Surface Roughness Analysis of Four Restorative Materials Exposed to 10% and 15% Carbamide Peroxide

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The aim of this study was to evaluate the effects of carbamide peroxide (CP) on surfaces of different restorative materials. Porcelain, composite resin, glass ionomer, and amalgam were analyzed in this study. Surface roughness (Ra) was measured before and after treatment with 10% and 15% CP. Fifteen percent CP increased Ra values in both the glass ionomer and amalgam subgroups, while 10% CP increased Ra values in the glass ionomer subgroup only. Changes in restorative material surfaces can be more severe when bleaching is completed without a clinician's supervision. Hence, thorough patient examinations must be done before, during, and after bleaching treatment. *Int J Prosthodont 2011;24:155–157.*

According to the current concepts of esthetics, tooth discoloration has become a cosmetic issue, and bleaching treatment, therefore, has become very popular. However, some bleaching treatments are carried out without a clinician's supervision, which makes this treatment risky.

Although investigated widely, carbamide peroxide bleaching gel was introduced relatively recently. Doubts still remain regarding its effect on restorative materials, either affecting their bonding capacity to the bleached tooth or altering the restorative material surface. Polish is a sine qua non characteristic, since both irregular and rough surfaces enable mechanical retention of dental plaque and pigments on the external surface of the restorative material, compromising its longevity. Hence, the aim of this in vitro study was to evaluate the effects of both 10% and 15% carbamide peroxide (CP) bleaching gels on the surfaces of restorative materials using surface roughness analysis.

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Materials and Methods

Two bleaching agents containing 10% and 15% CP (Opalescence, Ultradent) and four restorative materials (composite resin [TPH Spectrum, Dentsply], porcelain [Will Ceram, Williams], glass ionomer [GC Fuji II LC, GC], and amalgam [Permite, SDI Limited]) were used in this study. A round metallic matrix measuring 9 mm in diameter and 3-mm high was selected. A total of 60 samples were produced and stored in a humid environment oven at 37°C for 24 hours during the test. Fifteen samples were produced for each of the restorative materials and subdivided into three subgroups: control, 10% CP, and 15% CP.

Ceramic samples were inserted into the matrix, positioned on the asbestos strip, and sintered in an oven (model FV 100-P, EDG Equipamentos) at 960°C for 30 seconds. Thereafter, the samples were finished, polished, and glazed at 930°C for 30 seconds. Both composite and glass ionomer samples were placed into the matrix, light cured, finished, and polished. Amalgam samples were placed into the metallic matrix, and the samples were burnished and polished.

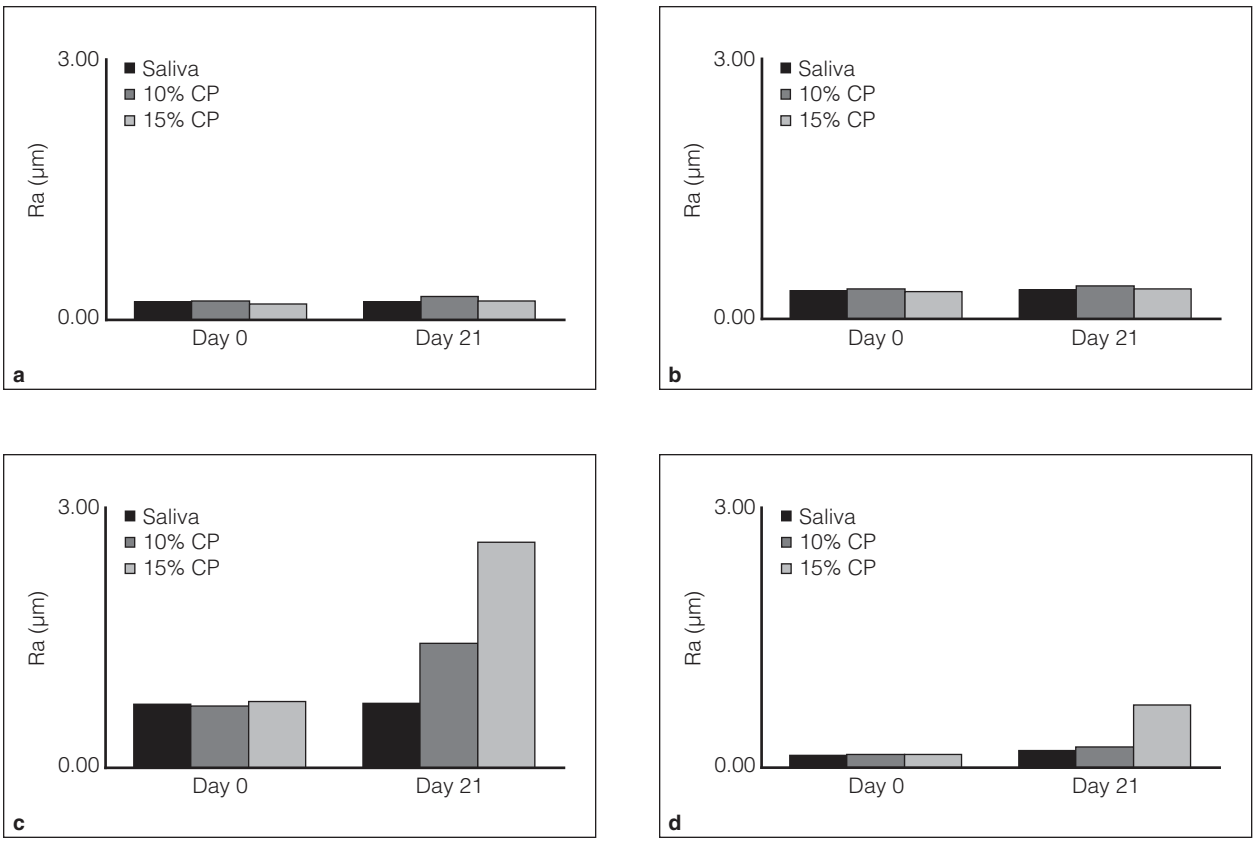
Samples were immersed in 1 cm^3 of CP for 6 hours daily. After completion of the immersion period, the samples were rinsed in tap water, dried with absorbent paper, and immersed in artificial saliva for the remaining 18 hours of the day. The immersion treatment was performed for 21 days, during which the control samples were stored in artificial saliva. Each sample was analyzed at baseline and after 21 days by the surface roughness meter Surfcorder SE 1700 (Kosaka Laboratory). The results were analyzed statistically using analysis of variance and the Student *t* test ($P < .05$).

Table 1 Ra Values (μm) for Each Substrate Analyzed

Restorative material/subgroup	Day 0	Day 21
Composite resin		
10% CP	0.22	0.27
15% CP	0.18	0.22
Artificial saliva	0.20	0.21
Porcelain		
10% CP	0.35	0.38
15% CP	0.31	0.34
Artificial saliva	0.32	0.33
Glass ionomer		
10% CP	0.71	1.43
15% CP	0.77	2.60
Artificial saliva	0.73	0.74
Amalgam		
10% CP	0.15	0.24
15% CP	0.15	0.72
Artificial saliva	0.14	0.19

Results

According to Table 1 and Figs 1a to 1d, surface roughness (Ra) values increased significantly in both glass ionomer and amalgam subgroups after 21 days of immersion in 15% CP. On the other hand, immersion in 10% CP only increased Ra values in the glass ionomer subgroup. There were no significant statistical differences in Ra values for both composite resin and porcelain subgroups when immersed in saliva, 10% CP, or 15% CP.



Figs 1a to 1d Comparison of Ra values of all three subgroups for **(a)** composite resin, **(b)** porcelain, **(c)** glass ionomer, and **(d)** amalgam before and after 21 days of immersion.

Discussion

Statistical results showed that neither porcelain nor composite resin demonstrated changes in Ra when immersed in both 10% and 15% CP. The present study is in agreement with research showing no structural changes in the microstructure of composite resin exposed to bleaching treatment.[1] However, there is controversy surrounding these results.[2,3] Some studies showed slight changes in Ra of composite resin after 30 days of exposure to CP, which might be comparable to long-term exposure.[4,5]

The higher percentage of CP (15%) caused greater Ra values for both glass ionomer and amalgam in this study. As far as glass ionomer is concerned, the statistical results of this study are in accordance to Attin et al.[1] In addition, according to this study as well as previous reports,[6] no color changes were detected visually in the restorative materials, except for amalgam, which was darker after 21 days of immersion in CP, a result of corrosion.

Conclusions

Thorough patient examinations must be completed before, during, and after bleaching treatment. Further, both amalgam and glass ionomer material replacement should be considered an alternative prior to bleaching.

References

1. Attin T, Hannig C, Wiegand A, Attin R. Effect of bleaching on restorative materials and restorations—A systematic review. Dent Mater 2004;20:852–861.
2. Cehreli ZC, Yazici R, García-Godoy F. Effect of home-use bleaching gels on fluoride releasing restorative materials. Oper Dent 2003;28:605–609.
3. Moraes RR, Marimon JLM, Schneider LFJ, Correr Sobrinho L, Camacho GB, Bueno M. Carbamide peroxide bleaching agents: Effects on surface roughness of enamel, composite and porcelain. Clin Oral Investig 2006;10:23–28.
4. Singleton LS, Wagner MJ. Peroxide tooth whitener concentration versus composite resin etching [abstract 1404]. J Dent Res 1992;71:281.
5. Turker SB, Biskin T. Effect of three bleaching agents on the surface properties of three different esthetic restorative materials. J Prosthet Dent 2003;89:466–473.
6. Monaghan P, Lim E, Lautenschlager E. Effects of home bleaching preparations on composite resin color. J Prosthet Dent 1992;68:575–578.

Literature Abstract

Removable implant-prosthodontic rehabilitation of the edentulous mandible: Five-year results of different prosthetic anchorage concepts

The aim of this study was to evaluate the clinical results and prosthodontic maintenance efforts of different rehabilitation methods in the treatment of the edentulous mandible. A 5-year prospective follow-up of two- and four-implant resilient bar-retained overdentures (IRODs) and four-implant rigidly milled bar-supported prostheses (ISP) were evaluated. Seventy-six consecutive patients with edentulous mandibles and maxillae were selected, with implants placed in the interforamina region. Implants used in this study were either cylindric (IMZ, Friadent) or screw-shaped (Frialoc, Friadent and Camlog root-line, Alltec). The patients were sequentially assigned to one of two different surgical groups (two or four interforaminal implants) and then to one of three different prosthodontic treatment groups. IROD design 1 was a two implant–retained mucosa-supported overdenture using an ovoid (Dolder) bar splinted on standard abutments. IROD design 2 involved a four implant–retained mucosa-supported overdenture with an ovoid bar connected to all the abutments, and the retention clips were placed either between implants or on distal cantilevers. The ISP design involved milled bars (titanium/gold) with the prosthesis being implant supported. The 5-year follow-up period evaluated peri-implant bone loss, probing, Plaque Index, Bleeding Index, and presence of calculus. The prostheses were also evaluated for implant component maintenance and prosthesis component maintenance for the IROD/ISP and opposing complete denture, as well as patient satisfaction. The results showed no implant losses in the 5-year period. There were no differences in the peri-implant soft tissue and bone resorption between IROD and ISP. The most frequent complication was activation or replacement of retention devices and relining of IROD designs 1 and 2. Significantly more maintenance procedures were required for the IROD designs as compared with the ISP design. There was no difference for the maintenance of the opposing conventional denture, and patient satisfaction did not differ between designs.

Weinländer M, Piehslinger E, Krennmair G. *Int J Oral Maxillofac Implants* 2010;25:589–597. **References:** 44. **Reprints:** Univ-Prof DDr Med Gerald Krennmair, Trauneggsiedlung 8, 4600 Wels, Austria. Email: krennmair@aon.at—*Y.L. Seetoh, Singapore*