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Original Research

Assessment of effect of cigarette smoking effects on the surface roughness of different denture base materials

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ABSTRACT:
Background: The heat-cured polymethylmethacrylate polymers have been the most popular choice as conventional denture base materials. The present study was conducted to assess the influence of cigarette smoking effects on the surface roughness of two different denture base materials. **Materials & Methods:** The present study was conducted on 60 specimens were fabricated from two commercially available denture base materials: heat-cured polymethylmethacrylate and flexible denture base materials. The surface roughness was measured before and after smoking using a profilometer. **Results:** Subgroup I comprised of heat-cured denture base material specimens (control group), subgroup II had flexible denture base material (control group), subgroup III had heat-cured denture base material and subgroup IV had flexible denture base material. The mean IR (μm) in subgroup I was 0.17, in subgroup II was 0.26, in subgroup III was 0.23 and in subgroup IV was 0.28. The mean FR (μm) in subgroup I was 0.54, in subgroup II was 0.72, in subgroup III was 1.4 and in subgroup IV was 1.8. The difference was significant (P< 0.05). **Conclusion:** Authors found that the surface roughness of the specimens fabricated from the flexible denture base material was found to be more compared to heat-cured denture base specimens after exposure to cigarette smoke.
Key words: Flexible denture base, Heat-cured denture, Smoking.

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INTRODUCTION

The heat-cured polymethylmethacrylate (PMMA) polymers have been the most popular choice as conventional denture base materials for nonmetallic denture fabrication since its introduction in 1937 because of low cost, less solubility, less water sorption, and ease fabrication of denture bases by simple processing techniques with acceptable physical and mechanical properties.[1] Regardless of many favorable properties, residual methyl methacrylate monomer may induce hypersensitivity reactions in some patients. Selection of denture base resins is equally important along with clinician's skills in designing and fabrication of a prosthesis as the patient has to use the prosthesis for a long period.[2] Nylon as a denture base material was first introduced in the fabrication of denture bases in the

1950s. Nylon is a type of thermoplastic polymer classified under polyamides, which are produced by the condensation reactions between a diamine and a dibasic acid. PMMA is amorphous while nylon is a crystalline polymer. This crystalline effect imparts properties such as insolubility of nylon in solvents, high heat resistance, and high strength with ductility.[3]

Dental plaque and associated biofilms have been generally accepted to be the etiology of dental caries and periodontal disease. Dental plaque is considered a dense, noncalcified bacterial mass firmly adherent to the tooth surface.[4] The plaque attaches to the tooth pellicle, an amorphous membranous layer, which covers the enamel surface and can be 0.1 to several microns thick. The microcolonies increase in size and eventually coalesce to form a continuous bacterial layer that grows in thickness. Bacterial accumulation is most commonly observed around irregularities of the tooth surface and along the gingival margin.[5] The present study was conducted to assess the influence of cigarette smoking effects on the surface roughness of two different denture base materials.

MATERIALS & METHODS

The present study comprised of 60 specimens were fabricated from two commercially available denture base materials: heat-cured polymethylmethacrylate and flexible denture base materials. The study was approved from institutional ethical committee.

The specimens for each type were divided into four subgroups: subgroup I, heat-cured denture base material specimens (control group); subgroup II, flexible denture base material (control group); subgroup III, heat-cured denture base material specimen exposed to cigarette smoking group; and subgroup IV, flexible denture base material specimens exposed to cigarette smoking. The smoke test group specimens were exposed to smoking in a custom-made smoking chamber for each specimen. The surface roughness was measured before and after smoking using a profilometer. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered.

RESULTS

Table I Distribution of specimens

Groups	Subgroup I	Subgroup II	Subgroup III	Subgroup IV
Material	Heat-cured denture base material specimens	Flexible denture base material	Heat-cured denture base material	Flexible denture base material
Number	15	15	15	15

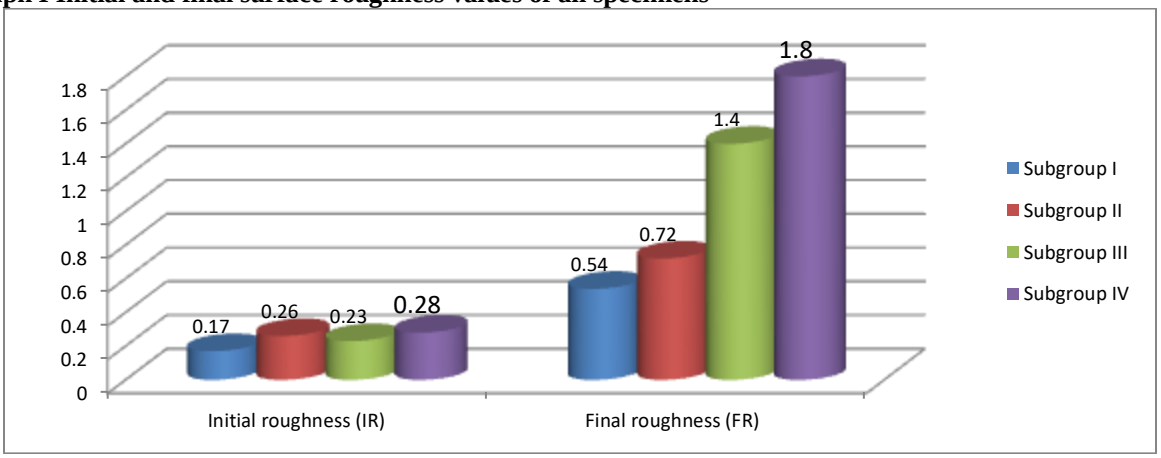
Table I shows that subgroup I comprised of heat-cured denture base material specimens (control group), subgroup II had flexible denture base material (control group), subgroup III had heat-cured denture base material and subgroup IV had flexible denture base material.

Table II Initial and final surface roughness values of all specimens

Roughness (µm)	Subgroup I	Subgroup II	Subgroup III	Subgroup IV	P value
Initial roughness (IR)	0.17	0.26	0.23	0.28	0.05
Final roughness (FR)	0.54	0.72	1.4	1.8	0.01

Table II, graph I shows that mean IR (µm) in subgroup I was 0.17, in subgroup II was 0.26, in subgroup III was 0.23 and in subgroup IV was 0.28. The mean FR (µm) in subgroup I was 0.54, in subgroup II was 0.72, in subgroup III was 1.4 and in subgroup IV was 1.8. The difference was significant (P< 0.05).

Graph I Initial and final surface roughness values of all specimens



DISCUSSION

The World Health Organization has reported cigarette smoking as a public health issue in billions of people across the world. The toxic substances of cigarettes are mainly produced during its burning, but some substances are already present in the plant.[6] In patients with smoking habit, the denture base materials are exposed to thousands of cigarette toxic substances such as ammonia, nickel, arsenic, carbon monoxide, formaldehyde, radioactive polonium, tar, and heavy metals. According to previous investigations, cigarette smoke can affect the surface roughness, color, and microhardness of various dental restorative materials such as composites.[7] The present study was conducted to assess the influence of cigarette smoking effects on the surface roughness of two different denture base materials.

In present study, The specimens for each type were divided into four subgroups: subgroup I, heat-cured denture base material specimens (control group); subgroup II, flexible denture base material (control group); subgroup III, heat-cured denture base material specimen exposed to cigarette smoking group; and subgroup IV, flexible denture base material specimens exposed to cigarette smoking. The smoke test group specimens were exposed to smoking in a custom-made smoking chamber for each specimen. Each group had 15 specimens. Bollen et al[8] found that the surface roughness of acrylic resin can be dependent on the polishing grit. Streptococcus sanguis, Bacteriodes gingivalis, and Candida albicans adhere in very high numbers to roughened acrylic resin versus smooth acrylic resin.

Kagermeier-Callaway et al[9] found that both Streptococcus oralis and Actinomyces viscosus adhered to rough denture surfaces. This study used four acrylic resin materials: chemically, heat, light, and microwave polymerized. The specimens were subjected to S. oralis or A. viscosus. This study tested both unpolished and polished specimens. Within 24 to 48 hours, the oral bacteria had colonized on the specimens. In some cases, the unpolished specimens had more bacterial colonization than the polished specimens. The heat-processed and microwaveable acrylic resins used in this study had both higher total and viable cell counts of A. viscosus and S.oralis on the polished samples versus the unpolished samples.

We found that mean initial roughness (IR) (μm) in subgroup I was 0.17, in subgroup II was 0.26, in subgroup III was 0.23 and in subgroup IV was 0.28. The mean final roughness (FR) (μm) in subgroup I was 0.54, in subgroup II was 0.72, in subgroup III was 1.4 and in subgroup IV was 1.8. Singh et al[10] included 40 specimens fabricated from heat-cured polymethylmethacrylate and flexible denture base materials (20 for each). The measurements were considered as the difference between the initial and final roughness measured before and after smoking. Paired t test and independent t-test were used to interpret differences in initial and final roughness values within and between groups respectively. Paired t-test showed a significant difference between initial surface roughness and final surface roughness within each subgroup.

There are millions of regular smokers in the world today, of which nearly 800 million are in developing countries. India is the fourth largest consumer of tobacco and the third largest producer of tobacco in the world.[11] There are about 250 million tobacco users in India, which accounts for about 19% of the world's 1.3 billion tobacco users. Tobacco smoke is a complex mixture presenting two distinct phases. The volatile phase and the particulate phase mainly consist of tar. When burning the cigarette, the resultant smoke contains multiple components, such as nicotine, ammonia, nickel, arsenic, carbon monoxide, carbon dioxide, tar, and heavy metals. During cigarette smoking, some degree of temperature changes might be seen in the oral cavity.[12]

CONCLUSION

Authors found that the surface roughness of the specimens fabricated from the flexible denture base material was found to be more compared to heat-cured denture base specimens after exposure to cigarette smoke.

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