Influence of in situ postbleaching times on shear bond strength of resin-based composite restorations

Marcos Eugenio Bittencourt, DDS, MS; Micheline Sandini Trentin, DDS, MS, ScD; Maria Salete Sandini Linden, DDS, MS, ScD; Ynara Bosco de Oliveira Lima Arsati, DDS, MS, ScD; Fabiana Mantovani Gomes França, DDS, MS, ScD; Flávia Martão Flório, DDS, MS, ScD; Roberta Tarkany Basting, DDS, MS, ScD, PhD

One of the most common esthetic problems in dentistry is tooth pigmentation or darkening, for which tooth bleaching is a conservative treatment.[1] However, clinicians frequently need to change resin-based composite restorations in anterior teeth after bleaching, because the restorations' color is not altered by the bleaching procedure.

Tooth bleaching is possible because the hard dental tissues are permeable to the bleaching agents. Because these agents have low molecular weights, they diffuse freely through the enamel and dentin. Once in the enamel and dentin, they act on the organic constitution of these structures, frequently altering the characteristics of the substrate.[2] In addition, bleaching agents can reduce the strength of the resin-based composite's bond to the recently bleached dental structure, causing late failure in marginal sealing.[3-6]

Dishman and colleagues[3] reported that the high concentration of oxygen that remains among enamel prisms is the main cause of

ABSTRACT

JADA CE CONTINUING EDUCATION ARTICLE 3

Background. The authors conducted an in situ study of the influence of various time intervals after tooth bleaching with 35 percent hydrogen peroxide on the bond strength of resin-based composite restorations.

Methods. After selecting 20 participants, the authors randomly fixed enamel and dentin blocks onto the buccal surfaces of posterior maxillary teeth one week before performing tooth bleaching with 35 percent hydrogen peroxide. After the bleaching treatment, they removed one block of dentin or enamel and prepared it for the bond strength tests according to these time intervals: no bleaching treatment (controls), immediately after bleaching, seven days after bleaching, 14 days after bleaching and 21 days after bleaching.

Results. The analysis of variance and Tukey test showed significant differences between times ($P < .05$), and shear bond strength values of resin-based composite to enamel and dentin were lower immediately after the bleaching treatment.

Conclusions. The authors found that 35 percent hydrogen peroxide reduces the bond strength to enamel and dentin and that it is necessary to wait seven days before performing adhesive restorative procedures.

Clinical Implications. The results of this study suggest that clinicians should allow seven days to elapse after completion of in-office bleaching with 35 percent hydrogen peroxide before placing adhesive restorations.

Key Words. In-office tooth bleaching; shear bond strength; 35 percent hydrogen peroxide.

JADA 2010;141(3):300-306.

Dr. Bittencourt is a doctoral student, Department of Restorative Dentistry, São Leopoldo Mandic Research Center, Campinas, São Paulo, Brazil.
Dr. Trentin is a professor, Department of Oral Medicine, Universidade de Passo Fundo, Rio Grande do Sul, Brazil.
Dr. Linden is a professor, Department of Oral Medicine, Universidade de Passo Fundo, Rio Grande do Sul, Brazil.
Dr. Arsati is a professor, Department of Restorative Dentistry, São Leopoldo Mandic Research Center, Campinas, São Paulo, Brazil.
Dr. França is a professor, Department of Restorative Dentistry, São Leopoldo Mandic Research Center, Campinas, São Paulo, Brazil.
Dr. Flório is a professor, Department of Preventive and Social Dentistry, São Leopoldo Mandic Research Center, Campinas, São Paulo, Brazil.
Dr. Basting is a professor, Department of Restorative Dentistry, São Leopoldo Mandic Research Center, Rua José Rocha Junqueira, 13 Bairro Swift, Campinas, São Paulo CEP: 13045-755 Brazil, e-mail "rbasting@yahoo.com". Address reprint requests to Dr. Basting.

reduced bond strength. From this perspective, polymerization of the adhesive system and resin-based composite can be inhibited by the presence of oxygen, damaging the marginal seal and promoting the beginning of the microleakage process. 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.[7]

To allow the residual oxygen to be eliminated, clinicians must allow some time to elapse between the bleaching procedure and restorative treatment. Nevertheless, there appears to be no consensus regarding the necessary waiting time. McGuckin and colleagues[8] emphasized the importance of selecting the appropriate bleaching agent and waiting between bleaching and performing the restorative treatment to achieve a better bond strength. However, they did not specify the minimal duration needed to maintain normal bond strength values. According to Shinohara and colleagues,[4] adequate bond strength is achieved two weeks after the completion of bleaching. Unlu and colleagues[6] reported that bond strength increased after teeth were immersed in saliva for one week after bleaching. Barbosa and colleagues[9] conducted an in vitro study and recommended waiting seven days after bleaching with 35 percent hydrogen peroxide to perform restorative procedures in enamel and 14 days to perform such procedures in dentin. In an in situ study, Barbosa and colleagues[10] found that adhesive restorations could be placed immediately after completion of bleaching treatment with 16 percent carbamide peroxide.

Bleaching agents can cause chemical alterations in the hard dental tissues, changing the ratio of organic to inorganic composition and increasing the tooth's solubility.

The majority of studies in the literature were conducted in vitro. However, real-life factors such as remineralizing properties and food and beverage consumption can affect enamel and dentin properties, thus influencing the waiting time with regard to bond strength after tooth bleaching. In situ studies allow researchers to obtain data that are closer to clinical reality, thus enabling them to establish more adequate parameters for fulfilling a restorative treatment protocol in patients undergoing tooth bleaching with 35 percent hydrogen peroxide.

The objective of this in situ study was to evaluate the influence of waiting time after bleaching with 35 percent hydrogen peroxide on the bond strength of resin-based composite restorations to enamel and dentin.

PARTICIPANTS, MATERIALS AND METHODS

Experimental design. In this study, the factor examined was elapsed time, at a control level (absence of bleaching) and at four experimental levels (immediately, seven days, 14 days and 21 days after bleaching).

One of us (M.E.B.) evaluated the sound human dentin and enamel. The experimental units consisted of 100 fragments of sound enamel and 100 fragments of sound dentin (200 in all). The 20 participants each received five blocks of enamel and five blocks of dentin, which we distributed randomly. We evaluated the dependent variable—shear bond strength—quantitatively and measured it in megapascals. The three basic principles of our experimental design were repetition, randomization and blocking.

Volunteer recruitment. After receiving approval for the project from the Ethics Committee on Research of the Dental School and the São Leopoldo Mandic Research Center, Campinas, São Paulo, Brazil, four of us (M.S.T., M.S.S.L., Y.B.O.L.A., F.M.G.F.) selected the participants, who provided written informed consent. The sample consisted of 20 adults (eight men and 12 women) with a mean age of 21 years (range, 18 to 25 years).

Preparation of dental fragments. We used completely unerupted human third molars after storing them in a 0.1 percent thymol solution with pH 7. After debridement and polishing with rubber cups, pumice and water at low speed, the clinician (M.E.B.) washed the teeth with distilled and deionized water. He sectioned them transversely (separating them into the root and coronal portions) and longitudinally in the mesiodistal direction to obtain 200 dental fragments, 100 of which were enamel (from the coronal portion) and 100 were dentin (from the root portion). He obtained fragments measuring 4 millimeters × 4 mm × 3 mm, with a surface area of 16 square millimeters. He then embedded the fragments in polystyrene resin with the aid of polyvinyl chlo-