLE 3:** Mean flexural strength values (MPa).

| Groups | Mean (Ra: mµ) | SD |
|---|---|---|
| Control group (Group 1) | 0.1109[a] | 0.038 |
| 100% viner (Group 2) | 0.1882[bd] | 0.031 |
| 50% dilution of vinegar (Group 3) | 0.1694[bc] | 0.040 |
| 2% gluteraldehyde (Group 4) | 0.1743[bcd] | 0.025 |
| 3% hydrogen peroxide (Group 5) | 0.1787[bd] | 0.025 |
| 5% sodium hypochlorite (Group 6) | 0.2109[d] | 0.018 |
| 2% sodium hypochlorite (Group 7) | 0.1866[bd] | 0.031 |
| MW oven on high power (650 watt) (Group 8) | 0.1922[bd] | 0.02 |
| UV sanitizer on high power (Group 9) | 0.1400[ac] | 0.007 |

Ra: Roughness value; SD: Standard deviation; MW: Microwave; UV: Ultraviolet.
*Different superscript lowercase letters indicate significant differences in columns (p<.05)

## DISCUSSION

In the present study, the effect of different disinfection methods on the surface roughness and flexural strength of PMMA was evaluated. The null hypothesis of the study was rejected as it was seen that some disinfection solutions had an effect on the surface roughness and flexural strength. Methacrylate polymers are the basic material used in the production of complete dentures, as they can be easily produced using thermal energy and are low cost.[8,11,16] However, some material properties may change during use or in maintenance processes, such as disinfection and cleaning. Chemical agents are frequently used for the disinfection and cleaning of prostheses. Nevertheless, during conventional chemical disinfection processes, polymer solubility or water absorption may change the surface or structure of the prosthesis through the effect of the solutions used.[32] These changes can lead to the formation of rough areas on acrylic resin surfaces, which can increase bacterial colonization. Consequently, it can be thought that the risk of prosthetic stomatitis increases as the disinfection of the prosthesis becomes very difficult. As a result of these possible changes, rough areas can be seen on acrylic resin surfaces, increasing bacterial colonization. This condition makes the disinfection of the prosthesis difficult and increases the risk of prosthetic stomatitis.[1,5,11,13,16,33]

Vinegar, which is a promising disinfectant in both medicine and food industry and is actually an acetic acid, is highly effective, low-toxic and cost-effective.[5,6,11] Researchers reported that disinfection with vinegar is suitable for removable dentures.[11] In a previous study, vinegar was reported to have similar effects with sodium hypochlorite and hydrogen peroxide, in terms of surface roughness of chemically disinfected acrylic samples.[5] In this study, the effect of disinfectants involving vinegar at two different concentrations on the surface roughness of acrylic resins was examined.

Glutaraldehyde, which is a highly effective disinfectant at 2% concentration, acts by disrupting the amino acids in the protein structure of microorganisms.[12,14,32] Therefore, 2% glutaraldehyde solution was preferred in the present study. Hydrogen peroxide is an environmentally friendly oxidizing agent as it breaks down into water and oxygen and is effective against viruses, bacteria, fungi and bacterial spores, especially when used in high concentrations.[14] Since 3% concentration has been reported to be effective for hydrogen peroxide, this rate was also used in our study.[5] Sodium hypochlorite, called the current gold standard solution, acts directly on the organic matrix, has fungicidal and bactericidal properties. It has also been reported that this solution may be effective in removing plaque stains due to its alkaline pH, which causes the polymer structure to dissolve.[16-18] In the present study, in addition to the comparison of this solution with other disinfectants, the efficiency of the concentration was also questioned and two different concentrations of solutions were prepared.

Previous studies have investigated the effect of MVs on the physical properties of complete dentures. Effective results of MV irradiation for disinfection of denture acrylic resins have been reported.[18,20] Yildirim Bicer et al. used different disinfectants, such as MV (650 W for 3 min), UV light, white vinegar (50% and 100%), NaOCI (1%), and the disinfection protocols and durations they adopted were parallel with those in the current study.[6] According to the results of the study, the methods used were effective against *C. albicans*.[7] In the present study, 650 W MVs were applied to acrylic resins for 3 min. UV irradiation, which is electromagnetic radiation with wavelengths of 100-400 nm, has been used for a long time as an effective disinfection method for microorganisms.[7,21] UV irradiation has some advantages such as rapid processing without the need for any chemicals or heat. In the literature, it has also reported that UV is effective in impression materials, implant materials, and dental hand tools.[7,21] In line with other studies, 280 nm UV light was applied for 20 minutes in this study.[6,19]

According to Pinto et al. disinfectant solutions decrease the surface hardness of acrylic resins, and material tests have shown a significant increase in surface roughness.[16] In another study evaluating the disinfection of acrylic resins polymerized by heat, an effective disinfection was achieved by keeping acrylic resins in 1% sodium hypochlorite and glutaraldehyde solutions for 10 min.[15] However, it should not be ignored that patients are not satisfied with the taste and smell of these disinfectants and that sodium hypochlorite has a bleaching effect.[15] In a similar study, 1% sodium hypochlorite and peracetic acid were found to affect the color and roughness properties.[17] Machado et al. reported that solutions containing sodium perborate significantly increased the surface roughness of acrylic resin.[18] Peracini et al. found that cleaning solutions containing alkaline peroxide significantly increased the surface roughness of acrylic resin.[27] On the other hand, Didinen and Keskin revealed the surface roughness of acrylic resins to be 0.0153 mm after MV disinfection.[19] According to Panariello et al., the surface roughness of acrylic resins polymerized by heat kept in solutions containing sodium hypochlorite, chlorhexidine gluconate, and peracetic acid did not change. In the long-term application of 2% glutaraldehyde, which can be used as a prosthetic cleaning material, roughening and reduction in hardness of the acrylic base were observed.[28] Although immersion in 2% chlorhexidine solution seemed effective in preventing denture stomatitis, serious discoloration occurred in the prosthesis base.[34] Cakan et al. reported that denture cleaners increased the surface Ras of the samples by measuring the surface Ras of the acrylic resin-containing primer and base material before and after the application of an effervescent-type cleaner.[30] Odagiri et al. found that disinfecting an autopolymerized acrylic-based resin with 5% sodium hypochlorite resulted in increased roughness (Ra 1.04 µm).[21] A previous study has shown that chemical hygiene clinical protocols at higher concentrations are more effective in killing microorganisms.[8] However, they have the disadvantage of roughening prosthetic surfaces, which may cause more biofilm deposition.[28] Among the eight different disinfectants applied in our study, 5% sodium hypochlorite (Group 6) and MV (Group 8) caused the highest surface roughness. In terms of surface roughness, the Ra values were found to increase in all groups, except for the UV group, compared with the control group.

In this study, surface roughness measurements of the acrylic resin samples were carried out using a profilometer, as in previous studies, and Ra was analyzed as the surface roughness parameter.[14,16,30] This method is easy to apply and calculate, and the results are reliable and comparable with other findings.[30] The surface roughness properties of dental materials are linked to microorganism retention. When Ra is below the threshold value of 0.2 µm, a decrease in adhesion of the microorganism to the material surface is expected.[16,30] In the current study, although the measured Ras were below this value before the cleaning operations, an increase in the surface roughness was observed in the group disinfected with 5% sodium hypochlorite (0.21 µm) after the disinfection process. On the basis of these findings, patients who use complete dentures should be informed about the products to use for maintenance and cleaning purposes, and they should be guided about the use of these products to clean their prosthesis. On the other hand, the physician should be careful against the problems that may arise due to the increase in surface roughness and perform the necessary controls.

The flexural strength property of acrylic resins is a combination of tensile and compression forces, and it characterizes the masticatory forces that prosthetic base resins are subjected to in a clinical setting. Thus, in our study, the three-point bending test was performed to determine flexural strength using a universal test device, similar to the literature.[12,29] Polyzois et al. reported that the flexural strength value is not affected by disinfectant type and immersion time.[20] Asad et al. kept two acrylic resins for seven days in three different disinfectants and found that the alcohol-based disinfectant significantly reduced flexural strength, unlike in the acrylic without cross-linking.[22] Furthermore, according to the study results, the researchers also reported that non-alcohol-based disinfectants had no significant effect on the flexural strength of both acrylics after seven days. In a similar study, it was reported that disinfecting acrylic resins with 4% chlorhexidine gluconate, 1% sodium hypochlorite, or 3.78% sodium perborate for 10 min did not affect flexural strength.[29] Sharma et al. investigated the effects of denture cleaners on the surface roughness and fracture resistance of acrylic resins and reported that the samples applied with sodium hypochlorite were affected.[14] Moreover, the flexural strength of acrylic resin was found to increase as a result of disinfection with 2% alkaline glutaraldehyde.[35] Orsi and Andrade reported that after disinfection with 1% sodium hypochlorite, a significant decrease in the flexural strength of PMMA was observed.[12] In the current study, disinfection with 100% vinegar, 5% sodium hypochlorite, and MW oven on high power decreased the flexural strength value of acrylic blocks.

Correct prosthesis cleaning is mandatory in elderly individuals to avoid oral diseases. Clearly, prosthetic hygiene is affected by various factors such as, disinfection method, impaired salivary flow, roughness of denture's surface and dental hygiene habits. However, patients should be informed by dentists to protect both the oral mucosa and their general health to ultimately create good oral and prosthetic hygiene.[13,33]

The present study has some limitations. Although only surface roughness and flexural strength were evaluated in our study, it has been stated in the literature that different disinfection methods may cause color change in acrylic resins.[26,28,34] In addition, in this study, the samples were not exposed to any aging procedure, except for treatment with disinfectants. Besides, the effectiveness of different disinfection methods on the antimicrobial activity was not evaluated. Considering these limitations and evaluating coloration, biofilm formation and aging factors in future studies will provide a better reflection of clinical conditions.

## CONCLUSION

Within the limitations of this study, the conclusions reached are as follows:

1. Except UV light, all groups showed an increase in surface roughness rates in terms of disinfection processes. The highest surface roughness was observed in the 5% sodium hypochlorite group.

2. 50% dilution of vinegar and UV light caused less adverse effects on flexural strength than other disinfection methods.

3. Various physical, chemical, or combined methods should be recommended for the cleaning of complete prostheses, especially in geriatric patients with insufficient hand-motor coordination. However, although these methods are recommended, high concentrations of chemicals can cause physical and mechanical changes in acrylic resins.

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***Conflict of Interest***

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

***Authorship Contributions***

***Idea/Concept:** Ali Can Bulut; **Design:** Ali Can Bulut, Almira Ada Diken Türksayar; **Control/Supervision:** Ali Can Bulut, Almira Ada Diken Türksayar; **Data Collection and/or Processing:** Ali Can Bulut; **Analysis and/or Interpretation:** Ali Can Bulut, Almira Ada Diken Türksayar; **Literature Review:** Ali Can Bulut, Almira Ada Diken Türksayar; **Writing the Article:** Ali Can Bulut, Almira Ada Diken Türksayar; **Critical Review:** Ali Can Bulut, Almira Ada Diken Türksayar; **References and Fundings:** Almira Ada Diken Türksayar; **Materials:**li Can Bulut, Almira Ada Diken Türksayar.*

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