

Original Article

Evaluation of Effects of Different Bleaching Agents on Bovine Surface Enamel

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ABSTRACT:

Background: Among various bleaching techniques for intrinsic tooth discoloration, vital and nonvital bleaching techniques are common one. The present study was conducted to evaluate the effects of bleaching agents with and without fluoride as well as the post-bleaching fluoridation on bovine surface enamel. **Materials & Methods:** This study was conducted in department of Endodontics. It included 60 extracted bovine incisors which were cut into halves, embedded and then divided into the following three groups. Group I: It consisted of 20 control specimens soaked in Hank buffer saline solution (HBSS) at 37 degree C for 2 weeks. Group II: It consisted of 20 specimens treated with 10% opalescence fluoride-free bleaching agent. Group III: It consisted of 20 specimens treated with 10% opalescence fluoride-free bleaching agent with additional 2% neutral sodium fluoride gel for 3 min. All specimens were evaluated for color change and micro hardness on day 7 and day 14. **Results:** The lightness change in DL was more significant than in Da and Db on Day 7. In group I, there was no color change. Group II, III showed DL and overall color change DE and increased by 3, 4 units, respectively. Group II, III showed comparable DL and DE values and greater than group I ($P < 0.01$) on Day 14. Group I showed minimal whitening effect and values were < 3 units. The color change was increased in DL and decreased in Db but unchanged in Da in groups II, III. The DE in all groups exceeded by 7. There were significant changes in the DL, Da, Db values in four bleaching groups from Days 7 to 14. **Conclusion:** In all groups, whitening efficiency was similar with increase in whiteness and decrease in yellow color saturation. Fluoridated bleaching gel improves whitening efficiency and results in less demineralization changes such as the erosion morphology and hardness loss.

Key words: Fluoridated bleaching gel, micro hardness, surface morphology

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INTRODUCTION

Among various bleaching techniques for intrinsic tooth discoloration, vital and non-vital bleaching techniques are common one. They use oxidizing agents such as hydrogen peroxide to remove intrinsic stains. They are widely used agents as they have safe to use. These properties have made them popular. Further modifications in these agents have opened multiple options for dentists in managing tooth discoloration.¹

In the modern era, aesthetic dentistry is becoming famous. The demand of tooth bleaching is increasing day by day and it has become the treatment of choice for tooth discoloration. If there is deposition of chromogenic material into dentin and enamel during the tooth development stage or after eruption, it leads to intrinsic tooth discoloration.²

Carbamide peroxide (CP) is a perhydrol-urea and hydrogen peroxide carbamide compound which degrades to urea and hydrogen peroxide. This agent with "night guard" bleaching technique, have proved effective and efficient in providing good results. However, altered surface morphology, decreased microhardness and loss of dental hard tissue volume are among few side effects of bleaching as shown by various authors. 10% CP has been proved to decrease the enamel microhardness as compared to higher level.³ However, a study performed by Potocnik et al.⁴ found that 10% CP causes local microstructural changes and there is no effect on enamel microhardness. 10% CP is a safest bleaching agent as demineralization is not clinically evident, moreover, it is soon followed by remineralization. Fluoridated bleaching agents are considered to reduce the adverse effects of tooth whitening. Topical fluoride is used to increase the hardness and acid resistance of

demineralized teeth. It may be used in tooth sensitivity peripherally by occluding the dentinal tubules and reducing dentinal fluid flow. Hence, fluoride application may be used for treating post-bleaching sensitivity.⁵ The present study was conducted to assess the effects of bleaching agents with and without fluoride as well as the post-bleaching fluoridation on bovine surface enamel.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It included 60 non-carious anterior teeth specimens. These specimens were stored in buffered saline. These teeth were cut into halves and were embedded in epoxy resin with the labial surface parallel to the horizontal plane. These specimens were then smoothed with 600- and 1000-grit silicone carbide abrasive paper and polished with a series of 30, 9, 6 and 1 mm diamond suspension. These specimens were then divided into 3 treatment groups:

Group I: It consisted of 20 control specimens soaked in Hank buffer saline solution (HBSS) at 37 degree C for 2 weeks. Group II had 20 specimens treated with 10% opalescence fluoride-free bleaching agent. Group III had 20 specimens treated with 10% opalescence fluoride-free bleaching agent with additional 2% neutral sodium fluoride gel for 3 min.

The specimens of group II, III were bleached 8 h/day X 14 days. The bleaching agents were applied on the enamel and stored at 100% humidity at 37 degree C. Rinsing with tap water was done after application of bleaching agent to each specimen for 1 minute and was stored in HBSS at 37 degree C. The color change, microhardness and surface topography were evaluated after 14 days. The color of each specimen was measured as baseline data on Day 0. The color of each specimen was assessed by the CIE-Labs system in L a b mode using a dental colorimeter. The assessed area was the cervical area, 1 mm occlusal to the cemento-enamel junction. After the bleaching treatment, the specimens were again inspected on Days 7 and 14 to measure the color changes. ‘‘L’’ represents the degree of gray and corresponds to a value of brightness. The ‘‘a’’ is a parameter in the red-green spectrum and ‘‘b’’ is a parameter in the blue-yellow spectrum.

RESULTS

Table I shows color change values differences in L, a and b between Days 7, 14 and baseline. The lightness change in DL was more significant than in Da and Db on Day 7. In group I, there was no color change. Group II, III showed DL and overall color change DE and increased by 3, 4 units, respectively. Group II, III showed comparable DL and DE values and greater than group I (P < 0.01) on Day 14. Group I showed minimal whitening effect and values were < 3 units. The color change was increased in DL and decreased in Db but unchanged in Da in groups II, III and. The DE in all groups exceeded by 7. There were significant changes in the DL, Da, Db values in 2 bleaching groups from Days 7 to 14. The enamel surface was unchanged on the unbleached specimen in Group I. Group II and III showed significant alteration with erosion appearance.

DISCUSSION

Fluoride helps in remineralizing dental erosion by forming a calcium fluoride layer and increasing resistance to acid attacks thus inhibiting demineralization. Chemical and physical properties of bovine teeth such as composition, hardness and tensile strength are close to human teeth. For the evaluation of bleaching methods, young bovine teeth are considered despite of higher lightness with the shade of bovine enamel than in human enamel.⁵

The present study was conducted to assess the effects of bleaching agents with and without fluoride as well as the post-bleaching fluoridation on bovine surface enamel. A recent study conducted by Attin et al.⁶ assessed the remineralizing property of various fluoride applications following bleaching treatment. Fluoride application preserves hardness after bleaching. De Oliveira et al.⁷ in their study commented that fluoride dentifrice along with bleaching treatment retains the enamel microhardness at baseline values.

In present study we included 60 non carious anterior teeth specimen which were divided into 3 groups of 20 teeth each. In each group, bleaching treatment was performed. First of all, we evaluated the color change values in each group at day 7, 14, 21 and 28. In group I, there was no color change whereas group II, III showed color change increased by 3, 4 units, respectively.

Table I Mean of value of color difference in groups recorded at day 7 and 14

Groups	Day 7				Day 14			
	L	a	b	E	L	a	b	E
Group I	1.6±0.72	0.12±0.3	0.32±0.38	2.12±1.3	2.6±0.52	0.42±0.3	0.12±1.18	2.62±1.3
Group II	4.2±3.2	0.14±0.3	-0.14±0.2	5.12±2.3	7.2±2.25	0.01±0.3	-0.34±0.8	7.8±2.6
Group III	3.02±3.4	-0.32±0.31	-0.15±0.2	5.02±2.4	5.02±3.4	-0.5±2.31	-3.15±2.2	7.12±1.4

There were significant changes in the DL, Da, Db values in four bleaching groups from Days 7 to 14. This is in agreement with Betke et al.⁸

In our study, we compared surface morphology in all groups. Group I showed unchanged enamel surface on the unbleached specimen. Group II and III showed significant alteration with erosion appearance. This is in agreement with Sharma et al.⁹

Adverse interactions between CP and fluoride may be resulted by adding fluoride in bleaching agent whereas calcium fluoride layer may hamper the whitening efficiency of CP. Burgmaier et al.¹⁰ in their study revealed that bovine teeth treated with CP followed by high-dosed fluoridation increased the fluoride uptake even though the structurally bound fluoride was lower than that in teeth receiving fluoridation only. The whitening efficiency of CP may be impaired by the calcium fluoride layer while the remineralization potential of fluoride may be hampered by CP. However, the limited available data regarding the potential problems supports the continued use of fluoridated bleaching gels.¹¹

CONCLUSION

In all groups, whitening efficiency was similar with increase in whiteness and decrease in yellow color saturation. Fluoridated bleaching gel improves whitening efficiency and results in less demineralization changes such as the erosion morphology and hardness loss.

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