

Original Research

Assessment of the fracture resistance of endodontically treated teeth treated with different bleaching agents

Kriti Dubey¹, Apoorva gupta², Tanmay Srivastava³, Sparsh Srivastava⁴, Shivam Shukla⁵, Anuska Chakraborty⁶

¹Senior Lecturer, Department of Conservative Dentistry & Endodontics, Rishiraj College of Dental Sciences and Research Centre, Bhopal, M.P.;

²Senior lecturer, Department of Conservative Dentistry and Endodontics, People's Dental Academy, Bhopal, M.P.;

³Junior resident 2nd year, Department of Oral Medicine and Radiology, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, U.P.;

⁴Junior resident 2nd year, Department Of Orthodontics and Dentofacial Orthopaedics, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, U.P.;

⁵BDS (Chandra Dental College & Hospital, Lucknow), Private Practitioner, Lucknow, U.P.;

⁶Junior resident 2nd year, Department of Oral and Maxillofacial Pathology and Oral Microbiology, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, U.P.

ABSTRACT:

Background: The bleaching agents most commonly used for the whitening of discolored endodontically-treated teeth are hydrogen peroxide, carbamide peroxide and sodium perborate. The present study was conducted to assess the fracture resistance of endodontically treated teeth treated with different bleaching agents. **Materials & Methods:** 40 freshly extracted human mandibular premolars were divided into 4 groups and different bleaching treatment was applied. All the specimens were subjected to fracture resistance test using Universal Testing Machine. **Results:** The mean force (Newton) required to fracture specimens in group I was 964 N, in group II was 920 N, in group III was 1248 N, in group IV was 1248 N and in group IV was 1524 N. The difference was significant ($P < 0.05$). **Conclusion:** The use of 10% sodium ascorbate antioxidant gel is effective in compensating for the decreased fracture resistance of endodontically treated and bleached teeth.

Key words: Bleaching, fracture resistance, sodium ascorbate.

Received: November 24, 2020

Accepted: December 27, 2020

Corresponding author: Dr. Kriti Dubey, Senior Lecturer, Department of Conservative Dentistry & Endodontics, Rishiraj College of Dental Sciences and Research Centre, Bhopal, M.P., India

This article may be cited as: Dubey K, Gupta A, Srivastava T, Srivastava S, Shukla S, Chakraborty A. Assessment of the fracture resistance of endodontically treated teeth treated with different bleaching agents. J Adv Med Dent Scie Res 2021;9(1):79-81.

INTRODUCTION

Tooth discoloration varies in etiology, appearance, localization, severity, and adherence to tooth structure.¹ It may be classified as intrinsic, extrinsic, or a combination of both.² Intrinsic discolorations of endodontically-treated teeth might result from pulp necrosis, intra-pulpal hemorrhage, pulp tissue remnants after endodontic therapy, products of tissue decomposition, inappropriate access cavity design that

traps chromophore materials inside the pulp chamber and/or obturation materials remaining in the pulp chamber due to insufficient cavity cleaning and placement of a dressing.³ Scaling and polishing of the teeth remove many extrinsic stains. For more stubborn extrinsic discoloration and intrinsic stain, various bleaching techniques may be attempted. Tooth bleaching can be performed extracoronally in-home or in-office vital

tooth bleaching as well as intracoronally in root-filled termed as nonvital tooth bleaching.⁴

The bleaching agents most commonly used for the whitening of discolored endodontically-treated teeth are hydrogen peroxide, carbamide peroxide and sodium perborate. Bleaching agents act by a redox reaction with the discolored substrate.⁵ When the bleaching agent is placed in the pulp chamber, reactive oxygen is released; the discolored substance is chemically reduced and transformed into a colorless material. Some techniques have been suggested to remove the remnant oxygen-free radicals in enamel and dentin after bleaching and also to reverse the compromised infiltration and polymerization of resin at the tooth interface.⁶ The present study was conducted to assess the fracture resistance of endodontically treated teeth treated with different bleaching agents.

MATERIALS & METHODS

The present study was conducted among 40 freshly extracted human mandibular premolars. Following removal of gutta-percha 2 mm apical to cemento-enamel junction and application of resin-modified glass ionomer as cervical barrier, all teeth were embedded in acrylic resin using cylindrical molds. Specimens were

divided into 4 groups: Group I specimens were subjected to inside and outside bleaching using 10% hydrogen peroxide followed by composite restoration. Group II specimens were subjected to inside-outside bleaching with 10% hydrogen peroxide and sodium perborate followed by composite restoration; Group III specimens were subjected to conditioning with 10% sodium ascorbate after inside-outside bleaching using 10% hydrogen peroxide followed by composite restoration; Group IV were negative control. Each group had 10 teeth. After endodontic treatment specimens were restored with composite. Finally, all the specimens were subjected to fracture resistance test using Universal Testing Machine. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

DISCUSSION

Many studies have reported the adverse effects of bleaching agents when applied to dental structures. These include external cervical resorption, cervical caries, increase dentin permeability, reduction in microhardness of dentin and enamel, reduction in bond strength, and increased microleakage in composite resin restorations performed after dental bleaching.⁷

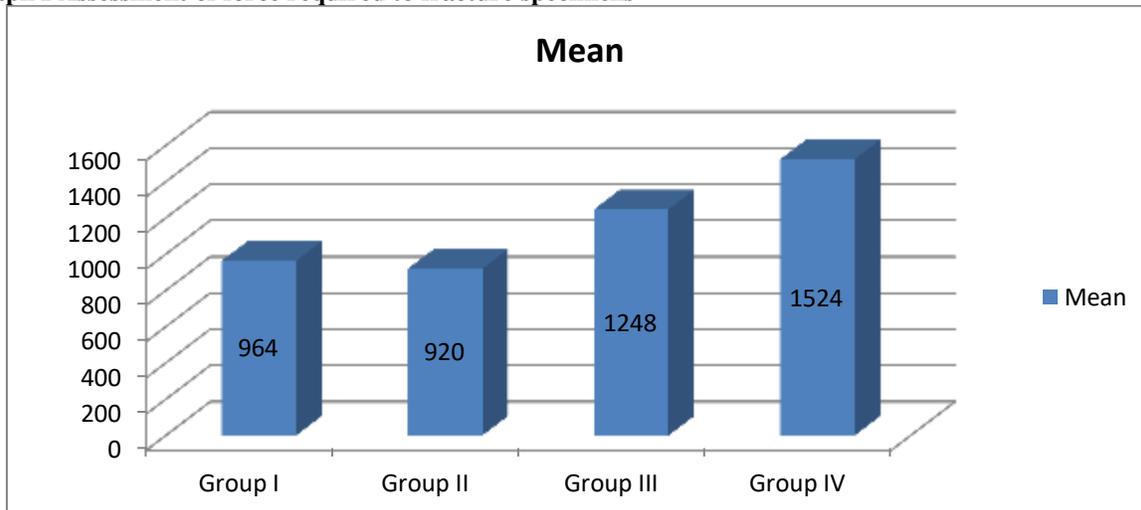
RESULTS

Table I Assessment of force required to fracture specimens

Groups	Mean	P value
Group I	964	0.04
Group II	920	
Group III	1248	
Group IV	1524	

Table I, graph I shows that mean force (Newton) required to fracture specimens in group I was 964 N, in group II was 920 N, in group III was 1248 N, in group IV was 1524 N and in group IV was 1524 N. The difference was significant (P< 0.05).

Graph I Assessment of force required to fracture specimens



These effects could be related to the presence of residual hydrogen peroxide in the interprismatic spaces as well as in the dentinal matrix and tubules.⁸ Bleaching agents also can cause chemical alterations in the hard dental tissues, changing the ratio of organic to inorganic composition, and increasing the tooth's solubility, which subsequently reduces the bond strength of resin-based composite restorations.⁹ However, the general approach is to postpone any bonding procedure for a while after bleaching since the reduction of bond strength has been shown to be temporary. The waiting period for bonding procedures after bleaching has been reported to vary from 24 h to 4 weeks. The present study was conducted to assess the fracture resistance of endodontically treated teeth treated with different bleaching agents.

In present study, mean force (Newton) required to fracture specimens in group I was 964 N, in group II was 920 N, in group III was 1248 N, in group IV was 1248 N and in group IV was 1524 N. Antony et al¹⁰ evaluated the fracture resistance of endodontically treated teeth restored with microhybrid composite following combination bleaching and to assess the antioxidizing effect of 10% sodium ascorbate hydrogel. Statistically significant difference in fracture resistance was present between Group 5 and Group 1 and also between Group 5 and Group 2. Unpaired t-test showed statistically significant difference between Group 1 and Group 3 and also between Group 2 and Group 4.

Türkün et al¹¹ proved that 10% sodium ascorbate was more effective in reversing the decreased shear bond strength to composites when compared to 2.5 and 5% of same reagent. Khoroushi et al¹² in vitro study assessed the fracture resistance of endodontically-treated teeth undergoing combination bleaching with 38% and 9.5% hydrogen peroxide gels as in-office and at-home bleaching techniques, respectively. In addition, the effect of an antioxidizing agent, sodium ascorbate, was investigated. Sixty maxillary premolars were endodontically-treated, received a glass ionomer barrier as a mechanical seal and were embedded in acrylic resin up to the cemento-enamel junction. The specimens were divided into four groups (n=15) as follows: G I: no bleaching, access cavity restored with resin composite (negative control); G II: bleached for three weeks daily using 9.5% hydrogen peroxide for two hours and three sessions of in-office bleaching using 38% hydrogen peroxide every seven days, then restored (positive control); G III: bleached similar to G II and restored after one week; G IV: bleached similar to G II, along with the use of an antioxidizing agent for 24 hours, then restored. In each in-office and at-home bleaching session, the whitening gels were applied to the buccal

surface of the tooth and placed inside the pulp chamber (inside/outside bleaching technique). Finally, the specimens underwent fracture resistance testing; the data were analyzed using ANOVA and Scheffé's test ($\alpha=0.05$). Significant differences were observed among the study groups (p<0.05). Groups I and II demonstrated the highest and lowest fracture resistance, respectively. The samples that were not bleached (Group I) and the 10% sodium ascorbate gel group (Group IV) demonstrated significantly higher fracture resistance than the positive control group (p<0.05).

CONCLUSION

Authors found that use of 10% sodium ascorbate antioxidant gel is effective in compensating for the decreased fracture resistance of endodontically treated and bleached teeth.

REFERENCES

1. Chng HK, Ramli HN, Yap AU, Lim CT. Effect of hydrogen peroxide on intertubular dentine. *J Dent* 2005;33:363-9.
2. Lewinstein I, Fuhrer N, Churaru N, Cardash H. Effect of different peroxide bleaching regimens and subsequent fluoridation on the hardness of human enamel and dentin. *J Prosthet Dent* 2004;92:337-42.
3. McGuckin RS, Thurmond BA, Osovitz S. Enamel shear bond strengths after vital bleaching. *Am J Dent* 1992;5:216-22.
4. Shinohara MS, Peris AR, Pimenta LA, Ambrosano GM. Shear bond strength evaluation of composite resin on enamel and dentin after nonvital bleaching. *J Esthet Restor Dent* 2005;17:22-9.
5. Teixeira EC, Hara AT, Turssi CP, Serra MC. Effect of nonvital tooth bleaching on resin/enamel shear bond strength. *J Adhes Dent* 2002;4:317-22.
6. Crim GA. Prerestorative bleaching: Effect on microleakage of class V cavities. *Quintessence Int* 1992;23:823-5.
7. Ulukapi H, Benderli Y, Ulukapi I. Effect of pre- and postoperative bleaching on marginal leakage of amalgam and composite restorations. *Quintessence Int* 2003;34:505-8.
8. Owens BM, Rowland CC, Brown DM, Covington JS 3rd. Postoperative dental bleaching: Effect of microleakage on class V tooth colored restorative materials. *J Tenn Dent Assoc* 1998;78:36-40.
9. Perdigão J, Francci C, Swift EJ Jr., Ambrose WW, Lopes M. Ultra-morphological study of the interaction of dental adhesives with carbamide peroxide-bleached enamel. *Am J Dent* 1998;11:291-301.
10. Antony A, Pillai R, Varghese NO, Sujathan UN, Afzal A, George S. Fracture resistance of teeth undergoing postendodontic bleaching: Comparison of four treatment modalities – An in vitro study. *Endodontology* 2019;31:150-7.
11. Türkün M, Celik EU, Kaya AD, Arici M. Can the hydrogel form of sodium ascorbate be used to reverse compromised bond strength after bleaching? *J Adhes Dent* 2009;11:35-40.
12. Khoroushi M, Feiz A, Khodamoradi R. Fracture resistance of endodontically-treated teeth: effect of combination bleaching and an antioxidant. *Operative dentistry*. 2010 Sep;35(5):530-7.